COTRUST

CTH200 Series PLC Controller

User Manual

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Shenzhen Co-trust Technology Co.,Ltd

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Safety Guidelines

Only qualified person should be allowed to install, operate and maintenance on CTH200 Series PLCs. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

COTRUST has no responsibility for any consequence caused by using this document.

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

	**Warning** Warning indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	**Caution** Caution used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
	**Notice** Notice indicates the supplementation and description for specific operation.

Correct Usage

Safety circuit must be used to ensure the PLC system can operate securely when the external power lost or PLC failed. The following should be considered in the Design:

Emergency brake circuit, safety circuit, Positive and reverse operation interlock circuit and the Up/Down threshold interlock switch of position for preventing device damage must be implemented in the external circuit of PLC.

The external safeguard circuit and safety mechanism must be designed for the output signal which indicating major accident, to ensure the device can operate securely.

The PLC can detect system exceptions which resulting all output turned off, to ensure the device can operate correctly, external control circuits needs to be implemented appropriately.

When the Relay Unit or Resistor Unit in PLC was damaged, the ON/OFF for PLC Outputs can not be controlled.

The Power system should implement lightning protection device, to prevent the PLC interfaces like power inputs/signal inputs and controller outputs from being damaged by lightning over-voltage.

Proper Installation

Don't install PLCs at the following places: dust, smut, conductive dust, corrosive gas, combustible gas, vibration and shock. Don’t expose the PLC into high temperature, moisture condensation, raining. Lightning, fire or misoperation can also cause damage to the product.

Prevent the metal filing and cable outlet falling into the PLC ventilation hole when wiring and tightening the screws, or else they can cause fire, failure and misoperation.

After installing PLC, there must be no sundries in case of fire, fault and misoperation caused by bad heat dissipation.

Hot plugging is not allowed, shield cable must be used to increase immunity of inference.

Wiring

Before Installation and wiring, all external powers must be cut-off, otherwise electric shock and device damage can be caused.

Cover the terminal plate before powering on, follow the instructions in this manual to connect power. PLC in/out signals wiring cannot be parallel with other High voltage or inference lines, they should be layout in separate slots.

Separate the PG terminal on CPU with high voltage.

Operation and maintenance

Don’t touch the terminals with power on, in case of electric shock and device damage .

Turn off the power and then clean and tighten screws, connect and disconnect communication cable.

Don’t dismantle the controller in case of damaging the internal parts.

Please reading this manual before modifying program, Start, test and stop the CPU.

Product obsolescence

The combustion of electrolytic capacitor on PCB can cause explosion, the main material on PLC is plastic which would generate toxic gas when burnt.

Please follow the local environment regulations to process the abandoned products

Preface

Thank you for choosing CO-TRUST PLCs products. Please reading this document before securely utilizing the abundant functions of this product.

Introduce

❑Chapter 1 describes the characteristics for CTH200 series CPUs and expansion modules;

❑Chapter 2 guides users to use CTH200 PLC;

❑Chapter 3 details the installation methods and dimensions for CTH200 PLC;

❑Chapter 4 details the specifications for CTH200 CPUs and expansion modules;

❑Chapter 5 describes the networks and communication protocols for CTH200 PLC;

❑Chapter 6 illustrates the main features for CTH200 PLC by use a few application examples;

❑Chapter 7 describes the Power budget calculation for CTH200 system;

❑Chapter 8 provides the fault diagnose for system Runtime;

❑Appendix provides application examples for multiple expansion modules and specified libraries, and all order number for this product profile.

Applicable Objects

All information about CTH200 PLC installing and debugging are oriented for Engineers, Installation technician, maintainer and automation qualified electrician.

Online Support

For related product materials and technical support, please visit http://www.co-trust.com

Contents

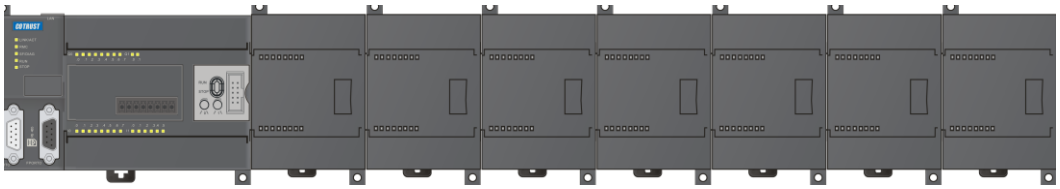
1 Product Overview

CTH200 PLCs are automatic controller oriented to the increasing OEM market in China. It combines rich experience of Co-trust engineers and can respond the market requirements for Industry 4.0. It features characteristics such as extensive models, variety expantions, Ethernet interaction, excellent performance, easy-to-use. This profile can provide economical and practical small automation solutions which facilitate the Industry 4.0 progress in China.

CTH200 is a joint name for all products in this family, which include CPU H224, CPU H226L, CPU H224X ,CPU H226XL, CPU H228XL (The CPUH228XL only has relay output model and the others all have relay output and transistor output models); CTH200 CPUs can support a variety of expansion modules including but not limited to digital I/O modules, analog I/O modules, temperature collection modules and DP communication modules, they can help you solve industry automation issues with flexibility.

CTH200 PLC can communicate with upper computer via Ethernet port or RS485 port, programming with Magicworks PLC (as of MagicWorks PLC V2.08) or MicroWin.

CTH200 system consists of one individual CPU or one CPU plus up to 7 various optional expansion modules.



1.1 CPU Introduction

CTH200 PLCs are robust small programmable controllers which encapsulating not only micro-processor but also multiple digital I/O points, it can expand up to 7 modules via communication bus.

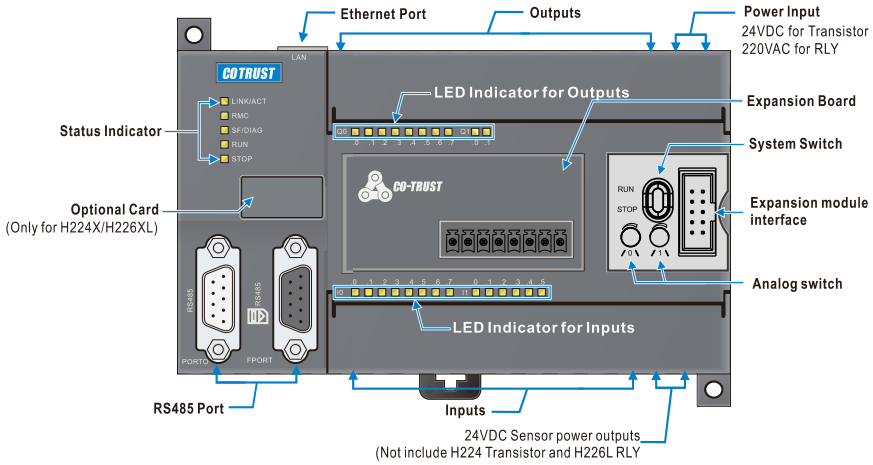


图 1-1 CTH200 PLC structure diagram

表 1-1 CTH200 CPUs

Specifications	Catalog number
CPU main-control modules	
CPU H224 12KB program/8KB data,24VDC supply,14DI/10DO transistor-source outputs, 0.5A, 1 PPI port, 1 freeport, 1 Ethernet port,3 50KHz motion outputs	CTH2 214-1AD33-0X24
CPU H224 12KB program/8KB data, 220VAC supply, 14DI/10DO relay outputs, 2A,1 PPI port, 1 freeport, 1 Ethernet port	CTH2 214-1BD33-0X24
CPU H226L 12KB program/8KB data,24VDC supply,24DI/16DO transistor-source outputs,0.5A, 2 PPI/freeports,1 Ethernet port,3 50KHz motion outputs	CTH2 216-2AD33-0X40
CPU H226L 12KB program/8KB data, 220VAC supply, 24DI/16DO relay outputs, 2A, 2 PPI/freeports,1 Ethernet port	CTH2 216-2BD33-0X40
CPU H224X 16KB program/108KB data, 24VDC supply, 14DI/10DO transistor-source outputs, 0.5A,1 PPI port, 1 freeport, 1 Ethernet port, 2 50KHz outputs (Pulse/Dir or PTO/PWM)	CTH2 214-1AX33-0X24
CPU H224X 16KB program/108KB data, 220VAC supply, 14DI/10DO relay outputs, 2A, 1 PPI port, 1 freeport, 1 Ethernet port	CTH2 214-1BX33-0X24
CPU H226XL 72KB program/110KB data, 24VDC supply, 24DI/16DO transistor-source outputs, 0.5A, 2 PPI/freeports,1 Ethernet port, 2 50KHz outputs (Pulse/Dir or PTO/PWM)	CTH2 216-2AX33-0X40
CPU H226XL 72KB program/110KB data, 220VAC supply, 24DI/16DO relay outputs, 2A, 2 PPI/freeports, 1 Ethernet port	CTH2 216-2BX33-0X40
CPU H228XL 96KB program/110KB data, 220VAC supply, 36DI/24DO relay outputs, 2A, 2 PPI/freeports, 1 Ethernet port	CTH2 218-3BX33-0X60

CPU Characteristics:

Stable and Reliable

- ESD and EFT immunity, approved for strict industry environment, CE certified
- Three proofings (moisture proofing, salt spray proofing and fungus proofing), suitable for various industry environment
- Permanent preservation for user program and data
- Multiple password protection; one-way download for kernel program, permanent confidential
- The communication interfaces all have lightning protection, providing high reliability
- Build-in real-time clocks

Robust communication

- Integrated 3 communication ports
- Support for various protocols like Ethernet, MPI, PPI, Freeport, MODBUS etc.
- Exchanging 200Bytes per read-write operation, enhanced networking communication

High intelligence

- Integrated parameter self-tuning fuzzy logic algorithm and temperature control PID library, with high accuracy and dynamic performance
- Build-in plenty of integrated functions with simplified programming and flexible control
- High-speed closed loop can be delivered to support some high-speed system application
- Abundant of motion control functions, suitable for some synchronization and positioning applications

High speed and high-capacity

- Logical operation rate: 0.22μs for H224&H226L; 0.15μs for H224X&H226XL
- Floating-point calculation rate: 12μs for H224&H226L; 8μs for H224X&H226XL
- High program capacity: 12K-72Kbytes
- Large data space: 8K-110Kbytes
- High-speed Input counter: 4 for H224&H226L; 6 for H224X&H226XL
- High speed pulse output: tripple for H224&H226L; dual for H224X&H226XL

Ultra system expandation

- Analog I/O: H224 and H226L up to 32 I/Os; H224X and H226XL up to 194 I/Os
- Digital I/O: H224 and H226L up to 128 I/Os; H224X and H226XL up to 640 I/Os
- Up to 7 Extended I/O modules

1.2 Expansion Modules

CTH200 series CPUs offers I/Os, but various expansion modules can also be utilized to provide more additional I/Os and communication functions. The expansion modules include digital I/O modules, analog I/O modules, temperature collection modules and DP communication modules etc. These modules each consists of different I/O number, used for configuring various scale of I/Os with high cost performance.

All modules are installed with standard DIN35 rail,

Table 1-2 Specifications for expansion modules

Module name and Specifications	Ord. No.
SM221 Digital Input module with 8 Inputs, 24VDC	CTH2 221-1BF32
SM221 Digital Input module with 16 Inputs, 24VDC	CTH2 221-1BH32
SM221 Digital Input module with 32 Inputs, 24VDC	CTH2 221-1BL32
SM222 Digital Output module with 8 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 222-1BF32
SM222 Digital Output module with 16 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 222-1BH32
SM222 Digital Output module with 32 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 222-1BL32

SM222 Digital Output module with 8 relay outputs, 2A	CTH2 222-1HF32
SM222 Digital Output module with 16 relay outputs, 2A	CTH2 222-1HH32
SM223 Digital Input/Output module with 4 24VDC inputs, 4 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 223-1BF32
SM223 Digital Input/Output module, 8 24VDC inputs, 8 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 223-1BH32
SM223 Digital Input/Output module, 16 24VDC inputs, 16 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 223-1BL32
SM223 Digital Input/Output module, 4 24VDC inputs, 4 relay outputs, 2A	CTH2 223-1HF32
SM223 Digital Input/Output module, 8 24VDC inputs, 8 relay outputs, 2A	CTH2 223-1PH32
SM223 Digital Input/Output module, 16 24VDC inputs, 16 relay outputs, 2A	CTH2 223-1PL32
SM231 Analog Input module with 4 inputs, 0～20 mA current input or ±5V, ±2.5V, 0～10V, 0～5V voltage input, isolated 12 bit resolution	CTH2 231-0HC32
SM231 Analog Input module with 8 inputs, ±2.5V, 0～10V, 0～5V voltage input or optional 0～20 mA current input, isolated 12 bit resolution	CTH2 231-5HF32
SM231 Thermal resistance Temperature Input module, 2 RTDs, isolated 16 bit resolution	CTH2 231-7PB32
SM231 Thermal resistance Temperature Input module, 4 RTDs, isolated 16 bit resolution	CTH2 231-7PC32
SM231 Thermocouple Temperature Input module, 4 TCs, J/K/R/S/T/E/N, isolated 16 bit resolution	CTH2 231-7PD32
SM231 Thermocouple Temperature Input module, 8 TCs, J/K/R/S/T/E/N, isolated 16 bit resolution	CTH2 231-7PF32
SM231 Thermocouple PID module, 4-points J/K model with intelligent PID, isolated 16 bit resolution	CTH2 231-7TD32
SM231 Thermocouple PID module, 8-points J/K model with intelligent PID, isolated 16 bit resolution	CTH2 231-7TF32
SM231 Hybrid temperature Input module, 2-points NTC or PT100, dual 0～20mA current or ±5V/±10V/0～10V/0～5V voltage inputs, isolated 16 bit resolution	CTH2 231-7ND32
SM231 Thermal resistance temperature Input Module, 8NTC/PT100, isolated 16 bit resolution	CTH2 231-7NF32
SM231 Weighing Module, single sensor input, 50Hz sample frequency, 0.01% accuracy, 6VDC, 150mA excitation power output per channel, isolated 16 bit resolution	CTH2 231-7WA32
SM232 Analog Output Module, dual ±10V supply or 0～20mA current outputs, isolated 12 bit voltage or 11 bit current resolution	CTH2 232-0HB32
SM232 Analog Output Module, quad ±10V supply or 0～20mA current outputs, isolated 12 bit voltage or 11 bit current resolution	CTH2 232-0HD32
SM235 Analog Input/Output Module, quad voltage/current inputs, single voltage/current output, isolated 12 bit voltage or 11 bit current resolution	CTH2 235-0KD32
SM253 Positioning module, two uniphase or AB phase HSC inputs, 2-axis PTO/PWM output, 200KHz, Co-trust motion ctr lib.	CTH2 253-1BH32
SM277A Profibus DP Slave Interface Module, 12Mbps traffic rate,	CTH2 277-0AA32

photoelectric isolated	
SM277B Profibus DP Slave module, 1.5Mbps traffic rate, photoelectric isolated	CTH2 277-0AB32
SM277C CAN Slave module, 8DI/6DO, photoelectric isolated, up to 7 extendable modules	CTH2 277-0AC32

Table 1-3 BD Expansion Board

Module Name	Specifications	Odr. No.
EBH AMS-03	Analog I/O Expansion Board, 2*12 bit resolution inputs, 1*12 bit resolution voltage/current output	CTH2 AMS-03S1-EB
EBH AMS-06	Analog I/O Expansion Board, 4*12 bit resolution inputs, 2*12 bit resolution voltage/current output	CTH2 AMS-06S1-EB
EBH CAN-01	CAN Master communication Expansion Board, 1Mbps, photoelectric isolated	CTH2 CAN-01S1-EB

Notice
H224/H226L in CTH200 profile don't support the CAN-01 expansion board.

Features

- CTH200 series CPU can support up to 7 expandable modules
- All Analog modules have integrated CPU, with advanced filter technique, can provide excellent sampling stability.
- ALL I/Os of Digital modules have implemented photoelectric isolation and disturbance rejection.
- Integrated bus isolation, power isolation and interchannel isolation, high immunity from interference and high sampling accuracy, with intelligent fault diagnosis.
- The PID modules like Temperature Control can promote the respond speed of program executing.
- The expansion board for CAN master and the DP Slave module can significantly increase the interconnectivity and communication performance.
- The analog I/O expansion board has dual 12 bit voltage inputs and single 12 bit voltage/current input.

1.3 Max. System Configuration

- Up to 7 expansion modules per PLC connection
- Digital image register: 128DI/128DQ for H224/H226L; 640DI/640DQ for H224X/H226XL, in which including private image for CAN communication.
- Analog image register: 32AI/32AQ for H224/H226L; 194AI/194AQ for H224X/H226XL, in

which including private image for CAN communication.

1.4 Network Architecture

The typical network architecture for CTH200 system is shown as following:

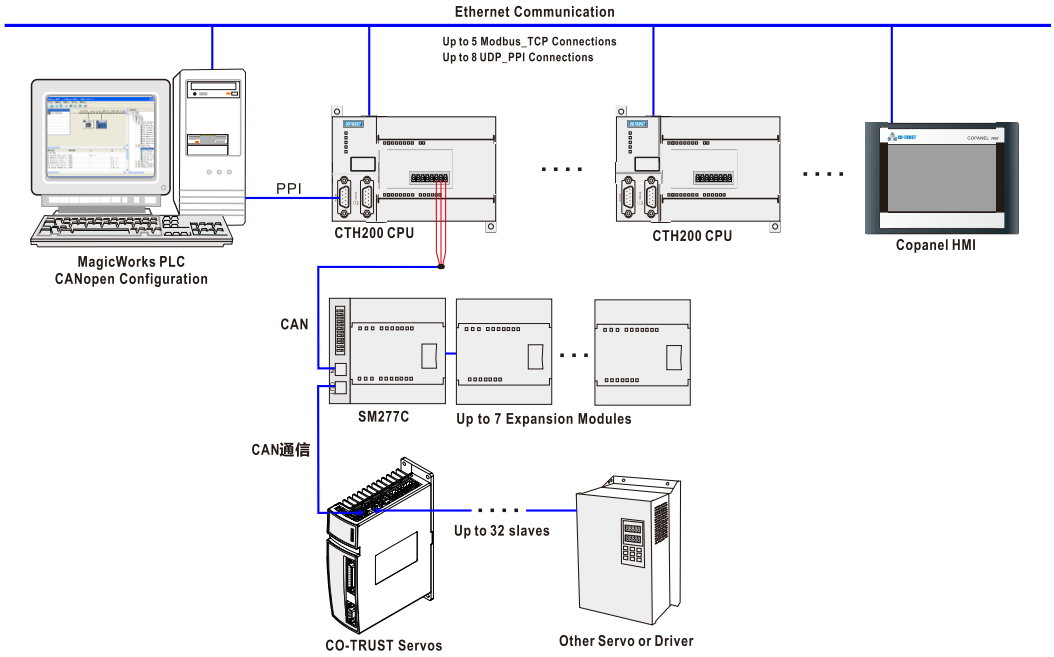


Figure 1-2 CTH200 Network Architecture

Note:

1. Inter-PLCs communication

H224/H226L: 8 UDP_PPI connections, max. 200 bytes per connection. 5 MODBUS_TCP connections, max. 240 bytes per connection.

H224X/H226XL: 8 UDP_PPI connections, including 4 masters and 4 slaves, max. 200 bytes per connection. 4 MODBUS_TCP connections, including 2 masters and 2 slaves, max. 240 bytes per connection.

H228XL: 8 UDP_PPI connections, including 4 master and 4 slave connections, max. 200 bytes per connection. 6 MODBUS_TCP connections, including 3 masters and 3 slaves, max. 240 bytes per connection

2. PLC & HMI (or third-party software) connection, with HMI or the third-party software as master

UDP_PPI: H224/H226L can connect up to 8 HMIs; 4 for H224X/H226XL/H228XL.

MODBUS_TCP: H224/H226L can connect up to 5 HMIs; 2 for H224X/H226XL and 3 for H228XL.

3. CPU can access other devices as master, equivalently a master connection for the CPU itself.

4. CPU can be accessed as slave by other devices, equivalently a slave connection for the CPU itself.

1.5 Standards and Specifications

CTH200 series PLCs have been approved for various international and industrial standards, the specifications for operating environment are shown as table 1-4:

Table 1-4 CTH200 series PLC standards and specifications

Environmental Conditions			
Transportation and Storage			
Items		**H224/H226L**	**H224X/H226XL/H228XL**
Temperature		-25℃ ~ 70℃	-40℃~+85℃
Pressure		1080hPa~660hPa (for altitude within -1000m ~ +3500m)	
Relative Humidity		5%~95%, no condensation	10%~95%, no condensation
Dropping		1m, 5 times, transport package	
Operation			
Temperature	H-installation	0℃~55℃	
	V-installation	0℃~45℃	
Pressure		1080hPa~795hPa (for altitude within -1000m ~ +2000m)	
Relative Humidity		10%~95%, no condensation	
Pollutant Concentration in severe environment		Low salt mist, moist, dust fog etc. SO2<0.5ppm, Relative Humidity <60%, no condensation H2S<0.1ppm, Relative Humidity <60%, no condensation	
EMC - Immunity			
ESD IEC61000-4-2		Contact discharge: ±4KV (Class A) Air discharge: ±8KV (Class A)	
EFT IEC61000-4-4		Power line: 2KV, 5KHz (Class A) Signal line: 2KV, 5KHz (I/Ocoupling clamp) (Class A) 1KV, 5KHz (Communication coupling clamp) (Class A)	
Impulse IEC61000-4-5		Power line: 2KV (asymmetric), 1KV (symmetric) (Class B)	
RFEMS IEC61000-4-3		80MHz~1GHz, 10V/m, 80%AM (1KHz) (Class A) 1.4GHz~2GHz, 3V/m, 80%AM (1KHz) 2GHz~2.7GHz, 1V/m, 80%AM (1KHz)	
RF interference IEC61000-4-6		0.15MHz~80MHz, 10V/m, 80%AM (1KHz) (Class A) 15KHz~150KHz, 10V/m, 80%AM (1KHz)	
Short interruption and volt change at DC input IEC61000-4-29		Short interruption: 10ms volt change: 80%~120%, 100ms	
Anti damping performance IEC61000-4-12		Power line: 1KV Digital I/O (as of 24V): 1KV	
Radiation Emission			
EMI Noise EN55011, class A group 1		Measured at 10m 30MHz~230MHz, < 40dB (uV/m) peak 230MHz~1000MHz, < 47dB (uV/m) peak	
AC Conduction interference EN55011, class A group 1		Measured at 10m 0.15~0.5MHz, < 79dB (uV/m) peak; < 66dB (uV/m) peak	

	0.5~30MHz, < 73dB (uV/m) peak; < 60dB (uV/m) peak
Environmental test criteria	
Hot operation IEC60068-2 Cold operation IEC60068-2	16 hours at 60℃ 16 hours at -10℃
Hot start IEC60068-2 Cold start IEC60068-2	2 hours at 60℃ 2 hours at -10℃
High-Low temperature cycle operation IEC60068-2	3h dwell time for -10℃~60℃, temperature rising rate 1℃/min, 2 cycles
Storage IEC60068-2	High-temperature: 72h at 70℃ Low-temperature: 72h at -40℃
Thermal shock IEC60068-2	3h dwell time for -40℃~70℃, variation time <1min. , 5 cycles
Hot and humid IEC60068-2	48h at 40℃
Alternate hot and humid test IEC60068-2	25℃~55℃ 95%, 2 cycles
sine vibration (bare machine) IEC60068-2	5~150Hz, $0.05G^2$/Hz 150Hz~500Hz -3dB/oct, 1h/axis, with X/Y/Z 3 axes
Impact (bare machine) IEC60068-2	15G, 11ms pulse, 3times/direction
Flow mixed gas corrosion test IEC60068-2-60	H2S: 0.1ppm, NO2: 0.2ppm, CL2: 0.02ppm Temperature 30℃, Humidity: 75%, cycle: 4days
Hipot test	
24V/5V Inter-Nominal circuit 110V/220V Circuit to GND 110V/220V Inter-circuit 110V/220V to 24V/5V	500 VAC 1500 VAC 1500 VAC 1500 VAC

2 QuickStart

This chapter introduces how to connect, program and run CTH200 series PLC with Magicworks.

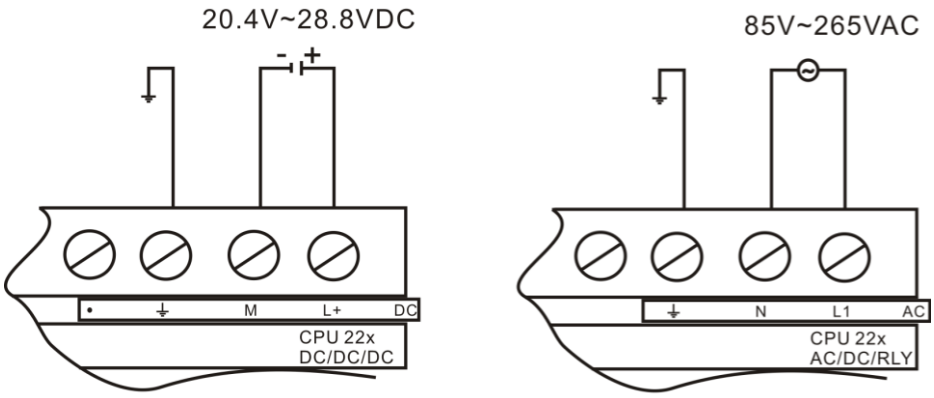
2.1 PLC Connection

■ When connecting CTH200 PLC, Please connect the CTH200 CPU to program device with the RS485 cable, then power up the CTH200 CPU.

■ CTH200 series PLC supports Ethernet communication, please connect the CTH200 CPU to program device with Standard Ethernet cable.

Power connection

The following Figures are diagram for 2 models of CPU:



DC Power AC Power

Figure 2-1 Power up the CTH200

	Warning Don't install and wire the CTH200 series PLC with power on, faulty operation can cause serious damage for machines and personal death. Ensure disconnecting power while install or disassemble any electric device.

Connecting with RS485 cable

How to connecting CTH200 CPU with Program computer using RS485 program cable is shown as figure 2.

	Notice Please install the drive for PLC program cable referring to Appendix K.

1. Connect USB port of the Cable to the communication port of program computer (PC), thus can generate a virtual serial port.

2, Connect RS485 interface of the cable to the Port0 or Port1 of CTH200 CPU.

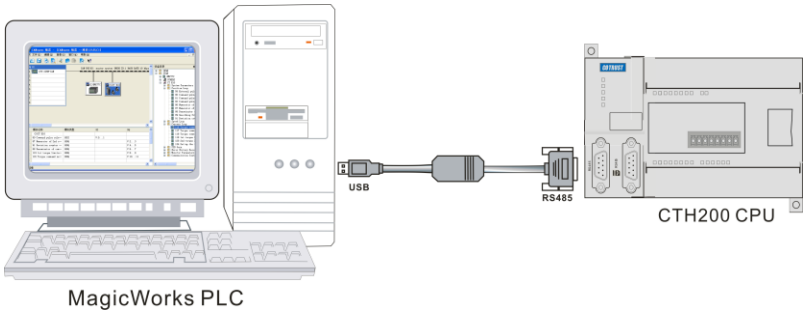


Figure 2-2 Cable connection between CTH200 PLC and PC

PLC connection with net cable

图 2-3 所示为使用标准网线连接 CTH200 CPU 与编程设备。

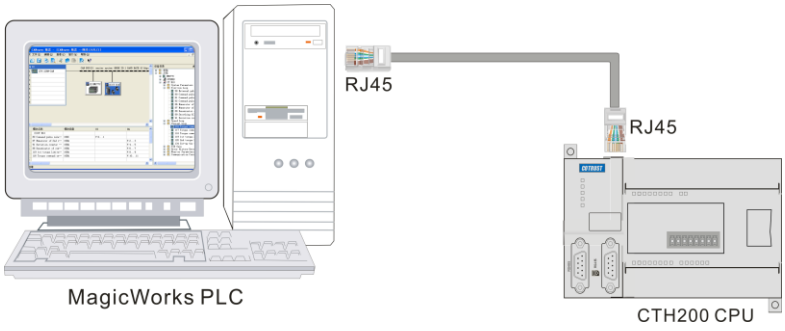


Figure 2-3 connection between CTH200 PLC&PC using net cable

Using MagicWorks PLC

Double-click the icon  to start MagicWorks PLC software, select “File -> New” to create a new project. As shown in figure 2-3, this is a new project, in which user can click the respective item to open components in the MagicWorks PLC.

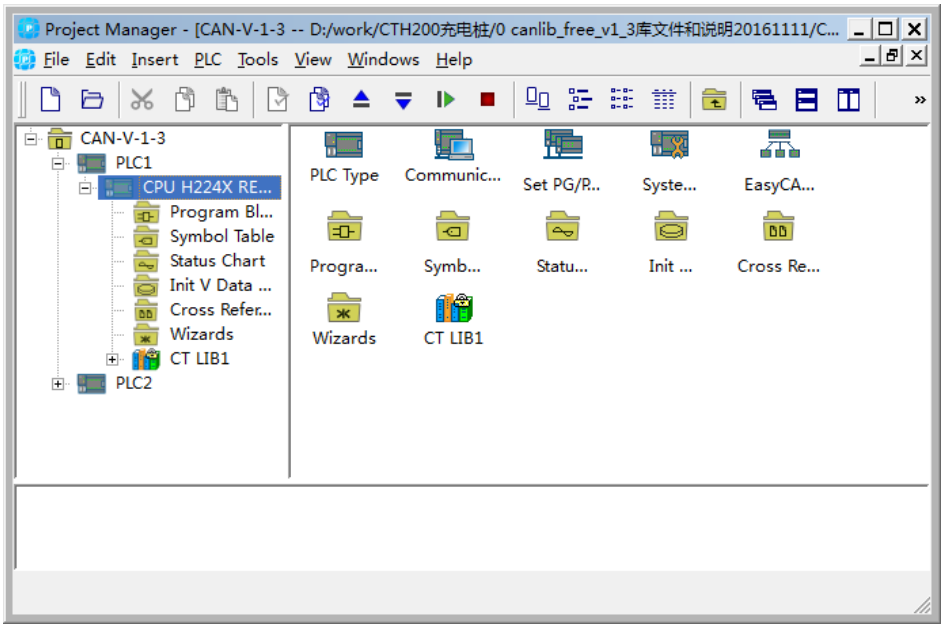


Figure 2-4 MagicWorks PLCnet cable

2.2 PLC Communication Settings

2.2.1 Serial port communication

Select the serial port communication protocol in “Set PG/PC Interface” dialog, which will be used as a interface for PLC communication. The default serial port is “PG/PC Cable (PPI)”, please proceed as following:

1) Click the “Set PG/PC Interface” in the “Communications” screen.

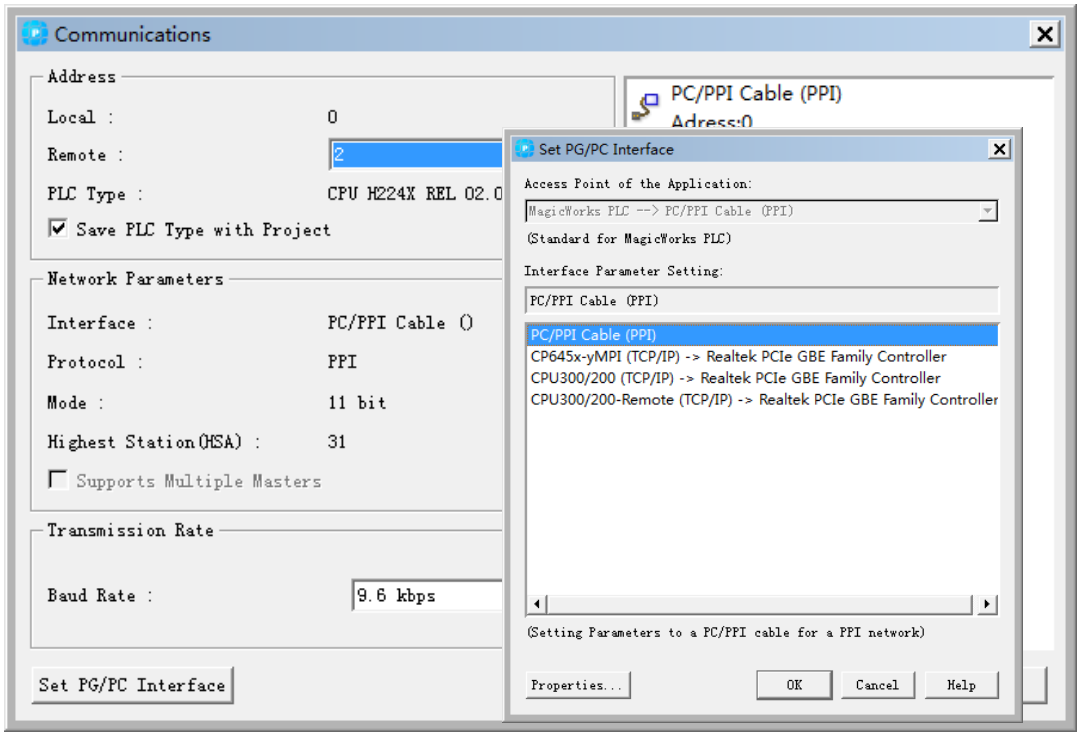
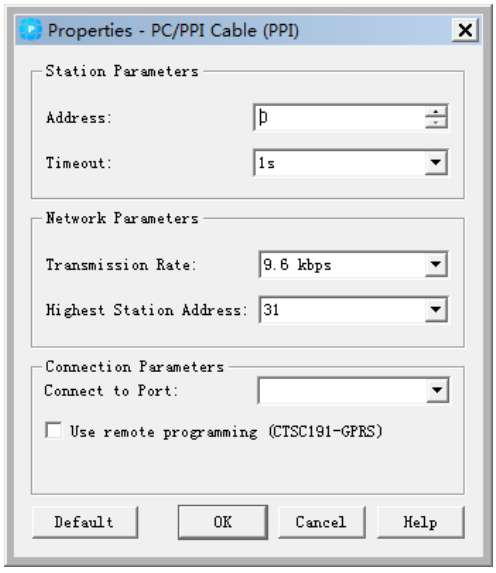


Figure2-5 Magicworks PLC serial port settings

2) Select the “PC/PPI Cable (PPI)” in “Set PG/PC Interface”, then click the “Properties” button in this dialog to set the communication parameters.

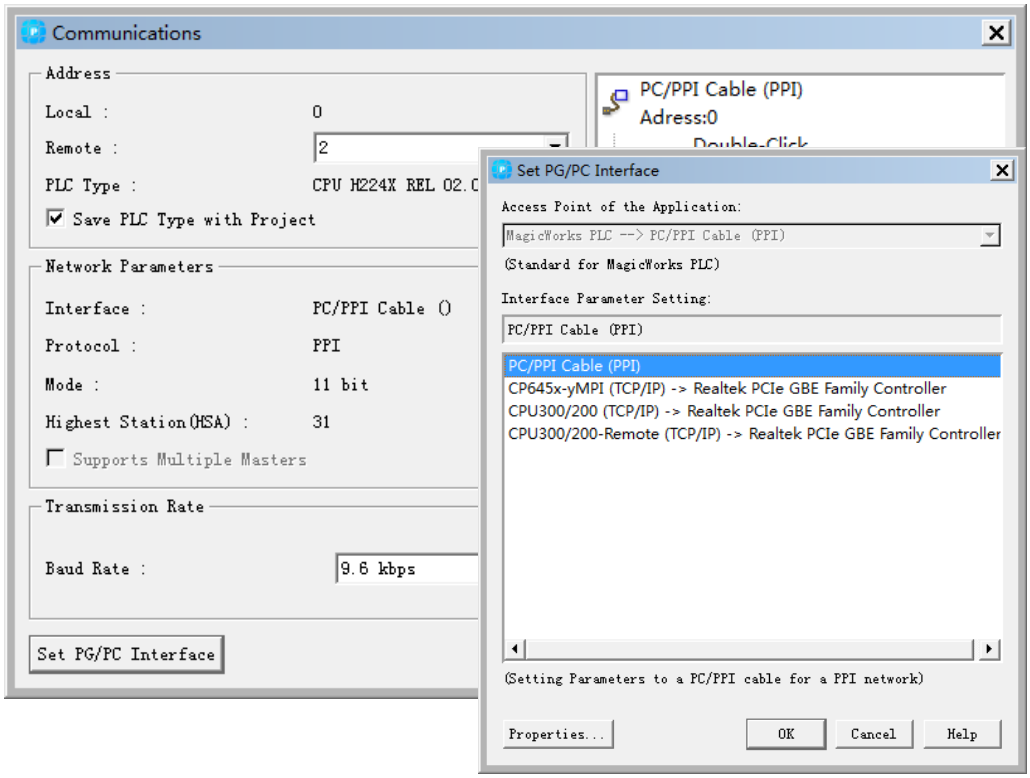


1) PC/PPI Address: 0

2)interface: COM1

3)Transmission rate: 9.6Kbps

Click OK to return to the “Communications” page. Then double-click Refresh to find the PLC.



Note: if communication failed, Please do examine as the following steps:

1) Check wiring

Please use the cable provided by Co-trust (Order No. CTS7-191-USB) and ensure the connector remained intact. Switch PLC to STOP when the communication protocol had changed previously.

2) Check the drive

The cable provided by Co-trust must have matched drive, please obtain the drive from the following site: http://www.co-trust.com/cn/service.php?dlm=11&xlm=17

3) Check the communication settings

1. Select the PPI protocol (PC/PPI Cable).

2. Ensure the selected COM port not hold by other programs.

3. Select the suitable baud rate.

2.2.2 Ethernet Communication

Users can select and set the Ethernet communication protocol for CTH200 PLCs in in “Set PG/PC Interface” dialog, the selected port would be used as a interface, the available interfaces are as following:

- CPU300/200 (TCP/IP)
- CPU300/200-Remote (TCP/IP)

Here with the CPU300/200 (TCP/IP) -> Realtek PCIe GBE Family Controller as example, the procedures are as following:

(1) Click “Set PG/PC Interface” in the Project tree.

(2) Choose “CPU300/200(TCP/IP)-> Realtek PCIe GBE Family Controller” in the dialog.

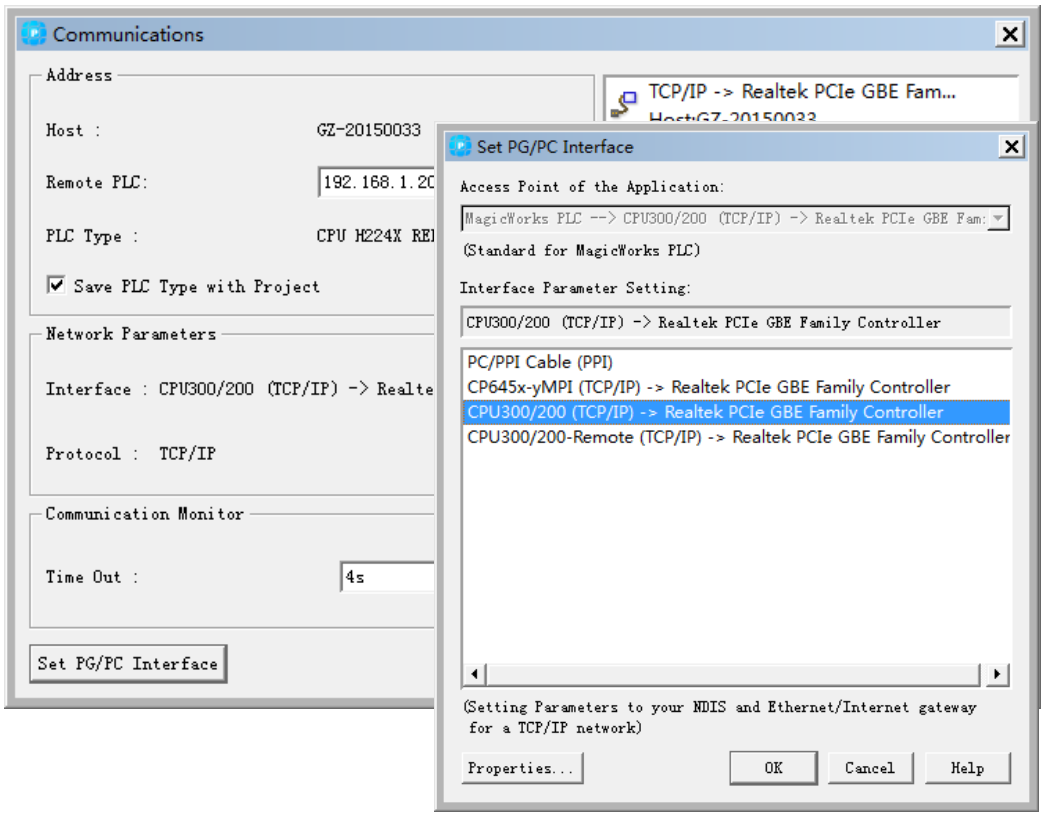
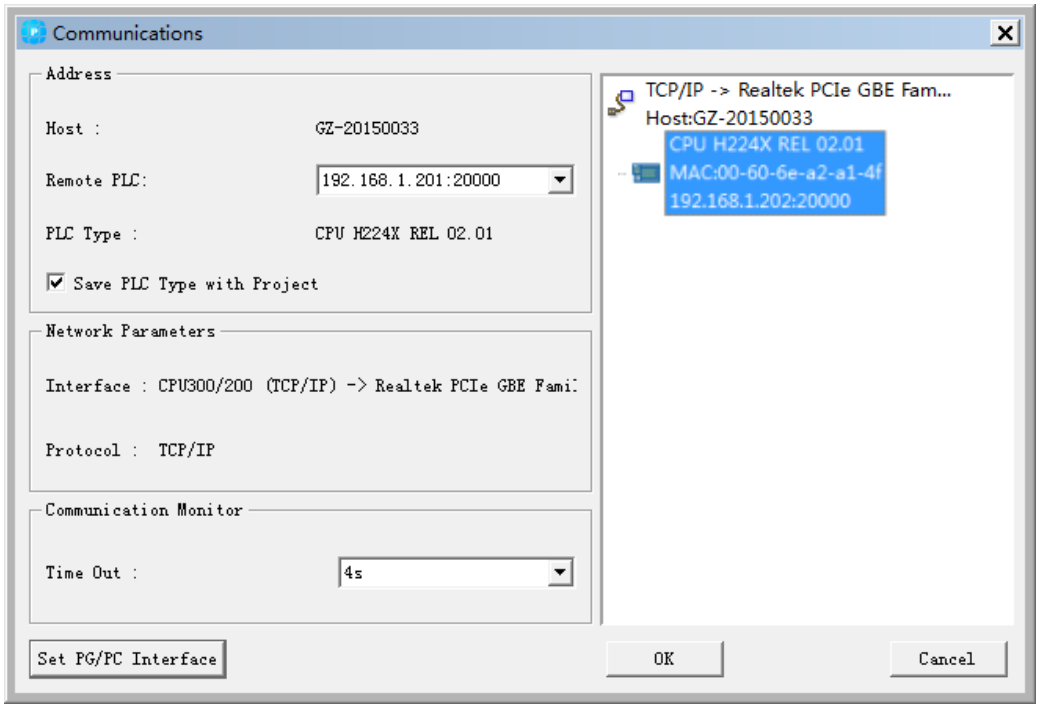


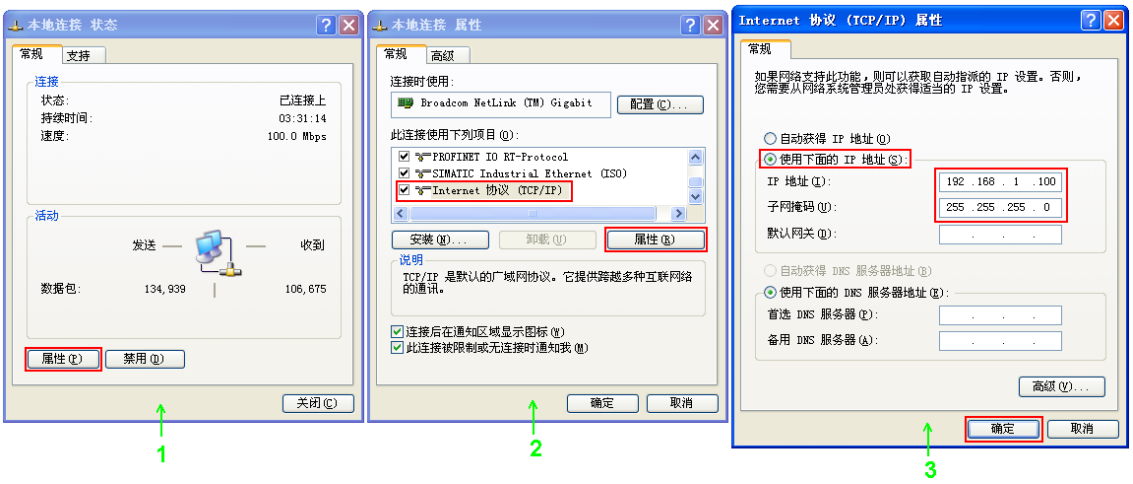
Figure 2-6 Magicworks PLC Ethernet communication setting

Build communication with CTH200 PLC:

1）Double-click the Refresh icon in the following dialog, MagicWorks PLC will search for and show the connected CTH200 CPU.



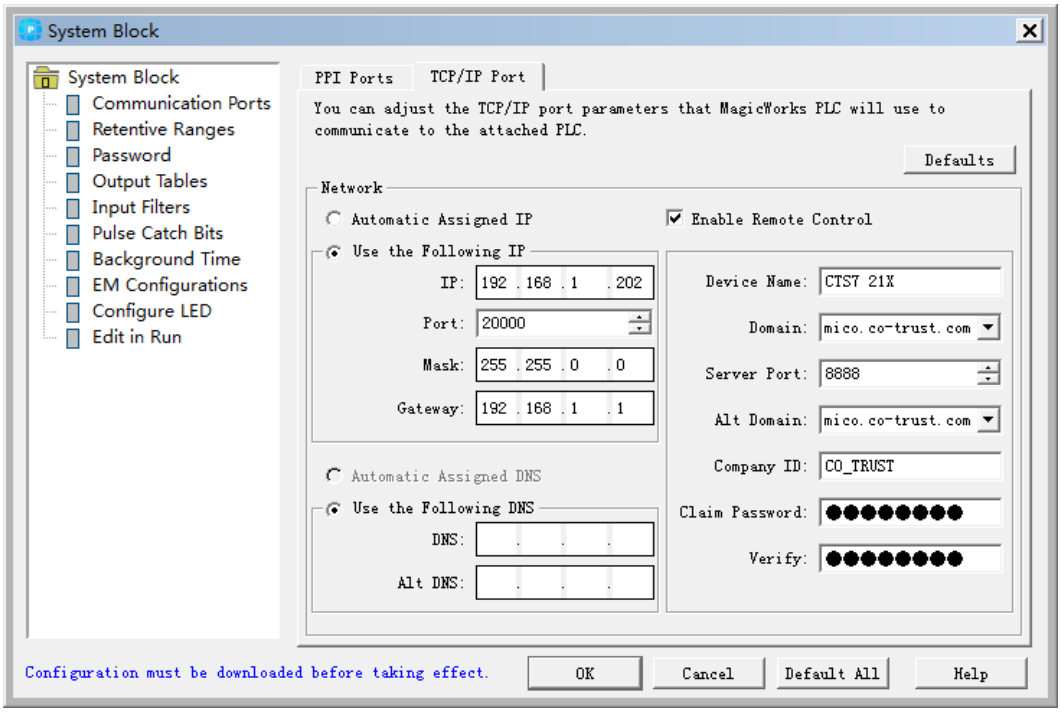
2）Users can choose the CTH200 station and click OK after searching. If the MagicWorks PLC haven't found CTH200 CPU, please check wring first and then validate the Communication settings, after which repeat the above steps. When the PLC communication has established, The IPs for PC and PLC should be in same segment but can't identical, as shown in the following figure, IP for PLC searched by PC is 192.168.1.202, then the PC IP should be 192.168.1.XXX (in which XXX ranges from 1 to-255). Please set PC IP as following procedures:



2.2.3 Modify PLC IP in System Block

After established communication connection and you need to modify the IP address for CPU, you can open the System Block in Magicworks PLC to modify IP address.

Note: the modification can be effective after download the System Block into PLC. Then you need to search PLC again to establish connection (refer to section 2.2.2)



2.3 Create Program Network

This section describes how to create, download and run PLC program to help users learn the application for CTH200 PLC. The following program example use 3 instructions to shift left 1 bit for value transferred in QB0 at 1s interval.

Here shows the ladder diagram and statement list to explain logic relationship in the program.

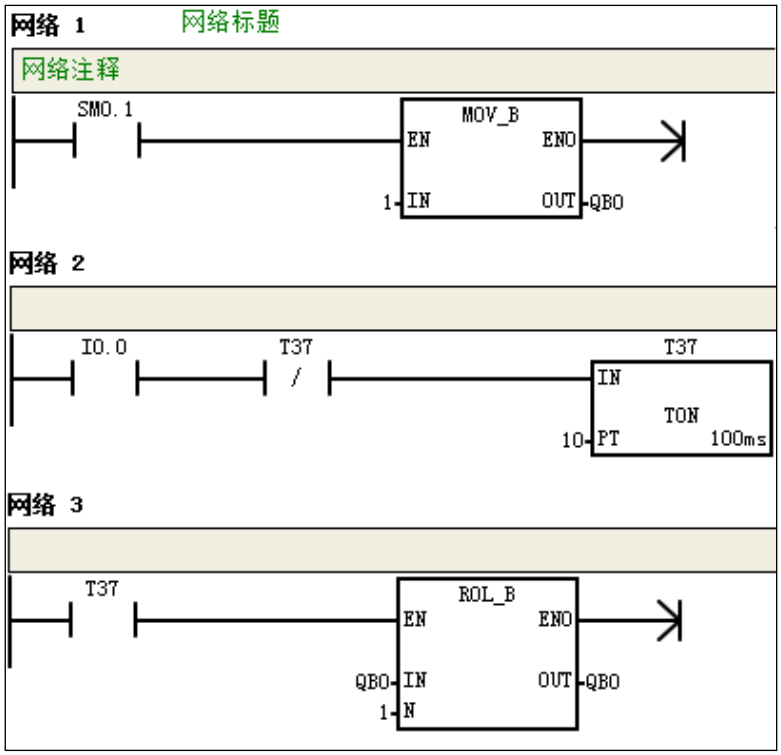


Figure 2-7 CTH200 program example

Statement list (with annotation):

```
Network 1:
LD SM0.1 // Enable with SM0.1
MOVB 1, QB0 // Transfer 1 to QB0
Network 2:
LD I0.0 // Enable signal
AN T37 // Circulate timer signal
TON T37, 10 // Set timer T37, Tme 100ms x 10 = 1s
Network 3:
LD T37 // Set enable pulse via T37
RLB QB0, 1 // QB0 shift 1 bit left, with the PLC LEDs light on at 1s interval.
```

2.3.1 Edit Program

Click the Program Block to open the program editor, as shown in figure 2-8. User can drag&drop the ladder instructions into program editor, or use the shortcut for available instructions directly.

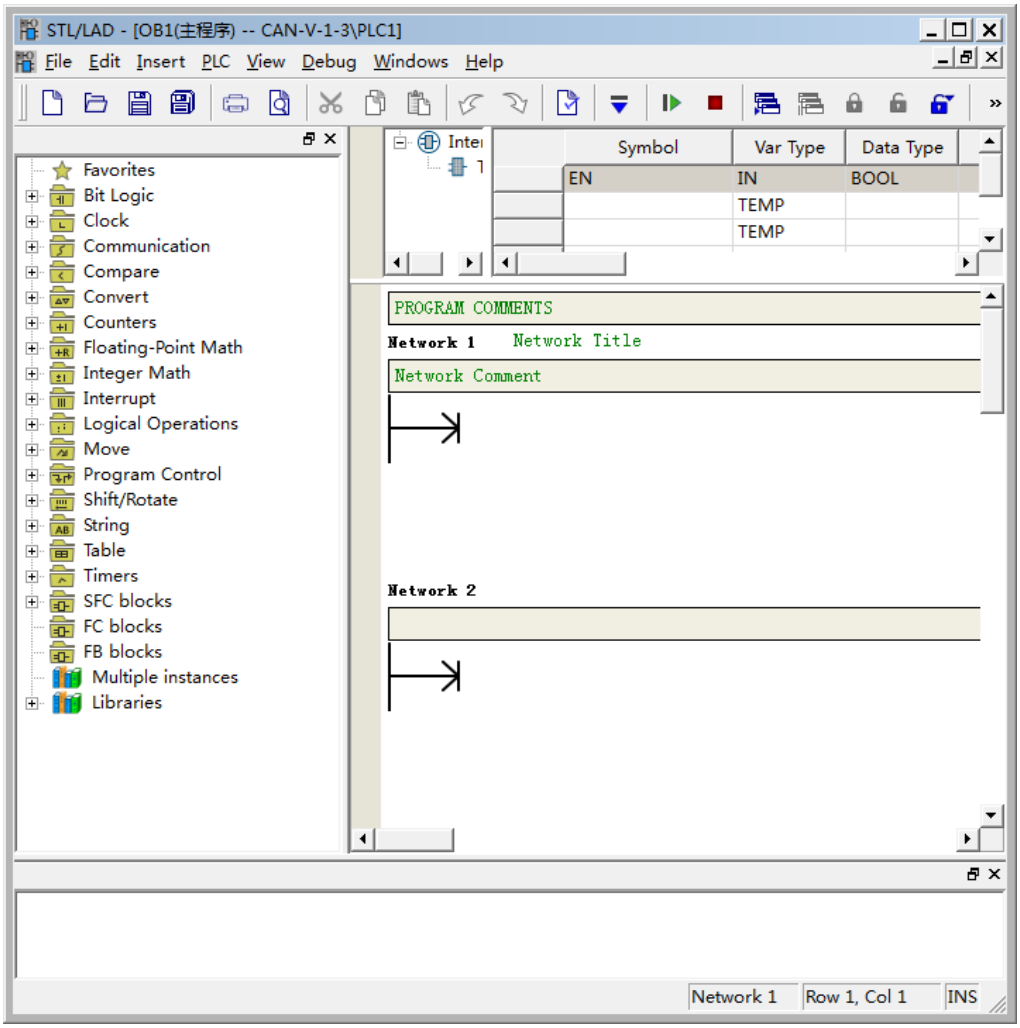


Figure 2-8 Program editor

2.3.2 Compile Program

The program needs to be compiled when editing completely:

1)Select menu command “PLC -> Compile” or click Compile button

2)The output window at bottom will show status for compiling, if there occurs error, user can click the prompt to view details

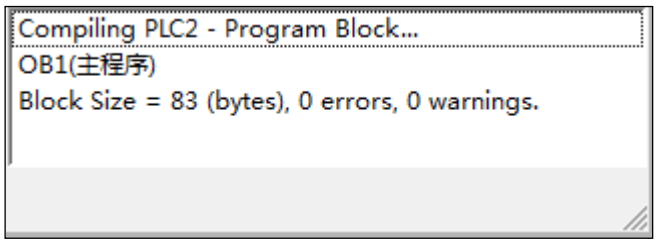


Figure 2-9 Program compile result

Save project:

1)Select menu command “File -> Save as”.

2)Enter the required project name in “Name” dialog.

3)Select the required project Storage.

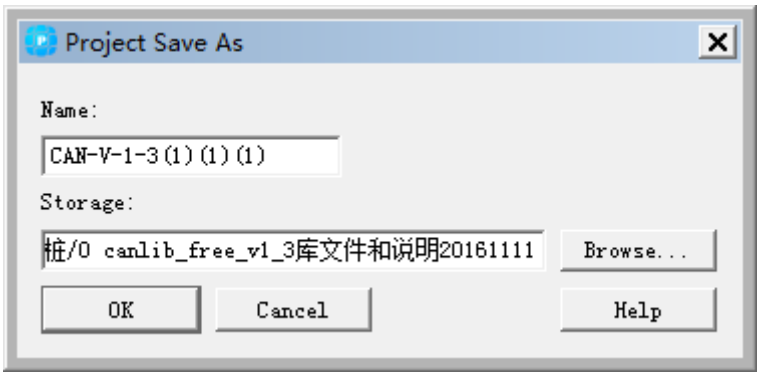


Figure 2-10 Project Storage

2.3.3 Download Program

Click the download icon in toolbar or select the menu command “PLC -> Download” to download the program into CTH200, as shown in Figure 2-11 and 2-12. CTH200 PLCs support read/write online, which means user can write instructions or parameters into PLCs during Running, without switching to STOP.

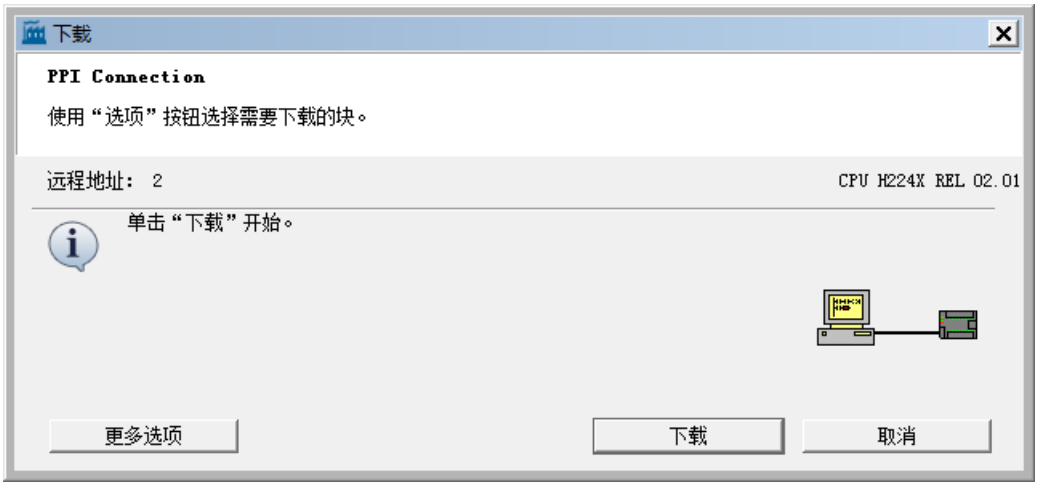


Figure 2-11 Download program in serial communication

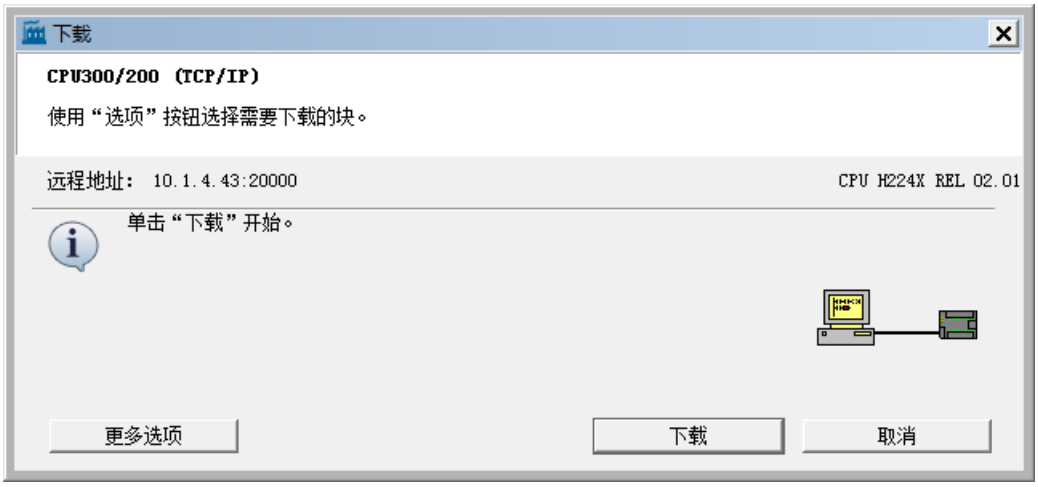


Figure 2-12 Download program in Ethernet communication

2.3.4 Run PLC

MagicWorks PLC can switch the CTH200 PLC into RUN mode and execute program when the Mode Switch of PLC set to RUN:

1)Click the RUN icon in toolbar or select the menu command “PLC -> RUN”.

2)Click Yes to enter RUN mode and the CPU would execute program, Q0.0-Q0.7 will light on circularly at 1s interval, which means left shaft the value circularly in Q memory.

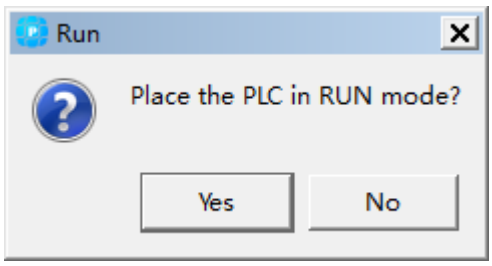


图 2-13 运行程序

Users can monitor the program via project tree -> state table. MagicWorks PLC would show the appropriate results. Click the icon or select menu command “PLC -> STOP” would stop the PLC.

3 Installation

CTH200 PLCs have been designed easy for installation, they can be fixed into backplane of the cabinet via mounting hole, or use the DIN clamp to mount on a standard DIN rail. It's compact structure allow users utilizing space efficiently.

This chapter will guide user for the installation and wiring of CTH200 PLCs

3.1 Important Notices

CTH200 PLCs can be installed on the backplane of cabinet or on the standard DIN rail, vertically or horizontally. Users must observe the following notices:

Isolate the PLC with Heat, HV and Electronic noise

According to the general conventions, PLC with low voltage must be isolated with HV and electronic noise sources.

When mounted on the backplane of cabinet, the PLC should be arranged into lower temperature area of the cabinet to extend its lifetime.

Try to avoid putting the AC power line, high energy and high switching frequency DC line, low voltage signal line and communication cable into one slot.

Make room for heat dissipation and wiring

CTH200 PLCs are designed with natural ventilation and heat dissipation, with at least 30mm space above and below the module. Distance between the front plane and back plane must be at least 80mm.

Notice

Comparing with horizontal installation, the max. Ambient temperature allowed with vertical installation should lack for 10℃, and CPU should be installed below all expansion modules.

Enough spaces should be left for cable wiring and connecting when installing CTH200 PLC.

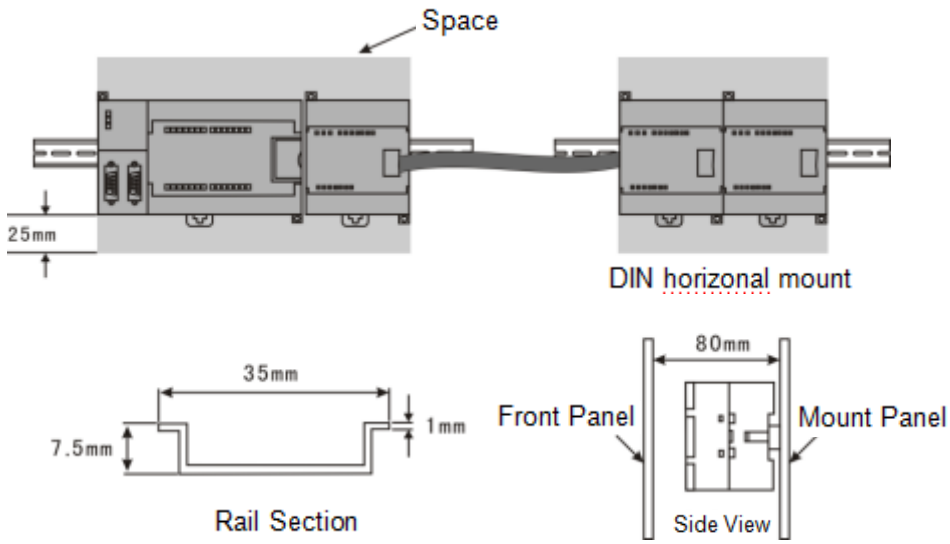


Figure 3-1 Installation

3.2 Installation Dimension Description

CTH200 PLC and all expansion modules have mounting holes, with which can be installed at back plane conveniently. The following figure shows the Installation Dimension for all PLC and expansion modules.

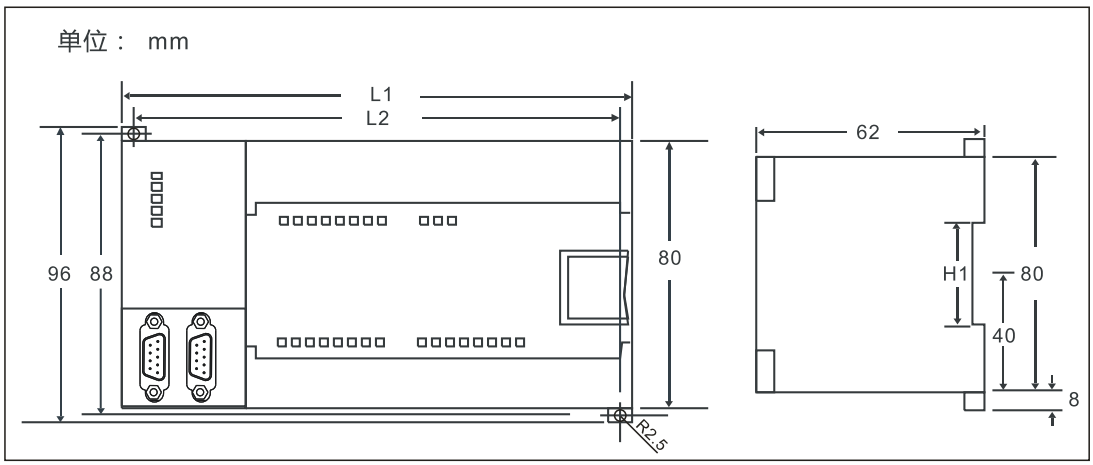


Figure 3-2 CTH200 PLC Installation Dimension

Table 3-1 Dimensions for CTH200 PLCs and expansion modules

Items	L1(mm)	L2(mm)
CPU H224/H224X	137	129
CPU H226X/H226XL	196.5	188.5
CPU H228XL	200	195
CTH2 221-1BL32, CTH2 222-1BL32 CTH2 223-1BL32, CTH2 223-1PL32	137	129
CTH2 221-1BF32, CTH2 222-1BF32, CTH2 222-1HF32 CTH2 223-1BF32, CTH2 223-1HF32, CTH2 232-0HB32	46	38

CTH2 221-1BH32, CTH2 222-1BH32, CTH2 223-1BH32, CTH2 223-1PH32, CTH2 231-0HC32, CTH2 235-0KD32, CTH2 231-0HF32, CTH2 231-7HB32, CTH2 231-7HC32, CTH2 231-7PB32, CTH2 231-7PC32, CTH2 231-7PD32, CTH2 231-7PF32, CTH2 231-7TF32, CTH2 231-7TD32, CTH2 231-7ND32, CTH2 231-7NF32, CTH2 277-0AA32, CTH2 277-0AB32	71.3	62.3
CTH2 277-0AC32	90	82

3.3 Installation Methods

CTH200 PLC can be installed at standard DIN35 rails or panels.

Prerequisites

Make sure the equipment had been powered off before assembly and disassembly, meanwhile, all related devices must also be powered off.

Warning

Don’t assemble and disassemble the CTH200 PLC and related devices with power, otherwise can cause electric shock or malfunction, even serious damage, injury or death.

Correct or equivalent modules must be used when changing or installing CTH200 PLC, meanwhile the direction and location must be correctly when changing modules, or it can result in damage, injury or death.

Notice

Incorrect modules would cause CTH200 PLC program failure.

Installation and Disassembly for CPU and expansion module

Following the procedures below:

- Mounting panel

1)Location the open holes according to the dimensions on Figure 3-1;
2)Fix the modules on backplane by using appropriate screws;
3)When using expansion modules, connect the flat cable for expansion modules to the extended port below the front cover.

- Mounting DIN rail

1)Fix the rail on backplane with 80mm distance.
2)open the DIN clamp below the module, lock the module back on DIN rail.
3)When using expansion modules, connect the flat cable for expansion modules to the extended

port below the front cover.

4)Spin the module to approach the DIN rail, then close the DIN clamp.

5)Check the DIN clamp fit the rail closely.

6)Don’t push the front of module, you can push the open holes instead to prevent damage.

- Mounting terminal strip

1)open the front cover of the terminal position.

2)make sure the module pins are alignment with the holes on terminal strip.

3)push the terminal strip down into module and lock it up.

Caution

When mounting the CTH200 PLC vertically in high vibration environment, the DIN rail blocks should be used, thus backplane mounting is highly recommended to achieve high vibration protection.

- Disassembling CPU or expansion modules

1)Dismantle the power of CTH200 CPU.

2)Dismantle all cables and wires on module.

3)Open the front cover to pull up the extended flat cable from neighbor expansion module if there has one.

4)Dismount out the mounting screw or open the DIN clamp.

5)Remove the CPU and modules.

- Disassembling terminal strip

1)Open the cover of the terminal strip.

2)Plug the screwdriver into the slot of terminal block as shown in the following picture.

3)Pull down and push out the strip.

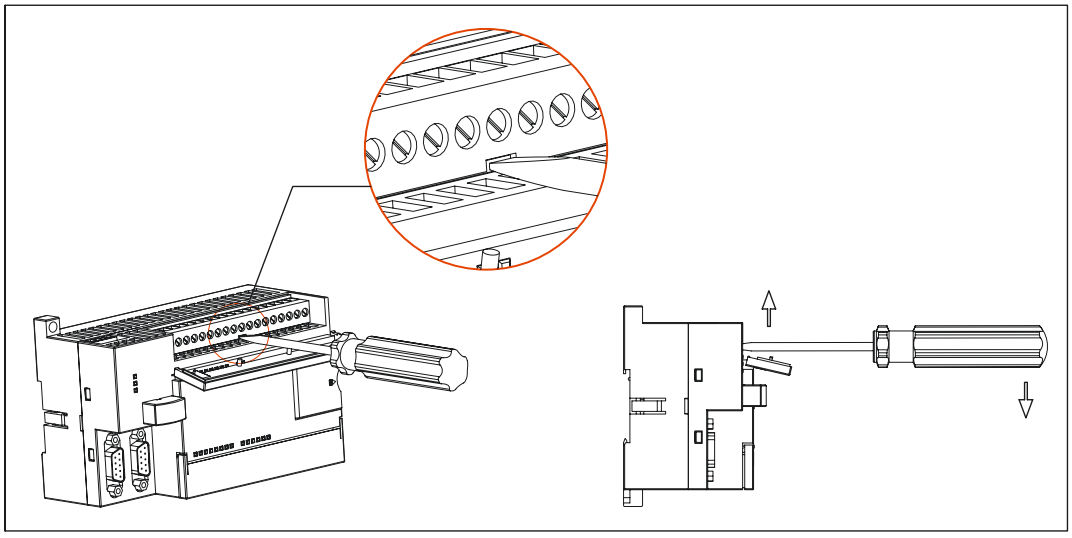


Figure3-3 Dismantle the terminal strip

3.5 Replace battery card

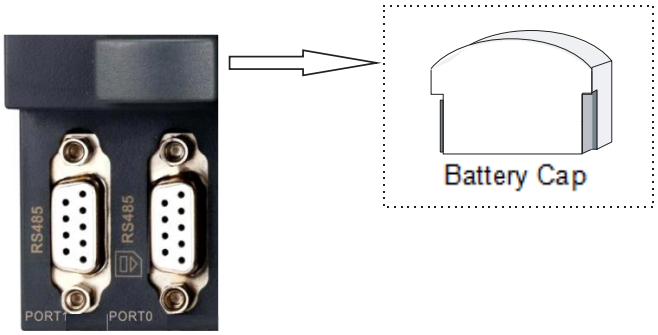
Battery card is optional for CTH200 PLCs and it is removable, please proceed as following to replace it:

1) Unplug the cap of battery card with power-off.

2) Remove the original card vertically, in case damaging the card slot.

3) Plug the new battery card into slot and close the cap again.

It's recommended to backup data and cut-off the power of PLC, then you can replace with new battery. Battery Cap



Caution

Make sure replacing battery card with same specifications and models. Be careful to assemble/disassemble the battery, avoid damaging the other parts. Save all related data before replacing.

3.4 Grounding and Wiring

CTH200 PLCs and related devices must all be powered down before grounding and wiring. The available Electrical coding rules must be obeyed and related safety standards should be followed while installing and operating all devices.

It's important for all devices to ground and wire correctly, providing the optimal features and best noise protection for your system.

Always follow appropriate safety precautions and ensure that power to the CTH200 is disabled before attempting to install or remove the CTH200 or related equipment.

警告

Failure to disable all power to the PLC and related equipment during grounding or wiring procedures could result in death or serious injury to personnel, and/or damage to equipment.

3.6 Suppression Circuit

You should equip inductive loads with suppression circuits to limit voltage rise when the control output turns off. Suppression circuits protect your outputs from premature failure due to high inductive switching currents. In addition, suppression circuits limit the electrical noise generated when switching inductive loads.

Notice
The effectiveness of a given suppression circuit depends on the application, and you must verify it for your particular use. Always ensure that all components used in your suppression circuit are rated for use in the application.。

DC Outputs and Relays That Control DC Loads

The DC outputs have internal protection that is adequate for most applications. Since the relays can be used for either a DC or an AC load, internal protection is not provided.

Figure 3-4 shows a sample suppression circuit for a DC load. In most applications, the addition of a diode (A) across the inductive load is suitable, but if your application requires faster turn-off times, then the addition of a Zener diode (B) is recommended. Be sure to size your Zener diode properly for the amount of current in your output circuit.

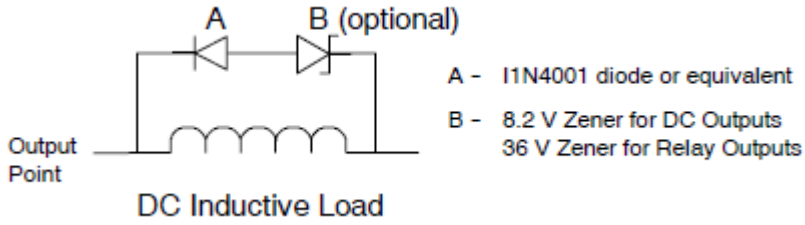


Figure 3-4 Suppression Circuit for a DC Load

AC Outputs and Relays That Control AC Loads

The AC outputs have internal protection that is adequate for most applications. Since the relays can be used for either a DC or an AC load, internal protection is not provided.

Figure 3-4 shows a sample suppression circuit for an AC load. When you use a relay or AC output to switch 115 V/230 VAC loads, place resistor/capacitor networks across the AC load as shown in this figure. You can also use a metal oxide varistor (MOV) to limit peak voltage. Ensure that the working voltage of the MOV is at least 20% greater than the nominal line voltage.

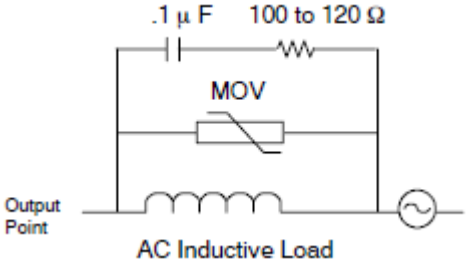


Figure 3-5 Suppression Circuit for an AC Load

4 Technical Specifications

4.1 General Technical Specifications

All S7-200 CPUs and expansion modules conform to the technical specifications listed in Table 4-1:

Table 4-1 Physical performance specifications for CTH200 PLCs

Item	Description
Rated Power	AC: 220V, DC: 24V
Input	AC: 85 V～265V, DC: 20.4 ~ 28.8V
Operation Temp	0 ～ 55℃
Storage Temp	-25 ～ 70℃
Ventilation	Inlet Air 50.8 mm below unit
Humidity	5 ～ 95% (non-condensing)
Electrical Interference	Pulse width 50ns, repetition frequency 5kHz, 2,000V voltage peak
Vibration	Frequency 10～57Hz, range 0.1mm, accel 1.0g, 10 times each dimension
High voltage insulation	Terminal to ground 2200VDC, I/O port to other terminal 1500VAC, dwell time 1 minute
Ground	Type 3 (single point grounding with multi-branch)
Operating environment	Dust proof, Noncorrosive environment
Toppling	100 mm, 4 drops, unpacked
Free Fall	1 m, 5 times, packed for shipment

4.2 CPU Specifications and Diagram

4.2.1 CPU Specifications

Table 4-2 Performance specifications for CTH200 CPUs

Items	Description		
	H224/H226L	H224X/H226XL	H228XL
Size (W×H×D)	137×96×71.3mm	196.5×96×71.3mm	200×100×69.5mm
Boolean execution speed	0.22μs	0.15μs	
Float execution speed	12μs	8μs	8μs

User Program		8+4KB	H224X: 12+4KB H226XL: 24+48KB H228XL: 48+24+24KB	
Data		8KB	H224X: 8+100KB H226XL/H228XL: 10+100KB	
Data hold with power-off		FlashROM, Max. 8KB, permanent	super-capacitor and lithium battery, Max. 10KB, 200 hours	
Digital I/O Image		128DI/128DQ (not including image for CAN communication)	640DI/640DQ (including image for CAN communication)	
Analog I/O Image		32AI/32AQ (not including image for CAN communication)	194AI/194AQ (including image for CAN communication)	
Bit Memory (M)		256 bits		
Local Memory (L)		64 bytes		
SCR (S)		256 bits		
Pulse inputs		14	14	36
HSC	Single phase	4 at 50KHz (HSC0~HSC3), only support HSC mode 0 and 9	6 at 50KHz (HSC0~HSC5)	
	Two phase	--	4 at 30KHz (not including HSC3 and HSC5)	
HSC input voltage		18~26V		
HSPSO (Transistor output)		Motion ctr outputs: 3 at 50KHz, Q0.0~Q0.2	Motion ctr outputs: 2 at 50KHz PTO/PWM: 2 at 50KHz Q0.0~Q0.1	
Timed interrupts		2 with 1 ms resolution		
Edge interrupts		4 up and/or 4 down		
Max. No. of expansion modules		7		
BD expansion board		1		
LED indicator		SF (RED): ON - system error, OFF - normal		
		RUN (Green): ON - Run, OFF - Stop		
		STOP (Orange): ON - Stop, OFF - Run		
		RMC (Green): ON - Enable RMC, OFF - Disable RMC		
		LINK/ACT (Green): ON - connected, flash - transfer, OFF - disconnected		
Run switch		RUN/STOP, reset IP settings with 6 times dial in 2s (note: RUN→STOP counts 1 and so as with STOP→RUN)		
Analog potentiometer		None	2 with 8 bit resolution	None
Real-time clock		Built-in with resolution of ±120s/m.		

Program Card	Support. users can choose to “overwrite/not overwrite” the program/data blocks.	
Battery Card	No	Yes
Memory Card	No	Yes
Timer	Total for 256 1ms: 4 10ms: 16 100ms: 236	Total for 512 1ms: 4 10ms: 272 100ms: 236
Counter	256 (data-hold while power-off)	

Table 4-3 Power specifications for CTH200 CPUs

Item	Description
Input Voltage	85~264VAC (47-63HZ), 20.4~28.8VDC, with anti-reverse protection
Inrush current	8A @ 264VAC, 6A @ 28.8VDC
Isolation (field to logic)	AC: 1500VAC DC: no isolation
Hold up time (loss of power)	120/240VAC: 10ms/20ms 24VDC: 10ms
Expansion bus +5V	660mA
BD expansion board +5V	200mA
Communication port +5V	10mA, 100R resistor
Sensor supply 24VDC	<=300mA, ripple noise (<10MHZ) <1V PP

表 4-4 Communication specifications for CTH200 CPUs

CPU	H224/H226L	H224X/H226XL	H228XL
RS485 communication			
No. of COM ports	H224/H224X: 2, in which 1 PPI and 1 freeport H226L/H226XL: 2, PPI/Freeport H228XL: 1, PPI/Freeport		
PPI Baud rate	9.6Kbps, 19.2Kbps, 187.5Kbps		
Freeport Baud rate	1.2Kbps～115.2Kbps		
Cable length (max.)	With Isolated repeater: 1000m at 187.5Kbps, 1200m at 38.4Kbps Without Isolated repeater: 50m		
Stations (max.)	32 for each segment, 126 for each network		
Masters (max.)	32		
Isolation	No		
Ethernet communication			
Interface type	1 standard Ethernet port		
communication standard	IEEE802.3		
transmission speed	10Mbps/100Mbps self-adaption		
self-adaption cross-connect	Yes	No	

Industrial Ethernet interface (10/100Mbps)	RJ45		
Protocol type	UDP_PPI, MODBUS_TCP, Ethernet		
Configuration method	PC Searching PLC and downloading configuration via Ethernet port		
Connections (Max.)	Up to 8 UDP and 6 TCP connections for each PLC		
IT connection (Max.)	8 UDP_PPI connections 5 MODBUS_TCP connections, master / slave insensitive	8 UDP_PPI connections, 4masters/4slaves. 4 MODBUS_TCP connections, 2masters/2slaves	8 UDP_PPI connections, 4masters/4slaves. 6个MODBUS_TCP connections, 3masters/3slaves
User data volume	Up to 200 bytes used for TCP/IP Up to 240 bytes used for MODBUS_TCP		
COM	Local: 1~65535 Remote MiCO server: mico.co-trust.com Port: 20000		
Time for start or restart after reset	Approx. 5s		
Indicators	SF (RED): ON - system error, OFF - normal		
	RUN (Green): ON - Run, OFF - Stop		
	STOP (Orange): ON - Stop, OFF - Run		
	RMC (Green): ON - Enable RMC, OFF - Disable RMC		
	LINK/ACT (Green): ON - connected, flash - transfer, OFF - disconnected		
Cable length (Max.)	100m		
Isolation	COM port isolated		
Cable	Ethernet: CAT5e shield cable		

Table 4-5 Digital input specifications for CTH200 CPUs

Item	H224/H224X	H226L/H226XL	H228XL
No. of Inputs	14	24	36
Input Type	Drain/Source		
Rated Voltage	24VDC		
Voltage Range	20.4~28.8VDC		
Surge	35VDC，持续0.5s		
Logic 1 (min.)	15 VDC, 2.5mA		
Logic 0 (max.)	5 VDC, 1mA		
Permissible leakage current (max.)	1mA		
Input filter	Configurable, H224/H226L support 3.4ms and 6.4ms; H224X/H226XL/H228XL support 0.2ms, 0.4ms, 0.8ms, 1.6ms, 3.2ms, 6.4ms, 12.8ms, default as 6.4ms		

Isolation (field to logic) Isolation groups	500VAC for 1 minute See wiring diagram
Inputs on simultaneously	All
Cable length (max.) Shielded Unshielded	 500 m normal inputs, 50 m HSC inputs 300 m normal inputs

Table 4-6 Digital output specifications for CTH200 CPUs

Items		Transistor	Relay	
		H224/H226L H224X/H226XL	H224/H226L H224X/H226XL	H228XL
Type		Solid State-MOSFET (Sourcing)	Dry contact	
Rated voltage		24VDC	24VDC 或 110V/220VAC	
Voltage Range		20.4~28.8VDC	5～30VDC: 5～250VAC	
Surge current (max.)		8A for 100ms	5A for 4s@10% duty cycle	
Rated current per point (max.)		0.5A	2.0A	
Rated current per common (max.)		6A	8A	
Lamp load (max.)		5W	DC 30W, AC 200W	
On State resistance (contact)		0.3 Ω typical (0.6 Ω max.)	0.2 Ω (maximum when new)	
Isolation Optical (galvanic, field to logic)		500VAC for 1 minute	1500VAC for 1 minute	
Delay (max.)	Off to on	H224/H226L: 15μs H224X/H226XL: 2μs(Q0.0, Q0.1), 15μs (all other)	H224/H226L: 50μs H224X/H226XL/H228XL: 10ms	
	On to off	H224/H226L: 130μs H224X/H226XL: 10μs(Q0.0, Q0.1), 130μs(all other)	H224/H226L: 200μs H224X/H226XL/H228XL: 10ms	
Lifetime mechanical cycles		--	10,000,000 (no load)	
Lifetime contacts		100,000 (rated load 2A)		
Outputs on simultaneously		All		
Connecting two outputs in parallel		No	Yes, only outputs in same group	
Cable length (max.) Shielded Unshielded		 500m 150m		

Specifications for program and data memory

Table4-7 Program Specifications for CTH200 CPUs

Items	Description	
Instructions	Basic instruction set for CTH200	
Software	Magicworks PLC/Step7 MicroWIN (Program for using Ethernet port is only supported with Magicwork PLC.)	
Interface	RS485/Ethernet port	
Program online	Support for H224X/H226XL/H228XL	
Program language	STL/LAD	
POU	Types/No.	Main program: 1(OB1)
		Subprogram: 128(0-127)
		Interrupt routine: 126(2-127), OB0 reserved, OB1 as main program
	Nesting depth	Main Program: 8 levels
		Interrupt routine: 1 level
Accumulator	4	
Built-in library	MODBUS RTU Communication library MODBUS TCP Communication library PID_T Communication library (H224/H226L supports 16 channels; H224X/H226XL/H228XL supports 64 channels)	

Table 4-8 Data memory specifications

Items	H224/H226L	H224X/H226XL /H228XL	H224/H226L	H224X/H226XL/ H228XL
	Digital input image area (I)		Digital output image area (Q)	
Bit address range	I0.0～I15.7	I0.0～I79.7	Q0.0～Q15.7	Q0.0～Q79.7
Byte address range	IB0~IB15	IB0~IB79	QB0~QB15	QB0~QB79
Word address range	IW0~IW14	IW0~IW78	QW0~QW14	QW0~QW78
DWord address range	ID0~ID12	ID0~ID76	QD0~QD12	QD0~QD76
Access	immediate/direct/indirect access			
Data hold	power-down data retention is not supported			
	Analog input image area (AI)		Analog output image area (AQ)	
Bits for each channel	16 bit			
Word address range	AIW0～AIW62	AIW0~AIW386	AQW0~AQW62	AQW0~AQW386
Access	immediate/direct/indirect access			
Data hold	power-down data retention is not supported			
	Variable memory(V)			
	H224/H226L	H224X	H226XL/H228XL	
Storage (bytes)	8K	8K (expanded up to 108K)	10K (expanded up to 110K)	
Bit address range	V0.0～V8191.7	V0.0～V8191.7	V0.0～V10239.7	
Byte address	VB0～VB8191	VB0～VB8191	VB0～VB10239	

range			
Word address range	VW0～VW8190	VW0～VW8190	VW0～VW10238
DWord address range	VD0～VD8188	VD0～VD8188	VD0～VD10236
Access	immediate/direct/indirect access		
Data hold	power-down data retention is not supported		
	special memory (SM)		
	H224/H226L	**H224X/H226XL/H228XL**	
Storage	550bytes	650bytes	
Bit address range	SM0.0~SM549.7	SM0.0~SM649.7	
Byte address range	SMB0~SMB549	SMB0~SMB649	
Word address range	SMW0~SMW548	SMW0~SMW648	
DWord address range	SMD0~SMD546	SMD0~SMD646	
Access	The first 30 bytes can be accessed with read-only, support direct/indirect access		
Note: for detailed information about SM, please refer to appendix L in this document.			
Internal memory (M)			
Storage (bytes)	32 bytes		
Bit address range	M0.0~M31.7		
Byte address range	MB0~MB31		
Word address range	MW0~MW30		
DWord address range	MD0~MD28		
Access	direct/indirect access		
Data hold	configurable as all or partial retention at power-down		
Local variable (L)			
Storage (bytes)	64 bytes		
Bit address range	L0.0~L63.7		
Byte address range	LB0~LB63		
Word address range	LW0~LW62		
DWord address range	LD0~LD60		
Access	direct access		
Data hold	Retention for subprogram (only for H224X and H226XL), no data retention.		
Accumulator register (AC)			
No.	4		
Bit address range	Not support		
Byte address range	AC0~AC3		
Word address range	AC0~AC3		
DWord address range	AC0~AC3		
Access	Direct access		

Data hold	Not support			
Sequence Control Relay (S)				
Storage (bytes)	32			
Bit address range	S0.0~S31.7			
Byte address range	SB0~SB31			
Word address range	SW0~SW30			
DWord address range	SD0~SD28			
Access	direct/indirect access			
Data hold	Not support			
Timer (T) - H224/H226L				
Type	**Resolution**	**Quantity**	**No.**	**Max. time**
TONR	1ms	2	T0, T64	32.767s
	10ms	8	T1~T4, T65~T68	327.67s
	100ms	54	T5~T31, T69~T95	3276.7s
TON/TOF	1ms	2	T32, T96	32.767s
	10ms	8	T33~T36, T97~T100	327.67s
	100ms	182	T37~T63, T101~T255	3276.7s
Timer (T) - H224X/H226XL/H228XL				
Type	**Resolution**	**Quantity**	**No.**	**Max. time**
TONR	1ms	2	T0, T64	32.767s
	10ms	8	T1~T4, T65~T68	327.67s
	100ms	54	T5~T31, T69~T95	3276.7s
TON/TOF	1ms	2	T32, T96	32.767s
	10ms	8+256	T33~T36, T97~T100, T256~T511	327.67s
	100ms	182	T37~T63, T101~T255	3276.7s
Access	Support direct/indirect accessing for counter register, only direct accessing for status bit			
Retention	Can be configurable for the current count value, not support for status bit			
Counter (C)				
No.	256			
counting mode	Count up/count down/count up and down			
Max. value	32767			
Access	Support direct/indirect accessing for counter register, only direct accessing for status bit			
Retention	Can be configurable for the current count value, not support for status bit			

Table 4-9 data types for CH200

Type	Size (bit)	description	Value range
Boolean	1	布尔值	0~1
Byte	8	Unsigned byte	0~255
Word	16	Unsigned integer	0~65535
integer	16	Signed integer	-32768~+32767
Dword	32	Unsigned double integer	0~4294967295

Double Integer	32	Signed double integer	-2147483648~+2147483647
REAL	32	IEEE 32 bits float	+1.175495E-38~+3.402823E+38 -1.175495E-38~-3.402823E+38
String	1~255 x 16	ASCII string: 1 bytes characters + ASCII characters	none

Password access control

Table 4-10 Password access control for CTH200

Items	Level 1	Level 2	Level 3	Level 4
Read-write user data	Y	Y	Y	Y
RUN/Stop/power on reset	Y	Y	Y	Y
Read-write real time clock	Y	Y	Y	Y
Write Q at STOP	Y	validate password	validate password	validate password
Mandatory data	Y	validate password	validate password	validate password
Upload program block/DB/hardware configuration	Y	Y	validate password	N
download program block/DB/hardware configuration	Y	validate password	validate password	validate password (hardware configuration is not permitted to download)
Clear program block/DB/hardware configuration	Y	validate password	validate password	validate password (hardware configuration is not permitted to delete, , Allow to delete all three)
Edit at Runtime	Y	validate password	validate password	N
First or multiple scan	Y	validate password	validate password	validate password
Refresh scan	Y	validate password	validate password	validate password
Project Comparison	Y	Y	validate password	N
Program condition monitoring (timestamp compare is allowed)	Y	Y	Y	Y
Program condition monitoring (timestamp compare is not allowed)	Y	validate password	validate password	N

Real time clock and interrupt

Table 4-11 Real time clock for CTH200

Factory setting	Not set, fixed at 00:00:00 of 1/1/1990, Sunday
Retention at power down	Approx. 100h (typical at 25℃)
Resolution	Bias <120s each month
Read clock	Read via TODR/TODRX instruction or software

Set clock	Set via TODW/TODWX instruction or software	
General clock format (8 bytes)		
T BYTE	**Description**	**Byte data**
0	Year(0-99)	Current year (BCD value)
1	Month(1-12)	Current Month (BCD value)
2	date(1-31)	Current date (BCD value)
3	hour(0-23)	Current hour (BCD value)
4	minute(0-59)	Current minute (BCD value)
5	second(0-59)	Current second (BCD value)
6	0	Reserved, always set as 00
7	day of the week(1-7)	The current day of the week, 1=sunday (BCD value)
Extended clock format (19 bytes)		
0	Year(0-99)	Current year (BCD value)
1	Month(1-12)	Current Month (BCD value)
2	date(1-31)	Current date (BCD value)
3	hour(0-23)	Current hour (BCD value)
4	minute(0-59)	Current minute (BCD value)
5	second(0-59)	Current second (BCD value)
6	0	Reserved, always set as 00
7	day of the week (1-7)	The current day of the week, 1=sunday (BCD value)
8	Time zone	00H-03H, 08H,10H-13H, FFH
9	Modified hours (0-23)	Modified values, hour (BCD value)
10	Modified minutes (0-59)	Modified values, minute (BCD value)
11	Starting month (1-12)	Starting month in DST (BCD value)
12	Starting date (1-31)	Starting date in DST (BCD value)
13	Starting hour (0-23)	Starting hour in DST(BCD value)
14	Starting minute (0-59)	Starting minute in DST (BCD value)
15	Ending month (1-12)	Ending month in DST (BCD value)
16	Ending date (1-31)	Ending date in DST (BCD value)
17	Ending hour (0-23)	Ending hour in DST (BCD value)
18	Ending minute (0-59)	Ending minute in DST (BCD value)

The following table lists interrupts supported by CTH200.

Table 4-12 interrupts supported by CTH200

Groups and priority	No.	Group	Description
Communication and diagnostic events (Top Priority)	8	0	Port 0: receive character
	9	0	Port 0: transfer complete
	23	0	Port 0: complete receiving message
	24	0	Port 1: complete receiving message
	25	0	Port 1: receive character
	26	0	Port 1: transfer complete
	36	0	Module diagnostics interrupt
disperse (Medium Priority)	0	1	rising edge, I0.0
	2	1	rising edge, I0.1
	4	1	rising edge, I0.2
	6	1	rising edge, I0.3
	1	1	falling edge, 10.0
	3	1	falling edge, I0.1
	5	1	falling edge, I0.2
	7	1	falling edge, I0.3
	12	1	HSC0 CV=PV
	27	1	HSC0 direction change
	28	1	HSC0 External recovery/Zphase
	13	1	HSC1 CV=PV
	14	1	HSC1 direction change
	15	1	HSC1 External recovery
	16	1	HSC2 CV=PV
	17	1	HSC2 direction change
	18	1	HSC2 External recovery
	19	1	PTO 0 complete interrupt
	20	1	PTO 1 complete interrupt
	32	1	HSC3 CV=PV
	29	1	HSC4 CV=P
	30	1	HSC4 direction change
	31	1	HSC4 External recovery/Z phase
	33	1	HSC5 CV=PV
Timer (Lowest priority)	10	2	timer interrupt 0
	11	2	timer interrupt 1
	21	2	Timer T32 CT=PT interrupt
	22	2	Timer T96 CT=PT interrupt

4.2.2 CPU Schematic and wiring diagrams

Schematics

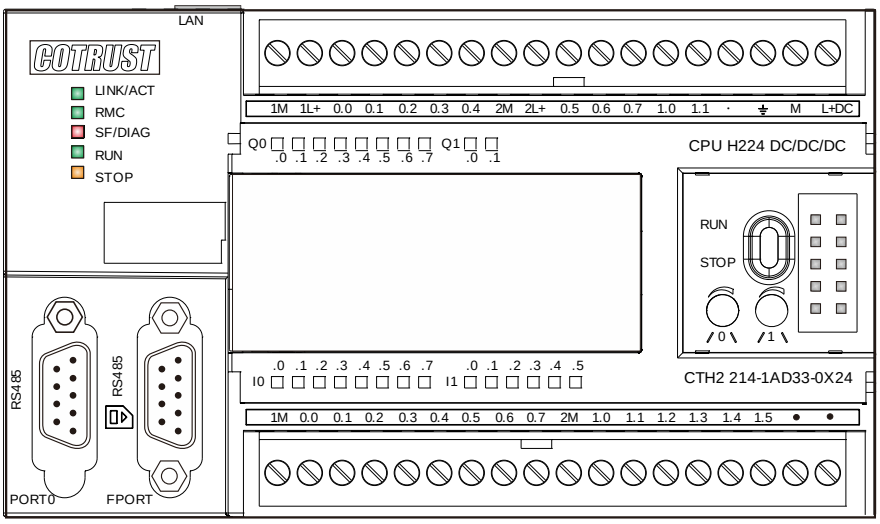


Figure 4-1 CTH2 214-1AD33-0X24

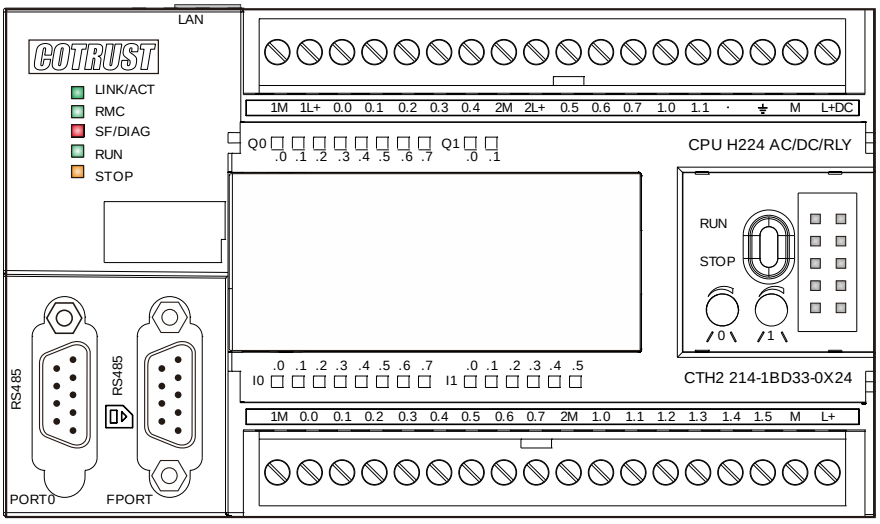


Figure 4-2 CTH2 214-1BD33-0X24

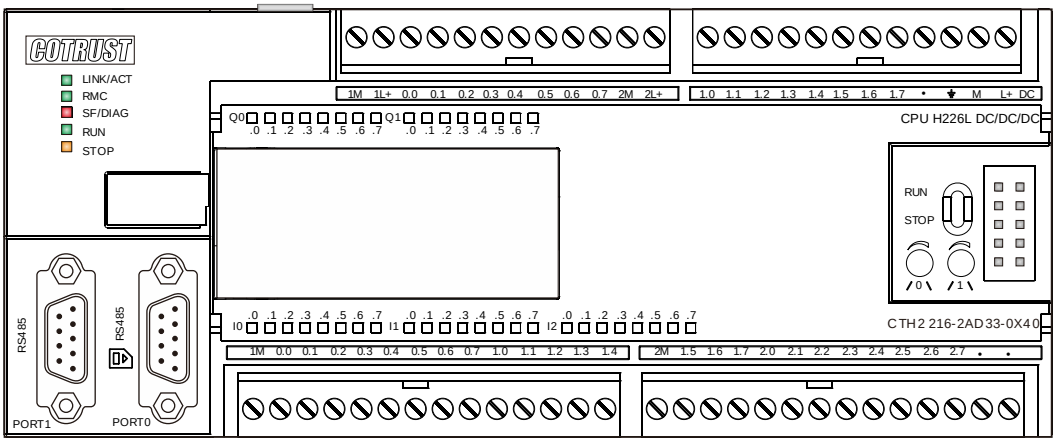


Figure 4-3 CTH2 216-2AD33-0X40

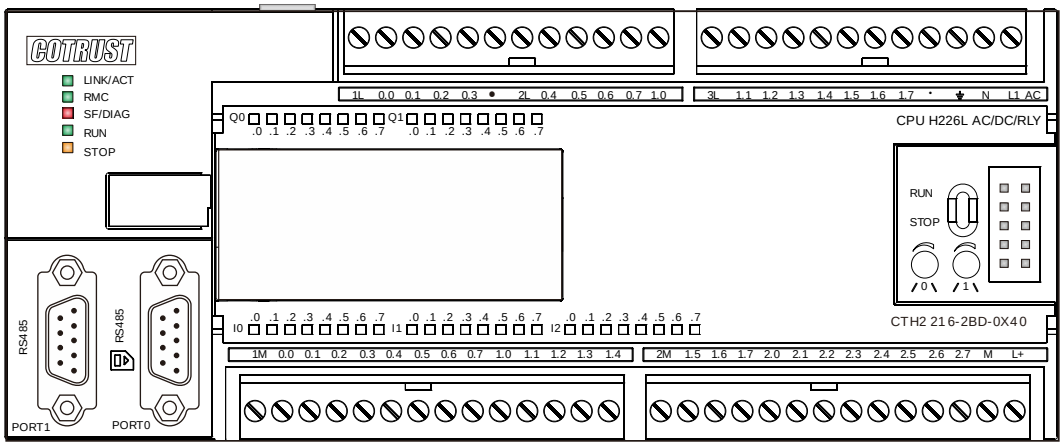


Figure 4-4 CTH2 216-2BD33-0X40

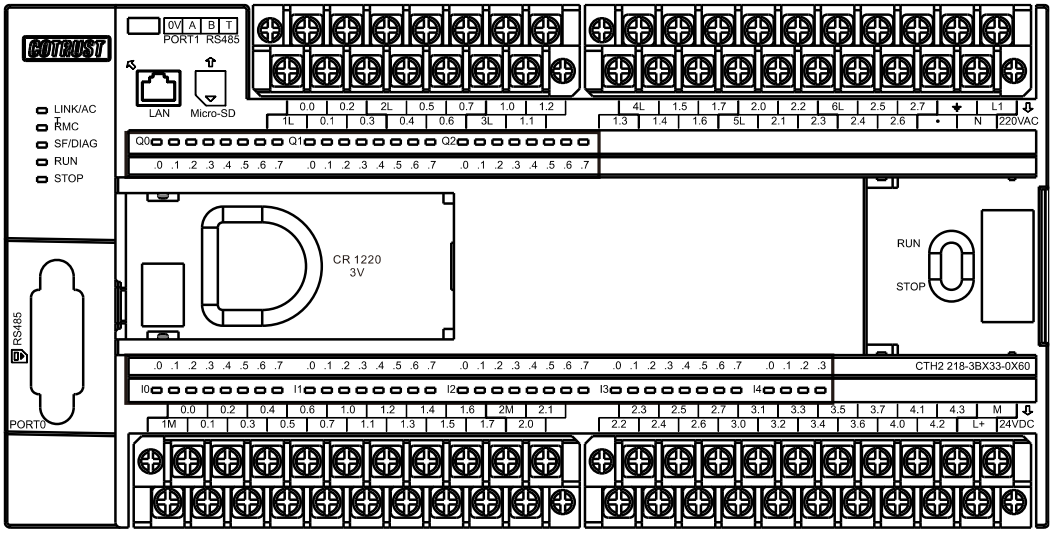


Figure 4-5 CTH2-218-3BX33-0X60

Wiring Diagrams

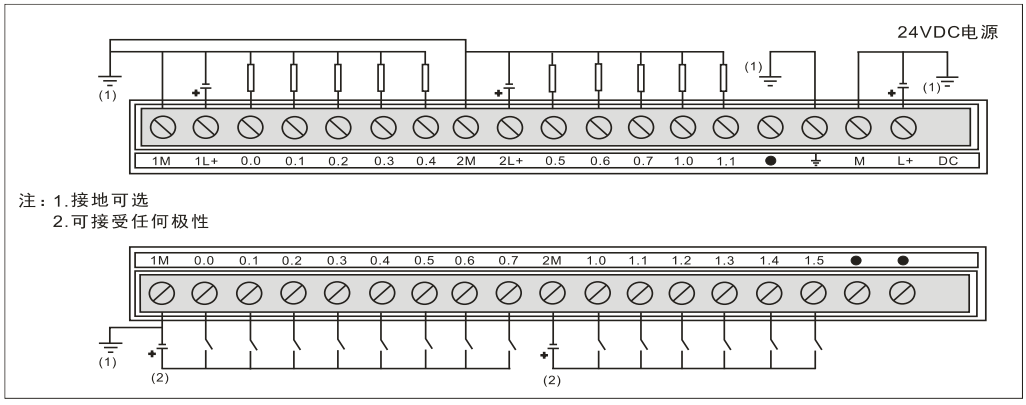


Figure 4-6 CTH2 214-1AD33-0X24

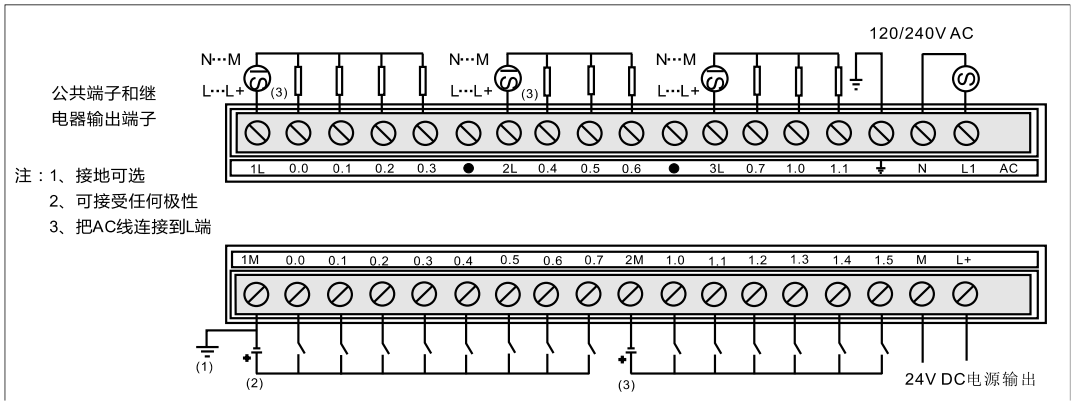


Figure 4-7 CTH2 214-1BD33-0X24

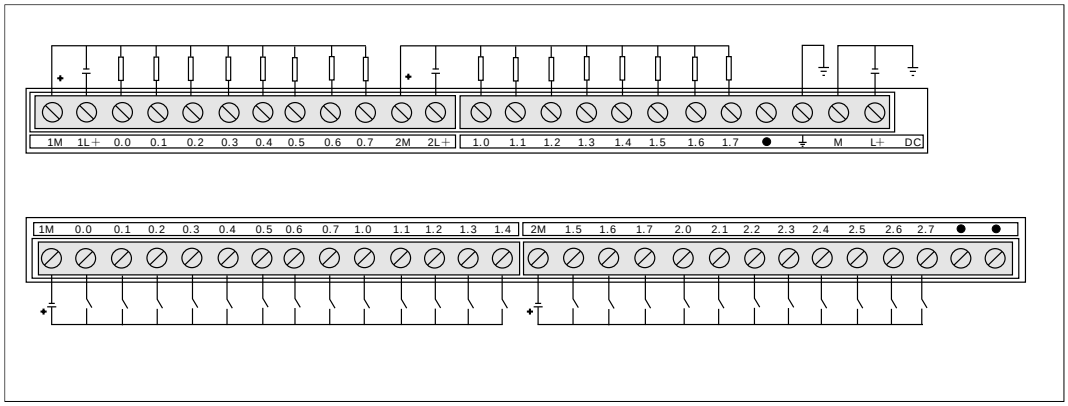


Figure 4-8 CTH2 216-2AD33-0X40

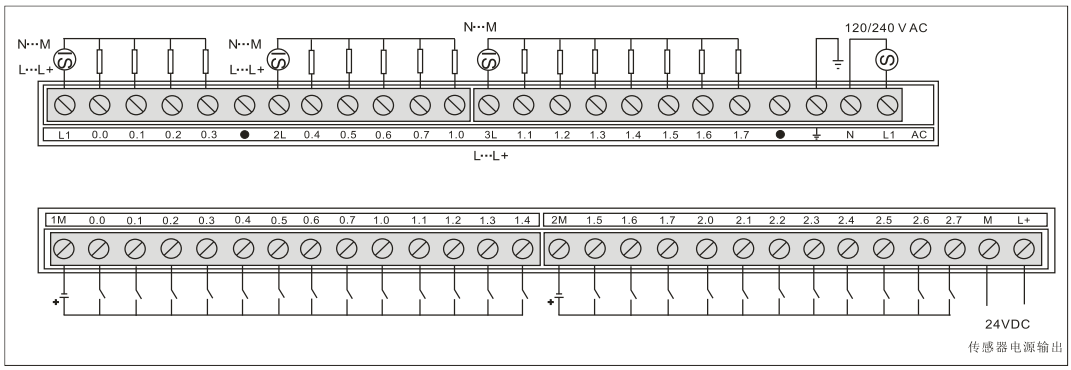


Figure 4-9 CTH2 216-2BD33-0X40

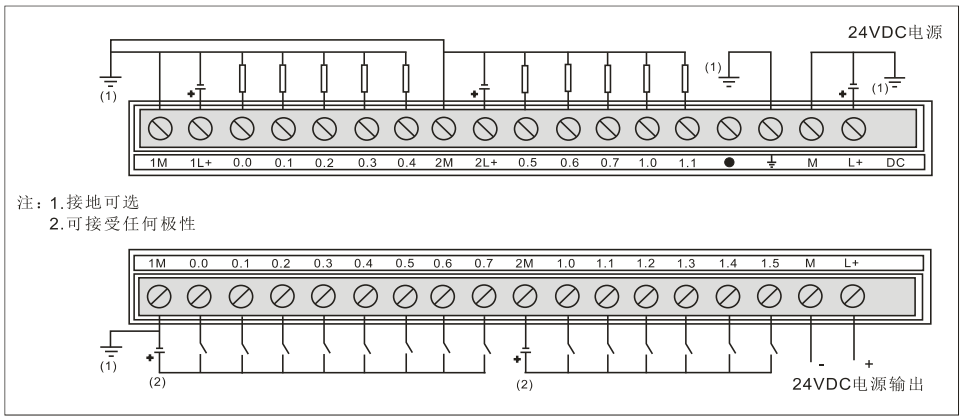


Figure 4-10 CTH2 214-1AX33-0X24

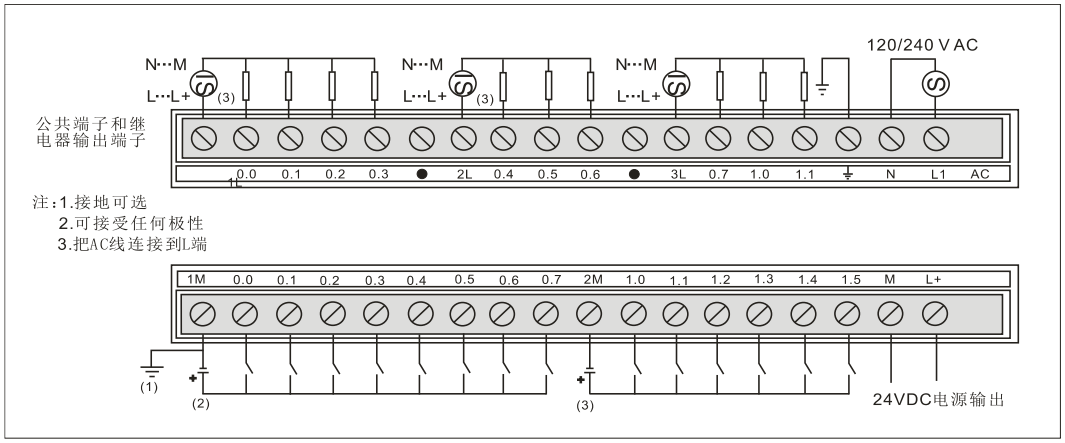


Figure 4-11 CTH2 214-1BX33-0X24

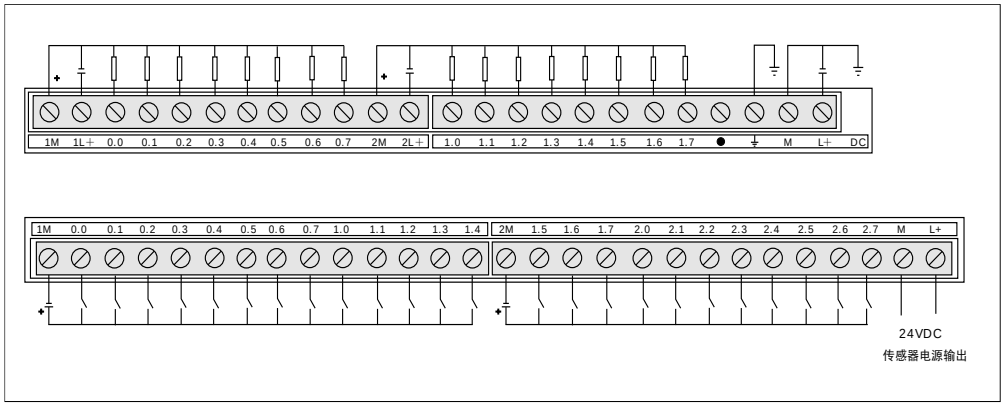


Figure 4-12 CTH2 216-2AX33-0X40

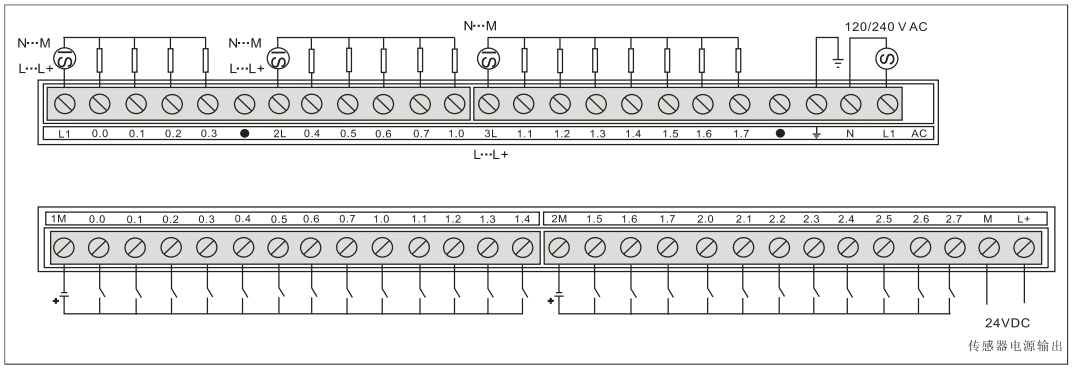


Figure 4-13 CTH2 216-2BX33-0X40

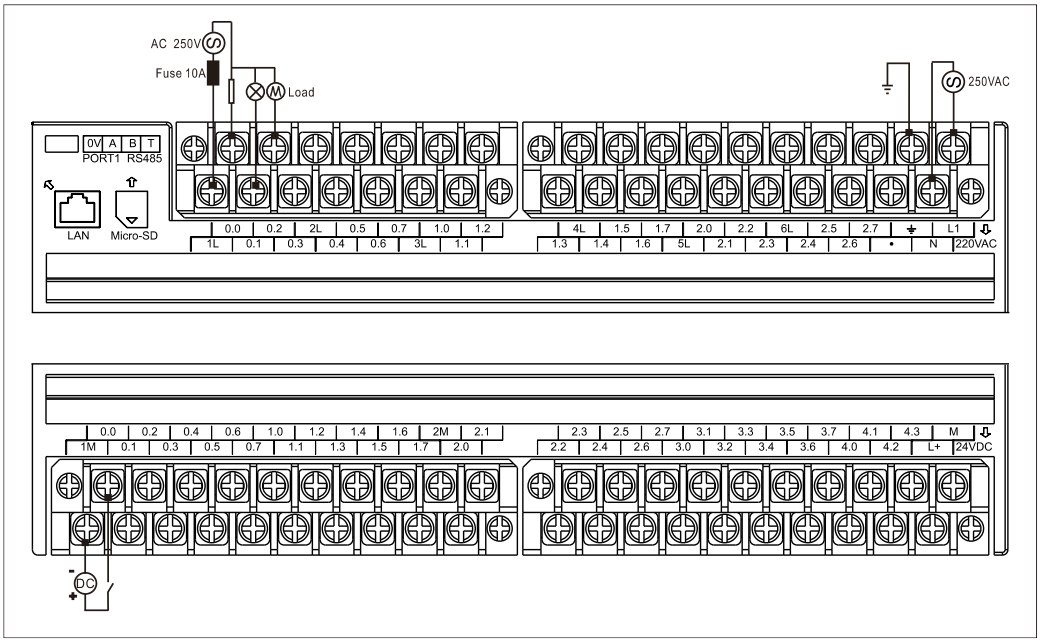


Figure 4-14 CTH2 218-3BX33-0X60

4.2.3 Communication Port

Pin Assignments for CTH200 PLC communication ports

Table 4-14-1 Standard RS485 Communication port

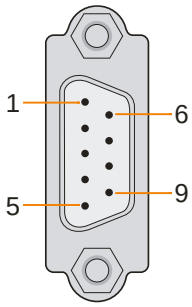
Connector	Pin Number	Port 0	Port 1
	1	Chassis ground	Chassis ground
	2	+24V Return	+24V Return
	3	RS485 signal B	RS485 signal B
	4	RTS (TTL)	RTS (TTL)
	5	+5V Return	+5V Return
	6	+5V, 100Ω	+5V, 100Ω
	7	+24V	+24V
	8	RS485 signal A	RS485 signal A
	9	NC	NC
	Connector shell	Chassis ground	Chassis ground

Table 4-14-2 4pin RS485 Communication port (only for CPU H228XL)

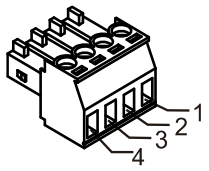
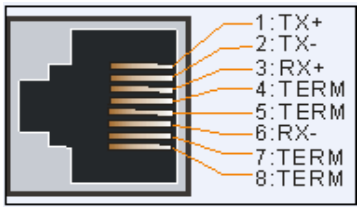
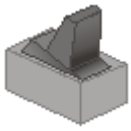
Connector	Pin Number	Signal	Definition
	1	0V	Logic common
	2	A	RS485 signal A
	3	B	RS485 signal B
	4	T	Terminal resistor, connect with pin2

Table 4-14-3 RJ45 Ethernet port

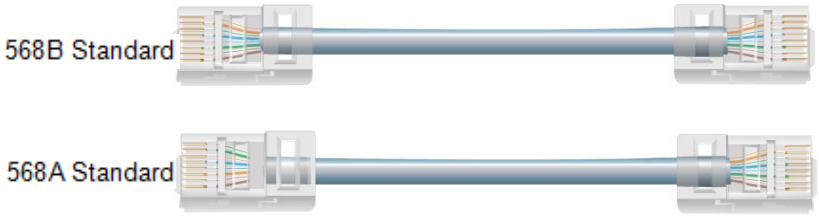
RJ45 Connector	Pin Number	Signal	Definition
	1	TX+	Data send positive
	2	TX-	Data send negative
	3	RX+	Data receive positive
	4	TERM	--
	5	TERM	--
	6	RX-	Data receive negative
	7	TERM	--
	8	TERM	--

4.2.4 DIP Switch

Two-state switch	State	Operation	Signal definition
	ON	UP	RUN
	OFF	Down	STOP
		Dial 6 times in 2 seconds	Reset IP (RUN->STOP counts, vice versa)

4.2.5 Standard networking cable

There are two kinds of specification shown as following:



parallel lines - identical sequence, 568B color code.
Crosswire - different sequence, 568A color code.

4.3 Digital Expansion Modules Specifications

4.3.1 Digital Input Modules Specifications

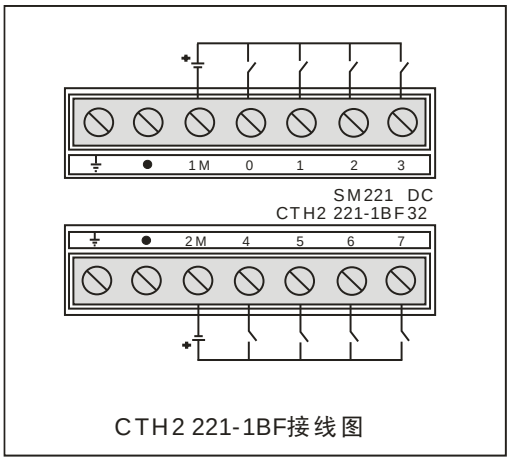
Table 4-16 Digital Input Modules Specifications

Order No.	CTH2 221-1BF32	CTH2 221-1BH32	CTH2 221-1BL32
Dimension			
Size (W×H×D)	46 × 96 × 62mm	71.3 × 96 × 62mm	138 × 96 × 62mm
Power Supply			
Power loss	2W	3W	3W
Power	24VDC		
+5VDC current	57mA	79mA	179mA

consumption			
Input			
Inputs	8	16	32
Type	Drain/Source		
Input Voltage			
Rated voltage	24VDC		
Max. Permit Voltage	30VDC		
Surge	35VDC, 0.5s		
Logic "1"	15～30V		
Logic "0"	0～5V		
Isolation			
Optical (galvanic, field to logic)	500VAC for 1 minute		
Isolation Groups	4 points		8 points
Input delay (max.)	4.5ms		
Leakage current (max.)	1mA AC		
Cable length (max.)			
Unshielded	300m		
Shielded	500m		
Output on simultaneously			
40℃	8	16	32
50℃	8	16	32

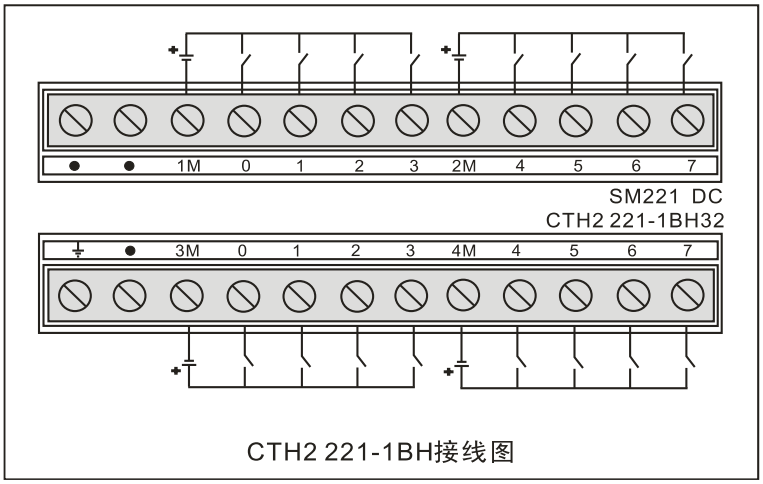
Wiring Diagrams

SM221 DI Module (CTH2 221-1BF32)



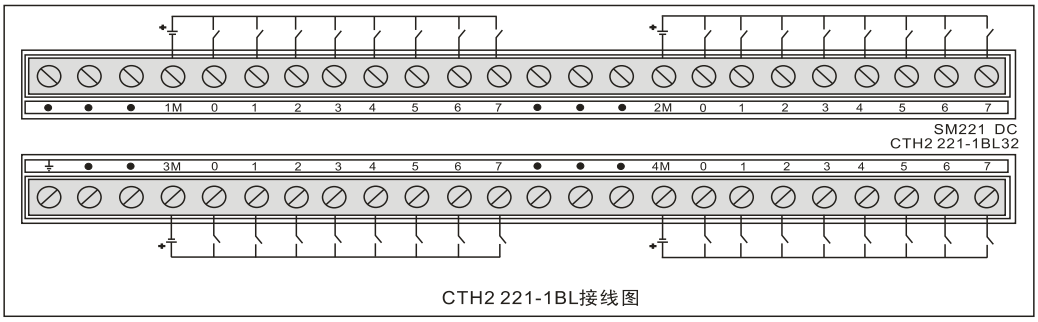
CTH2 221-1BF接线图

SM221 DI Module (CTH2 221-1BH32)



CTH2 221-1BH接线图

SM221 DI Module (CTH2 221-1BL32)



CTH2 221-1BL接线图

4.3.2 Digital Output Modules Specifications

Transistor Output

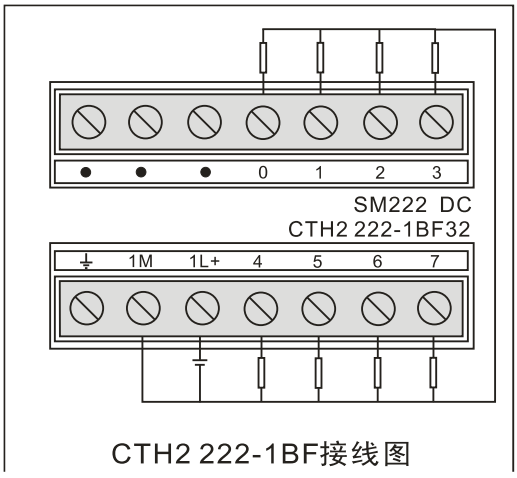
Table 4-17 Digital Output Modules Specifications

Order No.	CTH2 222-1BF32	CTH2 222-1BH32	CTH2 222-1BL32
Dimension			
Size(W×H×D)	46 × 96 × 62mm	71.3 × 96 × 62mm	138 × 96 × 62mm
Power supply			
Power loss	2W	3W	3W
+5VDC consumption	57mA	79mA	174mA
Output			
No.	8	16	32
Type	固态MOSFET		
Voltage			
Rated voltage	24VDC		
Voltage range	20.4～28.8VDC		
Logic"1"	Min. 20VDC		
Logic"0"	Max. 0.1VDC (10KΩ load)		
Output current			
Signal"1"	0.5A	0.5A	0.5A
Outputs per	8	8	8

common			
Output on simultaneously	8	16	32
Rated current per common (max.)	4A	4A	4A
Lamp load (max.)	5W	5W	5W
On state resistance (contact)	0.3Ω	0.3Ω	0.3Ω
Leakage current (max.)	10μA	10μA	10μA
Surge current (max.)	8A, 100ms	8A, 100ms	8A, 100ms
Isolation			
Optical (galvanic, field to logic)	500 VAC for 1 minute		
Isolation groups	8 points		
Output Delay (RL = 50Ω)			
Off to On	Max. 50μs		
On to Off	Max. 200μs		
Cable length (max.)			
Unshielded	150m		
Shielded	500m		

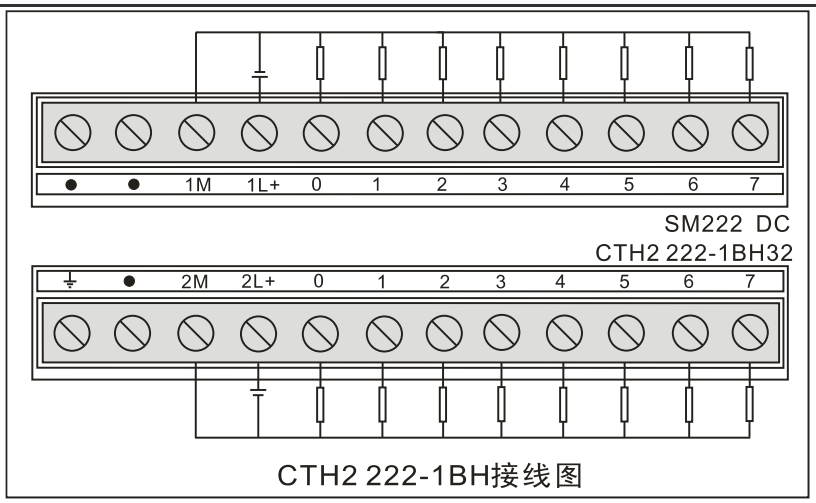
Wiring Diagrams

SM222 Transistor output module (CTH2 222-1BF32)



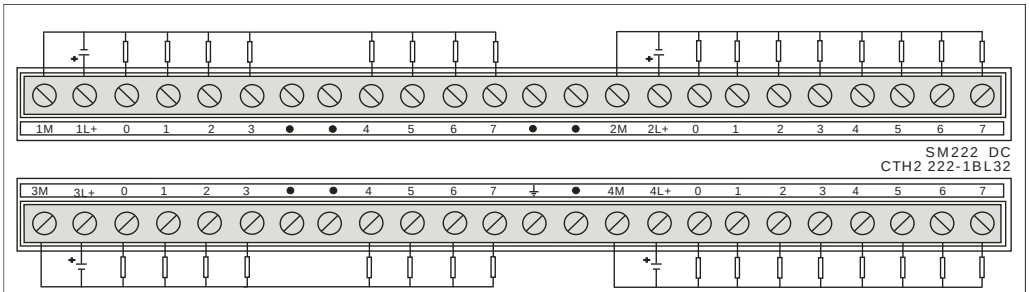
CTH2 222-1BF接线图

SM222Transistor output module (CTH2 222-1BH32)



CTH2 222-1BH接线图

SM222 Transistor output module (CTH2 222-1BL32)



CTH2 222-1BL接线图

Relay Output

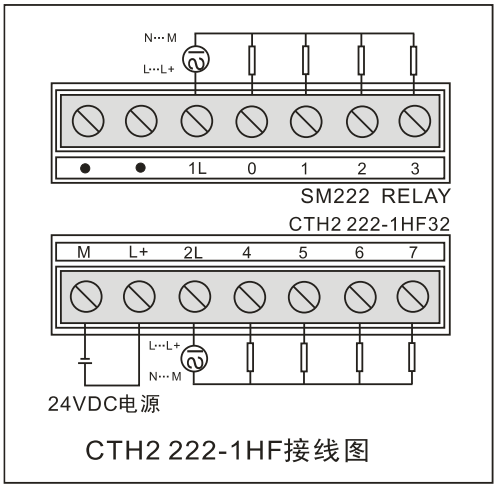
Table 4-18 Digital Output Module Specifications

Order No.	CTH2 222-1HF32	CTH2 222-1HH32
Dimension		
Size(W×H×D)	46 × 96 × 62mm	71.3 × 96 × 62mm
Power Supply		
Power loss	2W	3W
Consumption (+5VDC)	68mA	115mA
Output features		
No.	8	16
Type	Relay - dry contact	
Voltage range	DC: 5～30V, AC: 5～250V	
Output Current		
Logic "1"	2A	2A
Outputs per common	4	4
Output on simultaneously	8	16
Rated current per common (max.)	8A	8A
Lamp load (max.)	5W	5W
On state resistance (contact)	0.2Ω	0.2Ω

Surge current (Max.)	7A	7A
Short protection	External	External
Isolation		
Isolation groups	4 points	
Coil to logic	None	
Coil to contact	1500VAC for 1 minute	
Resistance (coil to contact)	Min. 100MΩ	
Relay		
Switching delay (max.)	15ms	
Switching frequency (max.)	1Hz	
Lifetime mechanical cycles	30,000,000	
Lifetime contacts	300,000	
Cable length (max.)		
Unshielded	150m	
Shielded	500m	

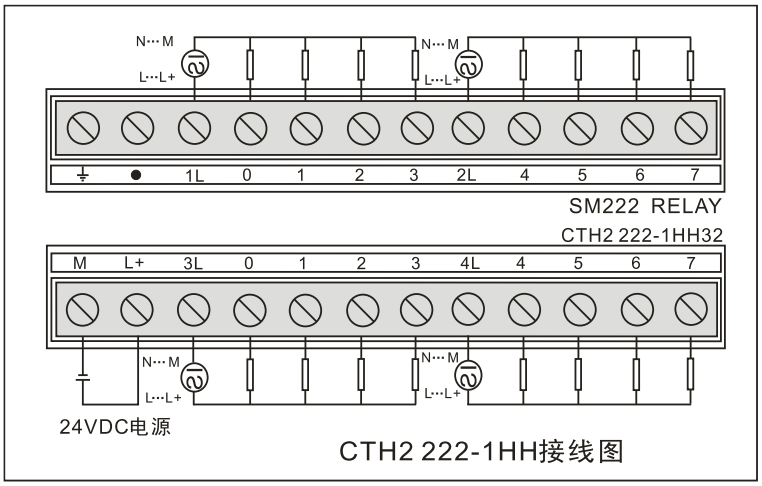
Wiring Diagrams

SM222 Relay output module (CTH2 222-1HF32)



CTH2 222-1HF接线图

SM222 Relay output module (CTH2 222-1HH32)



4.3.3 Digital Input/Output Module Specifications

Transistor Output

Table 4-19 Digital DI/DO Module Specifications

Features	4 DI/DO 24VDC	8 DI/DO 24VDC	16 DI/DO 24VDC
Order No.	CTH2 223-1BF32	CTH2 223-1BH32	CTH2 223-1BL32
Dimension			
Size (W×H×D)	46 × 96 × 62mm	71.3 × 96 × 62mm	138 × 96 × 62mm
Power supply			
Power loss	2W	3W	3W
+5VDC Consumption	57mA	73mA	115mA
Input			
No.	4	8	16
Type	drain/source		
Input Voltage			
Rated Voltage	24VDC		
Max. Permitted voltage	30VDC		
Surge	35VDC, 0.5s		
Logic “1”	15～30V		
Logic “0”	0～5V		
Isolation			
Optical (galvanic, field to logic)	500VAC for 1 minute		
Isolation Groups	4 points	8 points	
Input delay (max.)	4.5ms		
Leakage current (max.)	1mA AC		
Output on simultaneously			
40℃	4	8	16
50℃	4	8	16
Output			

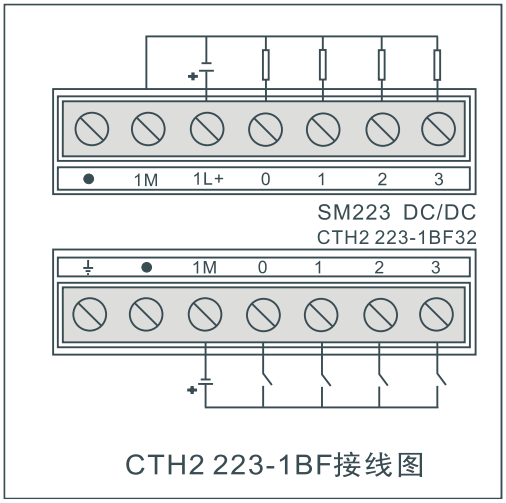
No.	4	8	16
Type	固态MOSFET		
Output Voltage			
Rated load Voltage	24VDC		
Range	20.4～28.8VDC		
Logic "1"	Min. 20VDC		
Logic "0"	Max. 0.1VDC (at 10KΩ load)		
Output Current			
Rated current per point (max.)	0.5A	0.5A	0.5A
Outputs per common	4	8	8
Output on simultaneously	4	8	16
Rated current per common (max.)	2A	4A	4A
Lamp load (max.)	5W	5W	5W
On state resistance (contact)	0.3Ω	0.3Ω	0.3Ω
Leakage current (max.)	10mA	10mA	10mA
Surge current (max.)	8A, 100ms	8A, 100ms	8A, 100ms
Isolation	Optical (galvanic, field to logic), 500VAC for 1 minute		
Isolation groups	4 points	4点	4/4/8点
Output Delay (RL = 50Ω)			
Off to On	Max 50ms		
On to Off	Max 200ms		
Cable length (max.)			
Unshielded	150m		
Shielded	500m		

Caution

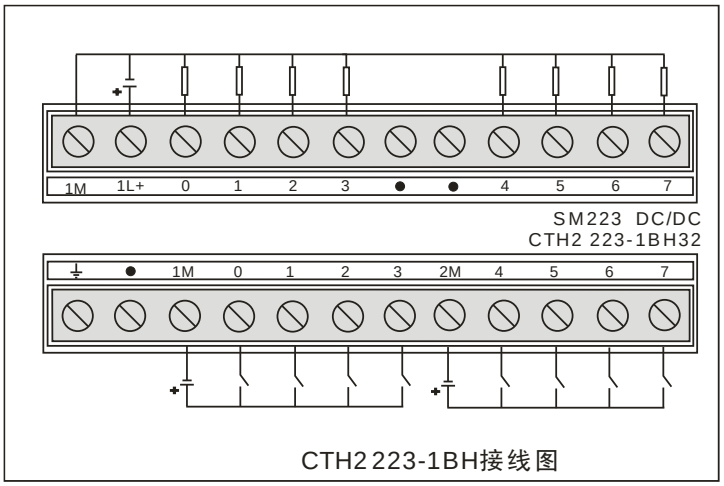
24V DC Digital expansion modules support Short, Overcurrent and Overvoltage Protection.

Wiring Diagrams

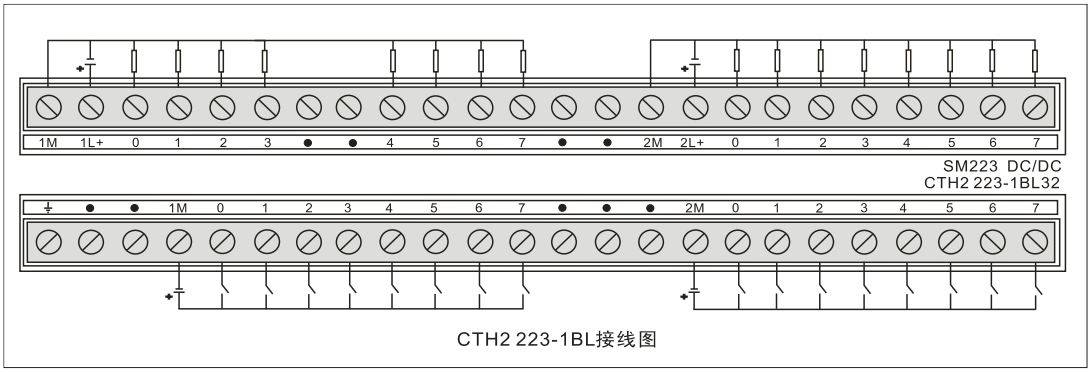
SM223 Digital I/O module (CTH2 223-1BF32)



SM223 Digital I/O module (CTH2 223-1BH32)



SM223 Digital I/O module (CTH2 223-1BL32)



Relay Output

Table 4-20 Digital I/O module Specifications

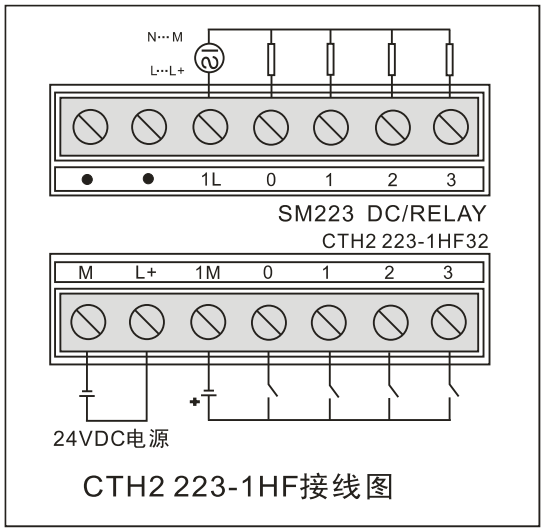
Features	4DI×24VDC 4DO×Relay	8DI×24VDC 8DO×Relay	16DI×24VDC 16DO×Relay
Order No.	CTH2 223-1HF32	CTH2 223-1PH32	CTH2 223-1PL32

Dimension			
Size(W×H×D)	46 × 96 × 62mm	71.3 × 96 × 62mm	138 × 96 × 62mm
Power Supply			
Power Loss	2W	3W	6W
+5VDC consumption	58mA	89mA	150mA
L+ current	output 9mA per point when switch on		
L+ Voltage	20.4－28.8VDC		
Input			
No.	4	8	16
Type	Drain/Source		
Input voltage			
Rating	24VDC		
Max. Permitted voltage	30VDC		
Surge voltage	35VDC, 0.5s		
Logic "1"	15～30V		
Logic "0"	0～5V		
Isolation			
Optical (galvanic, field to logic)	500VAC for 1 minute		
Isolation Groups	4 point	4 point	8 point
Input delay (max.)	4.5ms		
Leakage current (max.)	1mA AC		
Output on simultaneously			
40℃	4	8	16
50℃	4	8	16
Output			
No.	4	8	16
Type	Relay－dry contact		
Output voltage	DC: 5~30V, AC: 5~250V		
Output Current			
Signal "1"	2A	2A	2A
Rated current per common (max.)	8A	8A	8A
Light load	DC: 30W, AC: 200W	DC: 30W, AC: 200W	DC: 30W, AC: 200W
contact resistance	0.2Ω	0.2Ω	0.2Ω
surge current (max)	7A, Contact closure		
short-circuit protection	External		
继电器特性			
Switching delay (max.)	15ms		

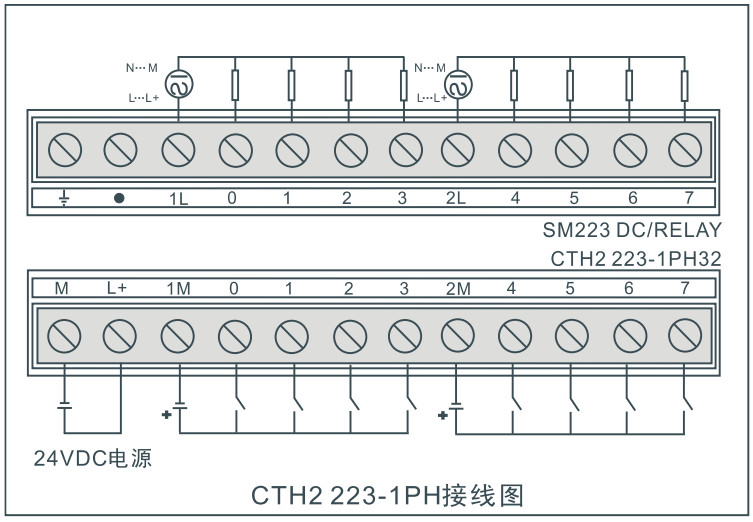
Switching frequency (max.)	1Hz
Lifetime mechanical cycles	30,000,000
Lifetime contacts	300,000
Cable length (max)	
Unshielded	300m
shielded	500m

Wiring Diagrams

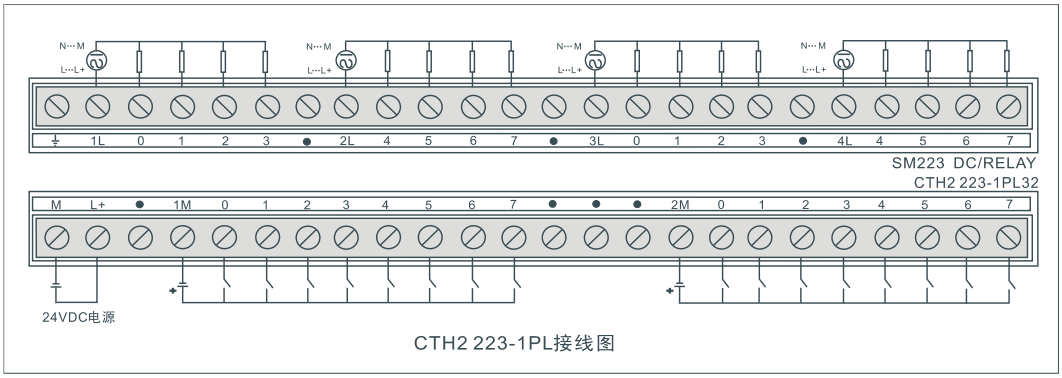
SM223 Digital I/O Module (CTH2 223-1HF32)



SM223 Digital I/O Module (CTH2 223-1PH32)



SM223 Digital I/O Module (CTH2 223-1PL32)



CTH2 223-1PL接线图

4.4 Analog Expansion modules Specification

4.4.1 Analog Input module Specification

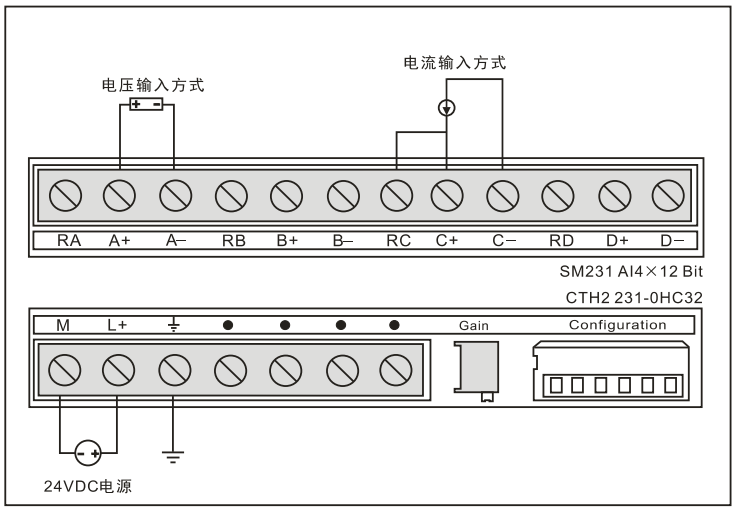
Table 4-21 SM231-0HC Specifications

Dimension	
Size (W×H×D)	71.3×96×62mm
LED	24V power , ON→normal, OFF→faulted
Power Supply	
+5VDC Consumption	87mA
L+	17mA
L+ Coil Voltage	20.4～28.8VDC
Power consumption	2W
Analog Input	
No.	4
Isolation (field to logic)	500VAC for 1 minute Opto-couplers isolation
Input type	Differential
Input ranges	
Voltage (unipolar)	0～10V, 0～5V
Voltage (bi-polar)	±5V, ±2.5V
Current	0～20mA
Data word format	
Unipolar	0～32000
bi-polar	-32000～32000
Resolution, full-scale	
Voltage (unipolar)	2.5mV(0～10V range); 1.25mV(0～5V range)
Voltage (bi-polar)	2.5mV(±5V range); 1.25mV(±2.5V range)
Current	5μA(0～20mA range)
Analog to digital conversion time	< 300μs
Analog input step response	1.5ms
Common mode	40dB, DC 60Hz

rejection	
Common mode voltage	Signal voltage plus common mode voltage must be ≤ 12V
DC Input impedance	》=10MΩ
Maximum input voltage	30V
Maximum input current	30mA

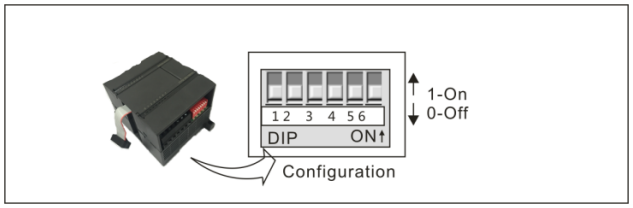
Wiring Diagrams

SM231 AI Module (CTH2 231-0HC32)



Calibration and Configuration

【DIP configuration】



【Input Calibration】

The calibration adjustments affect the instrumentation amplifier stage that follows the analog Multiplexer. Therefore, calibration affects all user input channels. Even after calibration, variations in the component values of each input circuit preceding the analog multiplexer will cause slight differences in the readings between channels connected to the same input signal

To meet the specifications, you should enable analog input filters for all inputs of the module.

Select 64 or more samples to calculate the average value.

To calibrate the input, use the following steps:

1) Turn off the power to the module. Configure DIP to Select the desired input range.

2) Turn on the power to the CPU and module. Allow the module to stabilize for 15 minutes.

3) Using a transmitter, a voltage source, or a current source, apply a zero value signal to one of the input terminals.

4) Read the value reported to the CPU by the appropriate input channel

5) Adjust the GAIN potentiometer until the reading is 32000.

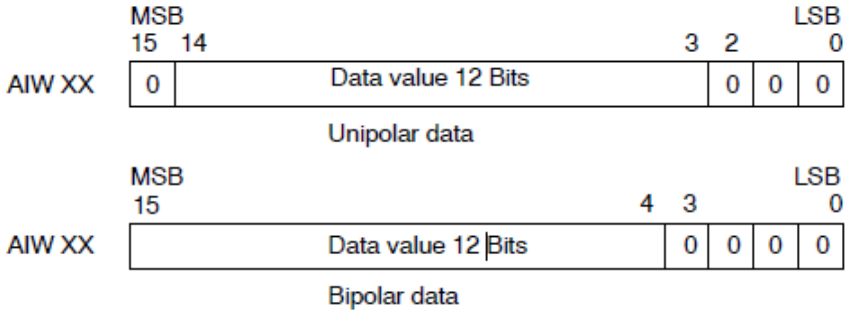
【DIP Configuration】

Figure 4-22 shows how to configure the DIP switch located on the module. SW 1/2/3 can be used for selecting AI range and SW4～SW6 must be set OFF. In these tables, ON is closed, and OFF is open. The same configuration must set for all Analog inputs.

Table 4-22 SM231-0HC DIP configuration

Unipolar			Full Scale Input	Resolution
SW1	**SW2**	**SW3**		
ON	OFF	ON	0 - 10V	2.5mV
	ON	OFF	0 - 5V	1.25mV
			0 - 20mA	5μA
Bipolar			**Full Scale Input**	**Resolution**
SW1	**SW2**	**SW3**		
OFF	OFF	ON	±5V	2.5mV
	ON	OFF	±2.5V	1.25mV

Input Data Format



Notice

The 12 bits of the analog-to-digital converter (ADC) readings are left-justified in the data word format. The MSB is the sign bit: zero indicates a positive data word value.

In the unipolar format, the three trailing zeros cause the data word to change by a count of eight for each one-count change in the ADC value.

In the bipolar format, the four trailing zeros cause the data word to change by a count of sixteen for each one count change in the ADC value.

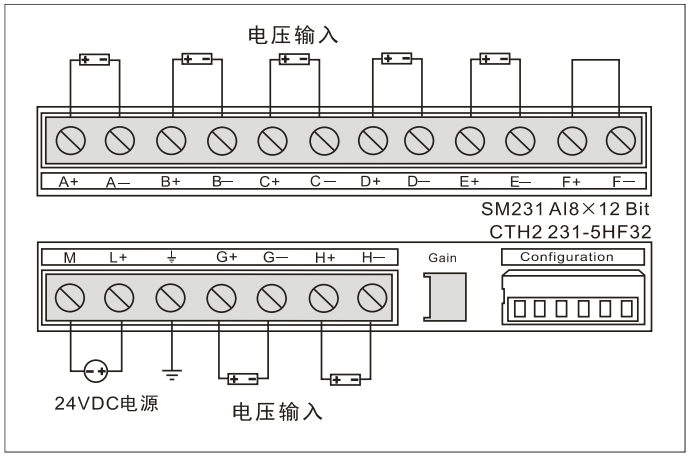
Table 4-23 SM231-5HF Specifications

Dimension	
Size (W×H×D)	71.3 × 96 × 62mm
LED	24V power , ON→normal, OFF→faulted
Power	
+5VDC Consumption	87mA
L+	50mA
L+ Coil Voltage	20.4～28.8VDC
Power consumption	2.5W
Analog Input	
No.	8

Isolation (field to logic)	Opto-couplers isolation, 500V AC for 1 minute
Type	Differential
Signal range	
Voltage (Unipolar)	0～10V, 0～5V
Voltage (Bipolar)	±2.5V (channel 0~7)
Current	0~20mA (channel 6~7)
Data word format	
Unipolar	0～32000
Bipolar	-32000～32000
Resolution, full-scale	
Voltage (Unipolar)	2.5mV (0～10V range); 1.25mV(0～5V range)
Voltage (Bipolar)	2.5mV(±5V range); 1.25mV(±2.5V range)
Analog to digital conversion time	Approx. 10ms
conversion time for 8 channels	100ms
Common mode rejection	40dB, DC - 60Hz
Common mode voltage	-12V≤ Signal voltage plus common mode voltage ≤+12V
DC Input impedance	Voltage ≥2MΩ Current 250Ω
Maximum input voltage	30VDC
Maximum input current	32mA
A/D Converter resolution	Unipolar 12bits, Bipolar 11bits+sign bit
Measure principle	successive approximation
Measuring error	0.5% (max)
Simulate input addressing	AIW

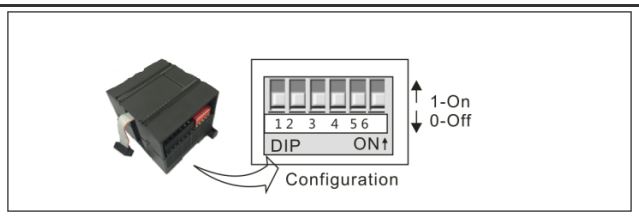
Wiring Diagrams

SM231 high precision AI Module (CTH2 231-5HF32)



<Note> terminate the unused inputs like F+ and F-.

【DIP configuration】



【Range selection】

Table A-21 shows how to configure the SM231 8AI module by using the DIP switches.

Switches 3 through 5 are used for selecting AI range as shown in table 4-24. select the analog input range and resolution. All inputs are set to the same analog input range and format. Table A-21 shows how to select for unipolar/bipolar (switch 6), gain (switches 4 and 5), and attenuation (switches 1, 2, and 3). In these tables, ON is closed, and OFF is open. The switch settings are read only when the power is turned on.

Switch 1/2 are used for selecting current input at channel 6/7, OFF for Voltage and ON for Curent Input.

Table 4-24 SM231-0HF DIP configuration

Unipolar			**Full Scale Input**	**Resolution**
SW3	**SW4**	**SW5**		
ON	OFF	ON	0-10V	2.5mV
	ON	OFF	0-5V	1.25mV
			0-20mA	5μA
Bipolar			**Full Scale Input**	**Resolution**
SW3	**SW4**	**SW5**		
OFF	OFF	ON	±5V	2.5mV
	ON	OFF	±2.5V	1.25mV

4.4.2 Analog Output Module Specification

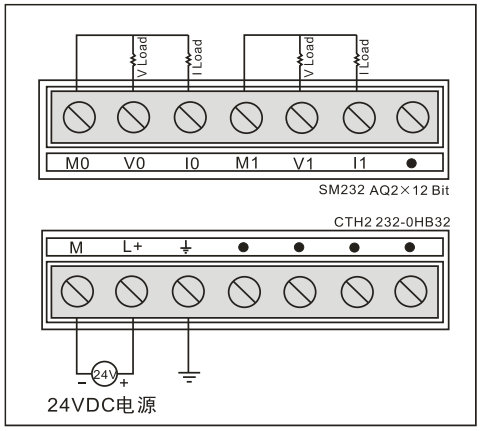
Table 4-25 Analog Output Module Specification

Features	SM232: 2 AQ × 12bits	SM232: 4 AQ × 12bits
Order No.	CTH2 232-0HB32	CTH2 232-0HD32
Dimension		
Size (W×H×D)	46 × 96 × 62mm	71.3 × 96 × 62mm
LED	24V power , ON→normal, OFF→faulted	
Power Supply		
+5VDC Consumption	87mA	87mA
L+	61mA	112mA
L+ Coil Voltage	20.4～28.8VDC	
Power consumption	2W	2W
Analog Output		
No.	2	4
Isolation (field to logic)	Opto-couplers isolation, 500V AC for 1 minute	
Range		
Voltage	±10V	

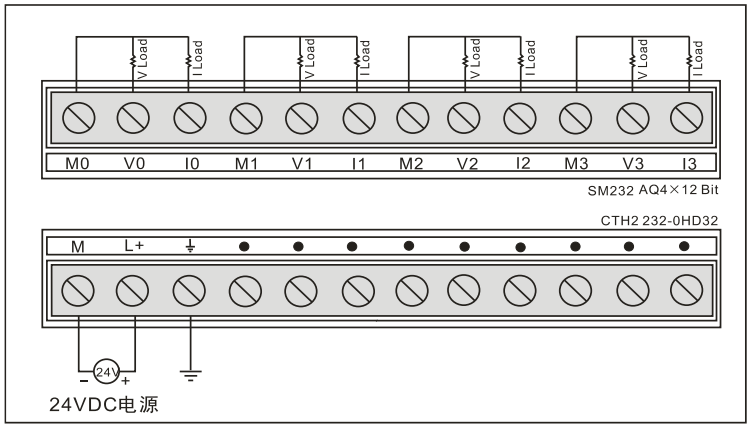
Current	0～20mA
Resolution	
Voltage	12位
Current	11位
Data Word Format	
Voltage	-32000～+32000
Current	0～32000
Measurement error	Typical: Full scale ±0.5%; Worst case: Full scale ±2%
Settling time	
Voltage	100μs
Current	2ms
Max Drive @24V DC	
Voltage	Minimal 5000Ω
Current	Max 500Ω

Wiring Diagrams

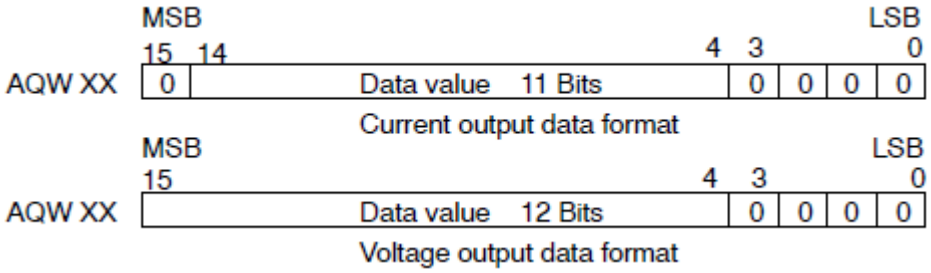
SM232 Analog Output Module (CTH2 232-0HB32)



SM232 Analog Output Module (CTH2 232-0HD32)



Output Data Format



Notice

The 12 bits of the digital-to-analog converter (DAC) readings are left-justified in the output data word format. The MSB is the sign bit: zero indicates a positive data word value. The four trailing zeros are truncated before being loaded into the DAC registers. These bits have no effect on the output signal value.

4.4.3 Analog I/O Module Specification

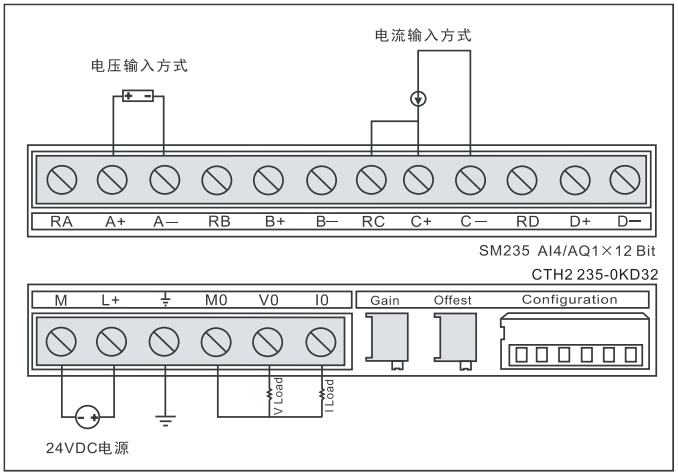
Table 4-26 Analog I/O Module Specification

Dimension	
Size (W×H×D)	71.3 × 96 × 62mm
LED	24V power , ON→normal, OFF→faulted
Power Supply	
+5VDC Consumption	87mA
L+	48mA
L+ Coil Voltage	20.4～28.8VDC
Power consumption	2W
Analog Input	
No.	4
Isolation (field to logic)	Opto-couplers isolation, 500V AC for 1 minute
Type	Differential
Scale Range	
Voltage input (Unipolar)	0-10V, 0-5V, 0-1V, 0-500mV, 0-100mV, 0-50mV
Voltage input (Unipolar)	±10V,±5V,±2.5V,±1V,±500mV, ±250mV, ±100mV,±50mV,±25mV
Current input	0～20mA
Data word Format (Full-Scale)	
Unipolar	0～32000
Bipolar	-32000~32000
Input Resolution	
Voltage input (Unipolar)	2.5mV(0～10V range); 1.25mV(0～5V range)
Voltage input (Unipolar)	2.5mV(±5V range); 1.25mV(±2.5V range)

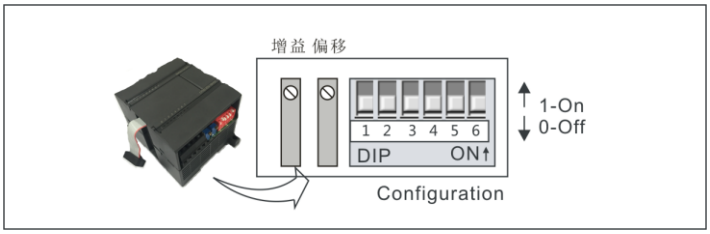
Current input	5μA(0～20mA range)
Analog to digital conversion time	< 300μs
Analog input step response	1.5ms
Common mode rejection	40dB, DC~60Hz
Common mode voltage	Signal voltage plus common mode voltage must be not > 12V
DC Input impedance	> 10MΩ
Maximum input voltage	30V
Maximum input current	30mA
A/D converter resolution	12位
Analog Output	
No.	1
Voltage output	±10V
Current output	0～20mA
Output resolution	
Voltage output	12位
Current output	11位
Data Word format	
Voltage output	-32000～+32000
Current output	0～32000
Accuracy	
Voltage output	Typical: Full scale ±0.5%, worst case: Full scale ±2%
Current output	
Settling time	
Voltage output	100μs
Current output	2ms
Max drive@24V DC	
Voltage output	Min 5000Ω
Current output	Max 500Ω

Wiring Diagrams

SM235 Analog I/O module (CTH2 235-0KD32)



【Calibration and DIP configuration】



【Calibration】

The calibration adjustments affect the instrumentation amplifier stage that follows the analog multiplexer. Therefore, calibration affects all user input channels. Even after calibration, variations in the component values of each input circuit preceding the analog multiplexer will cause slight differences in the readings between channels connected to the same input signal.

To meet the specifications, you should enable analog input filters for all inputs of the module. Select 64 or more samples to calculate the average value.

To calibrate the input, use the following steps:

1. Turn off the power to the module. Select the desired input range.

2. Turn on the power to the CPU and module. Allow the module to stabilize for 15 minutes.

3. Using a transmitter, a voltage source, or a current source, apply a zero value signal to one of the input terminals.

4. Read the value reported to the CPU by the appropriate input channel.

5. Adjust the OFFSET potentiometer until the reading is zero, or the desired digital data value.

6. Connect a full-scale value signal to one of the input terminals. Read the value reported to the CPU.

7. Adjust the GAIN potentiometer until the reading is 32000, or the desired digital data value.

8. Repeat step 3~7 as required.

【量程与增益选择】

Table 4-27 shows how to configure the SM235-0KD module using the configuration DIP switches .Switches 1~6 are used for selecting the analog input range and resolution, SW6 for Unipolar/Bipolar, SW4/5 for Gain, SW1/2/3 for Attenuation. All inputs should apply the settings. In this table, ON is closed, and OFF is open. The switch settings are read only when the power is turned on.

表 4-27-1 SM235-0KD DIP configuration (Unipolar)

Unipolar						Full scale input	Resolution
SW1	SW2	SW3	SW4	SW5	SW6		
ON	OFF	OFF	ON	OFF	ON	0 - 50mV	12.5μV
OFF	ON	OFF	ON	OFF	ON	0 - 100mV	25μV
ON	OFF	OFF	OFF	ON	ON	0 - 500mV	125μV
OFF	ON	OFF	OFF	ON	ON	0 - 1V	250μV
ON	OFF	OFF	OFF	OFF	ON	0 - 5V	1.25μV
ON	OFF	OFF	OFF	OFF	ON	0 - 20mA	5μA
OFF	ON	OFF	OFF	OFF	ON	0 - 10V	2.5mV

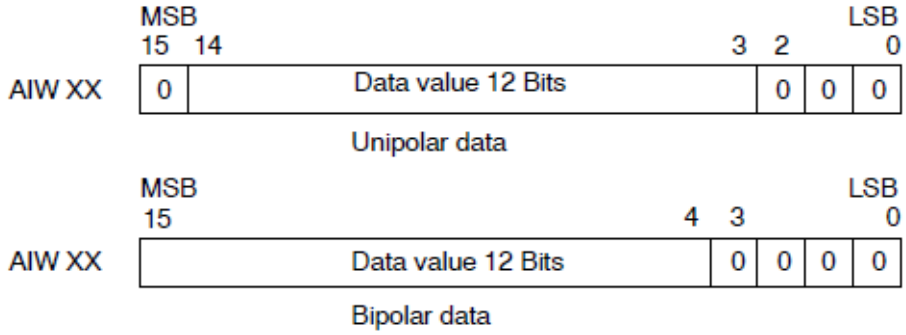
表 4-27-2 SM235-0KDDIP configuration (Bipolar)

Bipolar						Full scale input	Resolution
SW1	SW2	SW3	SW4	SW5	SW6		
ON	OFF	OFF	ON	OFF	OFF	±25mV	12.5μV
OFF	ON	OFF	ON	OFF	OFF	±50mV	25μV
OFF	OFF	ON	ON	OFF	OFF	±100mV	50μV
ON	OFF	OFF	OFF	ON	OFF	±250mV	125μV
OFF	ON	OFF	OFF	ON	OFF	±500mV	250μV
OFF	OFF	ON	OFF	ON	OFF	±1V	500μV
ON	OFF	OFF	OFF	OFF	OFF	±2.5V	1.25mV
OFF	ON	OFF	OFF	OFF	OFF	±5V	2.5mV
OFF	OFF	ON	OFF	OFF	OFF	±10V	5mV

表-4-27-3 SM235-0KD Unipolar/Bipolar, Gain and Attenuation Configuration

SM235 Switches						Unipolar/ Bipolar	Gain	Attenuation
SW1	SW2	SW3	SW4	SW5	SW6		---	---
---	---	---	---	---	ON	Unipolar	---	---
---	---	---	---	---	OFF	Bipolar	---	---
---	---	---	OFF	OFF	---	---	x1	---
---	---	---	OFF	ON	---	---	x10	---
---	---	---	ON	OFF	---	---	x100	---
---	---	---	ON	ON	---	---	无	---
ON	OFF	OFF	---	---	---	---	---	0.8
OFF	ON	OFF	---	---	---	---	---	0.4
OFF	OFF	ON	---	---	---	---	---	0.2

Input Data Format



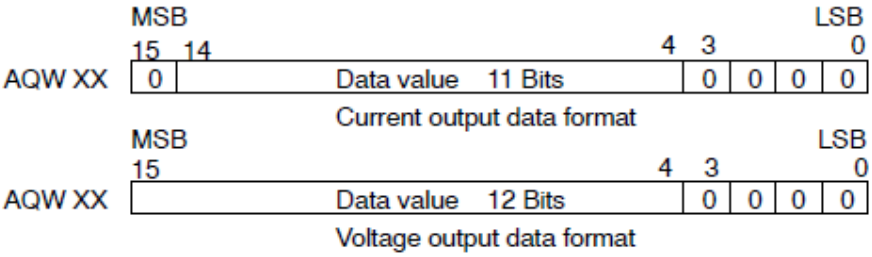
Tip

The 12 bits of the analog-to-digital converter (ADC) readings are left-justified in the data word format. The MSB is the sign bit: zero indicates a positive data word value.

In the unipolar format, the three trailing zeros cause the data word to change by a count of eight for each one-count change in the ADC value.

In the bipolar format, the four trailing zeros cause the data word to change by a count of sixteen for each one count change in the ADC value.

Output Data Format



Tip

The 12 bits of the digital-to-analog converter (DAC) readings are left-justified in the output data word format. The MSB is the sign bit: zero indicates a positive data word value. The four trailing zeros are truncated before being loaded into the DAC registers. These bits have no effect on the output signal value.

4.5 Thermocouple and RTD Expansion Module Specifications

4.5.1 RTD Module Specifications

Table 4-28 RTD Module Specification

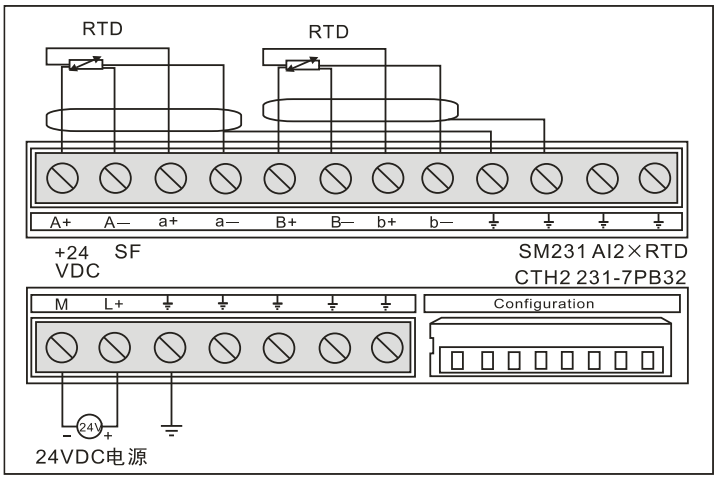
Features	SM231: 2AI×RTD	SM231: 4AI×RTD
Order No.	CTH2 231-7PB32	CTH2 231-7PC32
Dimension		
Size (W×H×D)	71.3 × 96 × 62mm	71.3 × 96 × 62mm

LED	24VDC Power indicator, ON=No Fault, OFF=No 24VDC Power; SF indicator, ON= Module fault; Flash = Override or open wire , OFF=No Fault	
Power supply		
+5VDC Consumption	87mA	87mA
L+	34mA	37mA
L+ Coil Voltage	20.4～28.8VDC	
Power consumption	1.7W	1.7W
Input		
Type	Module ground referenced RTD	
No.	2	4
Input range	RTD types (select one per module): Pt-100Ω, 200Ω, 500Ω, 1000Ω(α=3850ppm, 3920ppm, 3850.55ppm, 3916ppm, 3902ppm) Pt-10000Ω(α=3850ppm) Cu-9.035Ω(α=4720ppm) Ni-100Ω, 120Ω, 1000Ω(α=6720ppm, 6178ppm) R-150Ω, 300Ω, 600Ω	
RTD measuring range	Pt-100Ω, 200Ω, 500Ω, 1000Ω: -200℃～850℃ Pt-10000Ω: -200℃～600℃ NI-0.00672: -80℃～260℃ NI-0.006178: -60℃～300℃ Cu-0.004270: -200℃~260℃ <Note> error when exceeding this range, refer Table 4-30 for Diagnostic details.	
Isolation		
Field to logic	500VAC	
Field to 24 VDC	500VAC	
24 VDC to logic	500VAC	
Common mode input range (input channel to input channel)	0	
Common mode rejection	>120dB@120VAC	
Input resolution		
Temperature	0.1℃/0.1℉	
Voltage	15bits plus sign	
Measuring principle	Σ-Δ	
Module update time: All channels	425ms	825ms
Wire length to sensor	Max 100m	
Wire loop resistance	20Ω, 2.7Ω for Cu	
Noise suppression	85dB@ 50Hz/60Hz/400Hz	

Data word format	
Input impedance	>10MΩ
Maximum input voltage	30VDC(sense), 5VDC(source)
resolution	15bits plus sign
Input Filter attenuation	-3dB@21kHz
Basic error	0.1% FS (resistance)
repeatability	0.05% FS
AI Addressing method	AIW Addressing

Wiring Diagrams

SM231 2AI x RTD module (CTH2 231-7PB32)



SM231 4AI x RTD module (CTH2 231-7PC32)

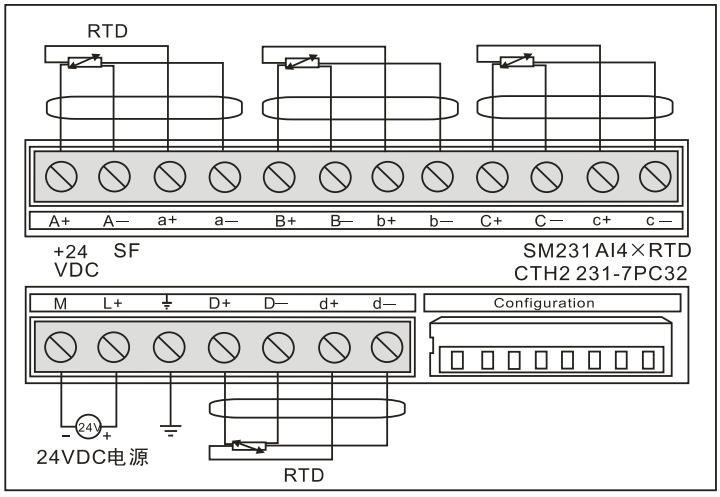


Table 4-29 RTD module diagnostic messages

Type	Channel Data	SF LED	24V LED	Range status bit	24V power failure
No power module	32766	OFF	OFF	0	1
Disconnection	32767(Upscale)	Flash	ON	1	0

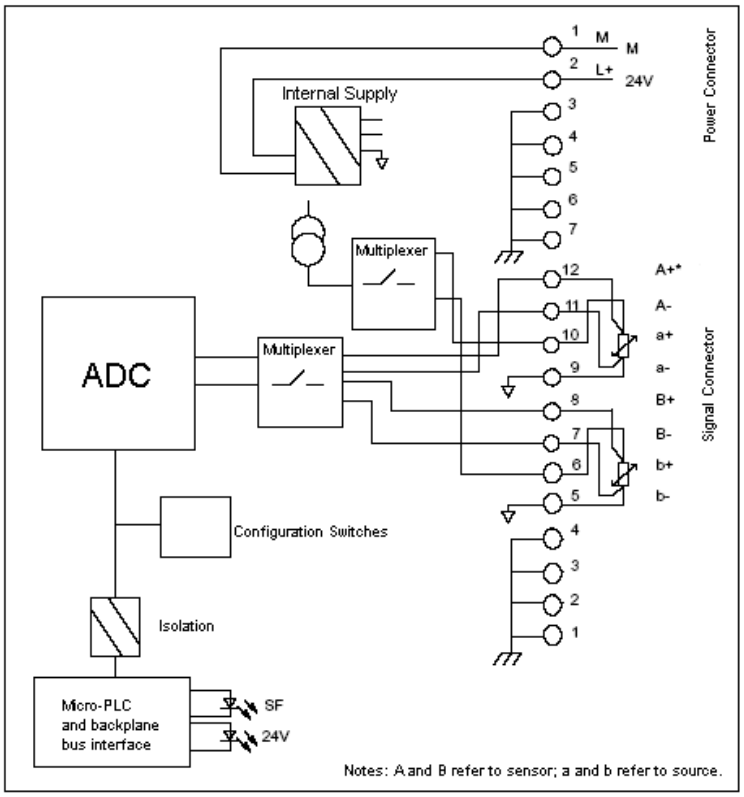
	-32768(Downscale)				
Out of temperature range	32767(Upscale) -32768(Downscale)	Flash	ON	1	0

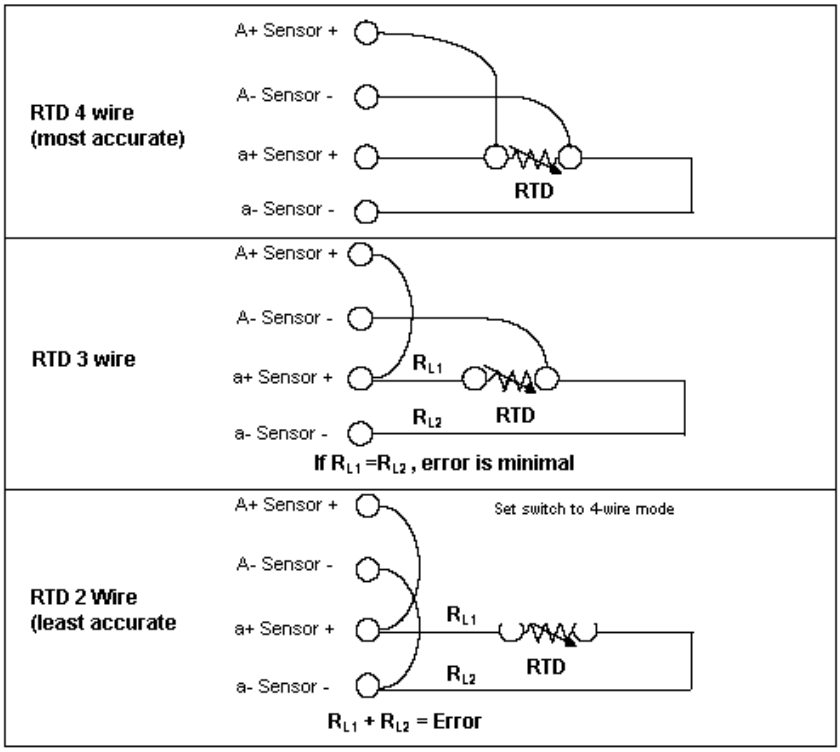
<Note> For relevant error code of each Module，please check the SMB8~21 according the modules sequence.

Table 4-30 SMB8~21 Diagnose Information

SMB8	Module 1 flag register
SMB9	Module 1 error register
SMB10	Module 2 flag register
SMB11	Module 2 error register
SMB12	Module 3 flag register
SMB13	Module 3 error register
SMB14	Module 4 flag register
SMB15	Module 4 error register
SMB16	Module 5 flag register
SMB17	Module 5 error register
SMB18	Module 6 flag register
SMB19	Module 6 error register
SMB20	Module 7 flag register
SMB21	Module 7 error register

RTD-Sensor Wiring





Notes: A refers to sensor; a refers to source

Users can connect the RTD sensor directly to CTH200 SM231 RTD module or using expansion path. Using shielded wire can achieve the best noise immunity, in which the wire must connect to 1-4 pin ground points of the signal connector and make the power connector to share the same ground points.

If you have an unused channel, you can wire the that channel with a resistor in place of the RTD to prevent open wire detection from causing the SF LED to blink. The resistor must be the nominal value of the RTD.

There are 3 methods above to connect RTD module to the sensor. Among that, the RTD 4-Wire has the best accuracy, the RTD 2-Wire has the least accuracy, therefore it's recommended to only using RTD 2-Wire in application which not emphasis accuracy.

【RTD module Configuration】

DIP switches enable you to select RTD type, wiring configuration, temperature scale, and burnout direction. The DIP switches are located on the bottom of the module as shown in Figure A-21. For the DIP switch settings to take effect, you need to power cycle the PLC and/or the user 24V power supply.

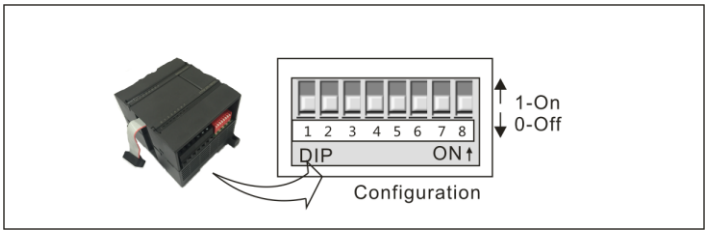


Table 4-31 Selecting SM231 RTD Types

RTD Type	SW1	SW2	SW3	SW4	SW5
100 Pt 0.003850(Default)	0	0	0	0	0

200Ω Pt 0.003850	0	0	0	0	1
500Ω Pt 0.003850	0	0	0	1	0
1000Ω Pt 0.003850	0	0	0	1	1
100Ω Pt 0.003920	0	0	1	0	0
200Ω Pt 0.003920	0	0	1	0	1
500Ω Pt 0.003920	0	0	1	1	0
1000Ω Pt 0.003920	0	0	1	1	1
100Ω Pt 0.00385055	0	1	0	0	0
200Ω Pt 0.00385055	0	1	0	0	1
500Ω Pt 0.00385055	0	1	0	1	0
1000Ω Pt 0.00385055	0	1	0	1	1
100Ω Pt 0.003916	0	1	1	0	0
200Ω Pt 0.003916	0	1	1	0	1
500Ω Pt 0.003916	0	1	1	1	0
1000Ω Pt 0.003916	0	1	1	1	1
100Ω Pt 0.00302	1	0	0	0	0
200Ω Pt 0.003902	1	0	0	0	1
500Ω Pt 0.003902	1	0	0	1	0
1000Ω Pt 0.003902	1	0	0	1	1
Reserved	1	0	1	0	0
100Ω Ni 0.00672	1	0	1	0	1
120Ω Ni 0.00672	1	0	1	1	0
1000Ω Ni 0.00672	1	0	1	1	1
100Ω Ni 0.006178	1	1	0	0	0
120Ω Ni 0.006178	1	1	0	0	1
1000Ω Ni 0.006178	1	1	0	1	0
10000Ω Pt 0.003850	1	1	0	1	1
10Ω Cu 0.004270	1	1	1	0	0
150Ω FS Resistance	1	1	1	0	1
300Ω FS Resistance	1	1	1	1	0
600Ω FS Resistance	1	1	1	1	

Table 4-32 DIP switch settings

SW6	Scale direction	SW7	Scale Unit	SW8	Wiring scheme
0	Upscale (+3276.7 degrees)	0	Celsius (℃)	0	3-wire
1	Downscale (-3276.8 degrees)	1	Fahrenheit (℉)	1	2 wire or 4-wire

4.5.2 Thermocouple Module Specifications

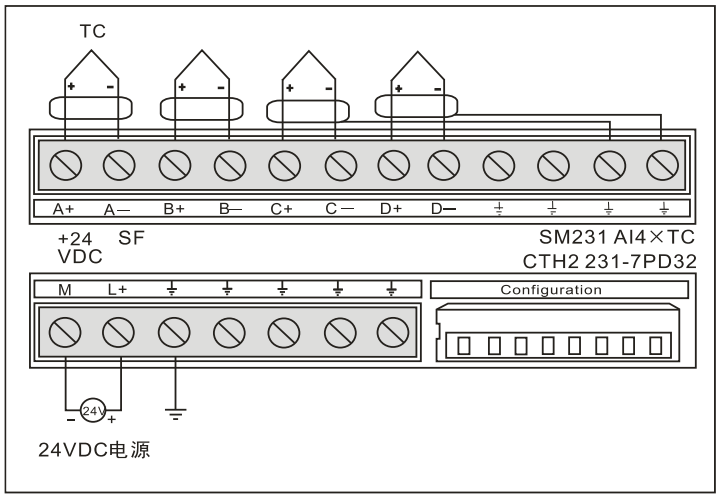
Table 4-33 SM231 Thermocouple Module Specifications

Items	SM231: 4AI×TC	SM231: 8AI×TC
Dimension		
Size (W×H×D)	71.3 × 96 × 62mm	71.3 × 96 × 62mm
LED	24VDC indicator: ON=No fault, OFF=no 24VDC power SF Indicator: ON=Module fault, Flash=Outrange or , OFF=No fault	
Power		
+5VDC consumption	87mA	87mA
L+	30mA	30mA
L+ coil voltage range	20.4～28.8VDC	
Power dissipation	1.7W	1.7W
Input		
Input type	Float TC	
No.	4	8
Input range	TC type: S, T, R, E, N, K, J Voltage range: +/-80mV **<Note>** for temperature measuring range, please refer to the TC measuring range in the end of this section. For error details , please refer to the Table 4-34 and 4-35.	
Isolation		
Field to Logic	500VAC	
Field to 24VDC	500VAC	
24V to Logic	500VAC	
Common mode input range (input channel to input channel)	120VAC	
Common mode rejection	>120dB@120VAC	
Sampling features		
Temperature resolution	0.1℃/0.1℉	
Voltage resolution	15 bits + sign bit	
Transfer principle	Σ-Δ	
Module update time: All channels	425ms	825ms
Wire length to sensor	Max. 100m	
Conductor loop resistance	Max. 100Ω	
Suppression of interference	85dB@ 50Hz/60Hz/400Hz	
Data word format	Voltage: -27648~+27648	
Input impedance	>1MΩ	
Max. Input voltage	30VDC	
Input Filter attenuation	-3dB@ 21kHz	
Basic error	0.1% FS(voltage)	

repeatability	0.05% FS	
cold junction error	±1.5℃	
Addressing method	AIW Addressing	VW Addressing

Wiring Diagrams

SM231 TC input module (CTH2 231-7PD32) x 4TC



SM231 TC input module (CTH2 231-7PF32) x 8TC

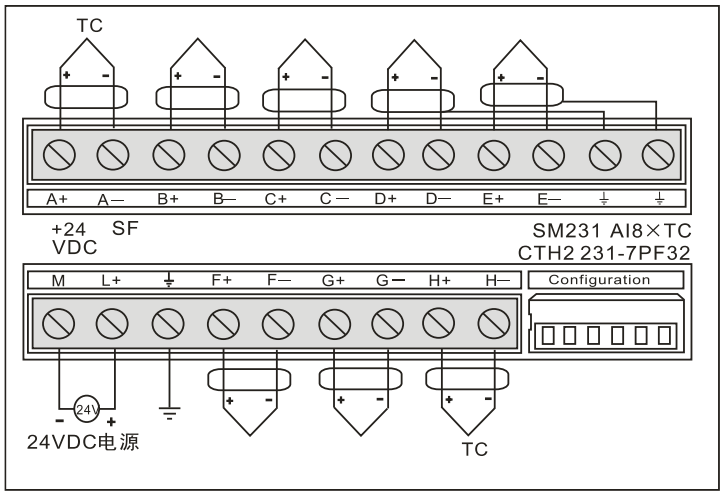


Table 4-34 TC module Diagnose

Error type	Channel data	SF LED	24V LED	Range status bit	24V Power fault
No power	32766	OFF	OFF	0	1
Open Wire	32767 (Upscale) -32768 (Downscale)	Flash	ON	1	0
Temperature Outrange	32767 (Upscale) -32768 (Downscale)	Flash	ON	1	0

<Note> For relevant error code of each Module，please check the SMB8~21 according the modules sequence.

Table 4-35 SMB8~21 Diagnose information

SMB8	Module 1 flag register

SMB9	Module 1 error register
SMB10	Module 2 flag register
SMB11	Module 2 error register
SMB12	Module 3 flag register
SMB13	Module 3 error register
SMB14	Module 4 flag register
SMB15	Module 4 error register
SMB16	Module 5 flag register
SMB17	Module 5 error register
SMB18	Module 6 flag register
SMB19	Module 6 error register
SMB20	Module 7 flag register
SMB21	Module 7 error register

TC measuring range

Data byte (1 digit=0.1°C)		Type J	Type K	Type T	Type E	Type R,S	类型N	±80mV	
Dec	Hex								
32767	7FFF	>1200.0°C	>1372.0°C	>400.0°C	>1000.0°C	>1768.0°C	>1300.0°C	>94.071mV	OF
↑	↑							↑	↑
32511	7EFF							97.071mV	OR
:	:								
27649	6C01							80.0029mV	
27648	6C00							80mV	NR
:	:								
17680	4510					1768.0°C			
:	:								
13720	3598		1372.0°C Overrange						
:	:						1300.0°C		
13000	32C8		1300.0°C						
:	:								
12000	2EE0	1200.0°C							
:	:				1000.0°C				
10000	2710			-400.0°C					
:	:								
4000	0FA0					400.0°C			
:	:								
1	0001	0.1°C	0.1°C	0.1°C	0.1°C	0.1°C	0.1°C	0.0029mV	
0	0000	0.0°C	0.0°C	0.0°C	0.0°C	0.0°C	0.0°C	0.0mV	
-1	FFFF	-0.1°C	-0.1°C	-0.1°C	-0.1°C	-0.1°C	-0.1°C	-0.0029mV	
:	:					Underrange			
-500	FE0C					-50.0°C			
-1500	FA24	-150.0°C							
:	:								
-2000	F830	Underrange	-200.0°C						
:	:								
-2100	F7CC	-210.0°C	Underrange						
:	:								
-2550	F60A			-255.0°C	-255.0°C				
:	:			Underrange	Underrange				
-2700	F574		-270.0°C	-270.0°C	-270.0°C		-270.0°C		
:	:								
-27648	9400							-80mV	
-27649	93FF							-80.0029mV	UR
:	:								
-32512	8100							-94.071mV	
#	#							↓	↓
-32768	8000	<-210.0°C	<-270.0°C	<-270.0°C	<-270.0°C	<-50.0°C	<-270.0°C	<-94.07mV	UF
Accuracy over full span		S0.1%	S0.3%	S0.6%	S0.1%	S0.6%	S0.1%	S0.1%	
Accuracy (normal range without cold junction)		S1.5°C	S1.7°C	S1.4°C	S1.3°C	S3.7°C	S1.6°C	S0.10°C	
Cold junction error		S1.5°C	S1.5°C	S1.5°C	S1.5°C	S1.5°C	S1.5°C	NA	
*OF = Overflow; OR = Overrange; NR = Normal range; UR = Underrange; UF = Underflow									
↑ indicates that all analog values greater than this and below the open wire threshold report the overflow data value, 32767 (0x7FFF). ↓ indicates that all analog values less than this and greater than the open wire threshold report the underflow data value, -32768 (0x8000).									

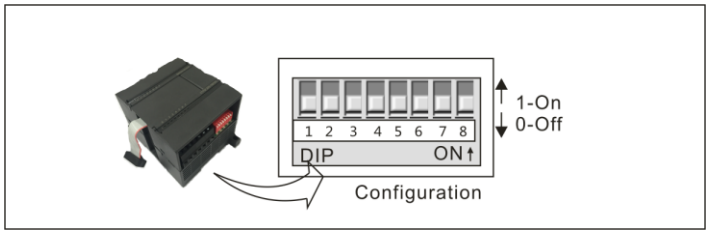
Module settings and DIP Configuration

● DIP configuration

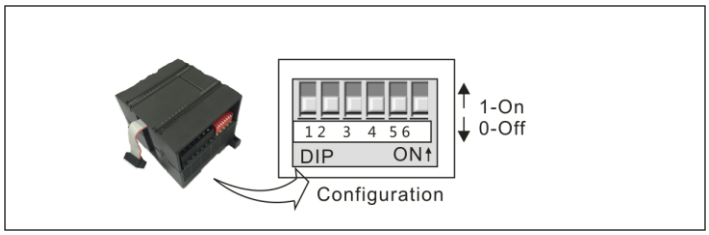
SM231 TC module can use 7 types of TC, J, K, E, N, S, T and R. It has a convenient isolated interface to allow connect weak analog signal (range ±80mV), All TC on module must be the same type and it's better to use isolated TC sensor.

Users can use DIP switch to configure TC type, Open Wire Detect, Scale Unit, Cold junction compensation and open-circuit fault direction as shown in the following figures.

For SM231 4TC module, SW1～SW3 are used for selecting TC type, SW4 remained OFF (unused), SW5 used for Open Wire Detect Direction, SW6 for Open Wire Detect Enable, SW7 for Scale Unit, SW8 for Cold junction.



For SM231 8TC module, SW1～SW3 are used for selecting TC type, SW4 for Open Wire Detect Direction, SW5 for Scale Unit, SW6 for Cold junction compensation.



The DIP configuration can be effective by cut-off and recycle the PLC/user's power supply.

Table 4-36 Selecting TC type:

TC type	SW1	SW2	SW3
J (default)	0	0	0
K	0	0	1
T	0	1	0
E	0	1	1
R	1	0	0
S	1	0	1
N	1	1	0
+/- 80mV	1	1	1

Table 4-37 SM231 Module DIP Configuration

Items	SM231 4TC		SM231 8TC	
	switch	setting	switch	setting
Open Wire Detect Direction	SW5	0: Upscale (+3276.7 Degrees)	SW4	0: Upscale (+3276.7 Degrees)
		1: Downscale (-3276.8 Degrees)		1: Downscale (-3276.8 Degrees)
Open Wire Detect Enable	SW6	0: Yes, 1: No	Fixed at Enable	
Scale Unit	SW7	0: Celsius, 1:Fahrenheit	SW5	0: Celsius, 1:Fahrenheit
Cold Junction	SW8	0: Yes, 1: No	SW6	0: Yes, 1: No

● Software configuration

For SM231 8AI×TC Input module, readings were saved in VW instead of AIW, the specific address depends on module location, calculated as following:

x(VWx) = Slot no. × 64 + Input channel no.× 2

Slot number corresponding with installation location, and the slot 0 is the first expansion module nearest to CPU, then the second is slot 1, and so on. There are all 8 Input channels from A to H and numbered as 0 to 7.

Based on the above equation, there is the address look-up table.

Table 4-38 SM231 TC module address look-up table

VWxx	Channel 0	Channel 1	Channel 2	Channel3	Channel 4	Channel5	Channel6	Channel 7
Slot 0	VW0	VW2	VW4	VW6	VW8	VW10	VW12	VW14
Slot 1	VW64	VW66	VW68	VW70	VW72	VW74	VW76	VW78
Slot 2	VW128	VW130	VW132	VW134	VW136	VW138	VW140	VW142
Slot 3	VW192	VW194	VW196	VW198	VW200	VW202	VW204	VW206
Slot 4	VW256	VW258	VW260	VW262	VW264	VW266	VW268	VW270
Slot 5	VW320	VW322	VW324	VW326	VW328	VW330	VW332	VW334
Slot 6	VW384	VW386	VW388	VW390	VW392	VW394	VW396	VW398

Tip

With CO-TRUST TD2X and SIEMENS TD200 have address fixed at VW0, if you need to use TD2X/TD200 and SM231 8TC Module simultaneously, the SM231 8TC module cannot be installed at Slot 0, or else it cannot operate.

4.5.3 Temperature Module specifications

CTH2 231-7ND32 Module

Table 4-39 SM231-7ND Module specifications

Order No.	CTH2 231-7ND32
Dimension	
Size (W×H×D)	71.3 × 96 × 62mm

LED indicator	24VDC indicator: ON=No fault, OFF=no 24VDC power SF Indicator: ON=Module fault, Flash=Out range or disconnect, OFF=No fault
Power supply	
+5VDC consumption	87mA
L+	60mA
L+ coil voltage range	20.4～28.8VDC
Power dissipation	1.7W
Input	
Thermistor input range	Thermistor Type: Pt-100(3850ppm, 3920ppm, 3850.55ppm, 3916ppm, 3902ppm) NTC(R25=10kΩ/B=3950, R25=10kΩ/B=3435)
Temperature Range	Pt-100: -50℃～850℃ NTC(R25=10K, B=3950): -40℃～120℃ NTC(R25=10K, B=3435): -40℃～150℃
Voltage input	0V～5V, 0V～10V, ±5V, ±10V
Current input	0～20mA
Input No.	2PT100/2NTC and 2AI
Isolation	
Field to Logic	500VAC
Field to 24VDC	500VAC
24V to Logic	500VAC
Common mode rejection	>120dB@120VAC
采样特性	
Temperature resolution	0.1℃/0.1℉
Voltage resolution	15bits ＋ sign bit
Transfer principle	Σ-Δ
Module update time: All channels	425ms
Wire length to sensor	Max. 100m
Conductor loop resistance	Max. 20Ω
Suppression of interference	85dB@50Hz/60Hz/400Hz
Data word format	Temperature (NTC: R25=10kΩ, B=3950K): -400～1200(only for channel 1/2) Temperature (NTC: R25=10kΩ, B=3435K): -400～1500(only for channel 1/2) Temperature (PT100): -500～2000(only for channel 1/2) Voltage/Current: Unipolar 0 ～ 32000, Bipolar -32000 ～ +32000(only for channel 3/4)
Input impedance	Voltage input>10MΩ; Current input=250Ω; NTC input>10MΩ
Max. Input voltage	30VDC(detect), 5VDC(source)
Input Filter attenuation	-3dB@21kHz
Basic error	0.1％FS(resistance)
repeatability	0.05％FS
Addressing method	AIW

Application Environment

■ Temperature: horizontal installation 0-55℃, vertical installation 0-45℃

■ Humidity: 95% Non - Condensing

Usage

SM231 NTC can be used for expanding CTH200 CPU analog measurement, connecting with CPU by Bus interface.

Table 4-40 SM231-7ND module configuration

Input type	SW1	SW2	SW3	SW4	SW5
	Valid for channel 1/2			Valid for channel 3/4	
100ΩPT0.003850(Default)	0	0	0	—	—
100ΩPT0.003920	0	0	1	—	—
100ΩPT0.00385055	0	1	0	—	—
100ΩPT0.003916	0	1	1	—	—
100ΩPT0.003902	1	0	0	—	—
NTC: R25=10kΩ, B=3950K	1	0	1	—	—
NTC :R25=10kΩ, B=3435K	1	1	0	—	—
Disable	1	1	1	—	—
0—5V	—	—	—	0	0
0—20mA	—	—	—	0	0
0—10V	—	—	—	0	1
-10V—10V	—	—	—	1	0
-5V—5V	—	—	—	1	1

SW6	Scale direction	SW7	Scale Unit	SW8	Wiring scheme
0	Upscale (+3276.7 degrees)	0	Celsius (℃)	0	3-wire
1	Downscale (-3276.8 degrees)	1	Fahrenheit (℉)	1	2 wire or 4-wire

【Procedures】

1) wiring the L+ and M terminals on the module with 24VDC power.

2) connect the module to CPU via the I/O expansion bus.

3) connect the CPU power supply and communication port.

4) connect the input signals according to wiring diagram as following figures, leave terminals of unused channel dangling, ground the EARTH terminal according to Grounding specification (single-point ground).

5) configure the sensor type and scale direction as requested.

6) switch on the power supply of CPU and the module.

【Obtain input values】

■ Users can read 2 bytes of input data per channel from the user program or Configuration software (such as MagicWorks PLC from Cotrust or MicroWIN from Siemens).

■ NTC full scale reading: -400～1200(R25=10K B=3950), Temperature range: -40.0～120.0℃; -400～1500(R25=10K B=3435), Temperature range: -40.0～150.0℃

PT100 full scale reading: -500～2000, Temperature range: -50.0～200.0℃

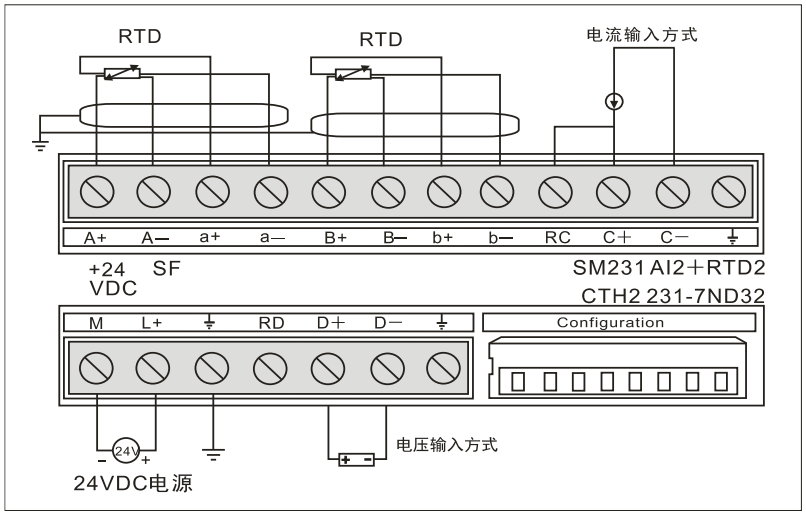
Readings at outrange or open wire depend on the scale direction (-32768 or 32767).

■ Voltage/Current full scale reading: -32000~32000, outrange readings up to -32767/32765 are valid.

■ Readings for all channels are 32766 while no power.

Wiring Diagrams

SM231 temperature input module (CTH2 231-7ND32)



CTH2 231-7NF32 module specifications

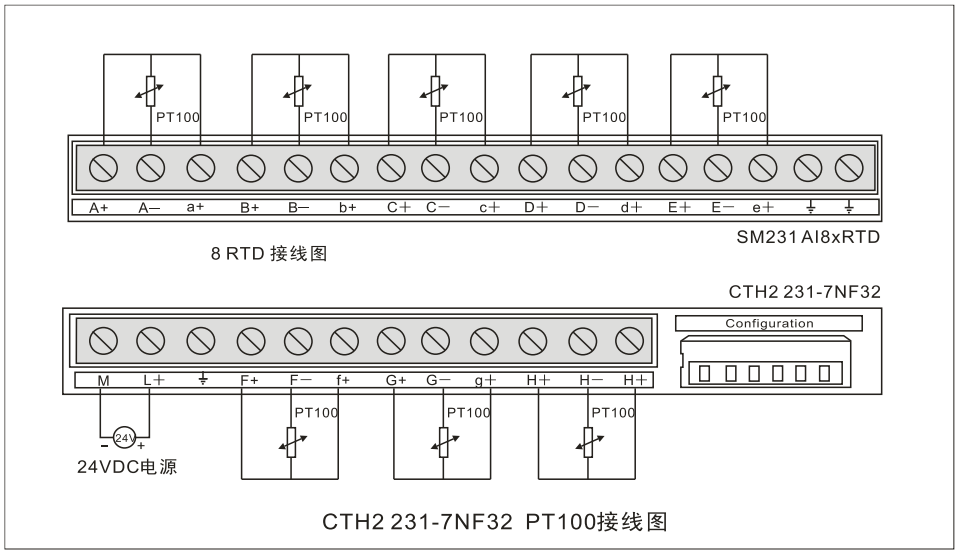
Table 4-41 SM231-7NF module specifications

Order No.	CTH2 231-7NF32
Size (W x H x D)	71.3 x 96 x 62mm
LED indicator	24VDC indicator: ON=No fault, OFF=no 24VDC power SF Indicator: ON=Module fault, Flash=Outrange or , OFF=No fault
Power supply	
+5VDC consumption	87mA
L+	32.5mA
L+ voltage range	20.4～28.8VDC
Power dissipation	1.8W
Input	
Input type	Pt100: α=3850PPm/3920PPM/3850.55PPM/3916PPM/3902PM NTC: R25=10k/B=3950 or R25=10k/B=3435
Temperature scale range	Pt100: -50℃～800℃ NTC(R25=10k/B=3950): -40℃～120℃ NTC(R25=10k/B=3435): -40℃～150℃

	<note> error when exceeding this range, refer Table 4-30 for Diagnostic details.
Input No.	8PT100/8NTC
Plug-in I/O terminal	Yes
Power isolation	Yes
Field-Logic	500VAC
Field-DC 24 V	500VAC
DC 24 V-Logic	500VAC
common-mode rejection	120dB@120VAC
Sampling features	
Temperature resolution	0.1℃/0.1℉
Measurement principle	Σ-Δ
Module update time: All channels	825ms
Max Wire length	100m
Max Wire loop resistance	20Ω
Suppression of interference	85dB@50/400 Hz
input impedance	>1KΩ
Measurement accuracy	±0.3℃
Open-wire detect	Pt100 detects 3 wires (NTC detects 2 wires), up to 3 minutes

Wiring Diagrams

SM231 temperature input module Pt100 (CTH2 231-7NF32)



CTH2 231-7NF32 PT100接线图

SM231 temperature input module NTC (CTH2 231-7NF32)

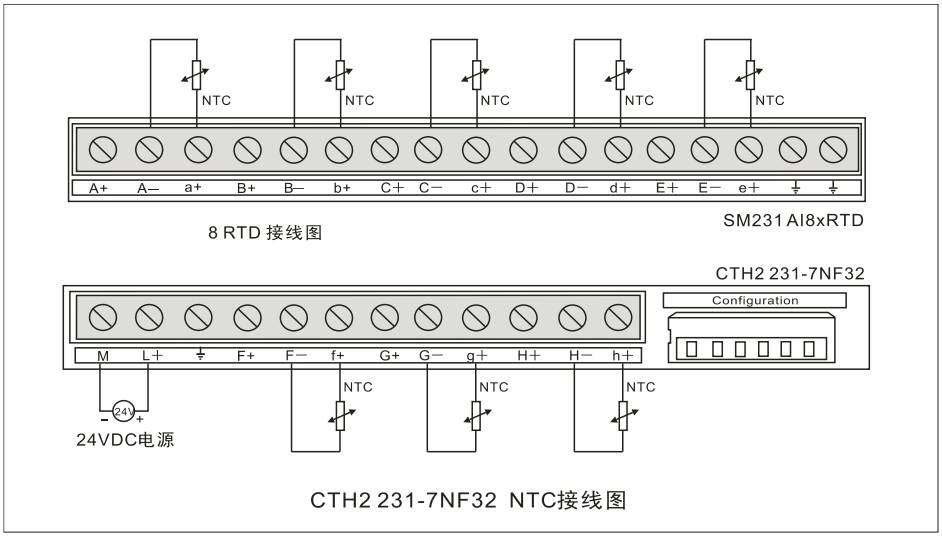


Table 4-42 SM231-7NF DIP configuration

Input Type	SW1	SW2	SW3
100Ω Pt 0.003850(Default)	**0**	**0**	**0**
100Ω Pt 0.003920	**0**	**0**	**1**
100Ω Pt 0.00385055	**0**	**1**	**0**
100Ω Pt 0.003916	**0**	**1**	**1**
100Ω Pt 0.00302	**1**	**0**	**0**
NTC R25=10K/B=3950	**1**	**0**	**1**
NTC R25=10K/B=3435	**1**	**1**	**0**
Disable	**1**	**1**	**1**

SW4	Scale direction	SW5	Scale Unit	SW6	Reserved
0	Upscale (+3276.7 degrees)	0	Celsius (℃)	0	no influence
1	Downscale (-3276.8 degrees)	1	Fahrenheit (℉)	1	no influence

Software configuration

For SM231 8AI×16bit Analog input module, readings were saved in VW instead of AIW, the specific address depends on module location, calculated as following:

x(VWx) = Slot no. × 64 + Input channel no.× 2

Slot number corresponding with installation location, and the slot 0 is the first expansion module nearest to CPU, then the second is slot 1, and so on. There are all 8 Input channels from A to H and numbered as 0 to 7.

Based on the above equation, there is the address look-up table.

Table 4-43 SM231-7NF address look-up table

VWxx	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
Slot 0	VW0	VW2	VW4	VW6	VW8	VW10	VW12	VW14
Slot 1	VW64	VW66	VW68	VW70	VW72	VW74	VW76	VW78
Slot 2	VW128	VW130	VW132	VW134	VW136	VW138	VW140	VW142

Slot 3	VW192	VW194	VW196	VW198	VW200	VW202	VW204	VW206
Slot 4	VW256	VW258	VW260	VW262	VW264	VW266	VW268	VW270
Slot 5	VW320	VW322	VW324	VW326	VW328	VW330	VW332	VW334
Slot 6	VW384	VW386	VW388	VW390	VW392	VW394	VW396	VW398

提示

With CO-TRUST TD2X and SIEMENS TD200 have address fixed at VW0, if you need to use TD2X/TD200 and SM231 8AI Module simultaneously, the SM231 8AI module cannot be installed at Slot 0, or else it cannot operate.

4.6 PID Module Specifications

【Main features】

- Isolation must be implemented between Bus, Power and all channels, with high reliability and interference immunity.
- 16bit sampling accuracy, with hardware filter technology to obtain more accurate and stable measuring values.
- Power supply can provide anti-protection and Surge absorption, suited for harsh environment.
- Integrated advanced fuzzy logic control algorithm, it can achieve accurate temperature control and well motion performance without program.
- PID output can be PWM, Analog or Bipolar output, used for heating and cooling control.

【Usage specifications】

- Insulation thermocouple should be used to achieve good immunity from interference
- Shielded wire must be used and single-end earthed.
- GND terminal must be connect to the ground.
- Short unused channels to eliminate the Break line fault alarm

Table 4-44 SM231-7TD/7TF module specifications

Features	SM231 4AI×TC PID	SM231 8AI×TC PID
Order No.	CTH2 231-7TD32	CTH2 231-7TF32
Dimension		
Size (W×H×D)	71.3 × 96 × 62mm	71.3 × 96 × 62mm
LED indicator	24VDC indicator: ON=No fault, OFF=no 24VDC power SF Indicator: ON=Module fault, Flash=Out range or disconnect, OFF=No fault	
Power supply		
+5VDC consumption	87mA	87mA
L+	34mA	39mA
L+ coil voltage range	20.4～28.8VDC	
Power dissipation	1.8W	1.8W

Input		
Type	Float TC	
Input range	K-type TC	
Input No.	4	8
Isolation		
Field to Logic	500VAC	
Field to 24VDC	500VAC	
24VDC to Logic	500VAC	
Common mode input range (input channel to input channel)	120VAC	
Common mode rejection	>120dB@120VAC	
Sampling features		
Temperature resolution	0.1℃/0.1℉	
Voltage resolution	15bits + sign bit	
Transfer principle	Σ-Δ	
Module update time: All channels	405ms	825ms
Wire length to sensor	Max 100m	
Conductor loop resistance	Max 100Ω	
Suppression of interference	85dB@ 50Hz/60Hz/400Hz	
Data word format	Voltage: -27648~+27648	
Input impedance	>1MΩ	
Max. Input voltage	30VDC	
Temperature resolution	15bits + sign bit	
Input Filter attenuation	-3dB@ 21kHz	
Basic error	0.1% FS(voltage)	
repeatability	0.05% FS	
Cold junction error	±1.5℃	
diagnostic program	LED: EXTF, SF	
PID performance		
PID algorithm	PID+FUZZY parameter adaptive tuning	
Sampling time	1s	
Min output pulse width	10ms	
PID Type	P, PI, PD, PID型	
PID output type	Analog or PWM control	
PID output polarity	Bipolar or Unipolar	

PID address and parameter configuration

● PID address computation

Address name	Formula	Note
PID parameter address	A=(2048+S*256)+16*C	S = slot No. (0～6) C = channel No. (SM231-7TF: 0～7, SM231-7TD: 0～3)
PID positive impulse output address	X=(2048+S*256)+12	
PID negative impulse output address	Y=(2048+S*256)+13	

● PID parameter output (Module to CPU)

Items	Address	Value range	Actual value
Actual temperature	VW A	-2000～13000	-200～1300 degrees
Status word	VW A+2		
PID Analog output	VW A+4	-32000～32000	

● PID parameter input (CPU to Module)

Items	Address	Value range	Actual value
Setting temperature	VW A+128	-2000～13000	-200～1300 Degree
Control byte		VB A+130 bit =0	VB A+130bit = 1
	V(A+130).0	PID not run, no output	PID run
	V(A+130).1	Integral works all the time, but Kp not self-adaptive	integral separation and Kp self-adaptive
	V(A+130).2	PID unipolar output, 0～32000	PID bipolar output, -32000～32000, support heating and cooling
	V(A+130).3	unused	
	V(A+130).4	Integral works	Integral not work
	V(A+130).5	Differential works	Differential not work
	V(A+130).6	Filter the actual temperature value, enhance Interference immunity	Not filter the actual temperature value
PID pulse output period	VW A+132	1～255	1～255s
Kp (proportional coefficient)	VW A+134	0～9999	0～999.9
Ti (integral time)	VW A+136	0～3600	0～3600s
Td (differential time)	VW A+138	0～3600	0～3600s

Positive impulse output address:

0 channel impulse output	V X.0
1 channel impulse output	V X.1
2 channel impulse output	V X.2
3 channel impulse output	V X.3
4 channel impulse output	V X.4
5 channel impulse output	V X.5
6 channel impulse output	V X.6

7 channel impulse output	V X.7

Negative impulse output address:

0 channel impulse output	V Y.0
1 channel impulse output	V Y.1
2 channel impulse output	V Y.2
3 channel impulse output	V Y.3
4 channel impulse output	V Y.4
5 channel impulse output	V Y.5
6 channel impulse output	V Y.6
7 channel impulse output	V Y.7

Application example:

Calculating the address of last PID loop on the second expansion module SM231-7TF.

According to the above statement: S=1, C=7

A Address, A=2048 + 1 * 256 + 16 * 7 = 2416

X Address, X=2048 + 1 * 256 + 12 = 2316

Y Address, Y=2048 + 1 * 256 + 13 = 2317

Set or read out the parameter values according to the following parameter address descriptions:

VW2544 //set temperature

VB2546 //control word (parameter self-adaptive, bipolar output)

VW2548 //pulse output period

VW2550 //Kp

VW2552 //Ti (s)

VW2554 //Td (s)

VW2416 //Actual temperature

VW2418 //status word

VW2420 //PID analog output

V2316.7 //positive pulse output

V2317.7 //negative pulse output

Note that, V memory which have been occupied by existing PID modules cannot be used for Program, you can call the designed program library for SM231 PID parameter configuration.

Address for module in slot 0: VW2048 to VW2298

Address for module in slot 1: VW2304 to VW2554

Address for module in slot 2: VW2560 to VW2810

Address for module in slot 3: VW2816 to VW3066

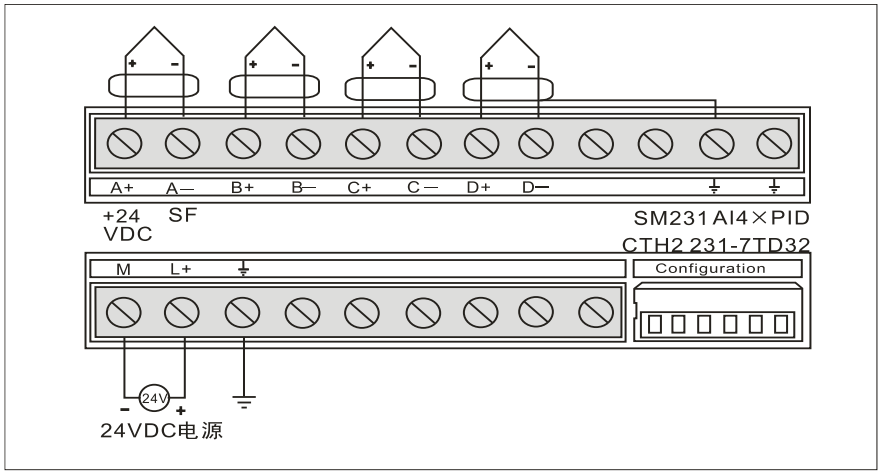
Address for module in slot 4: VW3072 to VW3322

Address for module in slot 5: VW3328 to VW3578

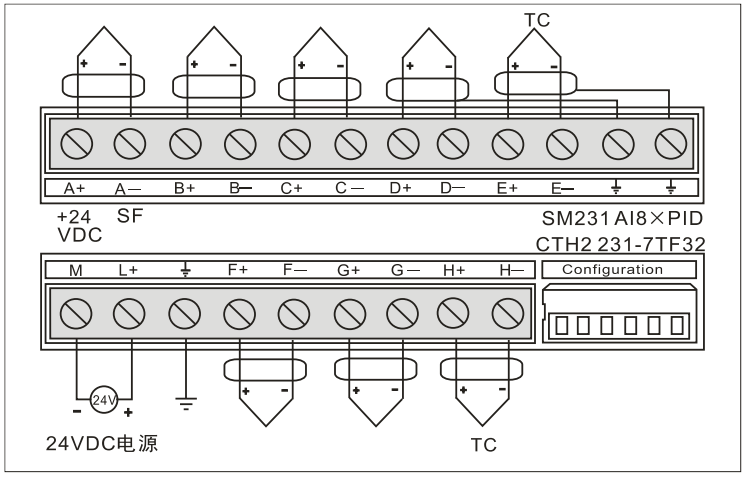
Address for module in slot 6: VW3584 to VW3834

Wiring Diagrams

SM231 TC PID module (CTH2 231-7TD32)



SM231 TC PID module (CTH2 231-7TF32)



【DIP Configuration】

SM231 TC module supports J/K-type thermocouple, it can provide a 6-bit DIP switch to set Scale Unit, Cold-junction compensation and open-circuit fault direction. For open-wire detect Enable, it's required as SM231 8TC.

6-bit DIP switch is located below the module as shown in the following figure. SW1～SW2 unused, SW3 for TC type, SW4 for open-wire detect direction, SW5 for Scale Unit, SW6 for Cold-junction enable. Cut-off and recycle the PLC power to make the DIP configuration effective.

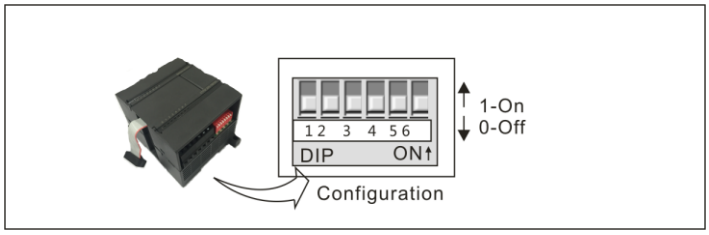


Table 4-45 SM231 DIP configuration

Items	Switch	Setting
TC type	SW3	0 - J; 1 - K
Open-wire detect direction	SW4	0 - Upscale (+3276.7 degrees); 1 - Downscale (-3276.8 degrees)
Scale Unit	SW5	0 - Celsius; 1 - Fahrenheit
Cold-junction enable	SW6	0 - Yes; 1 - No

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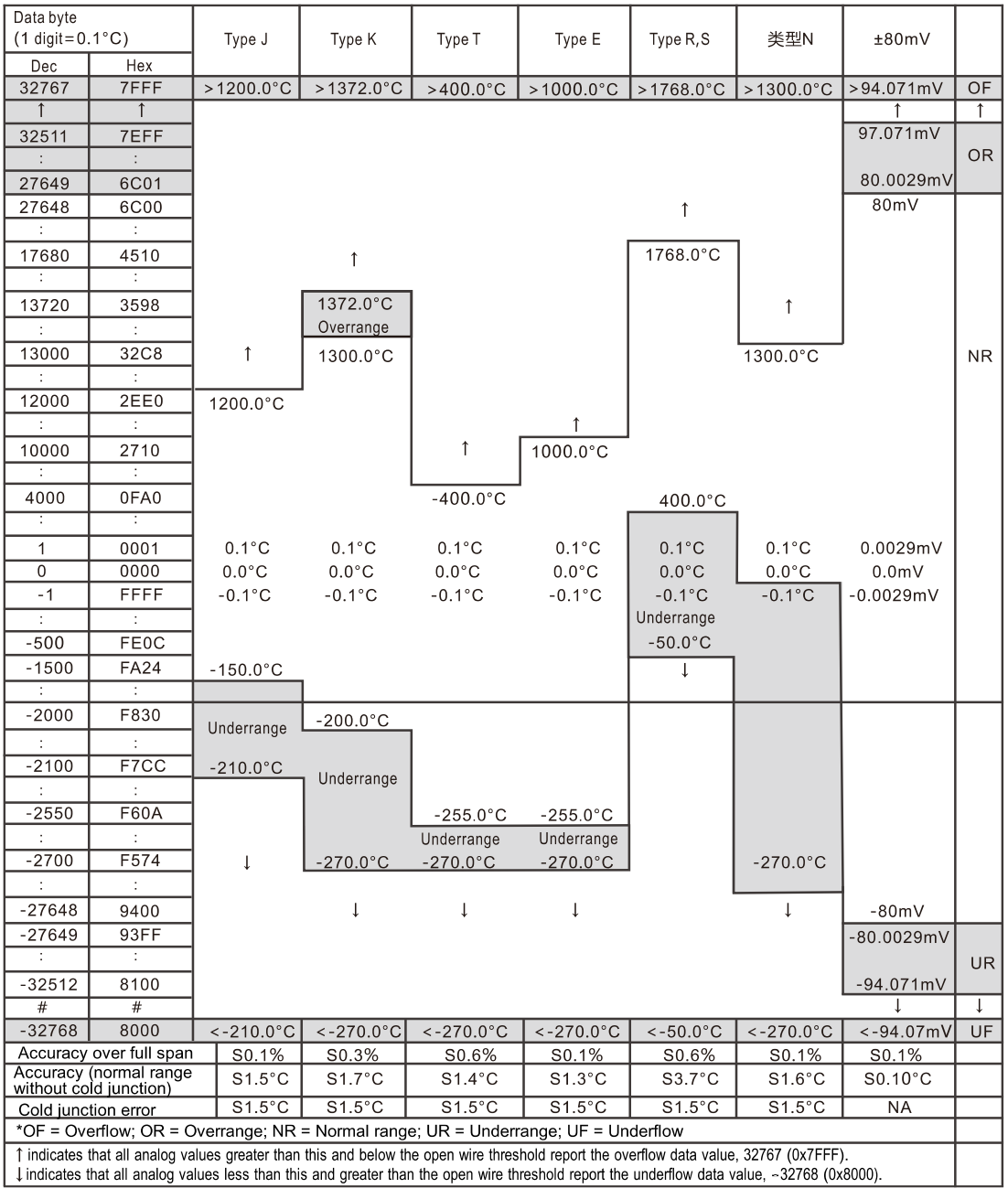


4.7 Communication Module Specifications

Specifications	Or. Number
SM277A Profibus DP Slave Interface Module, 12Mbps traffic rate, photoelectric isolated	CTH2 277-0AA32
SM277B Profibus DP Slave module, 1.5Mbps traffic rate, photoelectric isolated	CTH2 277-0AB32
SM277C CAN Slave module, 8DI/6DO, photoelectric isolated, up to 7 extendable modules	CTH2 277-0AC32

SM277A needs to be used together with CPU, but SM277B can be used as independent slave which can connect up to 6 expansion modules, the max I/Os is 128DI/128DO, 48AI/24AQ.

4.7.1 SM277A DP Slave Interface Module Specifications

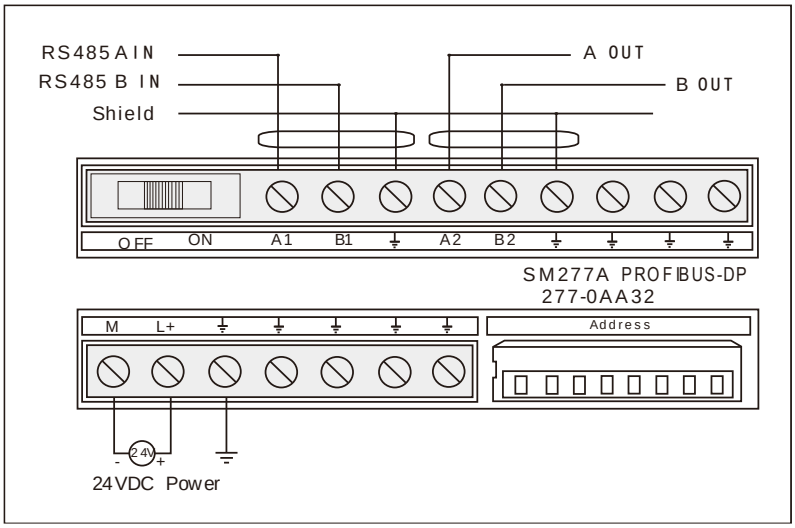
Table 4-46 SM277A module specifications

General				
Order No.	CTH2 277-0AA32			
Size (W×H×D)	71.3 × 96 × 62mm			
Port No.	1			
Electric interface	Isolated RS485			
Native I/O	0			
Max expansion modules	6			
PROFIBUS-DP/MPI baud rate (auro setting)	9.6/19.2/45.45/93.75/187.5/500Kbps; 1/1.5/3.6/12Mbps			
Protocol	PROFIBUS-DP and MPI			
LED	**OFF**	**Red**	**Flash Red**	**Green**
DX MODE	Not in data exchange mode	--	--	In data exchange mode
DP ERROR	No error	Leave the data exchange mode	parameterize/ configuration error	--
POWER	No 24V power	--	--	24VDC power is good
CPU FAULT	Good health	Internal fault	--	--
Cable length (Max)				
< 93.75Kbps	1200m			
187.5Kbps	1000m			
500Kbps	400m			
1 ~ 1.5Mbps	200m			
3 ~ 12Mbps	100m			
Network performance				

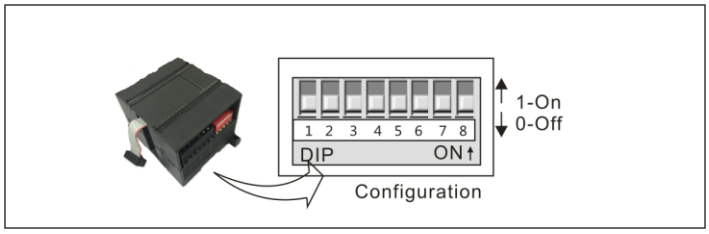
Station address	0 ~ 126 (setting by DIP switch)
Max stations per segment	32
Max stations per network	126, up to 125 SM277 stations
MPI connections	Total 6, 2 reserved (1 used for PG, the other used for OP)
24VDC Power requirement	
Voltage range	20.4 ~ 28.8VDC (class 2 or PLC sensor power)
Power consumption	2.3W
Max current (Module only with port active)	70mA
Ripple noise (＜10Mhz)	＜1V peak to peak (Max)

Wiring Diagram

SM277A DP Slave interface module (CTH2 277-0AA32)



DIP Address configuration



DIP SW1-8 (in binary), SW1 for the LSB, SW8 for the MSB (must be “OFF”), SW1-SW7 set as “ON” - “1”, “OFF” - “0”, calculated as following:

Address =SW1×2^0+ SW2×2^1 +SW3×2^2 +SW4×2^3+ SW5×2^4 +SW6×2^5 +SW7×2^6

Table 4-47 DIP Address configuration zoom table

Address	SW1~SW8	Address	SW1~SW8	Address	SW1~SW8
0	0000 0000	**43**	1101 0100	**86**	0110 1010
1	1000 0000	**44**	0011 0100	**87**	1110 1010
2	0100 0000	**45**	1011 0100	**88**	0001 1010
3	1100 0000	**46**	0111 0100	**89**	1001 1010

4	0010 0000	**47**	1111 0100	**90**	0101 1010
5	1010 0000	**48**	0000 1100	**91**	1101 1010
6	0110 0000	**49**	1000 1100	**92**	0011 1010
7	1110 0000	**50**	0100 1100	**93**	1011 1010
8	0001 0000	**51**	1100 1100	**94**	0111 1010
9	1001 0000	**52**	0010 1100	**95**	1111 1010
10	0101 0000	**53**	1010 1100	**96**	0000 0110
11	1101 0000	**54**	0110 1100	**97**	1000 0110
12	0011 0000	**55**	1110 1100	**98**	0100 0110
13	1011 0000	**56**	0001 1100	**99**	1100 0110
14	0111 0000	**57**	1001 1100	**100**	0010 0110
15	1111 0000	**58**	0101 1100	**101**	1010 0110
16	0000 1000	**59**	1101 1100	**102**	0110 0110
17	1000 1000	**60**	0011 1100	**103**	1110 0110
18	0100 1000	**61**	1011 1100	**104**	0001 0110
19	1100 1000	**62**	0111 1100	**105**	1001 0110
20	0010 1000	**63**	1111 1100	**106**	0101 0110
21	1010 1000	**64**	0000 0010	**107**	1101 0110
22	0110 1000	**65**	1000 0010	**108**	0011 0110
23	1110 1000	**66**	0100 0010	**109**	1011 0110
24	0001 1000	**67**	1100 0010	**110**	0111 0110
25	1001 1000	**68**	0010 0010	**111**	1111 0110
26	0101 1000	**69**	1010 0010	**112**	0000 1110
27	1101 1000	**70**	0110 0010	**113**	1000 1110
28	0011 1000	**71**	1110 0010	**114**	0100 1110
29	1011 1000	**72**	0001 0010	**115**	1100 1110
30	0111 1000	**73**	1001 0010	**116**	0010 1110
31	1111 1000	**74**	0101 0010	**117**	1010 1110
32	0000 0100	**75**	1101 0010	**118**	0110 1110
33	1000 0100	**76**	0011 0010	**119**	1110 1110
34	0100 0100	**77**	1011 0010	**120**	0001 1110
35	1100 0100	**78**	0111 0010	**121**	1001 1110
36	0010 0100	**79**	1111 0010	**122**	0101 1110
37	1010 0100	**80**	0000 1010	**123**	1101 1110
38	0110 0100	**81**	1000 1010	**124**	0011 1110
39	1110 0100	**82**	0100 1010	**125**	1011 1110
40	0001 0100	**83**	1100 1010	**126**	0111 1110
41	1001 0100	**84**	0010 1010		
42	0101 0100	**85**	1010 1010		

Terminal resistance setting

Terminal resistance	Meaning
ON	Located on the last node of network
OFF	Not Located on the last node of network

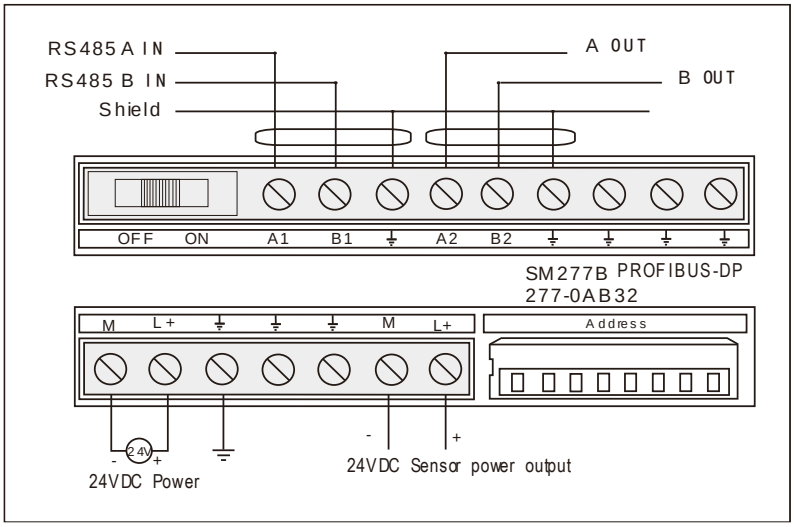
4.7.2 SM277B DP Slave Module Specifications

Table 4-48 SM277B Module Specifications

General	
Order No.	CTH2 277-0AB32
Size (W×H×D)	71.3 × 96 × 62mm
Port No.	1
electrical interface	Isolated RS485 (500VAC)
PROFIBUS-DP baud rate (auto-set)	9.6/19.2/45.45/93.75/187.5/500Kbps; 1/1.5Mbps
protocol	PROFIBUS-DP V0 slave device
Native I/O	None
Extended I/O	
Max extended modules permitted	6
Max I/Os (Image)	256(128 In/128 Out)
LED indicator	
ON(Green)	Light on after power up
SF(Red)	Light on when SM277B found error during serf-check (including address outrange) or expansion I/O module fault.
BF(Red)	Flash when no exchange with Master.
Cable length (max)	
< 93.75Kbps	1200m
187.5Kbps	1000m
500Kbps	400m
1~1.5Mbps	200m
Network performance	
Station address	0~126(set by DIP switch)
Max stations per segment	32
Max stations per network	126, up to 125 SM277B stations
24VDC power requirement	
Voltage range	20.4~28.8VDC (class 2 or PLC sensor power)
Isolation	None
Power consumption	8W
Output current for sensor (24VDC)	
Voltage range	20.4~28.8VDC (class 2 or PLC sensor power)
Max output current at 24V	400mA
Output current for expansion module (5VDC)	
Max output current at 5V	660mA

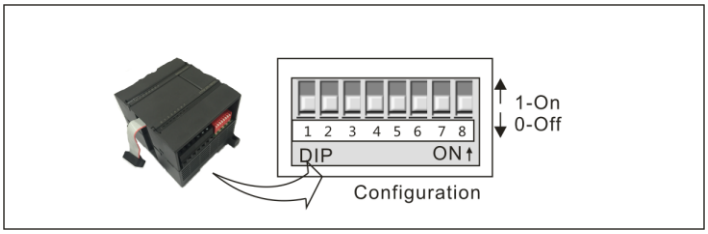
Wiring Diagram

SM277B PROFIBUS DP slave module (CTH2 277-0AB32)



Set PROFIBUS Address

Users can use DIP switch to set PROFIBUS address. If changes have been made to the address, you need to cut-off and recycle the power of SM277B module to make them effective.



DIP switch SW1-8 (in binary), SW1 for the LSB, SW8 for the MSB (must be “OFF”), SW1-SW7 set as “ON” - “1”, “OFF” - “0”, calculated as following:

Address =SW1×2^0+ SW2×2^1 +SW3×2^2 +SW4×2^3+ SW5×24 +SW6×25 +SW7×26

Table 4-49 DIP Address configuration zoom table

Address	SW1~SW8	Address	SW1~SW8	Address	SW1~SW8
0	0000 0000	**43**	1101 0100	**86**	0110 1010
1	1000 0000	**44**	0011 0100	**87**	1110 1010
2	0100 0000	**45**	1011 0100	**88**	0001 1010
3	1100 0000	**46**	0111 0100	**89**	1001 1010
4	0010 0000	**47**	1111 0100	**90**	0101 1010
5	1010 0000	**48**	0000 1100	**91**	1101 1010
6	0110 0000	**49**	1000 1100	**92**	0011 1010
7	1110 0000	**50**	0100 1100	**93**	1011 1010
8	0001 0000	**51**	1100 1100	**94**	0111 1010
9	1001 0000	**52**	0010 1100	**95**	1111 1010
10	0101 0000	**53**	1010 1100	**96**	0000 0110
11	1101 0000	**54**	0110 1100	**97**	1000 0110
12	0011 0000	**55**	1110 1100	**98**	0100 0110

13	1011 0000	**56**	0001 1100	**99**	1100 0110
14	0111 0000	**57**	1001 1100	**100**	0010 0110
15	1111 0000	**58**	0101 1100	**101**	1010 0110
16	0000 1000	**59**	1101 1100	**102**	0110 0110
17	1000 1000	**60**	0011 1100	**103**	1110 0110
18	0100 1000	**61**	1011 1100	**104**	0001 0110
19	1100 1000	**62**	0111 1100	**105**	1001 0110
20	0010 1000	**63**	1111 1100	**106**	0101 0110
21	1010 1000	**64**	0000 0010	**107**	1101 0110
22	0110 1000	**65**	1000 0010	**108**	0011 0110
23	1110 1000	**66**	0100 0010	**109**	1011 0110
24	0001 1000	**67**	1100 0010	**110**	0111 0110
25	1001 1000	**68**	0010 0010	**111**	1111 0110
26	0101 1000	**69**	1010 0010	**112**	0000 1110
27	1101 1000	**70**	0110 0010	**113**	1000 1110
28	0011 1000	**71**	1110 0010	**114**	0100 1110
29	1011 1000	**72**	0001 0010	**115**	1100 1110
30	0111 1000	**73**	1001 0010	**116**	0010 1110
31	1111 1000	**74**	0101 0010	**117**	1010 1110
32	0000 0100	**75**	1101 0010	**118**	0110 1110
33	1000 0100	**76**	0011 0010	**119**	1110 1110
34	0100 0100	**77**	1011 0010	**120**	0001 1110
35	1100 0100	**78**	0111 0010	**121**	1001 1110
36	0010 0100	**79**	1111 0010	**122**	0101 1110
37	1010 0100	**80**	0000 1010	**123**	1101 1110
38	0110 0100	**81**	1000 1010	**124**	0011 1110
39	1110 0100	**82**	0100 1010	**125**	1011 1110
40	0001 0100	**83**	1100 1010	**126**	0111 1110
41	1001 0100	**84**	0010 1010		
42	0101 0100	**85**	1010 1010		

Terminal resistance

Terminal resistance	Meaning
ON	Located on the last node of network
OFF	Not Located on the last node of network

4.7.3 SM277C CANopen Slave Module Specifications

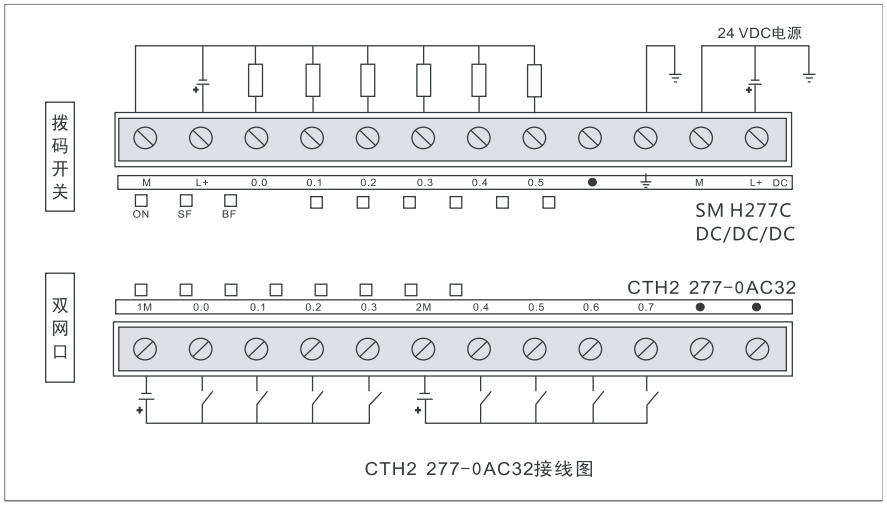
CANopen slave interface module implements optoelectronic isolation with high reliability and high interference immunity. Two RJ45 CANopen communication ports can be used with CAN master system to compromise a distributed control system. Up to 7 CTH200 modules can be expanded by using this module (PID module is not supported), build in 8DI/6DO of transistor type and a 12-pin address switch for selecting station address, baud rate and terminal resistor.

Table 4-51 SM277C Module Specifications

General		
Order No.		CTH2 277-0AC32
Size (W×H×D)		71.3 × 96 × 62 mm
Digital input		
Ports		2 RJ45 port for CANopen
Rated input voltage		24VDC
Type		Source/Drain (IEC class 1 source point)
Max continuous voltage		30VDC
Voltage surge		35VDC for 0.5s
Input delay		6.4ms (min. 6.3ms)
Isolation (Field to Logic)		Yes
Output on simultaneously		8 (all at 55℃)
Cable length	Shield	Max 500m
	Unshield	Max 300m
Digital Output		
Type		Solid-MOSFET (Source)
Rated output voltage		24VDC
output voltage range		20.4~28.8VDC
Output current (max at logic 1)		0.5A
Output groups		1
Outputs per common		6
Output on simultaneously		6
maximum current for single group		4.5A
Surge current		8A for 100ms
Isolation		Optical couple isolation, 500VAC for 1 minute
Output delay	OFF-ON	Max 15μs
	ON-OFF	Max 130μs
Cable length	Shield	Max 500m
	Unshield	Max 300m

Wiring Diagram

SM277C CANopen slave module (CTH2 277-0AC32)



CTH2 277-0AC32接线图

DIP Address switch setting

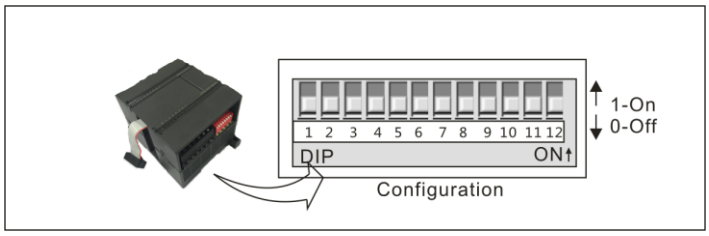
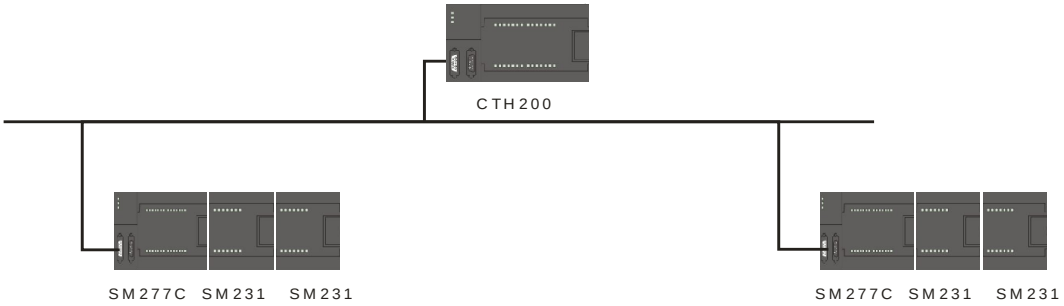


Table 4-52 DIP switch SW1-12 configuration

SM277-0AC32 DIP switch								
Switch		**Usage**						
SW1	Node address	In binary: 1 - lowest bit, 7 - highest bit Note: 0 - global address, 0 is not allowed during operation.						
SW2								
SW3								
SW4								
SW5								
SW6								
SW7								
SW8	Baud rate	In binary: 8 - lowest bit, 10 - highest bit						
SW9		DIP setting	111	110	101	100	011	010	001
SW10		Baud rate (Kbps)	1000	800	500	250	125	50	20
		Max length (m)	25	50	100	250	500	1000	2500
SW11	Terminal resistor	“ON” for device at network interface, “OFF” for the other.						
SW12	reserved	—						

Network Architecture



Hardware Diagnostic

SM 277C status LED can be used to diagnose the CANopen master-slave network.

Switch on the power of SM 277C, “ON” LED (Green) for the power would light on. If the BF and SF LEDs remain OFF, it’s indicating the SM 277C works normal, if they light on or flash, there can be fault in hardware configuration or wiring.

Table 4-53 SM 277C status LED description

LED	ON	OFF	FLASH	Note
ON	Normal power	No power	---	Power indicator
SF	expansion I/O module fault	expansion I/O module no fault	---	System Fault
BF	CAN network not detected	CAN network detected	Inconsistent configuration	Bus Fault

4.8 Weighing Module Specifications

Table 4-54 SM231 Weighing Module Specifications

Order No.	CTH2 231-7WA32
LED	24VDC indicator: ON=Power normal, OFF=no 24VDC power SF Indicator: ON=Module fault, Flash=Out range or disconnect, OFF=No fault
Power supply	
+5VDC consumption	＜140mA
L+	＜100mA
L+ coil voltage range	20.4~28.8VDC
Power dissipation	5W
Input features	
Input type	strain gage, with 4-wire or 6-wire
Input range	0~1mV/V 0~2mV/V 0~4mV/V
No.	One-channel weighing sensor
weighing sensor resistor	Without Explosion-proof interface: 40 Ω< R < 4010 Ω With Explosion-proof interface: 87 Ω< R < 4010 Ω
Isolation	

Field to Logic	500VAC
Field to 24VDC	500VAC
24V to Logic	500VAC
common mode rejection	>120dB@120VAC
Resolution performance	
Temperature effect on zero	≤±0.1μV/K
measurement principle	Σ-Δ
Cable length to senor	Max 500m
Noise rejection	85db@50Hz/60Hz
data word format	Voltage: 0~65535
Input resolution	16-bit
Basic error	0.05％Fs
Linear error	0.01％Fs

Terminal connection

Weighing module is a measurement module with high accuracy, which can be used for low level signal down to 1.5μV reliably. To acquire operation with no fault, it's essential to assemble and wire cable correctly.

Following these rules to wire the weighing sensor:

1) if more than 1 sensor would be connected (in parallel), a terminal box must be used. If distance from the senor to module is larger than to terminal box, a specified expansion box.

2) Cable Shield should always connect to the Cable gland of terminal box or expansion box.

3) Twisted Pairwire should be used and shielded:

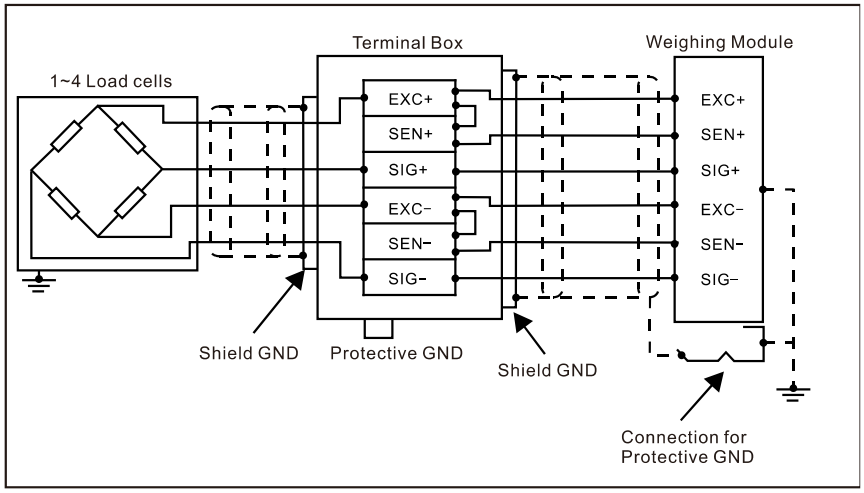
Sensor wire SEN+/SEN-

Voltage measurement wire SIG+/SIG-

Power voltage wire EXC+/EXC-.

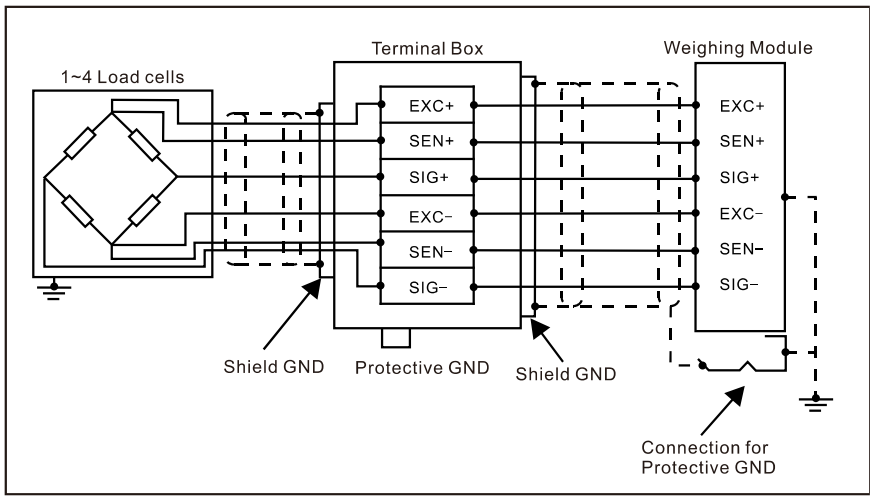
4) The shield must be connected to the shielded joint clamp.

1. 4-wire connection for the weighing sensor



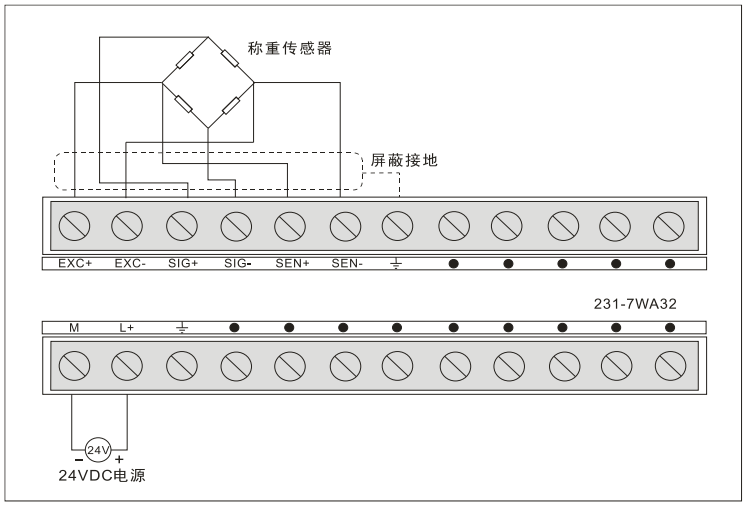
When Connecting 4-wire sensor, you must terminal the EXC+ with SENS+, EXC- with SENS-, or else the module can not work normally.

2. 6-wire connection for the weighing sensor



Wiring Diagram

SM231 weighing module (CTH2 231-7WA32)



4.9 Position Module Specifications

Table 4-55 Position Module Specifications

Order number	CTH2 253-1BH32
General	**24VDC input**
Number of inputs	8
Type	Drain/Source (IEC class1/Drain)
Rated voltage	24 VDC at typical 5mA
Maximum Continuous permissible voltage	30 VDC
Surge voltage	35 VDC for 0.5 s
Logic 1(Min)	15.6 VDC(I0.0, I0.1, I0.2, I0.4, I0.5, I0.6) at 2.72mA 12.8VDC(I0.3, I0.7) at 2.55mA
LOgic 0(Max)	15.4VDC(I0.0, I0.1, I0.2, I0.4, I0.5, I0.6) at 2.69mA 12.6 VDC(I0.3, I0.7) at 2.51mA

Input delay		< 1.1us(I0.0, I0.1, I0.2, I0.4, I0.5, I0.6) < 1ms(I0.3, I0.7)
Connection of 2 Wire Proximity Sensor (Bero) Permissible leakage current		1mA
Isolation (Field to Logic) Optical Isolation (Galvanic)		Yes 500 VAC for 1 minute
HS input rate HSC Logic 1=16～26 VDC		200KHz(single/dual phase) (I0.0, I0.4) 200KHz (A/B phase) (I0.0 & I0.1, I0.4 & I0.5) (Input Waveshape ratio 40%~60%)
Number of inputs on simultaneously		All
Cable length (max)	Shield	500m for standard input, 50m for HSC (using shielded twisted pair for HSC and ground the shield)
	Unshield	300m for standard input
HSC max commutating frequency		50KHz
		Transistor output
Number of outputs		8
Type		Solid – MOSFET(drain)
Rated voltage		24 VDC
Output voltage range		5~28.8 VDC
Surge current (max)		8A for 100ms
Logic 1(max)		0.5V
Logic 0(min)		VCC-0.5V
Rated current per point (max)		0.5A
Rated current per common (max)		2.0A
Leakage current (max)		10μA
lighting load (max)		3.5W
Sensing clamp voltage		L+ - 48 VDC, 1W power
On resistance		Typical 0.3 Ω (max 0.6Ω)
Isolation Optical Isolation (Galvanic) Isolation groups		 500 VAC, 1 minute Refer to the wiring diagrams below
Delay (max) Off to On On to Off		 0.2μs(Q0.0, Q0.1, Q0.2, Q0.3), 50μs(Q0.4, Q0.5, Q0.6, Q0.7) 0.2μs(Q0.0, Q0.1, Q0.2, Q0.3), 130μs(Q0.4, Q0.5, Q0.6, Q0.7)
Pulse frequency (max)		200KHz(Q0.0, Q0.2)
Outputs on simultaneously		All at 55°C
Two outputs parallel		Yes, only for outputs in the same group
Cable length	Shield	500m

(max)	Unshield	150m

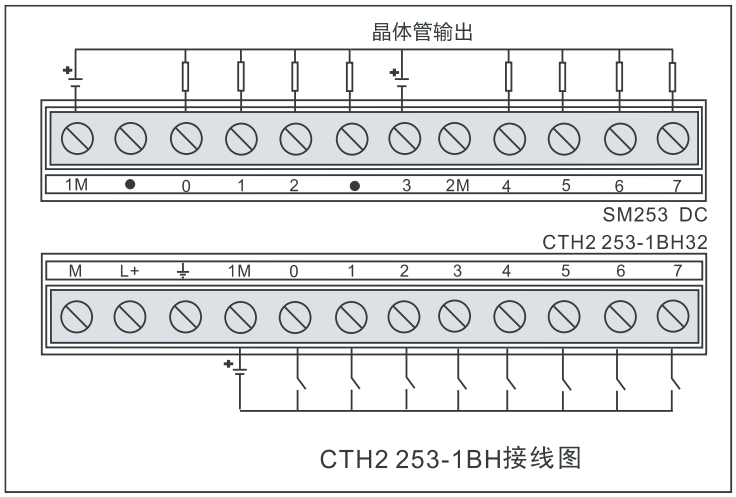
Caution

DO commands executing would be delayed a while during communication transfer; if there is a single SM253 position module attach after the CPU, the delay time for DO from enable to execute is about 780μs; if there are 5 position modules, the delay time would be 930μs.

SM253 modules are used for motion control, there are 2 independent HSC MC253_HSC0 and MC253_HSC1 (200KHZ for single/dual phases); 2 channels of independent 200KHz HSP output which support instructions like MC253_PTP/SPEED_CTL/PWM in the motion_ctrl_module_lib. Refer to the Appendix E for more details about the motion control library.

Wiring Diagrams

SM253 position control module (CTH2 253-1BH32)



CTH2 253-1BH接线图

Table 4-56 I/O function definition

Input	Definition	Output	Definition
I0.0	Pulse input for MC253_HSC0	Q0.0	Pulse output for axis 0
I0.1	External direction signal for MC253_HSC0	Q0.1	Direction signal for axis 0
I0.2	Reset signal for MC253_HSC0	Q0.2	Pulse output for axis 1
I0.3	Emergency stop for motion axis 0	Q0.3	Direction signal for axis 1
I0.4	Pulse input for MC253_HSC1	Q0.4	Normal outputs
I0.5	External direction signal for MC253_HSC1	Q0.5	
I0.6	Reset signal for MC253_HSC1	Q0.6	
I0.7	Emergency stop for motion axis 1	Q0.7	

4.10 BD Expansion Board Specifications and Installation

Description	Order No.
EBH AMS-03 Analog I/O Expansion Board, 2*12bits voltage resolution, 1*12bits voltage/current output resolution	CTH2 AMS-03S1-EB
EBH-AMS-06 Analog I/O Expansion Board,4*12bits voltage resolution, 2*12bits voltage output resolution	CTH2 AMS-06S1-EB
EBH CAN master communication Expansion Board, 1Mbps, optoelectronic isolation	CTH2 CAN-01S1-EB

4.10.1 Analog Expansion Board Specifications

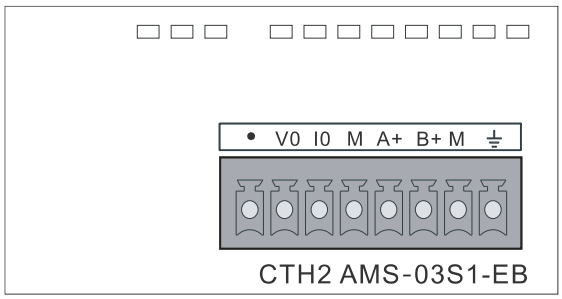
Analog Expansion Board EBH-AMS-03/EBH-AMS-06 can be used with CTH200 modules by invoking the Exboard_H200 library or access the designed special memory directly. For more details, refer to the section 6.4.2 in this document.

Table 4-57 Analog Expansion Board I/O features

Items		Specifications		
		EBH-AMS-03	EBH-AMS-06S1	EBH-AMS-06S2
Basic characteristics	Dimension (W×H×D)	24×14.4×68.2mm		
	Voltage supply	+5VDC		
	Current	60mA	60mA	200mA
LED	Power LED	Health status of power: ON - 5VDC normal, OFF - no power		
	SF LED	calibration status, FLASH - calibration failure		
Analog input	Power supply	5VDC, output current < 200mA		
	No. of inputs	2	4	
	Input type	Single-end voltage input		
	Input range	±10V		
	Data word format for full-scale	-32000 to +32000		
	DC input impedance	>100KΩ		
	Max input voltage	30VDC		
	Resolution	11 bits + 1 sigh bit		
	Isolation	None		
	Accuracy			
	Worst case (0-55 ˚)	±2.5% full scale		
	Typical (25 ˚)	±1.0% full scale		
	repeatability	±0.05% full scale		
	Conversion time for analog to digital	125ms		
	transform principle	Σ-Δ		
	Step response	Max 250ms		
	noise suppression	Typical -20dB@50Hz		
Analog	No. of output	1	2	

output	Signal range	Voltage 0-10V	Voltage 0-10V	--
		Current 0-20mA	--	Current 0-20mA
	Data word format for full-scale	0 to +32000		
	Resolution	12bits		
	LSB value	Voltage 5.00μA	Voltage 5.00μA	
		Current 2.50mV		Current 2.50mV
	Isolation	None		
	Accuracy			
	Worst case (0-55 ˚)	Voltage ±3% full-scale	Voltage ±3% full scale	--
		Current ±2% full scale	--	Current ±2% full scale
	Typical (25 ˚)	Voltage ±1% full scale	Voltage ±1% full scale	--
		Current ±1% full scale	--	Current ±1% full scale
	Settling time ● Resistive load ● capacitive load ● inductive load	0.1ms		 0.2 ms 3.3 ms 0.5 ms（1mH）
	Max output drive	Voltage ≥5000Ω		Current ≤500Ω

1. Schematic and terminal diagrams for AMS-03 are shown in the following figures



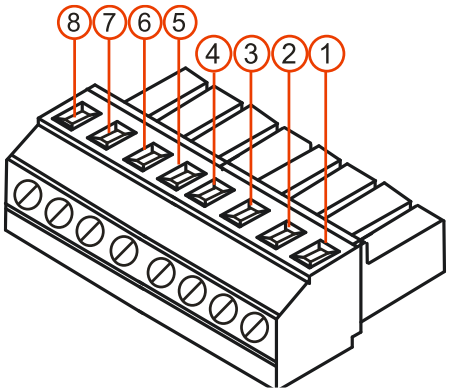
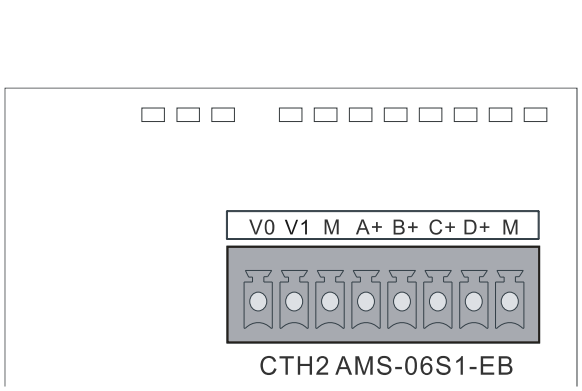
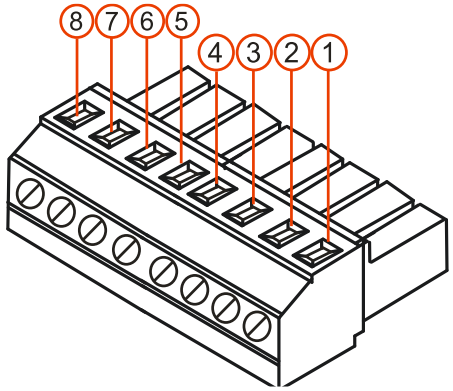


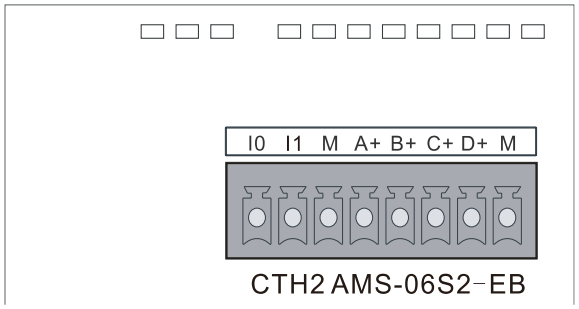
Table 4-58 AMS-03 Terminal definition

Terminal	Signal definition	Terminal	Signal definition
1	Float	5	Analog Input A+
2	Voltage output VO	6	Analog Input B+
3	Current output IO	7	Ground GND-M
4	Ground GND-M	8	Earth

2. Schematic and terminal diagrams for AMS-06 are shown in the following figures







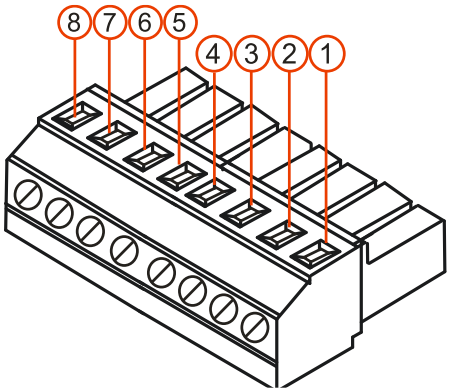


Table 4-59 AMS-06 Terminal definition

Terminal	Signal definition	Terminal	Signal definition
1	Output V0/I0	5	Analog Input B+
2	Output V1/I1	6	Analog Input C+
3	Ground GND-M	7	Analog Input D+
4	Analog Input A+	8	Ground GND-M

<**Note**> A+/B+/C+/D+ are voltage inputs for positive or negative voltage, V1 must be connected with Terminal 3, D+ connected with Terminal 8. M is the common Ground, any output connecting directly with M is not allowed, as the output short would be resulted.

4.10.2 CAN Expansion Board Specifications

Table 4-60 CAN-01 Expansion Board Specifications

Basic features							
Size (W×H×D)	137 x 96 x 62mm						
Suitable product	CPU H224X/H226XL						
Power dissipation	9W						
CANopen communication							
Communication interface	1 (8 Pin)						
Transmission rate (kbps)	1000	800	500	250	125	50	20
Max length (m)	25	50	100	250	500	1000	2500
Max station address	127						
Station address range	1-127						
Max no. of slaves	32						
Max Digital access		No. of Bytes	start address in memory				
	Input	64	IB16				
	Output	64	QB16				
Max Analog access		No. of channels	start address in memory				
	Input	8	AIW64				
	Output	8	AQW64				

Schematic and terminal diagrams for CAN-01 are shown in the following figures.

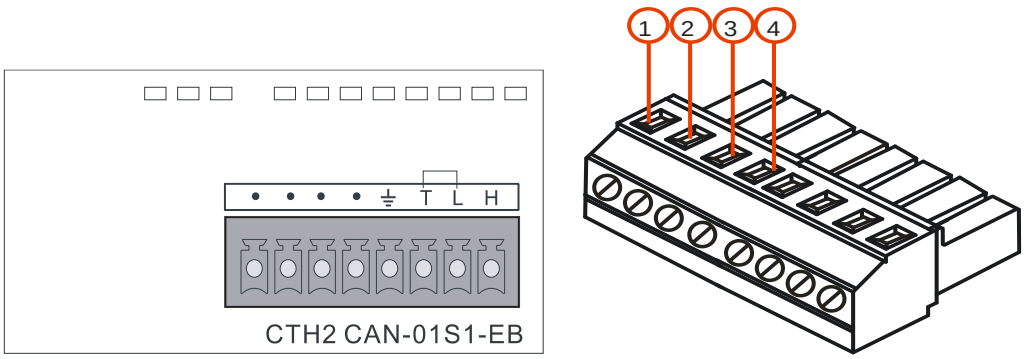


Table 4-61 Terminal definition

Terminal	Signal definition
1	CAN_H
2	CAN_L
3	Terminal 2 with 3 when matching Termination resistor
4	Ground

4.10.3 Expansion Board Installation

Following the below procedures to install Analog I/O and CAN expansion boards:

1、Make sure the power of CPU and related devices are all cut-off, lay down the CPU module.

2、Remove the cover plate along the left-side of Expansion Board.

3、Plug the Expansion Board into board slot, make sure the pins are fit closely with the socket.

4、Make the right-side of cover plate inclined to insert into slot on board slot of the CPU.

5、Press the left-side of the cover plate inclining, fit it onto CPU again.

Notice

- CTH200 CPUs all support Analog I/O expansion board, but only H224X and H226XL support CAN-01.
- CAN-01 can be used for CPU directly, but Analog I/O expansion board can be used for CPU only by invoking ExBoard_H200 library or special memory. For more details，please refer to the section 6.4.2.
- Hot-plug is not supported for the board.

5 Network Communication

CTH200 PLCs support common serial network communication including PPI, MPI, Freeport and DP, and more complex Ethernet communication, they can fulfill various network and communication requirements.

5.1 PPI Communication

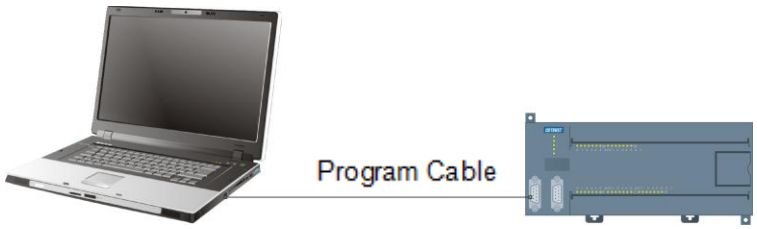
PPI is a master-slave protocol by which the master sends request to the slave for responding. If the master haven't send request, slaves would be standby. CTH200 PLCs support PPI protocol to use NETR/NETW instructions transferring data with baud rate 9.6kbps, 19.2kbps or 187.5kbps. CTH200 PLC uses the build-in programming port as normal Communication networking interface, no need for additional configuration for module or software.

Up to 31 PLCs, Copanel HMIs, Siemens OP/TP panel or MPI cards as station on Host can constitute the PPI communication network.

Single master in PPI

The following examples is one master with one slave.

Programming PG/PC as Master, CTH200 PLC as Slave.



Copanel HMI as Master, CTH200 PLC as Slave.

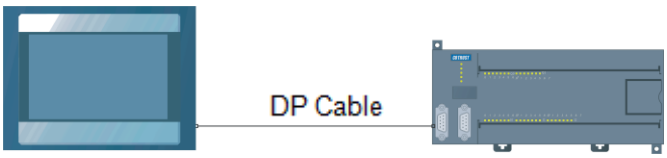
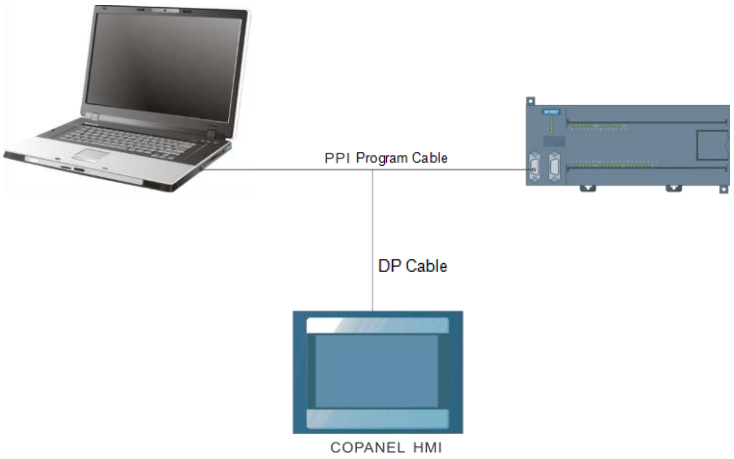


Figure 5-1 Single master in PPI

Note: it's recommended to use PLC Programming cable from Cotrust. Communication cable selection is depend on specific HMI, to avoid damaging devices.

Multiple masters in PPI

The following example is two masters with one slave.Programming PG/PC and HMI as Masters, CTH200 PLC as Slave.



The following example is multiple masters with multiple slaves.Programming PG/PC and HMI as Masters, CTH200 PLC as Slaves.

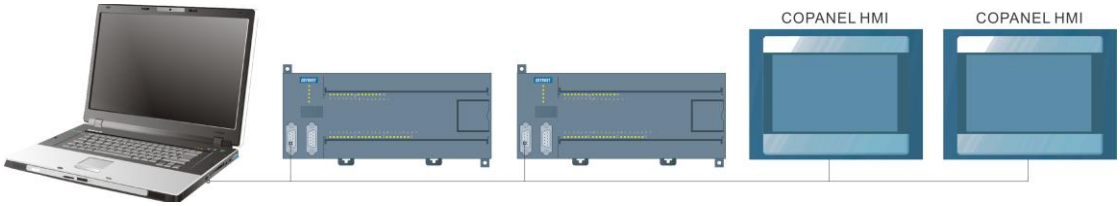


Figure 5-2 Multiple masters in PPI

The following example is multiple CTH200 CPUs interconnection, which using NETR/NETW instructions to achieve network communication. Each CTH200 CPUs can be either Master or Slave, they communicate with each other via the PPI port.

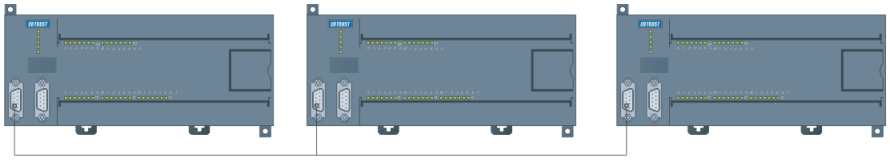


Figure 5-3 Multiple CPUs interconnection

5.2 MPI Communication

MPI Support master-slave and master-master communication.

CTH200 PLCs can be connected into MPI network by using built-in interface with baud rate 19.2Kbps or 187.5Kbps. they can communicate with SIMATIC S7-300/S7-400 CPU as slaves in MPI network.

Multiple masters in MPI network

As shown in the following figure, S7-300 PLC and Copanel HMI as masters in MPI network, CTH200 PLC as master. S7-300 master PLC read/write the data of CTH200 by using XGET and XPUT instructions.

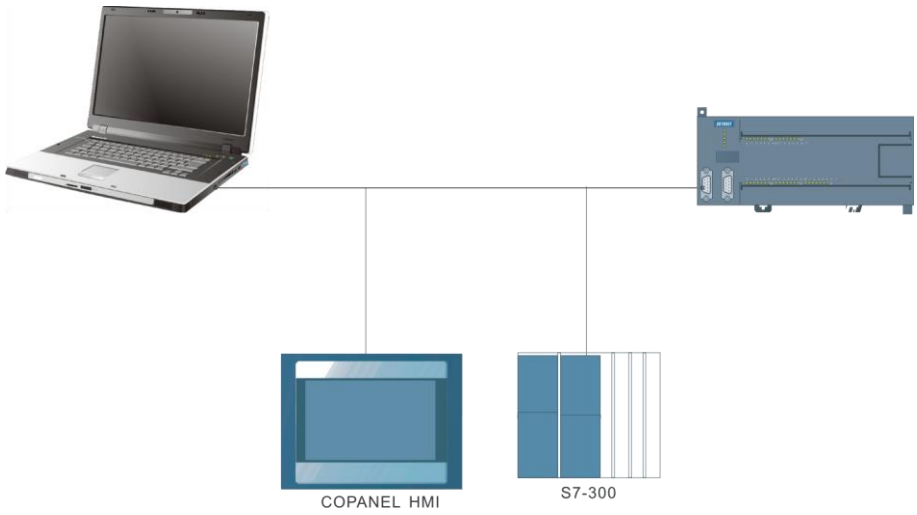


Figure 5-4 Multiple masters in MPI

5.3 Freeport communication

By using Freeport communication, CTH200 PLC can communicate with any third-party devices which disclosed communication protocols. These devices include Data acquisition module, controller, printer or bar code reader, drives, modems, host PC and so on.

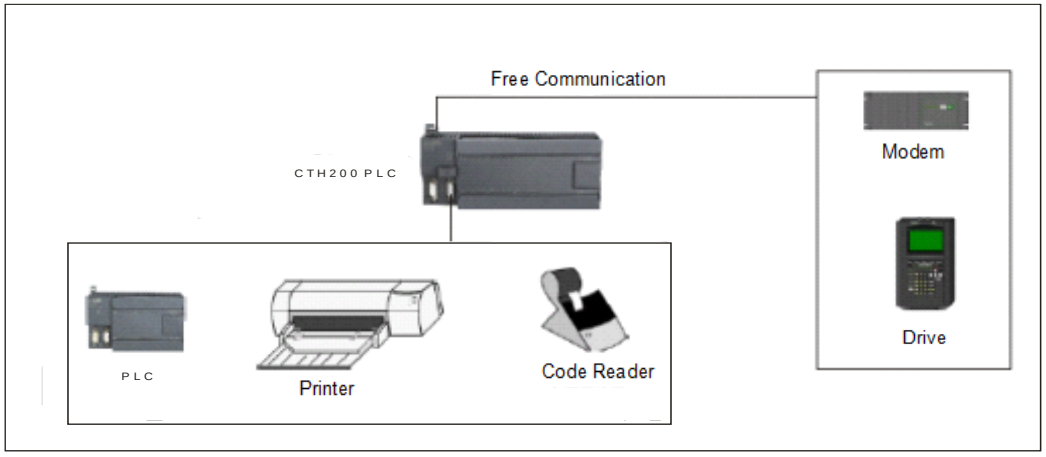


Figure 5-5 Freeport communication

5.4 CANopen Communication

CTH200 CPUs can be connected with CANopen slave module via Ethernet port. With other expansion modules attached, they can achieve real-time data exchange with high reliability. Typical CANopen communication architecture is shown in the following figure:

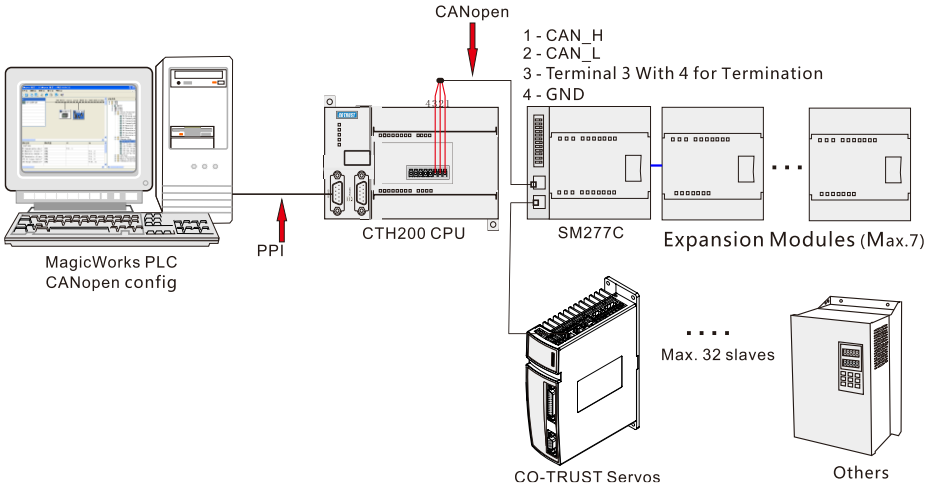


Figure 5-6 CANopen communication architecture

As shown in the above figure, CTH200 PLC connects with SM277 CANopen module and its expansion modules via CAN-01 expansion board, thus can control the Servo Drives.

Note: For more details about related terminals and wiring on the expansion board, please refer to the section 4.10.2.

5.5 Ethernet Communication

CTH200 PLCs use MagicWorks PLC software to realize Ethernet communication:

CTH200 PLC uses Ethernet port to connect with communication processor in industry Ethernet to realize the conversion from TCP/IP to MPI protocol. For remote programming and debugging PLC, Users can use MiCo system with MagicWorks PLC. Please refer to the MiCo System User Manual for more details at http://www.co-trust.com.

Typical network architecture is shown as following:

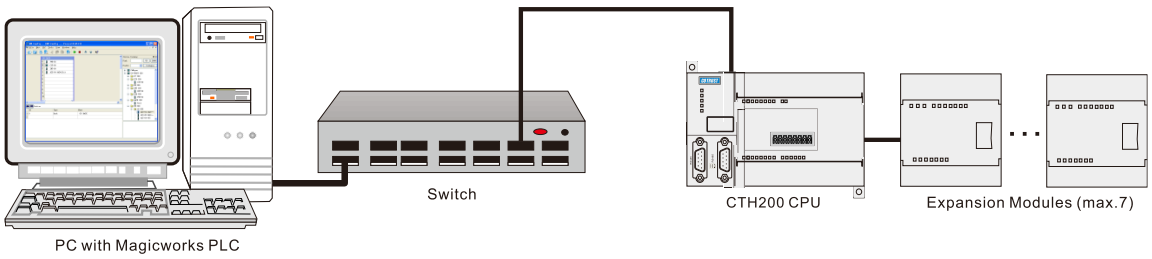


Figure 5-7 Ethernet communication architecture

6 Applications

In this chapter, there are several application examples about using various communication functions of CTH200 with Magicworks PLC software. 。

6.1 CANopen Communication

In this section, users would be guided to accomplish data transfer via CANopen communication by using an application example.

6.1.1 Components

In this example, we use CAN master expansion Board to build an CANopen network consisting of slave modules.

Table 6-1 example components

Components	Description
PG/PC with MagicWorks PLC	As of MagicWorks PLC V2.08
One PLC programming cable	Connect program station with master
One CTH200 CPU	CTH200 CPU as CANopen master
One CAN master expansion board	CAN-01
One slave device	SM277C
One CANopen Bus Cable	Shielded cable or twisted-pair
Three expansion modules	Connect with SM277C, 2 CTH200 digital and 1 analog modules
Two Servo drives	1 E10 and 1 third-party servo drive

Components description:

PG/PC

Make sure the PG/PC has been connected with CANopen master (via PPI). MagicWorks PLC as of V2.08 must be used.

PLC Programming cable

Cable connecting PG/PC with CANopen master CPU, used for downloading projects and monitoring data.

CANopen master

CPU H226XL with CAN-01 master expansion board as CANopen master.

CAN-01 Master expansion board

Used with CPU H224X/H226XL/H228XL, expanding for CANopen master.

CANopen Bus cable

Shielded cable or twisted-pair.

SM277C

SM277C with CAN dual-port and DIP switch for baud rate selecting, as CANopen Slave.

Expansion modules

Up to 7 CTH200 expansion modules can be used with SM277C.

Servo Drives

E10, can be used with third-party servos.

6.1.2 Network connection

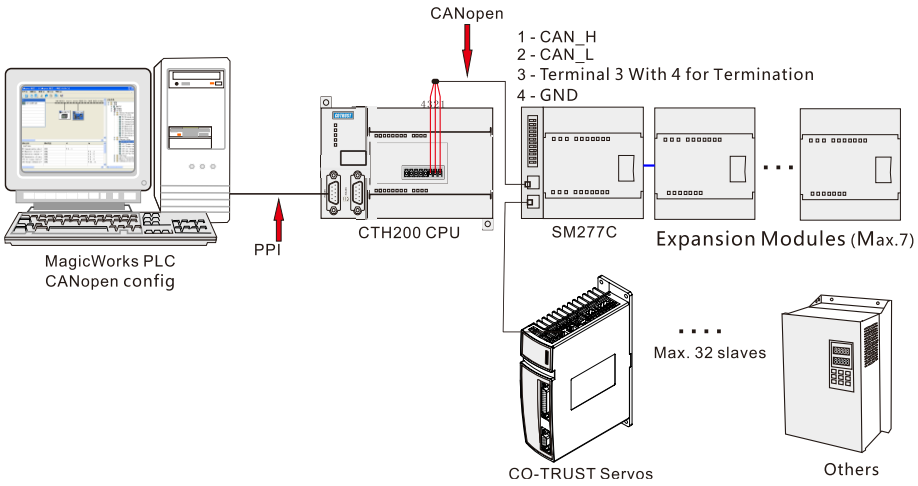


Figure 6-1 CANopen communication architecture

CANopen bus uses standard network cable to connect the CPU terminals as shown in the above figure.

6.1.3 Procedures

CANopen network configuration

1. Open the "EasyCAN Config" page

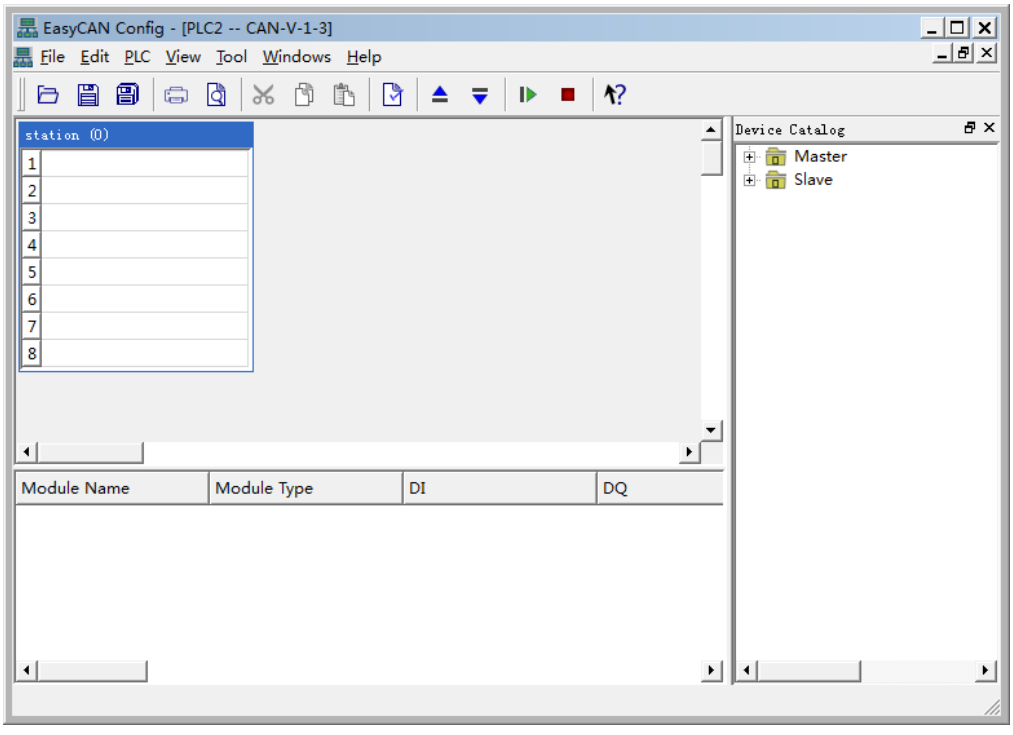
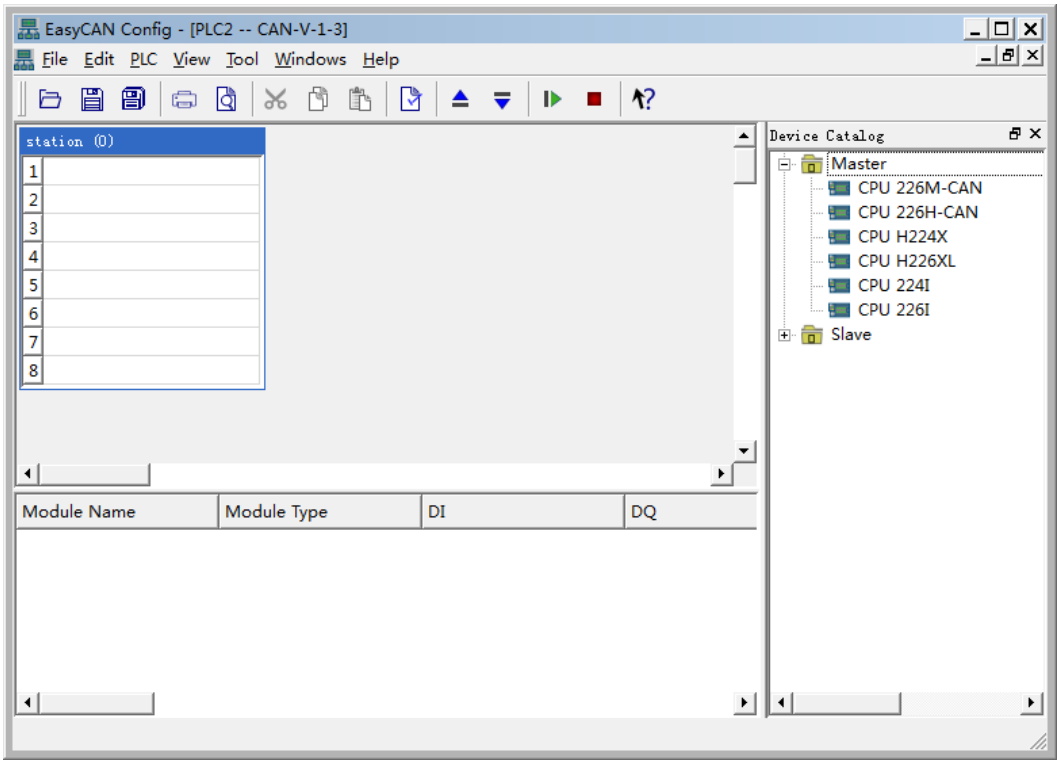


Figure 6-2 EasyCAN Config page

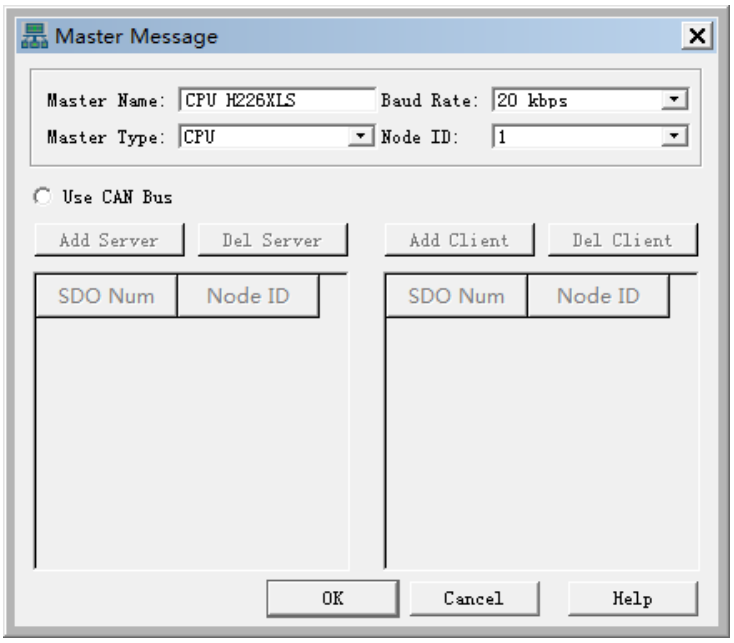
2. Add Master

In the CANopen Bus editor as shown in following figure, select the CTH200 PLC corresponding with device currently in use in the “Device Catalog” of Master, drag and drop it into slot 1 of Station 0.



Then, double-click the master CPU H226XL in slot 1, a information dialog would pop-up, shown in the following figure.

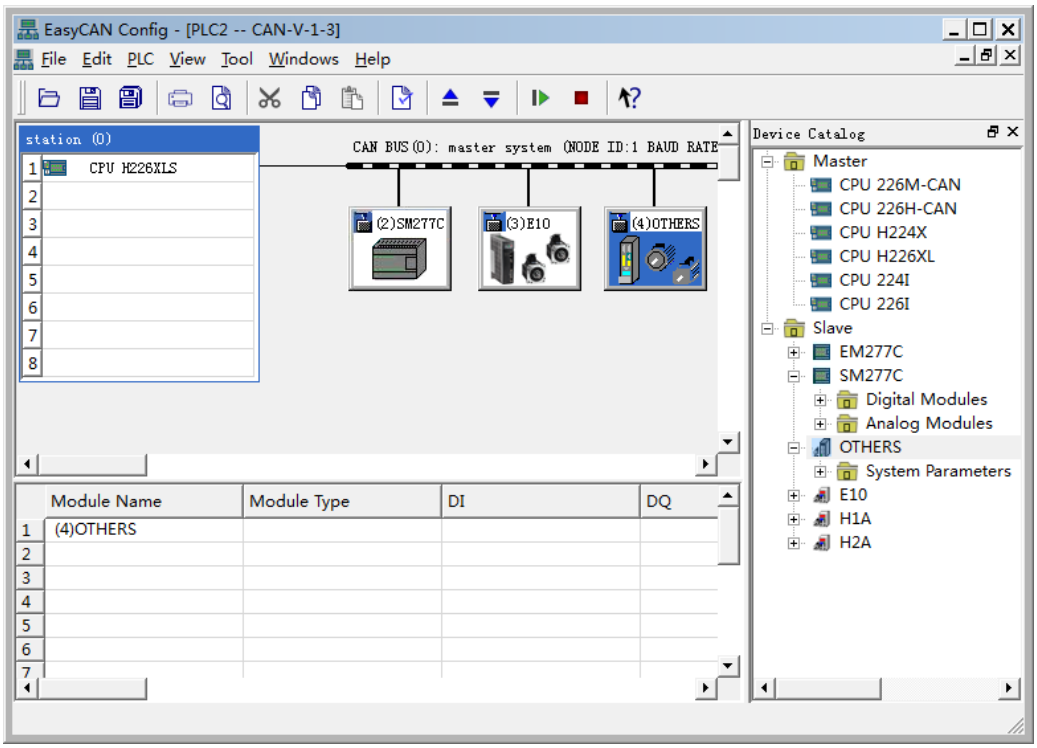
Here we set for 20kbps Baud Rate, CPU for Master Type, 1 for Node ID and check the “Use CAN Bus” box.



3. Slave Configuration

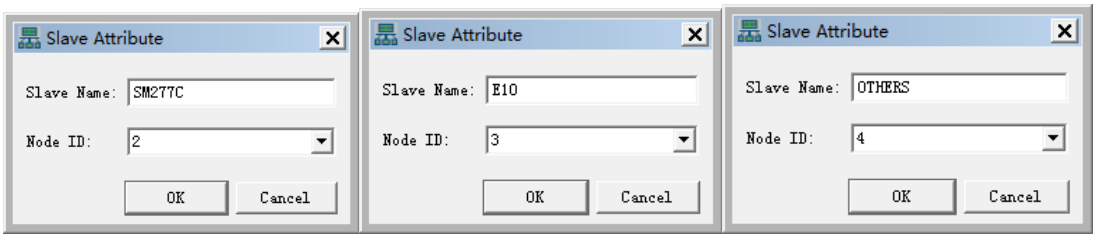
1) Add Slave

Click to expand the Device Catalog, open the slave node to select the slave device corresponding with current device, drag and drop it into the configuration area, while it would be connected with CAN BUS automatically.



2) Setting slave parameters

Double-click the icon below CAN BUS to pop-up the Slave Info Dialog.



Here you can set the following slave parameters:

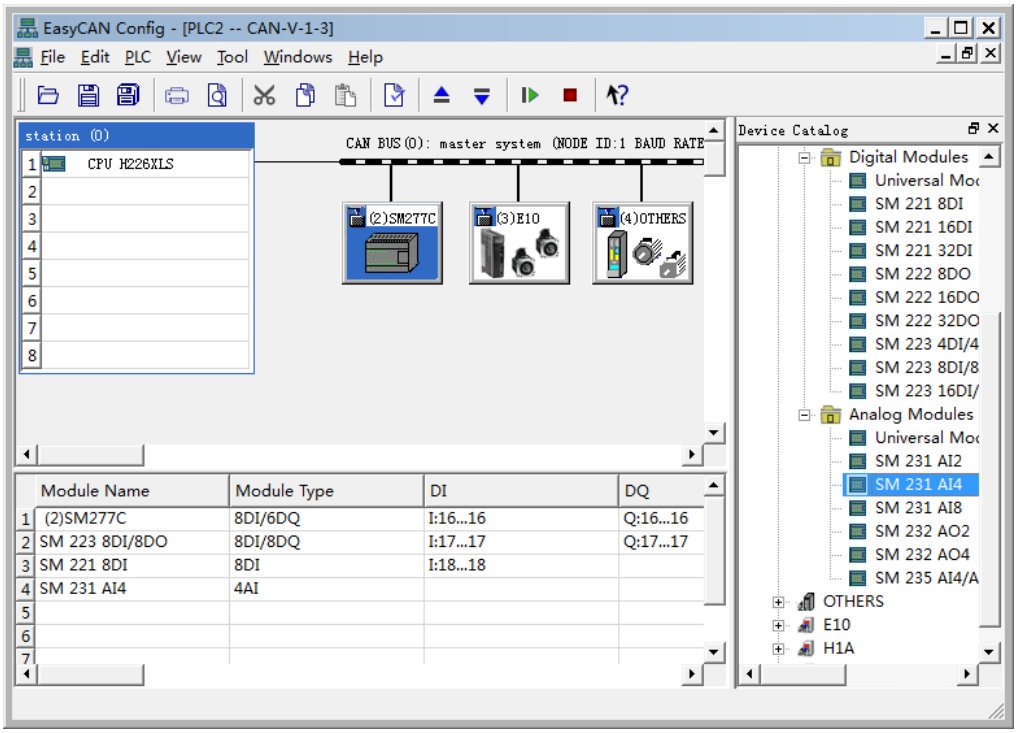
■ Slave Name: Name for the Slave (Default as SM277C, CT E10 or OTHERS).

■ Node ID: Range from 1 to 127.

3) Configure expansion modules for Slave SM277C

Click the right-side of Device Tree to open the Analog module or Digital module node under SM277C, check the module corresponding with current device, drag and drop it into specified slot, then the module can be added into current slave.

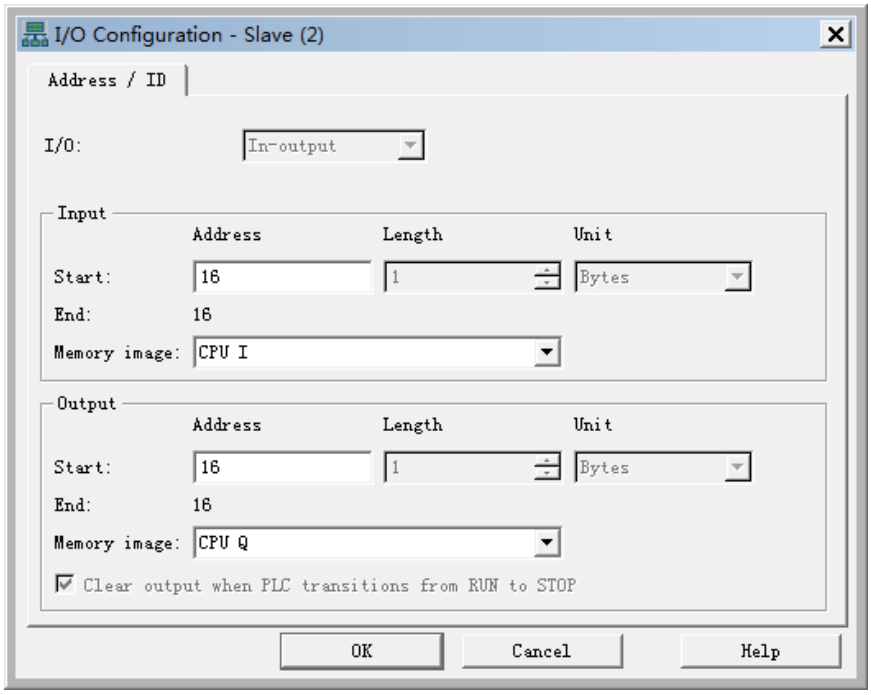
You can also double-click the required module nodes on Device Tree to add them into current slave in order. After which the I/Q address would be assigned automatically.



Modify the I/O Configuration

Magicwoks PLC as of V2.08 supports user-defined Start Address for I/O and adds V Memory image, to allow users select Memory image.

Double-click the non-blank line to pop-up this dialog:



Here you can modify the Start and End Addresses for Module I/Os and Memory image, the later is related with R/W attributes for currently selected parameters:

Digital Input: Image to CPU I Memory and V Memory;

Digital Output: Image to CPU Q Memory and V Memory;

Analog Input: Image to CPU AI Memory and V Memory;

Analog Output: Image to CPU AQ Memory and V Memory;

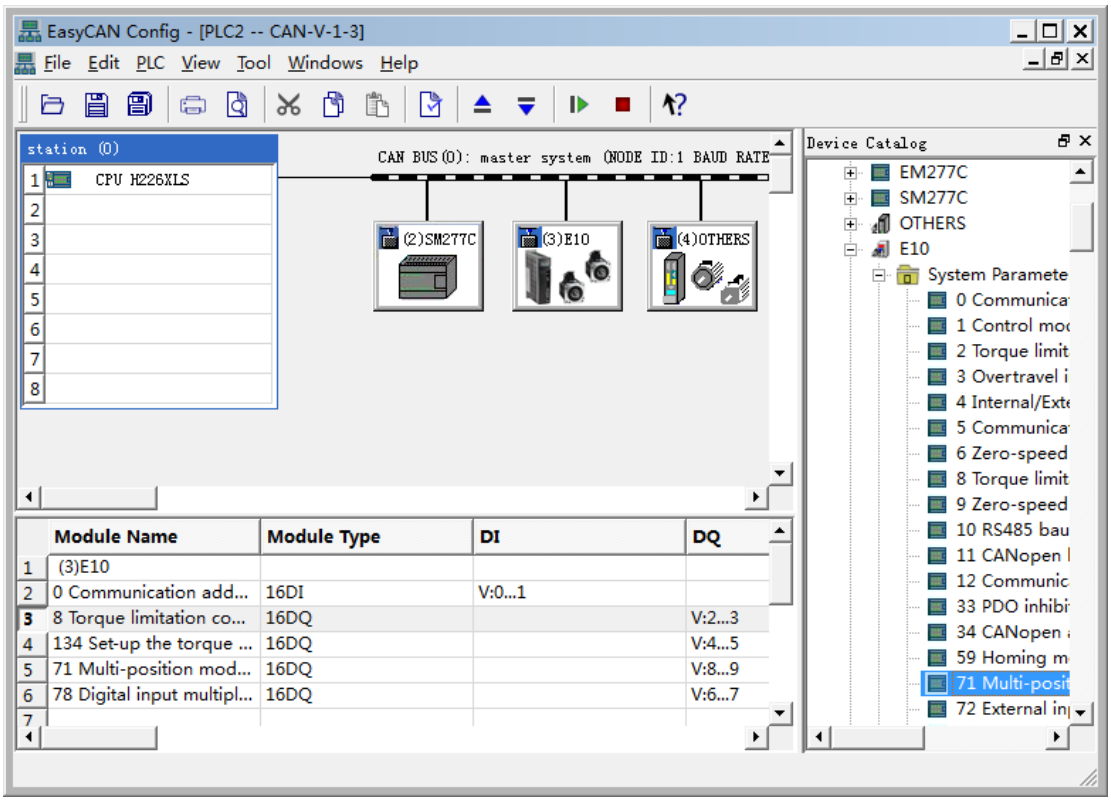
Table 6-2 Valid address range for Memories

Memory	Address Range
I	IB16~IB79
Q	QB16~QB79
AI	AIW64~AIW386
AQ	AQW64~AQW386
V	VB0~Vmax

Important Note: For specified modules, the I/O Type and Length cannot be modified unless the module type is Universal Module. The system would check the validity automatically for selected address. If corresponding module type cannot be found under SM277C, you can add Universal Module and make custom settings.

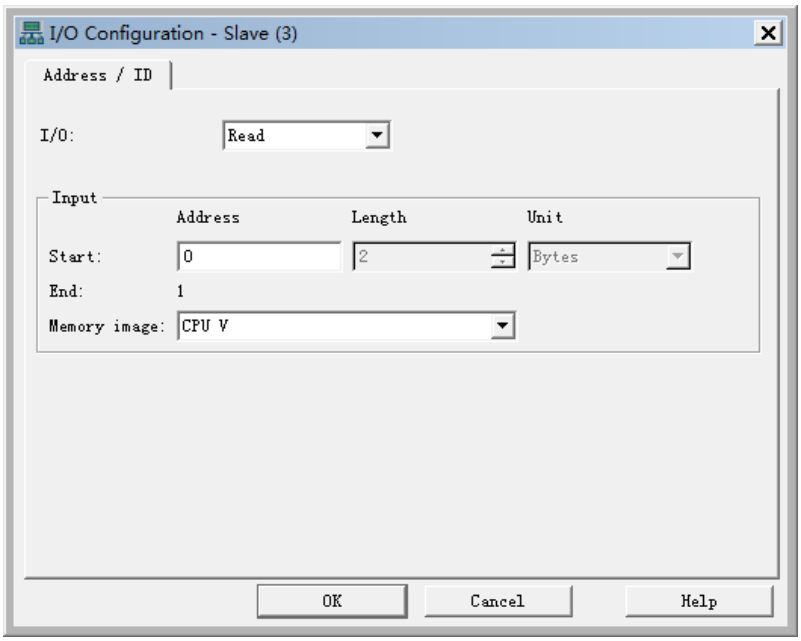
4) Configure Parameters for Slave CT E10

Click the Device Tree to open the various parameter types under CT E10, select required parameters and add them into module list. After that the minimal available I/Q addresses would be assigned automatically, you can modify that by double-clicking.



Modify IO Configuration

Double-click any parameter in the module list, the following dialog appears:



I/O: set the Read/Write attribute for parameters.

Start

• Address: set the Start address for parameters.

• Length: use Default value, not editable.

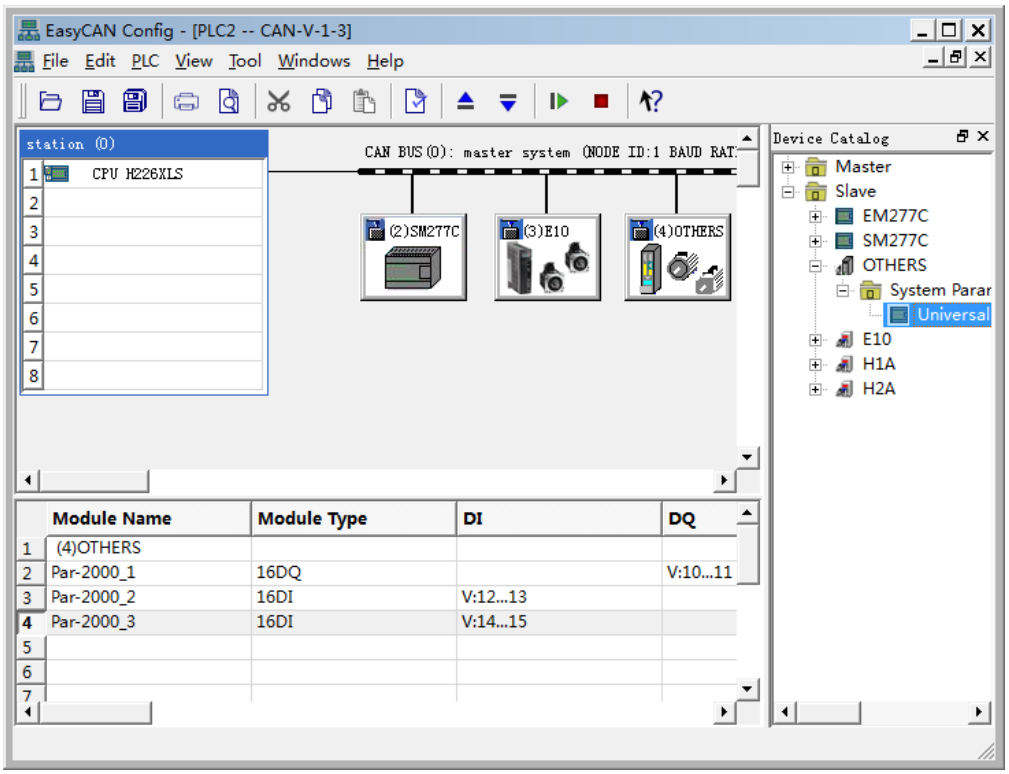
• Unit: use Default value, not editable.

End: use the value calculated by system.

Memory image: select the Memory image type for CPU, the available type is related with I/O Read/Write type.

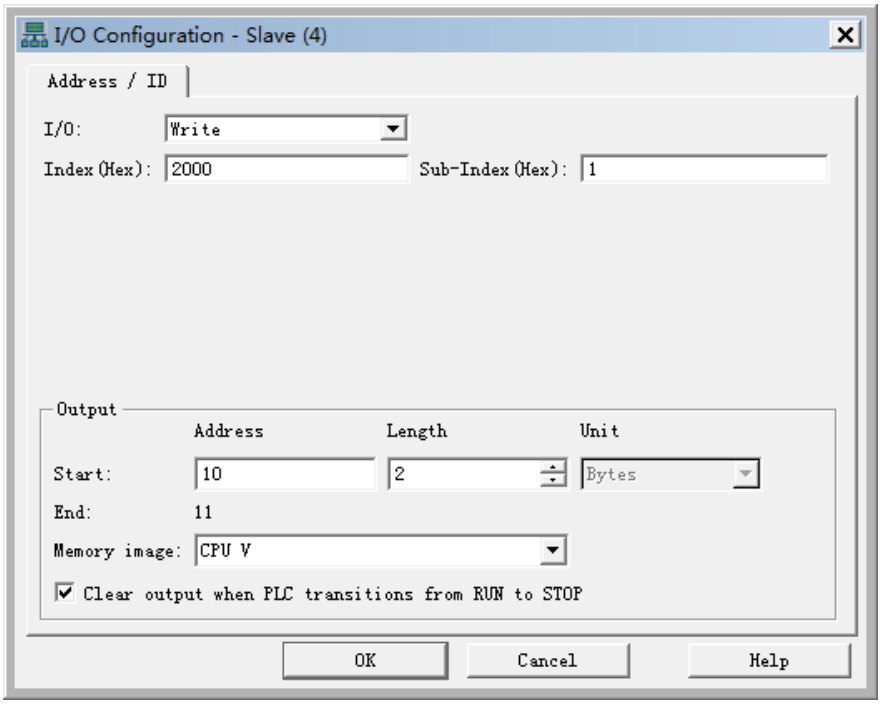
5) Configure Parameters for Third-party Slave

MagicWorks PLC as of V1.73 supports the third-party CANopen slave configuration, click and expand the Device Tree on the right, open OTHERS slave node to select required parameters and add them into module list. After that the minimal available I/Q addresses would be assigned automatically, you can modify that by double-clicking.



Modify IO Configuration

Double-click any parameter in the module list, the following dialog appears:



I/O: set the Read/Write attribute for parameters.

Index(Hex): Main index for selected slave parameter.

Sub-Index(Hex): Sub index for selected slave parameter.

Start

• Address: set the Start address for parameters.

• Length: It's required for Total length of configured R/W data is multiple of 4.

• Unit: use Default value, not editable.

End: use the value calculated by system.

Memory image: select the Memory image type for CPU, the available type is V and Q.

Clear output when PLC transitions from RUN to STOP: check this option to clear the contents in image address; or else the contents remain unchanged.

Notice

- For valid address range, refer to Table 6-2;
- The EDS Importing for third-party slave is not supported currently, please refer to the related product manuals for inputting main index and sub index;
- In actual connection. If the third-party slave has detected error, the corresponding SMB information area would display : 0x7 configuration parameter error;
- For details about Cotrust Servo Drives, please visit the website at http://www.co-trust.com/cn/product_show.php?id=77

4, Hardware Connection and Configuration

➢ Connect CPU H226XL with PC by using communication cable (the USB end connects to the USB socket of PC, the RS485 end connects to the RS485 port of CPU H226XL).

➢ connect the CAN port on CAN-01 board of CPU to the CAN port of SM277C by using communication cable.

➢ Set the DIP switch referring to the Table 6-3: Communication rate is 20kbps, Node ID is 4.

Figure 6-3 DIP switch selection

DIP7-DIP1 (Node address): in binary, MSB - DIP7, LSB - DIP1.

DIP10-DIP8 (Baud rate): in binary, MSB - DIP10, LSB - DIP8.

Notice

0 is the global address, which is forbidden while using.

Table 6-3 DIP switch configuration

DIP10	DIP9	DIP8	Communication rate (kbit/s)	Max distance (m)
OFF	OFF	ON	20	2500
OFF	ON	OFF	50	1000
OFF	ON	ON	125	500
ON	OFF	OFF	250	250
ON	OFF	ON	500	100
ON	ON	OFF	800	50

ON	ON	ON	1000	25

DIP11 (Terminal resistance): Set as ON only if the device is the last one in the device ring.

DIP12: Reserved.

➢ Attach the SM223 8DI/8DO, SM221 8DI and SM231 AI2*16BIT modules after the extended port of SM277C.

➢ Then check and confirm the wiring correctly.

➢ Switch on the power supplies for various devices in the system.

5. Save the current project after CANopen configuration completed, compile it in the EasyCAN configuration interface, download the CANopen configuration into PLC.

6. CPU H226XL has extended 64Byte I /64Byte Q / 162Words AI / 162 Words AQ Memory for CANopen，to serve as the Address image of each module. The I/Q Address of modules in EasyCAN configuration is shown in the following figure.

	Module Name	Module Type	DI	DQ
1	(2)SM277C	8DI/6DQ	I:16...16	Q:16...16
2	SM 223 8DI/8DO	8DI/8DQ	I:17...17	Q:17...17
3	SM 221 8DI	8DI	I:18...18	
4	SM 231 AI4*12Bit/16Bit	4AI		
5				
6				

Module

After configuration, you can monitor the I/Os for SM277C, SM221 8DI, SM223 8DI/8DO and SM231 AI4*12Bit/16Bit, as shown in the following:

	Address	Format	Current Value	
1	Q16.0	Bit	2#1	6 Outputs for SM277C(Q16.0~Q16.5)
2	Q16.1	Bit	2#1	
3	Q16.2	Bit	2#1	
4	Q16.3	Bit	2#1	
5	Q16.4	Bit	2#1	
6	Q16.5	Bit	2#1	
7	Q17.0	Bit	2#0	8 Outputs for SM223 8DI/8DO(Q17.0~Q17.7)
8	Q17.1	Bit	2#1	
9	Q17.2	Bit	2#1	
10	Q17.3	Bit	2#0	
11	Q17.4	Bit	2#0	
12	Q17.5	Bit	2#1	
13	Q17.6	Bit	2#1	
14	Q17.7	Bit	2#1	
15	Q18.0	Bit	2#0	8 Inputs for SM231 8DI(I18.0~I18.7)
16	Q18.1	Bit	2#0	
17	Q18.2	Bit	2#0	
18	Q18.3	Bit	2#0	
19	Q18.4	Bit	2#0	
20	Q18.5	Bit	2#0	
21	Q18.6	Bit	2#0	
22	Q18.7	Bit	2#0	
23	AIW64	Signed	-32768	4 Inputs for SM231 4AI(AIW64~70)
24	AIW66	Signed	-32768	
25	AIW68	Signed	-32768	
26	AIW70	Signed	-32768	

6.2 Modbus TCP Communication

This Guide leads users to create an application by using a specific instance, thus can help users understand the Modbus TCP communication function of CTH200。

In the Modbus TCP communication network, with CPU as Slave, the communication is independent with the whole cycle period; with CPU as Master, the Receiving / Sending is controlled by user program.

When using the EtherNET port for Modbus TCP communication, CTH200 PLC can serve as Modbus TCP slave directly without any configuration, the default port number is 502 and if you need to modify IP address, please refer to the Chapter 2 Getting Started.

When CTH200 PLC serve as Modbus TCP master to communicate with other slaves, you need to use Modbus TCP Wizard or Ct_Mbus_master_tcp_single library to configure the master communication.

Notice

Please refer to the Section 5.5.3 in “Maigcworks PLC user Manual” V1.40 for how to use the Modbus TCP Wizard and Ct_Mbus_master_tcp_single library. The related Manuals and Library files can be downloaded from http://www.co-trust.com/.

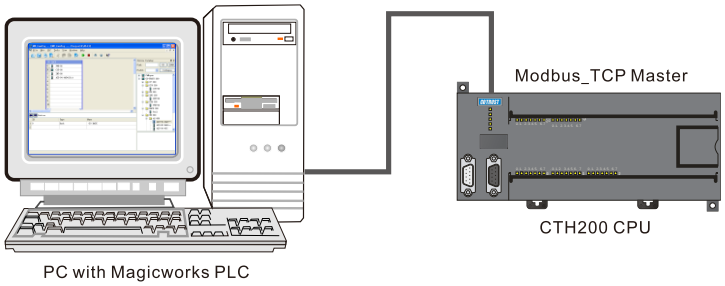
6.2.1 Components

Table 6-4 example components

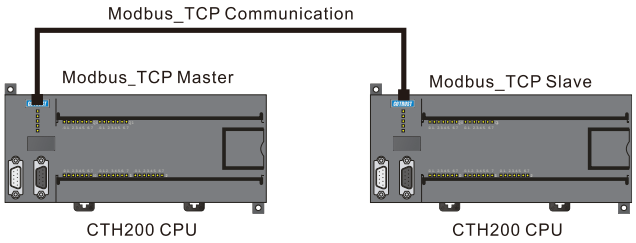
Component	Description
Program Device PG\PC	Installed with MagicWorks PLC (as of V2.08), used for CTH200 PLC configuration, programming and debugging.
CPU	Two CTH200 PLC, one for Modbus_TCP master, the other for Modbus_TCP slave, they communicate with each other via EtherNET port.
Standard Network Cable	• connect CTH200 PLC and Program device • connect PLC (Modbus_TCP master) and PLC (Modbus_TCP slave)

6.2.2 Network connection

Connect Program device with CTH200 PLC by standard network cable, then use the CT_Modbus_TCP library from COTRUST to program the Modbus master (CTH200):



Connect Modbus_TCP master and Modbus_TCP slave by standard network cable, Modbus_TCP master write data from specified address to the Modbus_TCP slave, then read data from Modbus_TCP slave, thus realize the Modbus TCP communication:



Notice

CPU H224X/H226XL/H228XL not support adaptive crossover, thus the PLCs should use Crossover Cable to implement ModBus_TCP.

6.2.3 Procedures

Step 1: connect cable

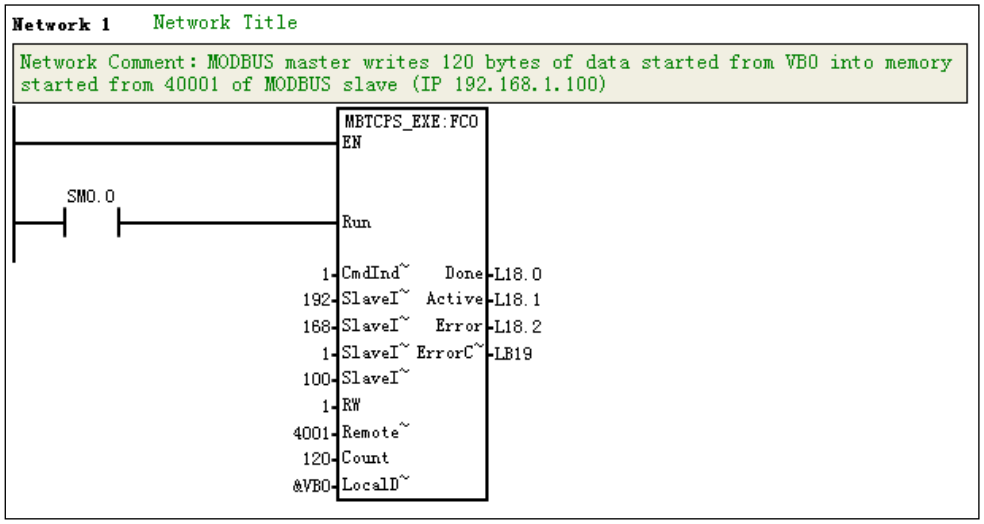
Connect PC with Modbus_TCP master by using a standard network cable.

Step 2: set Communications

Create a new project in MagicWorks PLC and add a CTH200 station, refer to the Section 2.2 PLC Communication Settings to establish a communication connection between CTH200 PLC and PC.

Step 3: Program for the Modbus master (CTH200 PLC)

1) open the Program Block in MagicWorks PLC to program for the Modbus_TCP master. you can use either Ct_Mbus_master_tcp_single library or Modbus TCP Wizard, here with MBTCPS_EXE instruction from Ct_Mbus_master_tcp_single library as example:



<Note> if multiple R/W operations need to be configured, it's recommended to use the Modbus TCP Wizard in the MagicWorks PLC. For details, refer to the section 5.5.3 ModBus-TCP Wizard in Magicworks PLC User Manual V1.4.

2) When the program finished, compile and download it into Modbus_TCP master device.

The following table is the definition of MBTCPS_EXE instruction from Ct_Mbus_master_tcp_single library

Symbol	Variable type	Data type	Description
EN	IN	BOOL	Enable instruction
RUN	IN	BOOL	Start communication, edge triggered
CmdIndex	IN	BYTE	number for calling MBTCPS_EXE, which cannot be repeated, valid range 1～255
SlaveIP0	IN	BYTE	1st byte of the slave address
SlaveIP1	IN	BYTE	2nd byte of the slave address
SlaveIP2	IN	BYTE	3rd byte of the slave address
SlaveIP3	IN	BYTE	4th byte of the slave address
SlavePort	IN	WORD	Monitored port of slave, if the slave is a CTH200 PLC, then the port is default as 502.
RW	IN	BYTE	Read = 0; Write = 1
RemoteAddr	IN	DWORD	ModBus Address (default as 40001)
Count	IN	WORD	No. of elements (1-120 words or 1-1920bits)
LocalDatapt r	IN	DWORD	Local data pointer (such as &VB1000)
Done	OUT	BOOL	Done flag (0 = undone; 1 = done)
Active	OUT	BOOL	Instruction activation (0 = active; 1 = inactive)
Error	OUT	BYTE	0: no error 1: error
ErrorCode			Error code, valid when Done = 1 Details refer to the following List.

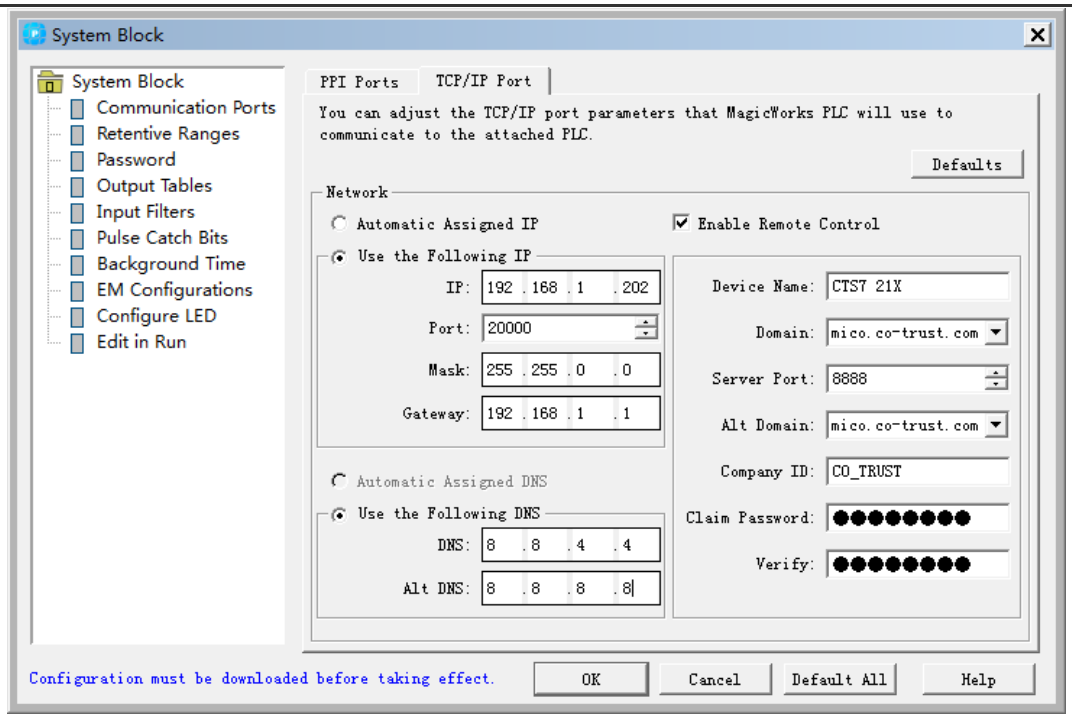
Error Code List

Error Code	Description
0	No error
1	Reached the max number of connections
2	Establishing connection
3	Timeout error
4	Errror with requested parameter
5	Instruction not enabled
6	Connection is busy handling other request

Step 4: Modbus TCP master interconnect with Modbus TCP slave

When configuring Modbus TCP slave, the slave IP must be corresponding with IP set by master. If you need to modify IP address of the slave, open the System Block in Magicworks PLC as following figure to operate here.

Additionally, for ModBus TCP communication between PLCs, it’s required that the port number of slave should not less than 1024.



Step 5: Debug

Following the above orders to connect the master and slave, then read out 120 data started from Modbus_TCP address 40001 in the state table of MagicWorks PLC. If the content is consistent with data in the memory for Modbus_TCP master, then Modbus TCP communication is successful.

6.2.4 Address Image for ModBus TCP slave

ModBus address is consist of Data Type and 5~6 character values of the offset. The first 1 or 2 is Data Type, the other is a value conforming to the data type. ModBus-TCP slave support the following addresses:

Address Image for slave with TCP protocol

ModBus slave address	CTH200 address
000001	Q0.0
000002	Q0.1
000003	Q0.2
...	...
000127	Q15.6
000128	Q15.7
010001	I0.0
010002	I0.1
010003	I0.2
...	...
010127	I15.6
010128	I15.7
030001	AIW0
030002	AIW2
030003	AIW4

...	...
030032	AIW62
040001	VW0
040002	VW0+2
...	...
04xxxx	VW0+2 x (xxxx-1)

6.3 UDP PPI Communication

This section would lead users to create a application for CTH200 UDP PPI communication (EtherNET Port).

In the UDP PPI network, CPU works as master which is independent with the whole cycle period; with CPU as Master, the Receiving / Sending is controlled by user program.

When using the EtherNET port for Modbus TCP communication, CTH200 PLC can serve as Modbus TCP slave directly without any configuration, the default port number is 502 and if you need to modify IP address, please refer to the Chapter 2 Getting Started.

The CTH200 PLCs can serve as UDP PPI master or slave to communicate with other devices in the same LAN by using NETW/NETR Wizard or UDP_NETR/UDP_NETW instructions. The CTH200 PLC can also be used as slave of HMI in the UDP_PPI network.

Notice

For details about how to use NETW/NETR Wizard, please refer to the Section 5.5.2 in “Maigcworks PLC user Manual” V1.40. The related Manuals and Library files can be downloaded from http://www.co-trust.com.

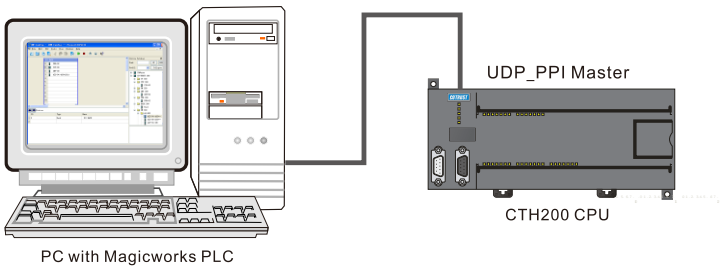
6.3.1 Components

Table 6-5 UDP PPI example components

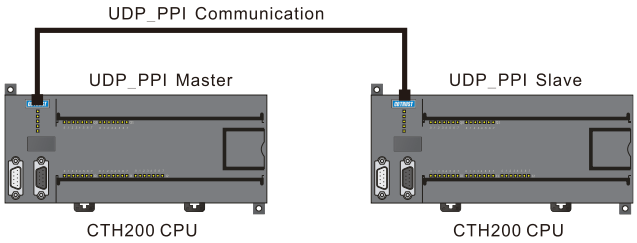
Components	Description
Program Device PG\PC	Installed with MagicWorks PLC (as of V2.08), used for CTH200 PLC configuration, programming and debugging.
CPU	Two CTH200 PLC, one for UDP_PPI master, the other for UDP_PPI slave, they communicate with each other via EtherNET port.
Standard Network Cable	• connect the CTH200 PLC with PG/PC • connect CTH200 PLC (UDP_PPI master) with CTH200 PLC (UDP_PPI slave)

6.3.2 Network connection

Connect the PG\PC with CTH200 by using standard cable, then the PG/PC would be used for UDP_PPI master (CTH200 PLC) programming:



Connect UDP_PPI master and UDP_PPI slave by using standard network cable, UDP_PPI master writes data from specified address to the UDP_PPI slave, then read data from UDP_PPI slave, thus realize the UDP_PPI communication:



Notice

CPU H224X and H226XL not support adaptive crossover, thus a crosswire should be used for UDP_PPI communication.

6.3.3 Procedures

Step 1: connect cable

Using a standard cable to connect the PC with UDP_PPI master (CTH200) as shown in the above figures。

Step 2: Set communication

Create a new project in MagicWorks PLC and add a CTH200 station, refer to the Section 2.2 PLC Communication Settings to establish a communication connection between CTH200 PLC and PC.

Step 3: Program for UDP_PPI master (CTH200)

There are two methods to Read/Write the UDP_PPI Master.

1）Using UDP_NETR/UDP_NETW Instructions to program for the UDP_PPI Master

Parameter table for UDP_NETR/UDP_NETW Instruction:

D	A	E	0	Error Code	0
The 1st byte for IP Address					1
The 2nd byte for IP Address					2
The 3rd byte for IP Address					3
The 4th byte for IP Address					4
The upper byte for port number					5
The lower byte for port number					6
The 1st byte for remote station pointer <I, Q, M, V, DB> (4 bytes)					7
The 2nd byte for remote station pointer					8
The 3rd byte for remote station pointer					9
The 4th byte for remote station pointer					10

Data length	11
Data byte 0	12
Data byte 1	13
...	**...**
Data byte 199	211

D: Done (Function completely), 0= No, 1=Yes

A: Active (function sequence), 0=No , 1=Yes

E: Error, 0=No , 1=Yes

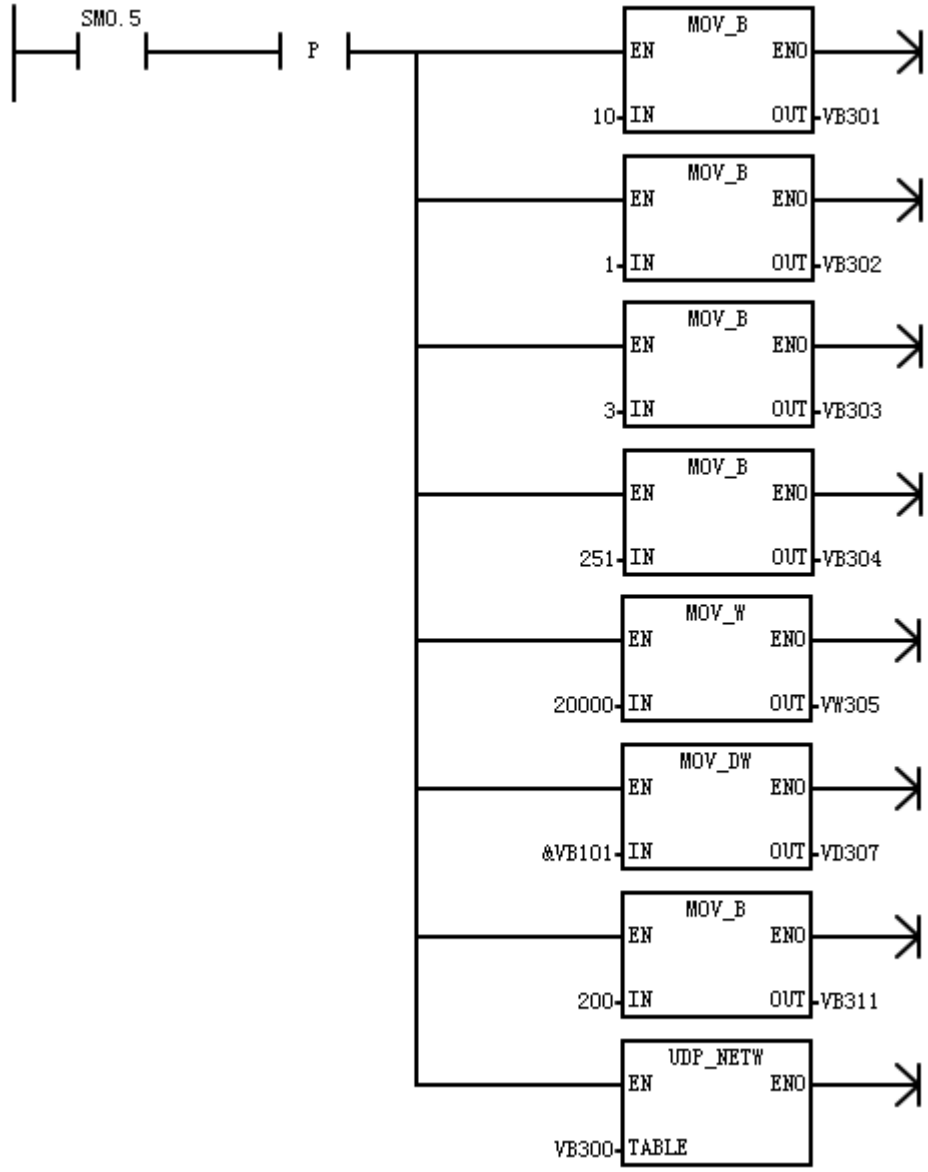
The lower 4 bit for the 1st byte is error code, defined as following:

Error Code	Description
0	No error
1	Timeout Error; no response from remote station
2	Receive error; validation, frame or checksum error in the response
3	Offline error; duplicate address or Conflicts resulted by hardware fault
4	Queue overflow error; activated more than 8 UDP_NETR/UDP_NETW block
6	illegal parameter; UDP_NETR/UDP_NETW table contains a illegal or invalid value
7	No resources; the remote station is busy (uploading or downloading sequences)
8	Error in layer 7; violate the application protocol
9	Information error; Data address error or Data length incorrect

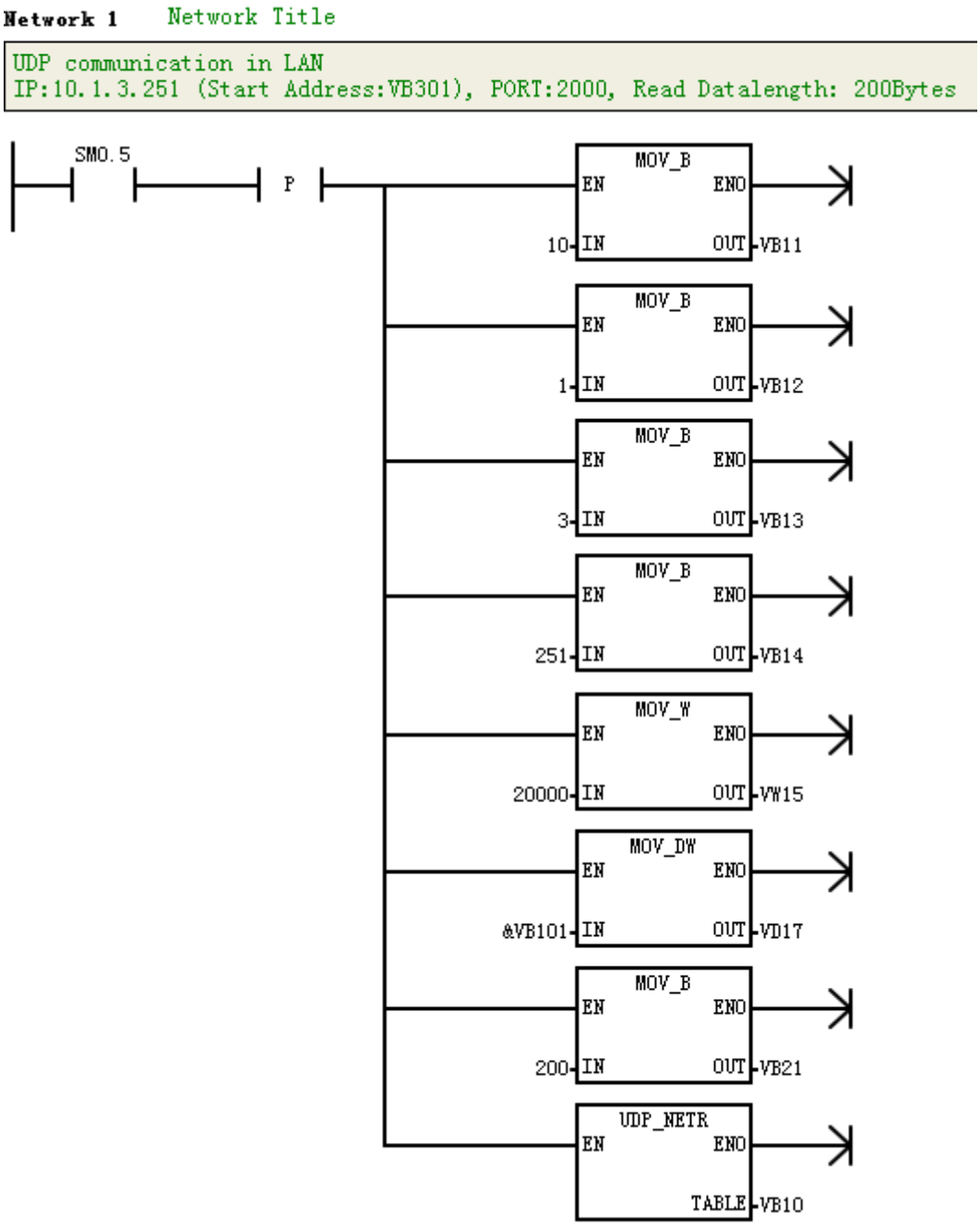
Network1: write the data of 200 bytes in the UDP_PPI master (started from: VB312) to UDP_PPI slave(IP: 10.1.3.251, started from: VB101).

Network 1 Network Title

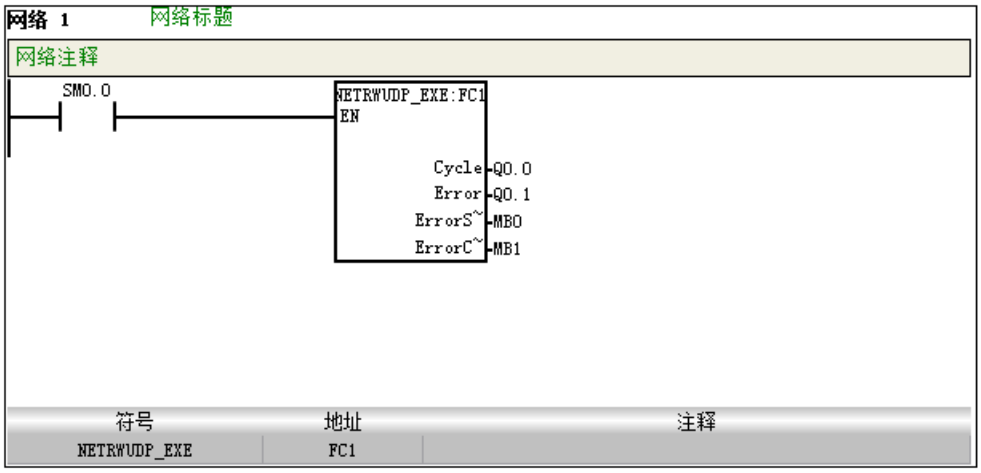
```
UDP communication in LAN
IP:10.1.3.251 (Start Address:VB301), PORT:2000, Write Datalength: 200Bytes
```



Network2: read the data of 200 bytes from the UDP_PPI slave (IP: 10.1.3.251, started from: VB101) to UDP_PPI master (started from: VB22) .



2) Program the UDP_PPI master by using NETR/NETW-UDP instruction Wizard



3）After editing the program, compile and download it into UDP_PPI master (must be called by SM0.0).

Step 4: UDP_PPI master communicates with slave

1) power up the UDP_PPI master and slave.

2) connect the EtherNET ports of UDP_PPI master and slave to realize the UDP PPI communication.

6.3.4 Address Image for UDP PPI

The normal NETR/NETW instruction is used for UDP_PPI communication , multiple kinds of registers can be configured and the Address Image for slave is direct mapping.

6.4 Analog I/O Expansion Board

CTH200 CPUs can all equipped with Analog I/O Expansion Board. The board embedded in to master CPU via bus connection. It provides collected analog signals, processing results and diagnostic information for CPU by bus interface, then the master CPU will process these data based on specific user program and send Digital data to related expansion modules, which can control the size of analog signals.

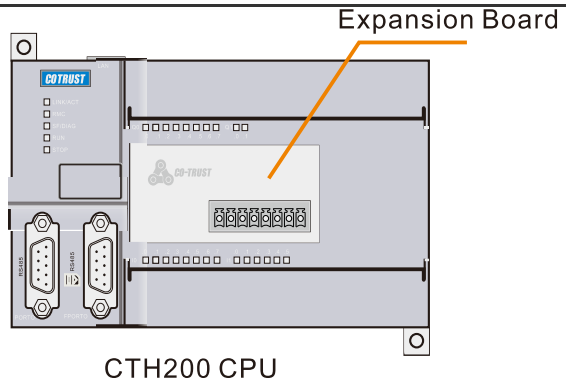
There are two methods to access Analog Board:

1 calling dedicated expansion instruction library

2 Access SM memory directly.

6.4.1 Installation Notes

Dismantling the up coverplate on CPU as shown in the gray box of following figure, align the pins of expansion board and fix it, then cover the up plate, cautions must be taken while doing these operations.



For terminal connections between Analog Expansion Board and CPU, please refer to the section 4.10.1.

6.4.2 Access the Expansion Board

The usage for Analog expansion board is different with CAN-01 board which can be used directly by inserting, it must use dedicated instructions or special SM memory.

- **Access SM directly**

SMW116~SMW126 in CPU is used for Analog image of expansion board. First with AI, 4 words started from SMW116; then with AQ, 2 words from SMW124.

2AI/1AQ: SMW116 for AIW0, SMW118 for AIW2, SMW124 for AQW0

Function	Image address	Function	Image address
A+ input	SMW116	Module type	SMB114
B+ input	SMW118	Module status	SMB115
VO output	SMW124		

4AI/2AQ：SMW116 for AIW0, SMW118 for AIW2, SMW120 for AIW4, SMW122 for AIW6, SMW124 for AQW0, SMW126 for AQW2

Function	Image address	Function	Image address
A+ input	SMW116	V0/I0 output	SMW124
B+ input	SMW118	V1/I1 output	SMW126
C+ input	SMW120	Module type	SMB114
D+ input	SMW122	Module status	SMB115

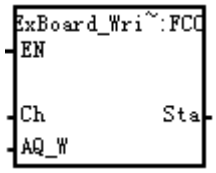
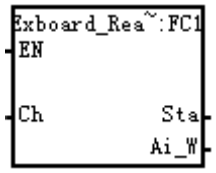
SMB115 Module status defined as in the following table:

Name	Function	Value
Module type	With module	0x1E：4AI/2AQ 0x19：2AI/1AQ 0x20：CAN expansion board
	No module	0x00
Module status	Normal	0x00
	Communication error	0x01
	Calibration failed	0x02
	Access error	0xFF

- **Calling expansion instruction library**

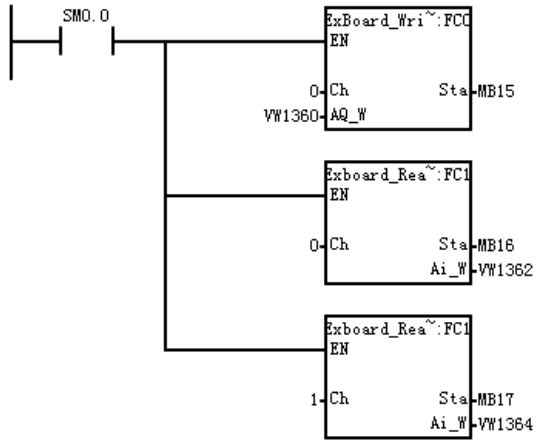
Users can use the Magicworks PLC dedicated library Exboard_H200 to access expansion board, you can down load it from our website. For information about how to import this library, refer to appendix A.

Table 6-6 expansion instructions

Write Access			**Read Access**		
Name: ExBoard_WriteAq			Name: ExBoard_ReadAi		
					
Symbol	variable type	Data type	Symbol	variable type	Data type
Ch	IN	BYTE	Ch	IN	BYTE
AQ_W	IN	WORD	Ai_W	OUT	WORD
Sta	OUT	BYTE	Sta	OUT	BYTE
Comments					
Ch: channel number, value: 0 AQ_W: AQ value Sta: 0 - normal; -1 - error			Ch: channel number, value: 0~1 Ai_W: Ai value Sta: 0 - normal; -1 - error		

Example

Ladder diagram	STL and program comments

	LD SM0.0
	CALL ExBoard_WriteAq, 0, VW1360, MB15
	CALL Exboard_ReadAi, 0, MB16, VW1362
	CALL Exboard_ReadAi, 1, MB17, VW1364
	// enable the board to program
	// call the ExBoard_WriteAq, write the AQ of Ch 0, store the status value into MB15
	// call the Exboard_ReadAi, read the Ai of Ch 0, store the status value into MB16
	// call the Exboard_ReadAi, read the Ai of Ch 1, store the status value into MB17

6.5 Recipe and Data Log

6.5.1 Using recipe

Magicworks PLC provides the Recipe Wizard to help you organize recipes and recipe definitions. Recipes are stored in the memory cartridge instead of the PLC. All recipes are stored in the memory cartridge. Therefore, to use the recipe feature, an optional 64kB or 256kB memory cartridge must be installed in the PLC. All recipes are stored in the memory cartridge. However, a single recipe is read into PLC memory when the user program is processing this individual recipe. For example, if you are making cookies, there may be recipes for chocolate chip, sugar, and oatmeal cookies. Only one type of cookie can be made at a time, so the proper recipe must be selected and read into PLC memory.Figure 6-4 illustrates a process for making multiple types of cookies using recipes. The recipe for each type of cookie is stored in the memory cartridge. Using a TP10 text display, the operator selects the type of cookie to be made, and the user program loads that recipe into memory.

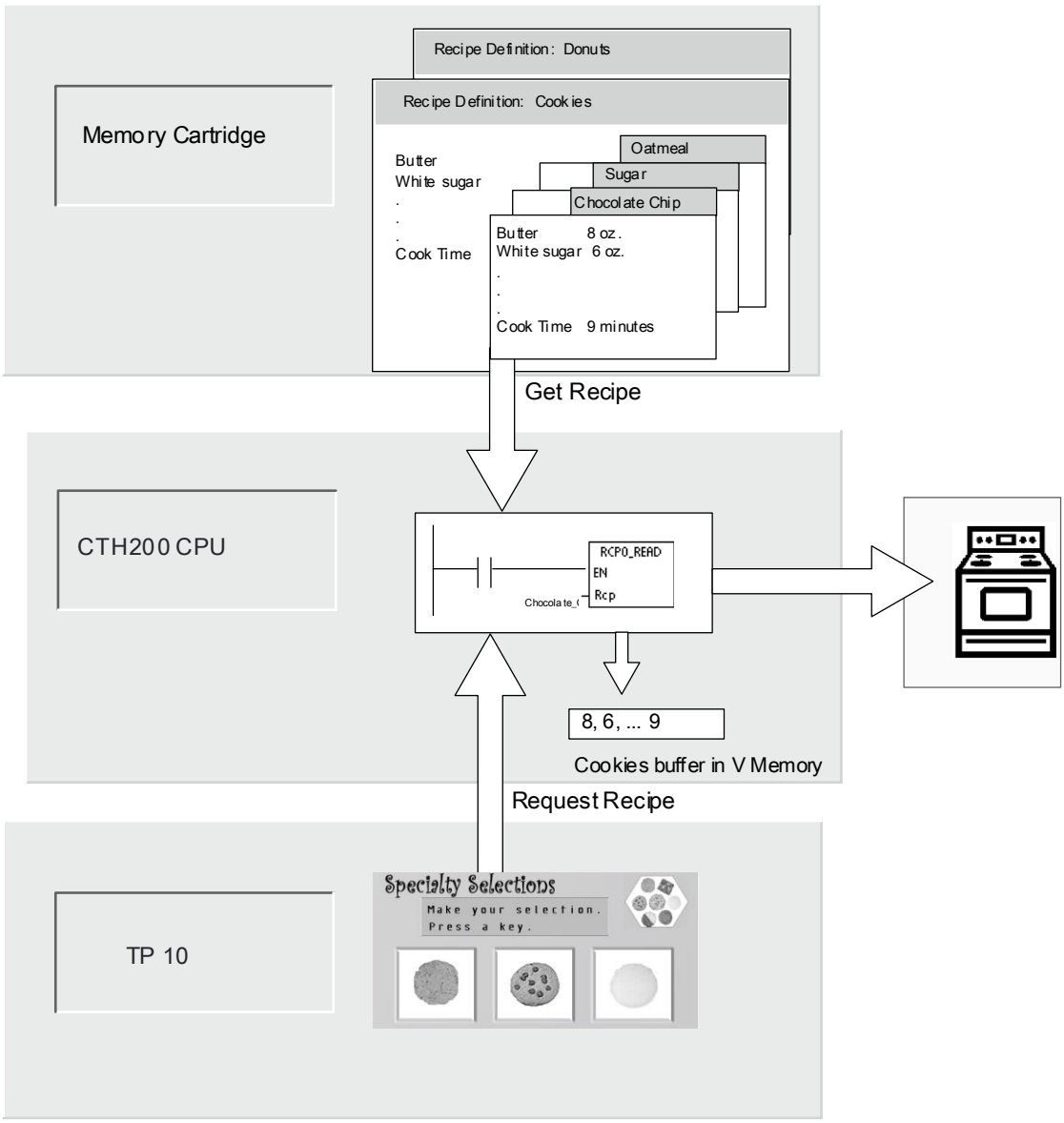


Figure 6-4 Example of Recipe Application

Recipe Definition and Terminology

To help you understand the Recipe Wizard, the following definitions and terms are explained.

1. A recipe configuration is the set of project components generated by the Recipe Wizard. These components include instruction subroutines, data block tabs, and symbol tables.

2. A recipe definition is a collection of recipes that have the same set of parameters. However, the values for the parameters can vary depending upon the recipe.

3. A recipe is the set of parameters and parameter values that provides the information needed to produce a product or control a process.

For example, different recipe definitions can be created, such as donuts and cookies. The cookie recipe definition may contain many different recipes, such as chocolate chip and sugar cookies.

Example fields and values are shown in the following table.

Example of Recipe Definition -- Cookies

Filed Name	Data Type	Chocolate_Chip (recipe 0)	Sugar (recipe 1)	Comment
Butter	Byte	8	8	Ounces
White_Sugar	Byte	6	12	Ounces
Brown_Sugar	Byte	6	0	Ounces
Eggs	Byte	2	1	each
Vanilla	Byte	1	1	Teaspoon
Flour	Byte	18	32	Ounces
Baking_Soda	Real	1.0	0.5	Teaspoon
Baking_Powder	Real	0	1.0	Teaspoon
Salt	Real	1.0	0.5	Teaspoon
Chocolate_Chips	Real	16	0.0	Ounces
Lemon_Peel	Real	0.0	1.0	Tablespoon
Cook_Time	Real	9.0	10.0	Minutes

Using the Recipe Wizard

Use the Recipe Wizard to create recipes and recipe definitions. Recipes are stored in the memory
cartridge. Recipes and recipe definitions can be entered directly in the Recipe Wizard. Later changes to individual recipes can be made by running the Recipe Wizard again or by programming with the RCPx_WRITE instruction subroutine:

1. A symbol table for each recipe definition. Each table includes symbol names that are the same as the recipe field names. These symbols define the V memory addresses needed to access the recipe values currently loaded in memory. Each table also includes a symbolic constant to reference each recipe.

2. A data block tab for each recipe definition. This tab defines the initial values for each V memory address represented within the symbol table.

3. A RCPx_READ instruction subroutine. This instruction is used to read the specified recipe from the memory cartridge to V memory.

4. A RCPx_WRITE instruction subroutine. This instruction is used to write recipe values from V memory to the memory cartridge.

Defining Recipes

To create a recipe using the Recipe Wizard, select the Tools > Recipe Wizard menu command.

The first screen is an introductory screen defining the basic operations of the recipe wizard. Click on the Next button to begin configuring your recipes. To create a recipe definition, follow the steps below. See Figure 6-5.

1. Specify the field names for the recipe definition. Each name will become a symbol in your project as previously defined.

2. Select a data type from the drop down list.

3. Enter a default value and comment for each name. All new recipes specified within this definition will begin with these default values.。

4. Click Next to create and edit recipes for this recipe definition.

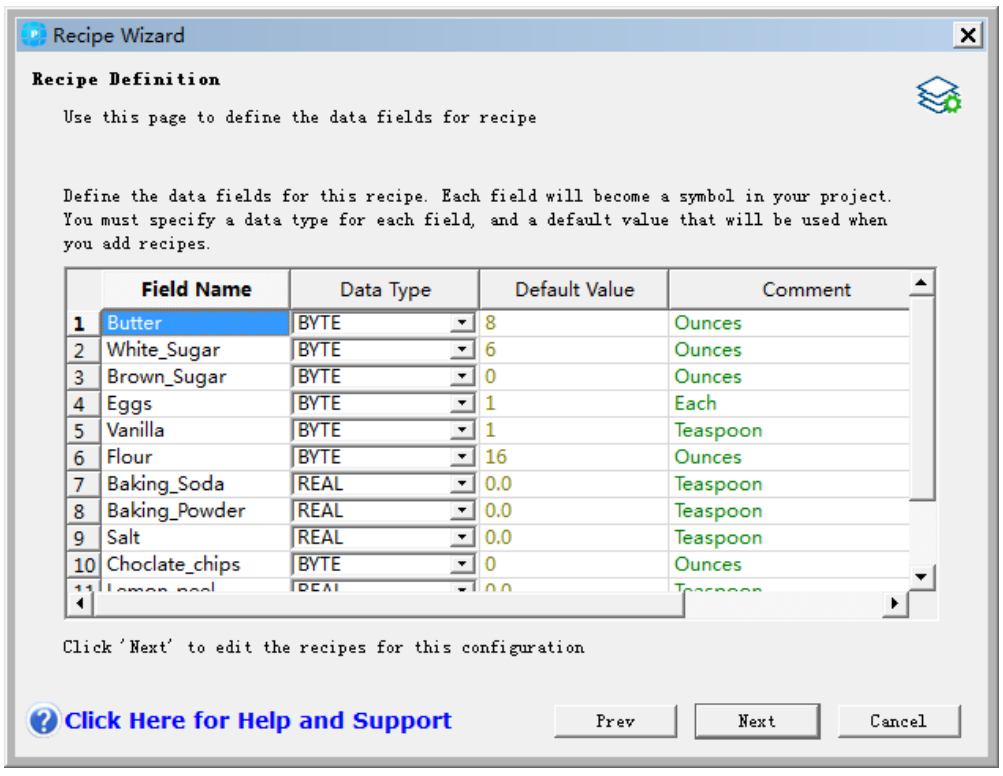


Figure 6-5 Defining Recipes

Use as many rows as necessary to define all data fields in the recipe. You can have up to four different recipe definitions. The number of recipes for each definition is limited only by the available space within the memory cartridge.

Creating and Editing Recipes

The Create and Edit Recipes screen allows you to create individual recipes and specify values for these recipes. Each editable column represents a unique recipe.

Recipes can be created by pressing the New button. Each recipe is initialized with the default

values specified during the creation of the recipe definition.

Recipes can also be created from the right mouse context menu by copying and pasting existing recipes. New columns will be inserted to the left of the current cursor position including the comment field.

Each new recipe will be given a default name that includes a reference to the recipe definition and recipe number. This name will be in the form of DEFx_RCPy.

To create and edit recipes, follow the steps below. See Figure 6-6.

1. Click on the Next button to get to the Create and Edit Recipe window.

2. Select the New button to insert a new recipe as needed.

3. Rename the recipe name to an appropriate non-default name.

4. Change the values in each recipe data set as needed.

5. Click Next.

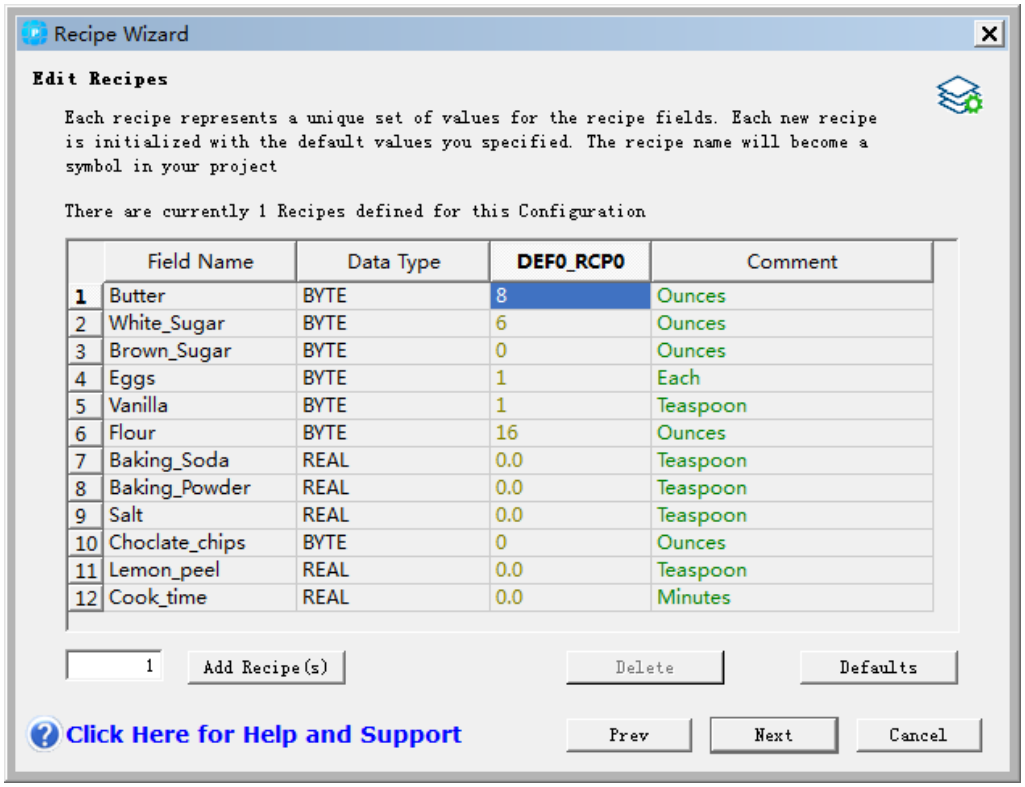


Figure 6-6 Creating and Editing Recipes

Allocating Memory

The Allocate Memory screen specifies the starting address of the V memory area that will store the recipe loaded from the memory cartridge. You can either select the V memory address or let the Recipe wizard to suggest the address of an unused V memory block of the correct size. To allocate memory, follow the steps below. See Figure 6-7.

1. To select the V memory address where you want the recipe to be stored, click in the window and enter the address.

2. To let the Recipe Wizard select an unused V memory block of the correct size, click the Suggest Address button.

3. Click the Next.

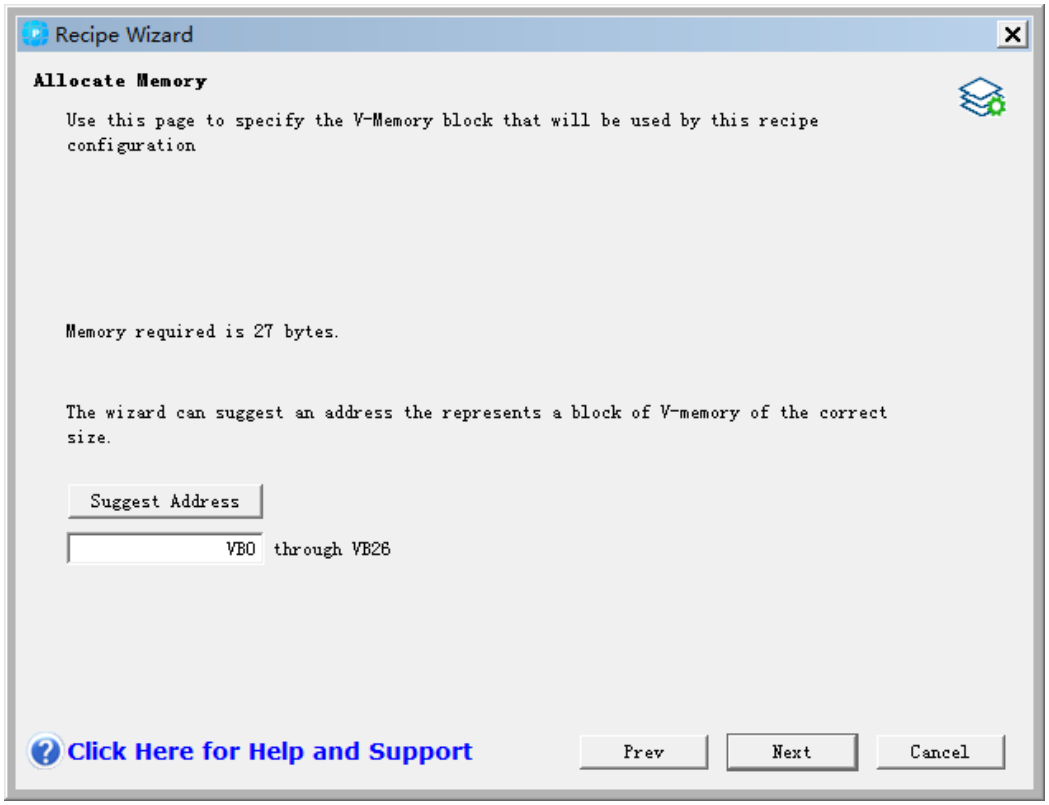


Figure 6-7 Allocating Memory

Project Components

The project components screen lists the different components that will be added

to your project. See Figure 6-8. Click Finish to complete the Recipe Wizard and add these components. Each recipe configuration can be given a unique name. This name will be shown in the project tree with each wizard configuration. The recipe definition (RCPx) will be appended to the end of this name.

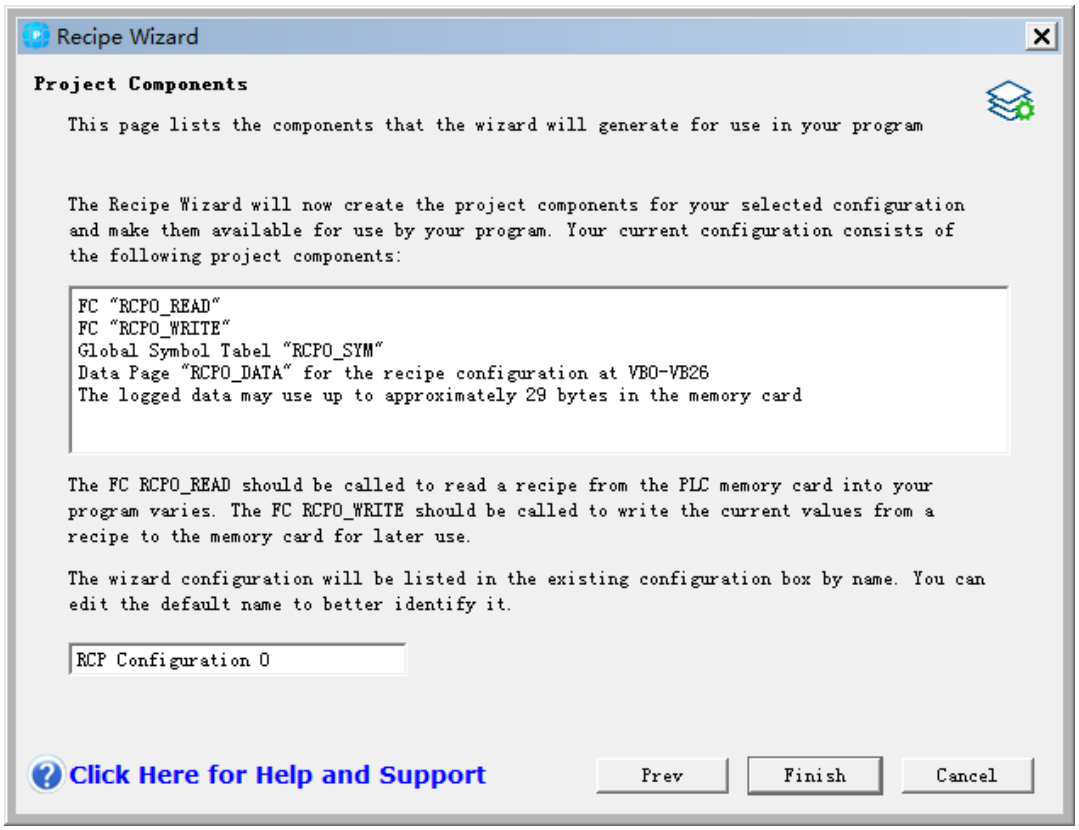
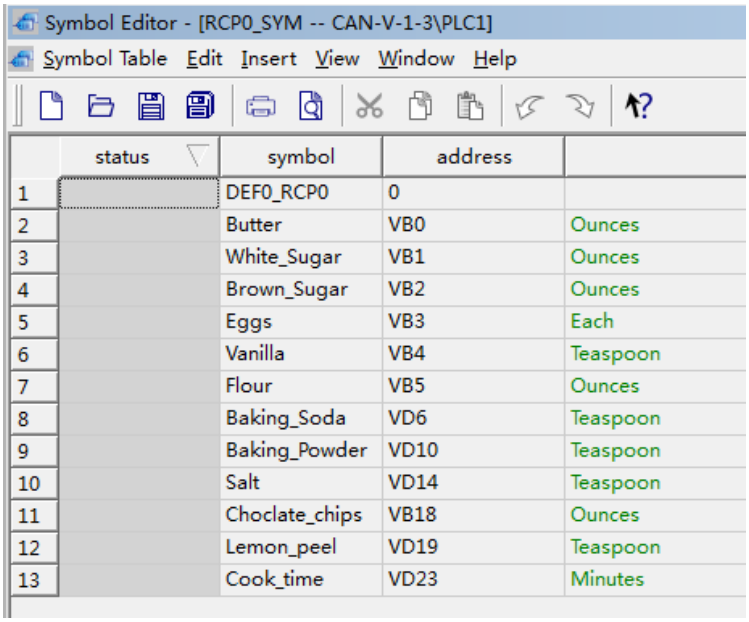


Figure 6-8 Project Components

Using the Symbol Table

A symbol table is created for each recipe definition. Each table defines constant values that represent each recipe. These symbols can be used as parameters for the RCPx_READ and RCPx_WRITE instructions to indicate the desired recipe. See Figure 6-9.

Each table also creates symbol names for each field of the recipe. You can use these symbols to access the values of the recipe in V memory.



	status	symbol	address	
1		DEF0_RCP0	0	
2		Butter	VB0	Ounces
3		White_Sugar	VB1	Ounces
4		Brown_Sugar	VB2	Ounces
5		Eggs	VB3	Each
6		Vanilla	VB4	Teaspoon
7		Flour	VB5	Ounces
8		Baking_Soda	VD6	Teaspoon
9		Baking_Powder	VD10	Teaspoon
10		Salt	VD14	Teaspoon
11		Choclate_chips	VB18	Ounces
12		Lemon_peel	VD19	Teaspoon
13		Cook_time	VD23	Minutes

Figure 6-9 Symbol Table

Downloading the Project with a Recipe Configuration

To download a project that contains a recipe configuration, follow the steps below. See Figure

6-10.

1. Select File > Download. 。

2. In the dialog, under Options, ensure that the Program Block, Data Block, and Recipes boxes are checked.

3. Click the Download button.

Edit Existing Recipe Configurations

To edit existing recipe configurations follow the steps below. See Figure 6-11.

1. Click on the configuration drop down list and select an existing recipe configuration.

2. To delete an existing recipe configuration, click on the Delete Configuration button.

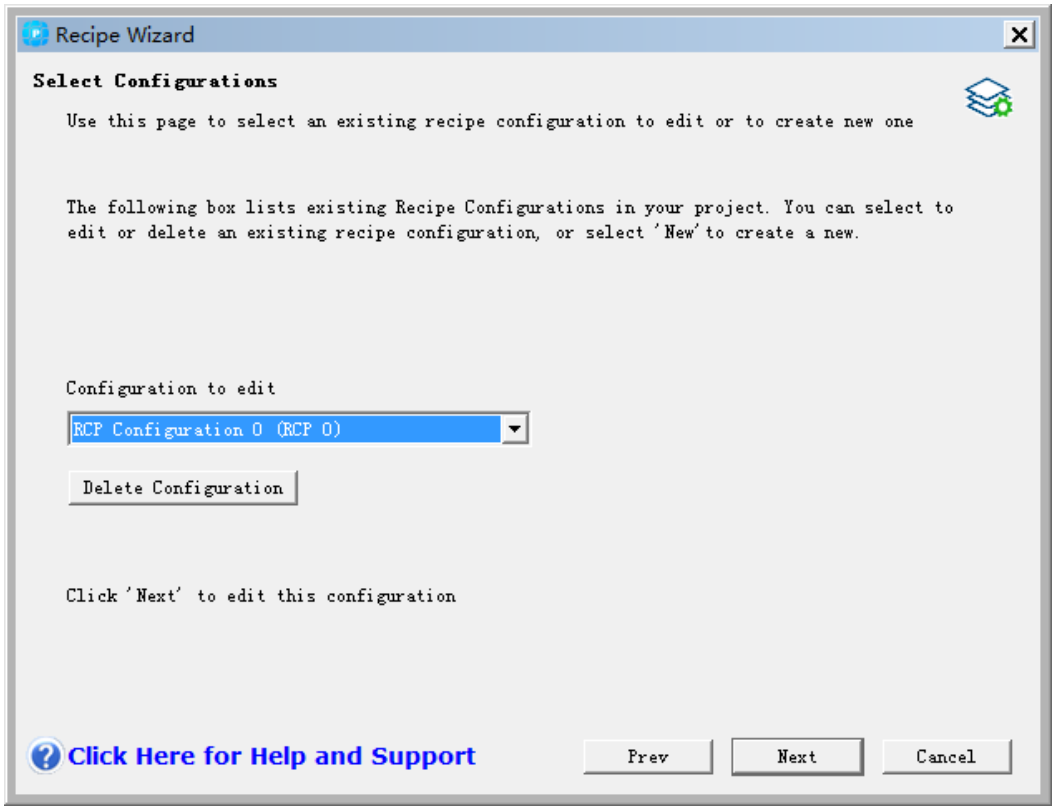


Figure 6-11 Editing recipe

Instructions Created by the Recipe Wizard

RCPx_Read Subroutine

The Subroutine RCPx_READ is created by the Recipe Wizard and is used to read an individual recipe from the memory cartridge to the specified area in V memory.

The x in the RCPx_READ instruction corresponds to the recipe definition that contains the recipe that you wish to read.

The EN input enables the execution of the instruction when this input is high.

The Rcp input identifies the recipe that will be loaded from the memory cartridge.

The Error output returns the result of the execution of this instruction. See Table 6-8 for definitions of the error codes.

RCPx_Write Subroutine

The Subroutine RCPx_WRITE is created by the Recipe Wizard and is used to replace a recipe in the memory cartridge with the contents of the recipe contained in V memory.

The x in the RCPx_WRITE instruction corresponds to the recipe definition that contains the recipe that you wish to replace.

The EN input enables the execution of the instruction when this input is high.

The Rcp input identifies the recipe that will be replaced in the memory cartridge.

The Error output returns the result of the execution of this instruction. See Table 6-8 for definitions of the error codes.

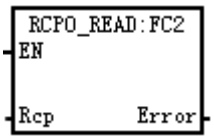
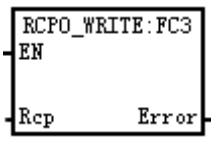
RCPx_Read	RCPx_Write
	

Table 6-7 Valid Operands for the Recipe Subroutine

Input/Output	Data Type	Operands
Rcp	word	VW, IW,QW, MW, SW, SMW, LW, AC, *VD, *AC, *LD, constant
Error	byte	VB, IB, QB, MB, SB, SMB, LB, AC, *VD, *AC, *LD

Table 6-8 Error Codes for the Recipe Instructions

Error code	Description
0	No Error
132	Access to the memory cartridge failed

Notice

The EEPROM used in the memory cartridge will support a limited number of write operations. Typically, this is one million write cycles. Once this limit has been reached, the EEPROM will not operate properly.

Make sure that you do not enable the RCPx_WRITE instruction on every scan. Enabling this instruction on every scan will wear out the memory cartridge in a relatively short period of time.。

6.5.2 Using Data Logs

Maigicworks PLC provides the Data Log Wizard to store process measurement data in the memory cartridge. Moving process data to the memory cartridge frees V memory addresses that

would otherwise be required to store this data。

With this feature, you can permanently store records containing process data under program control. These records can optionally contain a time and date stamp. You can configure up to four independent data logs. The data log record format is defined using the new Data Log Wizard.

All data logs are stored in the memory cartridge. To use the data log feature, you must have installed an optional 64K or 256K memory cartridge in your PLC. See Appendix A for information about the memory cartridges.

You must use the S7-200 Explorer to upload the contents of your data logs to your computer. An example of a Data Log application is shown in Figure 6-12.

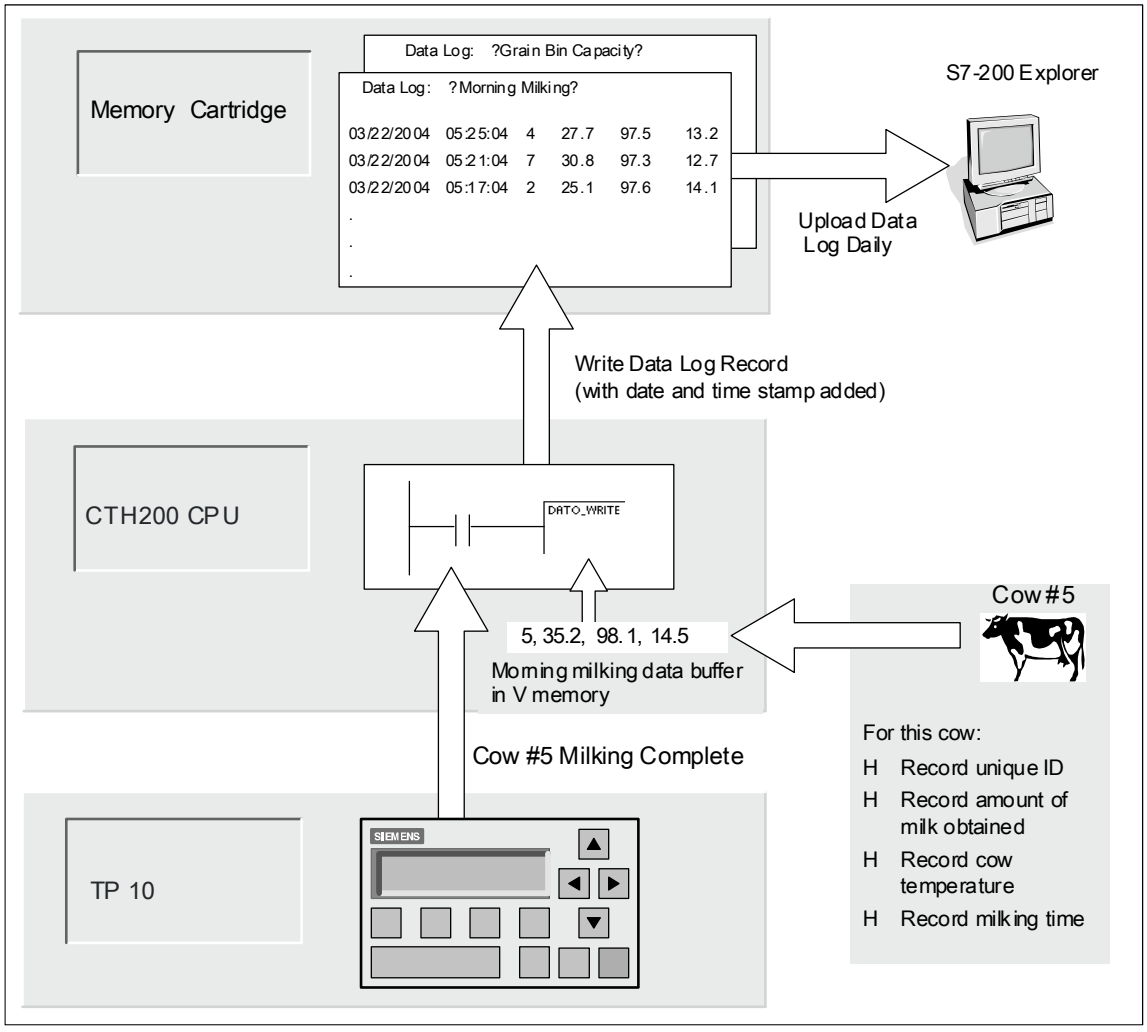


Figure 6-12 Example of Data Log Application

Data Log Definition and Terminology

To help you understand the Data Log Wizard, the following definitions and terms are explained:

1. A data log is a set of records usually ordered by date and time. Each record represents some process event that records a set of process data. The organization of this data is defined with the data log wizard.

2. A data log record is a single row of data written to the data log.

Using the Data Log Wizard

Use the Data Log Wizard to configure up to four data logs. The Data Log Wizard is used to:

1. Define the format of the data log record
2. Select data log options such as time stamp, date stamp, and clear data log on upload
3. Specify the maximum number of records that can be stored in the data log
4. Create project code used to store records in the data log.

The Data Log Wizard creates a data log configuration that includes the following:

1. A symbol table for each data log configuration. Each table includes symbol names that are the same as the data log field names. Each symbol defines the V memory addresses needed to store the current data log. Each table also includes a symbolic constant to reference each data log.

2. A data block tab for each data log record that assigns V memory addresses for each data log field. Your program uses these V memory addresses to accumulate the current log data set.

3. A DATx_WRITE subroutine. This instruction copies the specified data log record from V

4.memory to the memory cartridge. Each execution of DATx_WRITE adds a new data record

5.to the log data stored in the memory cartridge.

Data Log Options

You can configure the following optional behaviors for the data log. See Figure 6-13。

Time Stamp

You can include a Time Stamp with each data log record. When selected, the CPU automatically includes a time stamp with each record when the user program commands a data log write.

Data Stamp

You can add a Date Stamp to each data log record. When selected, the CPU automatically includes a date stamp with each record when the user program commands a data log write.

Clear Data Log

Clear Data Log -- You can clear all records from the data log whenever it is uploaded. If you set the Clear Data Log option, the data log will be cleared each time it is uploaded.

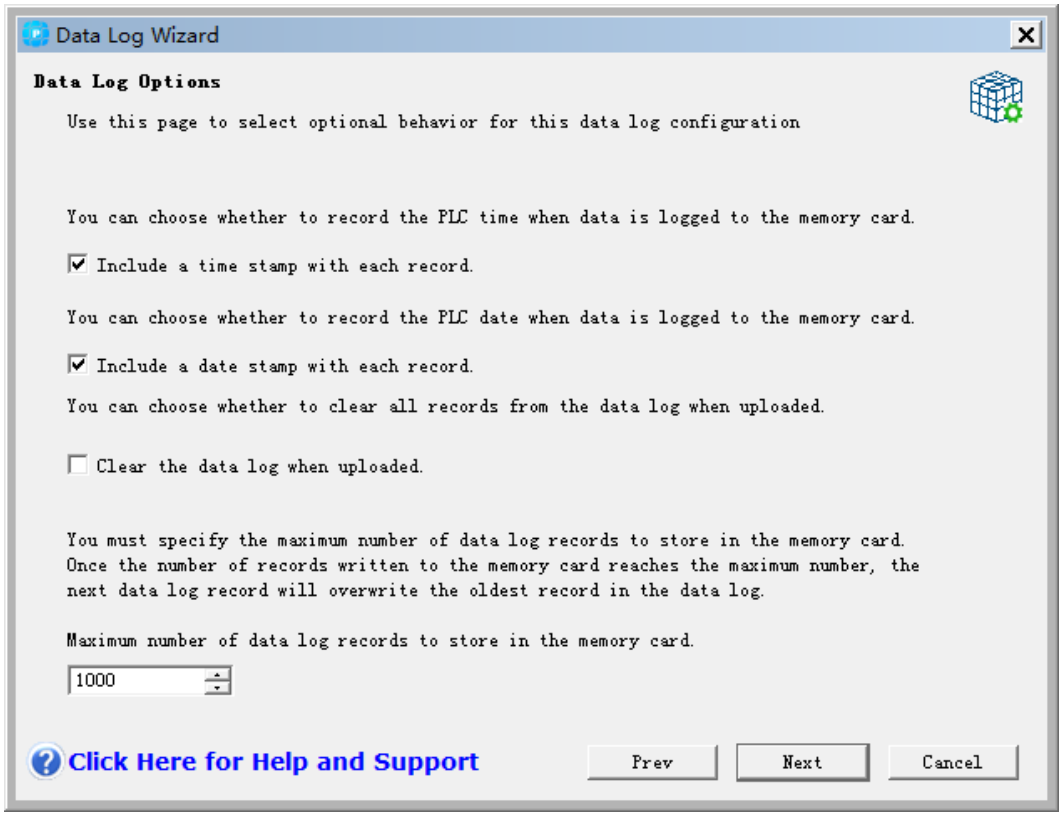


Figure 6-13 Data Log Options

Data logs are implemented as a circular queue (when the log is full, a new record replaces the oldest record). You must specify the maximum number of records to store in the data log. The maximum number of records allowed in a data log is 65,534. The default value for the number of records is 1000.

Defining the Data Log

You specify the fields for the data log and each field becomes a symbol in your project. You must specify a data type for each field. A data log record can contain between 4 and 203 bytes of data. To define the data fields in the data log, follow the steps below. See Figure 6-14.

1. Click on the Field Name cell to enter the name. The name becomes the symbol referenced by the user program.

2. Click on the Data Type cell and select a data type from the drop down list.

3. To enter a comment, click on the Comment cell.

4. Use as many rows as necessary to define a record.

5. Click Next.

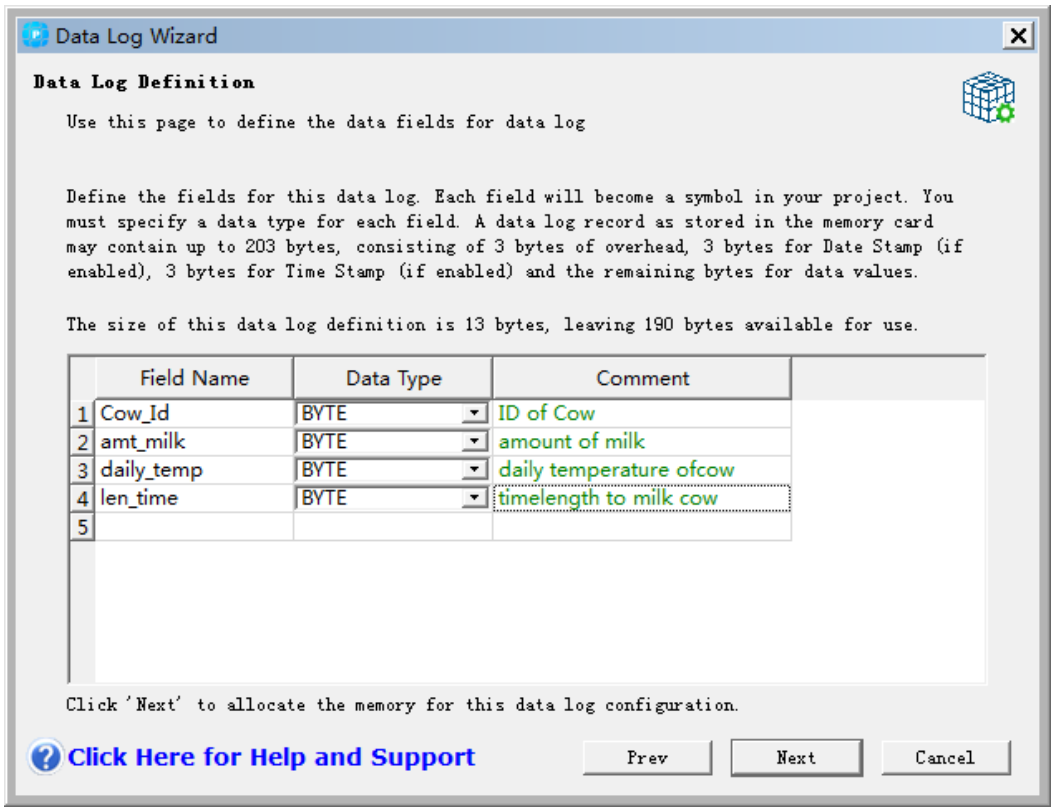


Figure 6-14 Defining the Data Log

Allocating Memory

The Data Log Wizard creates a block in the V memory area of the PLC. This block is the memory address where a data log record will be constructed before it is written to the memory cartridge. You specify a starting V memory address where you want the configuration to be placed. You can either select the V memory address or let the Data Log wizard suggest the address of an unused V memory block of the correct size. The size of the block varies based on the specific choices you have made in the Data Log wizard. See Figure 6-15.

To allocate memory, follow the steps below:

1. To select the V memory address where the data log record will be constructed, click in the Suggested Address area and enter the address.

2. To let the Data Log Wizard select an unused V memory block of the correct size, click the Suggest Address button.

3. Click the Next button.

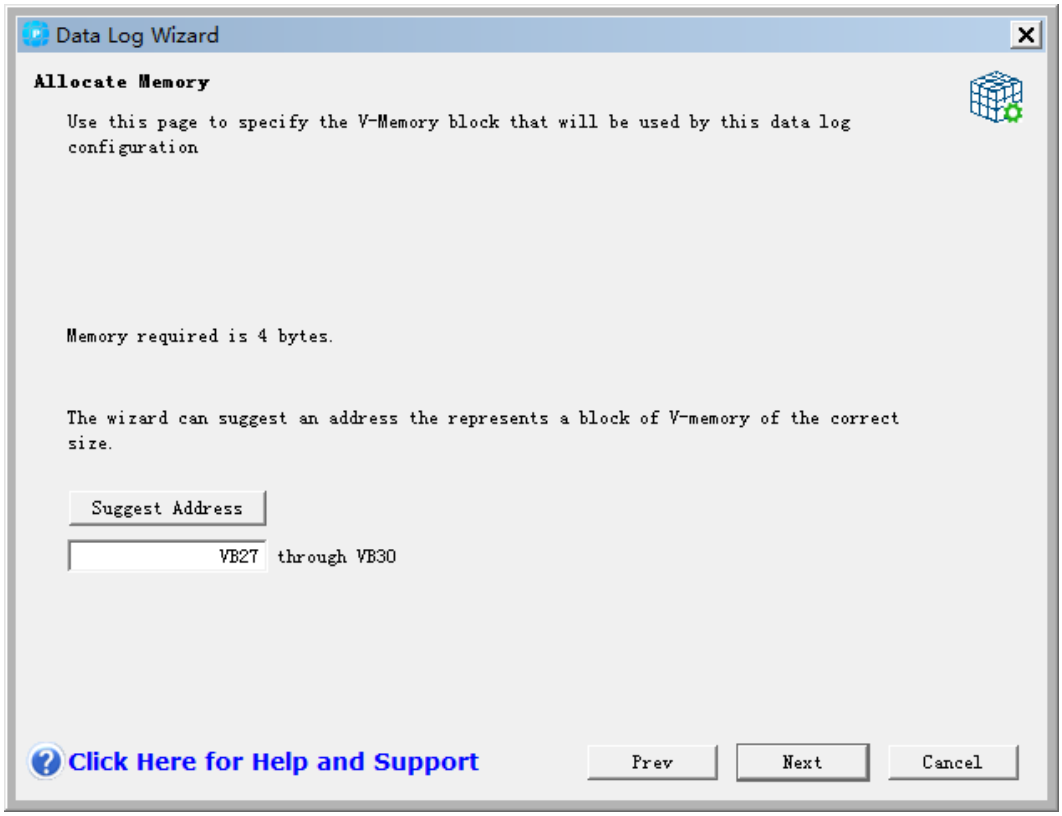


Figure 6-15 Allocating Memory

Project Components

The project components screen lists the different components that will be added to your project. See Figure 6-16. Click Finish to complete the Data Log Wizard and add these components . Each data log configuration can be given a unique name. This name will be shown in the project tree with each wizard configuration. The data log definition (DATx) will be appended to the end of this name.

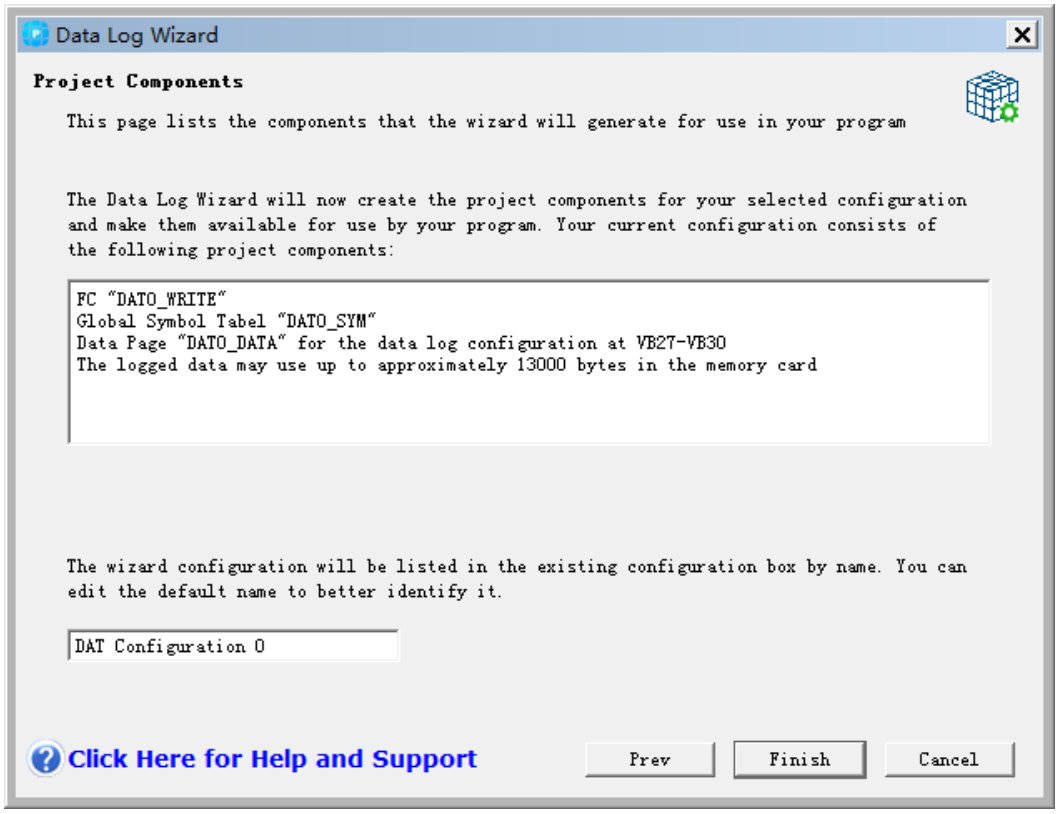


Figure 6-16 Project components

Using the Symbol Table

A symbol table is created for each data log configuration. Each table defines constant values that represent each data log. These symbols can be used as parameters for the DATx_WRITE instructions.

Each table also creates symbol names for each field of the data log. You can use these symbols to access the values of the data log in V memory.

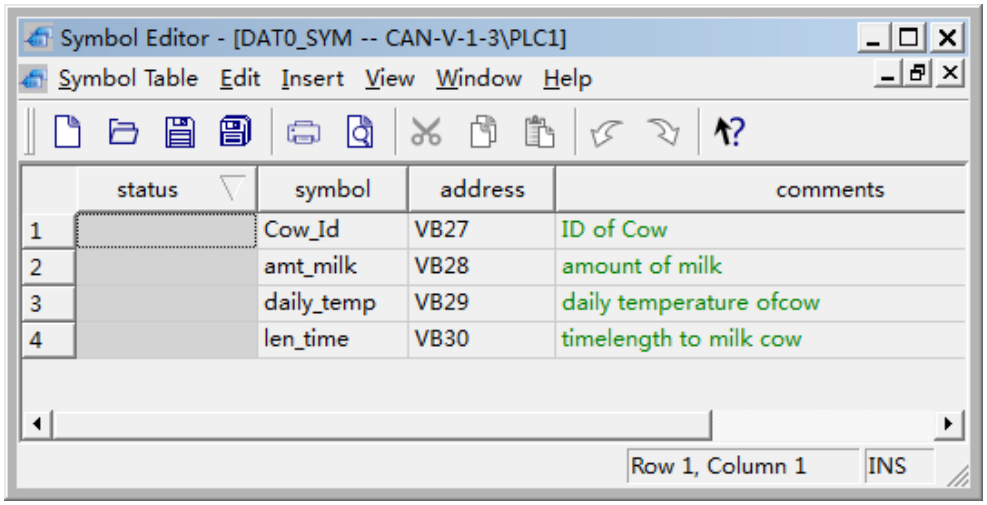


Figure 6-17 Symbol Table

Downloading a Project that contains a Data Log Configuration

You must download a project that contains a data log configuration to an S7-200 CPU before the data log can be used. If a project has a data log configuration, then the download window has the Data Log Configurations option checked by default.

Notice

When you download a project that contains data log configurations, any data log records currently stored on the memory cartridge will be lost.

To download a project that contains data log configurations, follow the steps below. See Figure 6-18.

1. Select File > Download.

2. In the dialog, under Options, ensure that the Data Log Configuration box is checked.

3. Click the Download button.

Using the S7-200 Explorer

The S7-200 Explorer is the application used to read a data log from the memory cartridge, and then store the data log in a Comma separated Values (CSV) file.

Each time a data log is read, a new file is created. This file is saved in the Data Log directory. The file name is formatted as follows: PLC Address, data log name, date, and time.

You can choose whether the application associated with the CSV expansion is automatically launched when the data log has successfully been read. This selection is available from the right mouse menu of the data log file.

The Data Log directory will be below the directory specified during installation. The default installation directory is c:\program files\siemens\Microsystems (if STEP 7 is not installed). The default installation is c:\siemens\Microsystems (if STEP 7 is installed).

To read a data log, follow the steps below:

1. Open Windows Explorer. The My S7-200 Network folder should automatically become visible.

2. Select the My S7-200 Network folder.

3. Select the correct S7-200 PLC folder.

4. Select the memory cartridge folder.

5. Find the correct data log configuration file. These files will be named DAT Configuration x (DATx).

6. Select the right mouse context menu, and then select Upload.

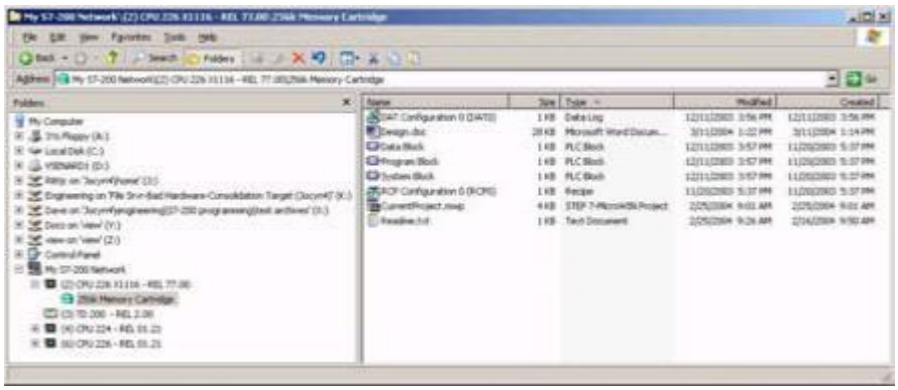


Figure 6-19 using S7--200 Explorer

Edit Existing Data Log Configuration

To edit an existing data log configuration, follow the steps below :

1. Click on the configuration dropdown list and select an existing data log configuration as shown in Figure 6-20.

2. To delete an existing data log configuration, click on the Delete Configuration button. You can have up to four different data logs.

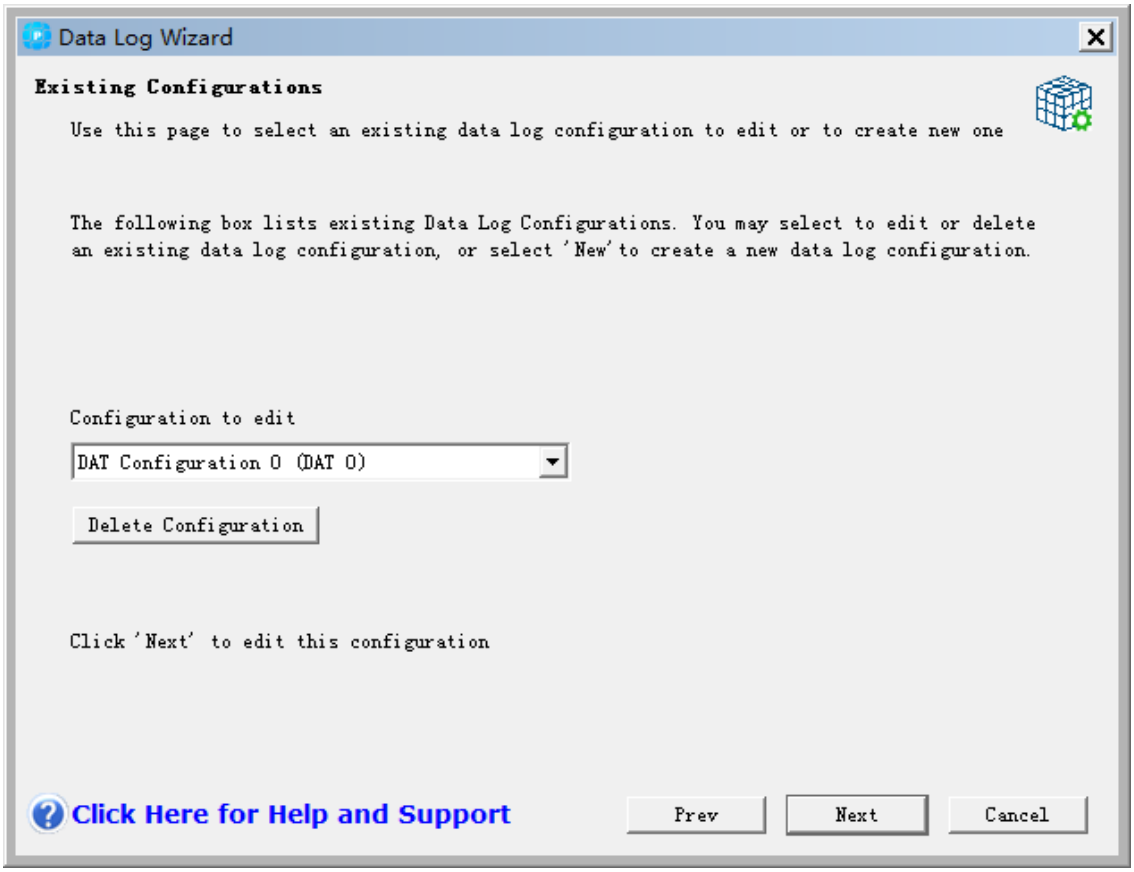


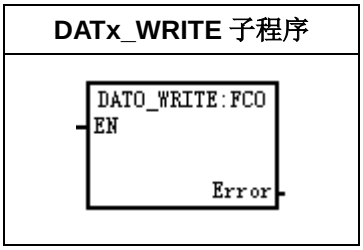
Figure 6-20 Edit Existing Data Log Configurations

Instruction Created by the Data Log Wizard

Instruction Created by the Data Log Wizard

DATx_WRITE Subroutine

The Subroutine DATx_WRITE is used to log the current values of the data log fields to the memory cartridge. DATxWRITE adds one record to the logged data in the memory cartridge. A call to this subroutine appears as follows.



Error 132 is returned when this instruction fails to correctly access the memory cartridge.

Table 6-9 Parameters for the DATAx_WRITE Subroutine

Inputs/Outputs	Data Type	Description
Error	Byte	VB, IB, QB, MB, SB, SMB, LB, AC, *VD, *AC, *LD

Notice

The EEPROM used in the memory cartridge will support a limited number of write operations. Typically, this is one million write cycles. Once this limit has been reached, the EEPROM will not operate properly.

Make sure that you do not enable the DATx_WRITE instruction on every scan. Enabling this instruction on every scan will wear out the memory cartridge in a relatively short period of time.

7 Power Budget

The CTH200 CPU has an internal power supply that provides power for the CPU itself, for any expansion modules, and for other 24 VDC user power requirements. Use the following information as a guide for determining how much power (or current) the CTH200 CPU can provide for your configuration.

7.1 Power Requirements

Each CPU supplies both 5 VDC and 24 VDC power:

Each CPU has a external 24 VDC sensor supply that can supply 24 VDC for local input points or for relay coils on the expansion modules. If the power requirement for 24 VDC exceeds the power budget of the CPU, you can add an external 24 VDC power supply to provide 24 VDC to the expansion modules. You must manually connect the 24 VDC supply to the input points or relay coils

The CPU also provides 5 VDC power for the expansion modules when an expansion module is connected. If the 5 VDC power requirements for expansion modules exceeds the power budget of the CPU, you must remove expansion modules until the requirement is within the power budget.

The specifications in Chapter 4 provide information about the power budgets of the CPUs and the power requirements of the expansion modules

Notice

If the CPU power budget is exceeded, you may not be able to connect the maximum number of modules allowed for your CPU.

Caution

Connecting an external 24 VDC power supply in parallel with the S7-200 DC Sensor Supply can result in a conflict between the two supplies as each seeks to establish its own preferred output voltage level.
The result of this conflict can be shortened lifetime or immediate failure of one or both power supplies, with consequent unpredictable operation of the PLC system.
Unpredictable operation could result in death or serious injury to personnel, and/or damage to equipment. The CTH200 24VDC Sensor Supply and any external power supply should provide power to different points. A single connection of the commons is allowed.

7.2 5VDC Supply

Table 7-1 5VDC Power Consumption

CPU and DP	5VDC current for extended I/O (mA)	Expansion modules	Current at 5VDC (mA)
CPU H224/H224X H226L/H226XL SM277B	660 660 660	SM 221-1BF	57
		SM 221-1BH	79
		SM 221-1BL	179
		SM 222-1BF	57
		SM 222-1BH	79
		SM 222-1BL	174
		SM 222-1HF	68
		SM 222-1HH	115
		SM 223-1BF	57
		SM 223-1BH	73
		SM 223-1BL	115
		SM 223-1HF	58
		SM 223-1PH	89
		SM 223-1PL	150
		SM 231-0HC	87
		SM 231-0HF	87
		SM 231-1HF	87
		SM 231-5HF	87
		SM 232-0HB	87
		SM 232-0HD	87
		SM 235-0KD	87
		SM 231-7PB	87
		SM 231-7PC	87
		SM 231-7PD	87
		SM 231-7PF	87
		SM 231-7TD	87
		SM 231-7TF	87
		SM 231-7HF	87
		SM 231-7ND	87
		SM 231-7NF	87
		SM 231-7WA	140

7.3 24VDC Supply

Table 7-2 24VDC Power Consumption

24VDC current (mA)		24VDC current for Expansion module (mA)	
CPU H224/H224X CPU H226L/H226XL SM277B	300 300 400	SM222-1BL	54
		SM222-1HF	80
		SM222-1BF	14
		SM222-1BH	22
		SM222-1HH	159
		SM223-1BF	10
		SM223-1BH	11
		SM223-1BL	22
		SM223-1HF	40
		SM223-1PH	80
		SM223-1PL	159
		SM231-0HC	17
		SM231-0HF	31
		SM231-1HF	30
		SM231-5HF	31
		SM232-0HD	112
		SM232-0HB	61
		SM235-0KD	48
		SM231-7PB	34
		SM231-7PC	37
		SM231-7PD	130
		SM231-7PF	30
		SM231-7ND	60
		SM231-7NF	33
		SM231-7HF	37
		SM231-7TD	34
		SM231-7TF	39
		SM277A	70

7.4 Power calculation example

This section describes how to determine the power allocation for PLC power supply.

Table 7.4 shows a calculation of CTH200 PLC system, which consists of the following components:

- CPU H224X
- SM223 modules, in which the SM223-1PH32 has 8 DC inputs/8 relay outputs

- SM221 modules, in which SM221-1BF32 has 8 DC inputs
- There are 62 inputs and 42 outputs

In this example, the CTH200 CPU provides sufficient 5VDC current bur not sufficient for 24VDC current of all inputs and relay coils. I/Os need 536mA but CTH200 CPU can only provides 300 mA, thus the system needs to provide at least 236mA additional power to operate all I/Os.

Table 7-3 Power Budget

Items	5VDC	24VDC
Current from CPU H224X native power	660 mA	300 mA
Minus		
System requirements	5VDC	24VDC
CPU H224X, 14 inputs		14* 4 mA= 56 mA
4 个 SM 223-1PH32, needs 5V current	4*89 mA= 356mA	
2 个 SM 221-1BF32, needs 5V current	2*57 mA= 114 mA	
4 个 SM 223-1PH32, each has 8 inputs		4*8*4 mA= 128 mA
4 个 SM 223-1PH32, each has 8 relay coils		4*8*9 mA= 288 mA
2 个 SM 221-1BF32, each has 8 inputs		2*8*4 mA= 64 mA
Total power consumption	470 mA	536 mA
Equal to		
Budget for Current Balance	5VDC	24 VDC
Total current Balance	190 mA	-236 mA

8 Fault Diagnose

CPU would execute the following operations when faulted:

1）Get into STOP Mode

2）Light up the SF/DIAG (Red) LED indicator and STOP indicator

3）Disconnect the outputs

Check the following conditions:

1）CTH200 CPU and expansion modules are powered normally.

2）I/O terminals for CTH200 CPU and expansion modules are fastened by using screws and connector.

3）Check the connection of communication cable is operation normally.

4）Adjust the Baud rate, Port or IP address when you cannot find the PLC.

Except for the above, you can read the diagnostic information from MagicWorks PLC, or inspect the LED indicators for PLC internal and external exception.

8.1 Diagnose with MagicWorks PLC

The faulted status would last until the error cleared, then user can open MagicWorks PLC software → double-click the project interface → select menu item“PLC”→“Information” to check the error information.

Table 8-1 Diagnose function

Supported event type	Code and Description	
	Code	Event Description
CPU nonfatal error	0x00	No fatal errors present; no error
	0x01	HSC box enabled before executing HDEF box
	0x02	Conflicting assignment of input interrupt to a point already assigned to a HSC
	0x03	Conflicting assignment of inputs to an HSC already assigned to input interrupt or other HSC
	0x04	Attempted execution of an instruction that is not allowed in an interrupt routine
	0x05	Attempted execution of a second HSC/PLS with the same number before completing the first (HSC/PLS in an interrupt routine conflicts with HSC/PLS in main program)
	0x06	Indirect addressing error
	0x07	TODW (Time-of-Day Write) or TODR (Time-of-Day Read) data error
	0x08	Maximum user subroutine nesting level exceeded
	0x09	Simultaneous execution of XMT/RCV instructions on Port 0

	0x0A	Attempt to redefine a HSC by executing another HDEF instruction for the same HSC
	0x0B	Simultaneous execution of XMT/RCV instructions on Port 1
	0x0C	Reserved
	0x0D	Reserved
	0x0E	Reserved
	0x0F	Illegal numeric value in compare contact instruction
	0x10	Reserved
	0x11	Reserved
	0x12	Reserved
	0x13	Illegal PID loop table
	0x80	Program too large to compile; reduce program size
	0x81	Reserved
	0x82	Illegal instruction; check instruction mnemonics.
	0x83	Missing MEND or instruction not allowed in main program: add MEND instruction, or remove
	0x85	Missing FOR; add FOR instruction or delete NEXT instruction.
	0x86	Missing NEXT; add NEXT instruction or delete FOR instruction.
	0x87	Missing label (LBL, INT, SBR); add the appropriate label.
	0x88	Missing RET or instruction not allowed in a subroutine: add RET to the end of the subroutine or remove incorrect instruction
	0x89	Missing RETI or instruction not allowed in an interrupt routine: add RETI to the end of the interrupt routine or remove incorrect instruction.
	0x8B	Illegal JMP to or from an SCR segment
	0x8C	Duplicate label (LBL, INT, SBR); rename one of the labels.
	0x8D	Illegal label (LBL, INT, SBR); ensure the number of labels allowed was not exceeded.
	0x90	Illegal parameter; verify the allowed parameters for the instruction.
	0x91	Range error (with address information); check the operand ranges.
	0x92	Error in the count field of an instruction (with count information); verify the maximum count
	0x93	size.
	0x94	FOR/NEXT nesting level exceeded.
	0x95	Missing LSCR instruction (Load SCR)
	0x96	Missing SCRE instruction (SCR End) or disallowed instruction before the SCRE instruction
	0x97	User program contains both unnumbered and numbered EV/ED instructions
	0x98	Illegal edit in RUN mode (edit attempted on program with unnumbered EV/ED instructions)
	0x99	Too many hidden program segments (HIDE instructions)
	0x9A	Attempt to switch to Freeport mode while in a user interrupt

	0x9B	Illegal index (string operation in which a starting position value of 0 is specified)
CPU fatal error	0x00	No fatal errors present
	0x01	Reserved
	0x02	Reserved
	0x03	Scan watchdog time-out error
	0x04	Reserved
	0x05	Reserved
	0x06	Reserved
	0x07	Reserved
	0x08	Reserved
	0x09	Reserved
	0x0A	Reserved
	0x0B	Reserved
	0x0C	Reserved
	0x0D	Reserved
	0x0E	Reserved
	0x0F	Reserved
	0x10	Internal software error
	0x11	Compare contact indirect addressing error
	0x12	Compare contact illegal floating point value
	0x13	Reserved
	0x14	Program is not understood by this S7-200
	0x15	Compare contact range error
Log once for each scanning cycle		
Diagnose events Refer to table 8-2	0x00	No fault
	0x01	Module is busy
	0x02	Module time-out with no response
	0x03	Module type unmatched
	0x04	Module version unmatched
	0x05	Software error
	0x06	Module waiting flag is time-out
	0x07	Bus ACK error
	0x08	Bus CRC validation error
	0x10	Memory shift outrange
	0x11	Module not ready
	0x12	Module configuration error
	0x13	Module not support this instruction
	0x15	Module internal diagnose
	0x16	Module has mo power

Table 8-2 special memory diagnose

SMB8	Module 1 flag register
SMB9	Module 1 error register
SMB10	Module 2 flag register
SMB11	Module 2 error register
SMB12	Module 3 flag register
SMB13	Module 3 error register
SMB14	Module 4 flag register
SMB15	Module 4 error register
SMB16	Module 5 flag register
SMB17	Module 5 error register
SMB18	Module 6 flag register
SMB19	Module 6 error register
SMB20	Module 7 flag register
SMB21	Module 7 error register
SMB200~SMB549	Status for intelligent module

8.2 Diagnose by using CTH200 CPU module

Table 8-4 Description for CTH200 LED indicators

Indicator	LED	Description
SF/DIAG	Red	ON: system fault, OFF: no fault
RMC	Green	ON: CPU communicates with remote server successfully (Ethernet port configured correctly) OFF: communication for remote server is failed or forbidden (communication access controlled by DIP switch)
RUN	Green	ON: system operation, OFF: system stop
STOP	Orange	ON: system stop, OFF: system operation
LINK/ACT	Green	ON: connected, FLASH: Transmission, OFF: Disconnected

<Note>: STOP and SF LED would light on synchronously started from the beginning of power lose to power down, and the system would log a event.

Appendix

A CT-MODBUS Master and Slave libraries

A.1 CT_MODBUS Libraries

All have 4 libraries, master and slave libraries for PORT0, master and slave libraries for PORT1.

CT_MODBUS function mainly used for Siemens CPU program and data. CT_MODBUS function block is built-into the CPU, not require data space, provided for user as a set of functions.

Notice

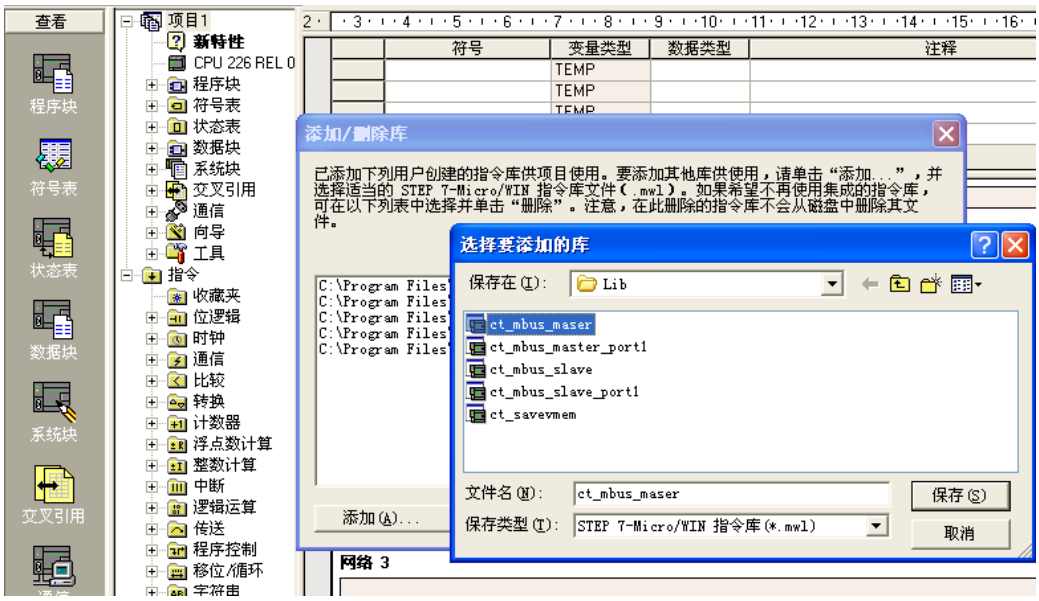
For the libraries, please visit: http://www.co-trust.com/cn/service_show.php?id=124

A.2 Library Installation (General)

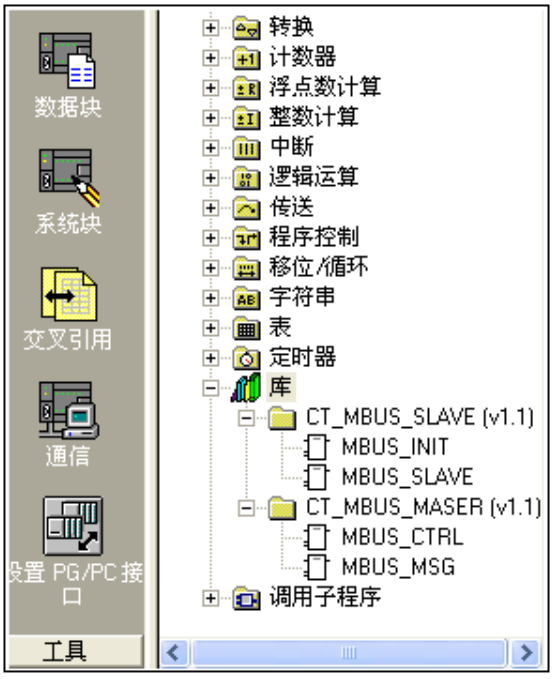
【Add library file】

In the “File”--“Add/Delete Library”, locate the file “ct_mbus_master.mwl”&“ct_mbus_slave.mwl”, as shown in the below figure:

Click Add(&A) to select the required library.

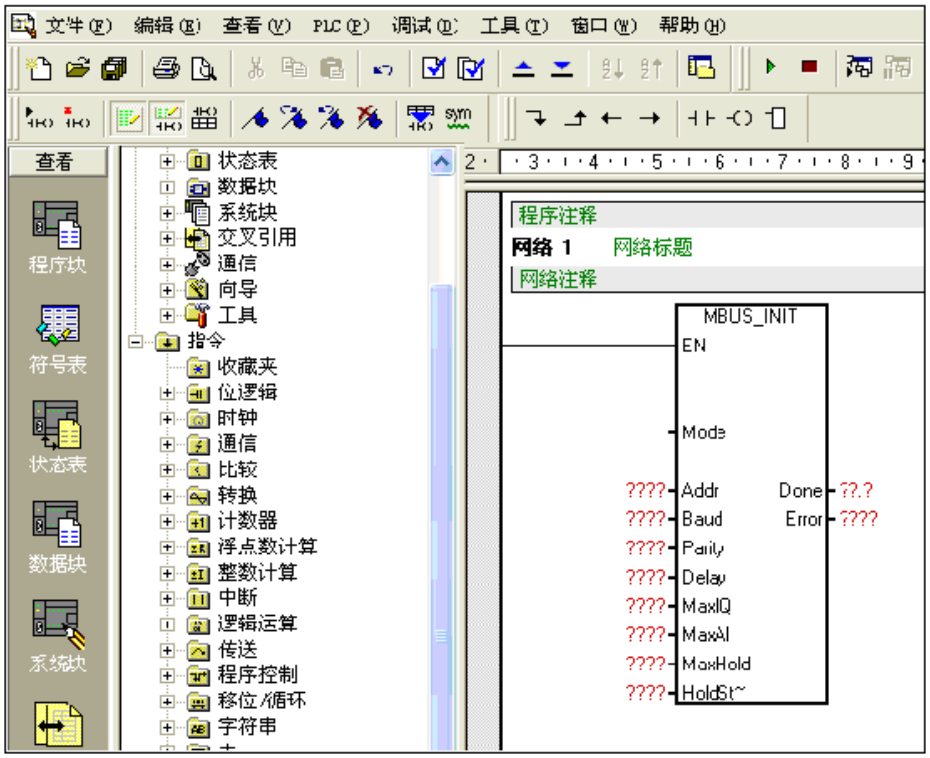


After installed successfully, you can see the new CT_MBUS_MASTER and CT_MBUS_SLAVE libraries below the Libraries of Directory Tree:



【Calling CT_MODBUS library】

Click to select the required network, then double-click the “MBUS_INIT”, “MBUS_SLAVE”, “MBUS_CTRL”, “MBUS_MASTER” under Libraries, they would be added into the network as shown below:



A.3 CT_MODBUS Function description

【Modbus Address】

Modbus addresses are normally written as 5 or 6 character values containing the data type and the offset. The first one or two characters determine the data type, and the last four characters select the proper value within the data type. The Modbus master device then maps the addresses to the correct functions.

The following addresses are supported by the Modbus Slave instructions:

00001~00128 for actual output of Q0.0--Q15.7;

10001~10128 for actual output of I0.0—I15.7;

30001~30032 for analog input register, mapping into AIW0~AIW62;

40001~4XXXX for holding register, mapping into V memory;

All Modbus addresses are one-based. Table below shows the mapping of Modbus addresses to the CTH200 addresses. The Modbus Slave Protocol allows you to limit the amount of inputs, outputs, analog inputs, and holding registers (V memory) accessible to a Modbus master.

Modbus Address	CTH200 Address
000001	Q0.0
000002	Q0.1
000003	Q0.2
……	……
000127	Q15.6
000128	Q15.7
010001	I0.0

010002	I0.1
010003	I0.2
……	……
010127	I15.6
010128	I15.7
030001	AIW0
030002	AIW2
030003	AIW4
……	……
030032	AIW62
040001	HoldStart
040002	HoldStart+2
040003	HoldStart+4
……	……
04xxxx	HoldStart+2 x (xxxx-1)

【Using Modbus slave protocol instructions】

※ CT_MODBUS slave protocol instructions occupied resources of CTH200 CPU

1) Based on the specific Modbus protocol library, use Port 0 or Port 1 for Modbus slave communication. When Port 0 or Port 1 has been used for Modbus, it cannot been used for other purpose. MBUS_INIT instruction can whether decide to use the Port for Modbus or PPI.

2) All SM related with selected Port communication.

3) Need to use 92 bytes of data program.

※ Steps for using Modbus slave protocol instructions in CTH200 program

1) insert a MBUS_INIT instruction into your program, and only execute once. This instruction can initiate or modify the Modbus communication parameters, and the hidden subroutines and interrupts would be added into program automatically.

2) Only 1 MBUS_SLAVE instruction can be used in your program. It would be executed in each cycle to provide service for all requests received.

3) Use communication cable to connect the Comm port of CTH200 CPU with Modbus master.

※ Functions supported by Modbus slave protocol instructions

Modbus slave protocol instructions support Modbus RTU protocol. These instructions use Freeport function of S7-200, support most of the common Modbus functions:

Functions	Description
1	Read single/multiple coil (discrete output) status. Function 1 returns the on/off status of any
2	number of output points (Qs).

3	Read single/multiple contact (discrete input) status. Function 2 returns the on/off status of any
4	number of input points (Is).
5	Read single/multiple holding registers. Function 3 returns the contents of V memory. Holding
6	registers are word values under Modbus and allow you to read up to 120 words in one request.
15	Read single/multiple input registers. Function 4 returns Analog Input values.
16	Write single coil (discrete output). Function 5 sets a discrete output point to the specified value.

※ MBUS_INIT Instruction

The MBUS_INIT instruction is used to enable and initialize, or to disable Modbus communications. Before the MBUS_SLAVE instruction can be used, the MBUS_INIT instruction must be executed without errors. The instruction completes and the Done bit is set immediately, before continuing to the next instruction.

The instruction is executed on each scan when the EN input is on.

Name	Type	Value range	Note
Mode	bit		Selects the communications protocol: an input value of 1 assigns port 0 to Modbus protocol and enables the protocol, and an input value of 0 assigns port 0 to PPI and disables Modbus protocol.
Addr	Byte	1~247	Set the address
Baud	Double-word	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	Set baud rate (bps)
Parity	Byte	0-no parity 1-odd parity 2-even parity	Parity setting All settings use 1 stop bit.
Delay	Integer	0~32767	Extend the time-out condition of standard informaiton by increasing the specified time in ms
MaxIQ	Integer	0~128 0 - disable the R/W operations for I/O	Set the available I/Qs Recommend the 128 for MaxIQ, i.e allow accessing all I/Q.
MaxAI	Integer	0~32 0 - disable reading the Analog Inputs	Set the available no. of input word registers MaxAI value: 32 for H224/H224X 32 for H226L/H226XL

Name	Type	Value range	Note
MaxHold	Integer	0~32767	Set the available word registers in V memory
HoldStart	Double-word	Pointer for V memory	Set the started address for available holding registers in V memory
Done	Bit		Done turns on when MBUS_INIT instruction complete
Error	Byte		Error output includes the result of this instruction

※ MBUS_SLAVE instruction

MBUS_SLAVE instruction used for request from Modbus master, it's required to be executed in each cycle to check and response the Modbus request. When the EN switched on, the instruction would be executed in each cycle, but has no input parameter.

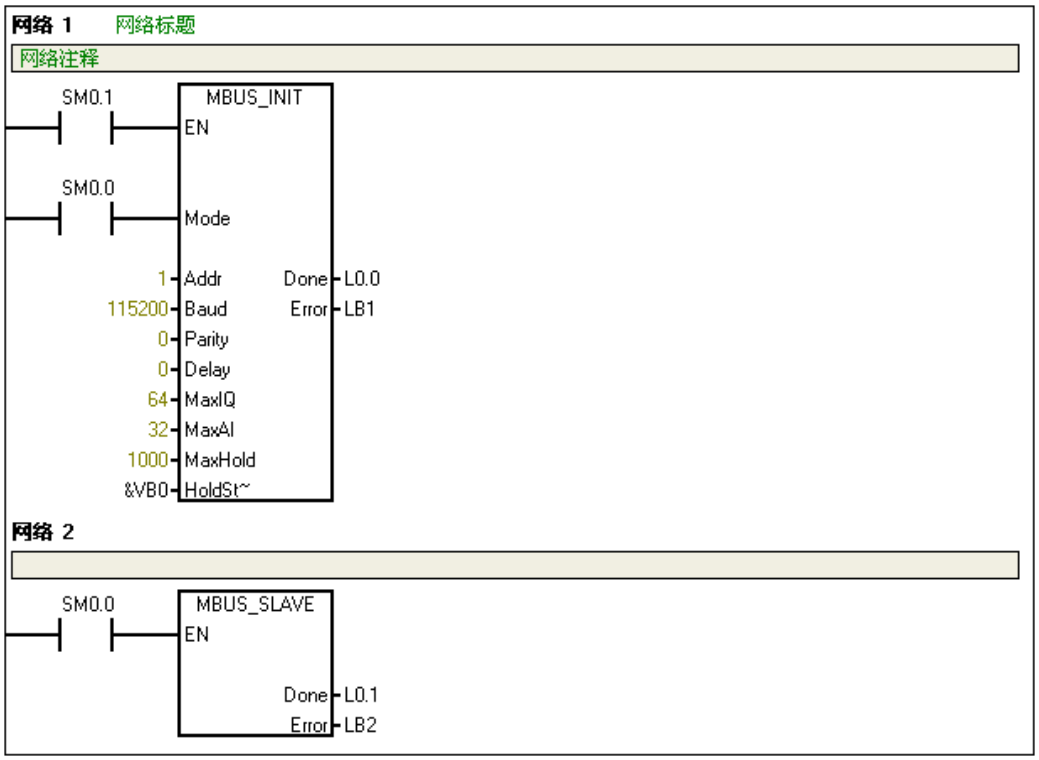
Name	Type	Value range	Note
Done	Bit		When the MBUS_SLAVE instruction responds to the Modbus request, Done switched on. Otherwise the Done switched off
Error	Byte	Refer to the following error code	Error output includes the result of this instruction. Only valid when the Done switch-on and notchanged even when it switch-off.

Error Code:

0	No error
1	Error for memory range
2	Error for Baud rate or validation
3	Invalid slave address
4	Invalid value for Modbus parameter
5	Duplicate symbolic address for holding register and Modbus slave
6	Error for receiving validation
7	Error for receiving CRC
8	Invalid function request/unsupported function
9	Invalid memory address in the request
10	Slave not enabled

※ Modbus slave protocol instruction

The following ladder program sets a slave address of 1, Baud rate 115200, no Parity:



※ MBUS_INIT parameters configuration description

Addr	Slave address = 1
Boud	Baud rate - 115200
Party	No Parity
Delay	Delay time - 0 ms
MaxIQ	Max 64 I points & 64 Q points (000001-0000064 and 010001-010064)
MaxAI	Max readable 32 AIs (030001-030032)
MaxHold	Max usable holding registers in V memory (in bytes)
StartHold	Modbus master can access the Start address of V momory (such as &VB0)

【Using Modbus master protocol instructions】

※ Modbus master protocol instructions use the CPU resources of CTH200.

1) Based on the specific Modbus protocol library, use Port 0 or Port 1 for Modbus slave communication. When Port 0 or Port 1 has been used for Modbus, it cannot been used for other purpose. MBUS_INIT instruction can whether decide to use the Port for Modbus or PPI.

2) All SM related with selected Port communication.

3) Need to use 119 bytes of data program.。

※ MBUS_CTRL instruction

Using SM0.0 to call the MBUS_CTRL instruction, initiating the master and enable the function control.

Parameter description:

Name	Type	Value range	Note
Mode	Bit		Set communication mode 1 - enable Modbus function; 0 - changed to PPI
Baud	D-word	11200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	Baud rate (bps)
Parity	Byte	0--No Parity 1--odd parity 2--odd parity	Set Parity. All settings use 1 stop bit
Timeout	Integer	1~32767	Time during The master waiting for slave response , in ms Typical 1000 ms
Done	Bit		Done bit, indicating initiation complete, then set to 1 automatically.
Error	Byte	0--No error 1--invalid Parity 2--invalid Baud rate 3--invalid mode	Initiation error code Valid only when Done is 1.

※ MBUS_MSG instruction

Using SM0.0 to call Modbus RTU master subroutine MBUS_MSG, the First 接通发送一个 Modbus 请求。同一时刻只能有一个读写功能(即 MBUS_MSG)使能。

Parameter description:

Name	Type	Value range	Notes
First	Bit		R/W Request bit. Each new Read request needs to be trigger by pulse.
Slave	Byte	1~247	Slave address
RW	Byte	0~Read 1~Write	Operation command
Addr	DWord	00000~0xxxx--digital output 10000~1xxxx--digital output 30000~3xxxx--analog input 40000~4xxxx--holding register	Select the data type for R/W
Count	Integer		No. Of communication data (Bits or Words). Max R/W data amount for each MBUS_MSG instruction of Modbus is 120 words.
DataPtr	DWord		Data pointer, into which the the read-back data returned for

			reading instruction, the write-out data returned for writing instruction.
Done	Bit		Done bit for the R/W function
Error		Refer to the following error code.	Error Code. Valid only when Done is 1.

Error Code:

0	No error
1	Error for Response check
2	Unused
3	Receiving Timeout (no response from slave)
4	Error for the requested parameter
5	Modbus/FPort not enabled
6	Modbus busy for other request
7	Response error (not the requested operation)
8	Response for CRC checksum error
101	Requested function not supported by slave
102	data address not supported by slave
103	Data type not supported by slave
104	slave failure
105	The slave received information but the response been delayed
106	Slave is busy and rejects the information
107	Slave rejects the information
108	Parity error in slave memory

B CTH200 CPU extended program space

B.1 Function Description

Dynamic library FB is provided for CTH200 CPU to extend program space and increase security. The library need to be download into PLC before the program can be download and compiled into independent program block. Each CTH200 CPU can load two 24K Dynamic library (“ct_lib1” and “ct_lib2”).

B.2 Instructions

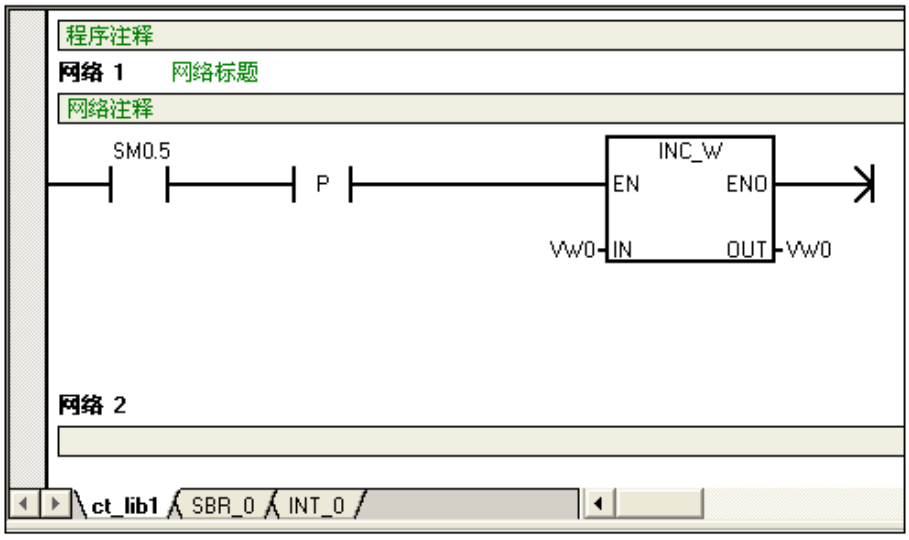
【Application range】

CTH200 CPU each can load up to two Dynamic library (“ct_lib1” and “ct_lib2”), the specific library and size supported is shown as following table:

CPU	ct_lib1	ct_lib2
H224/H224X	4K	Not support
H226L/H226XL	24K	24K

【Create Dynamic Library】

In the project, create all program blocks which used as dynamic libraries and name the Main block as ct_lib1 or ct_lib2, then download into PLC. Thus a function library can be created which including dynamic link libraries of all subroutines.

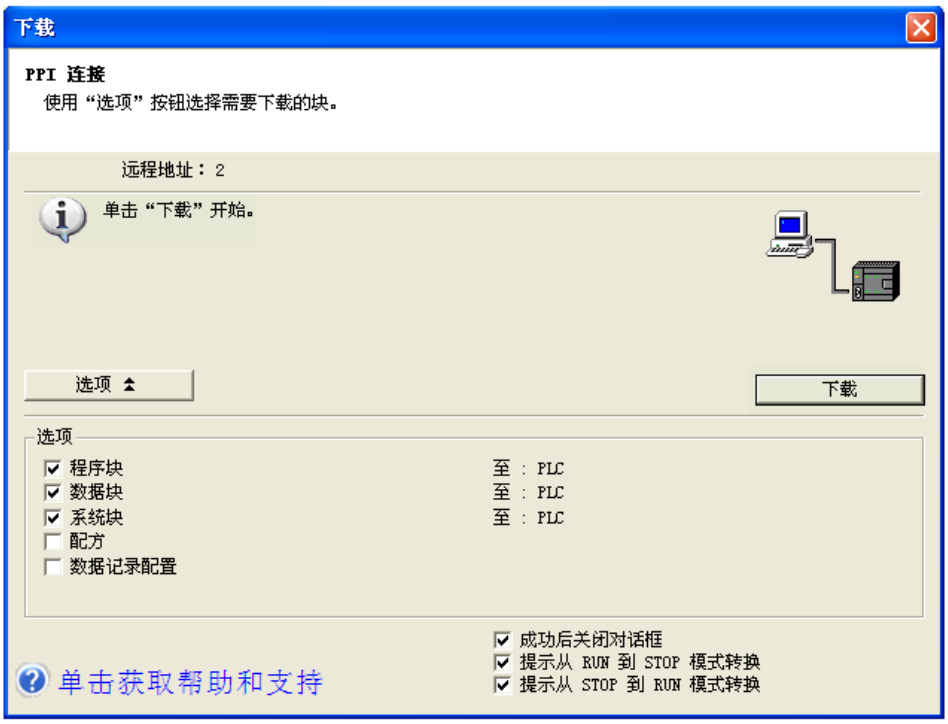


【Download dynamic library】

After downloading, the previous library and program block would be cleared, a dynamic library named ct_lib1 created.

Notice

Make sure only the program block be downloaded.



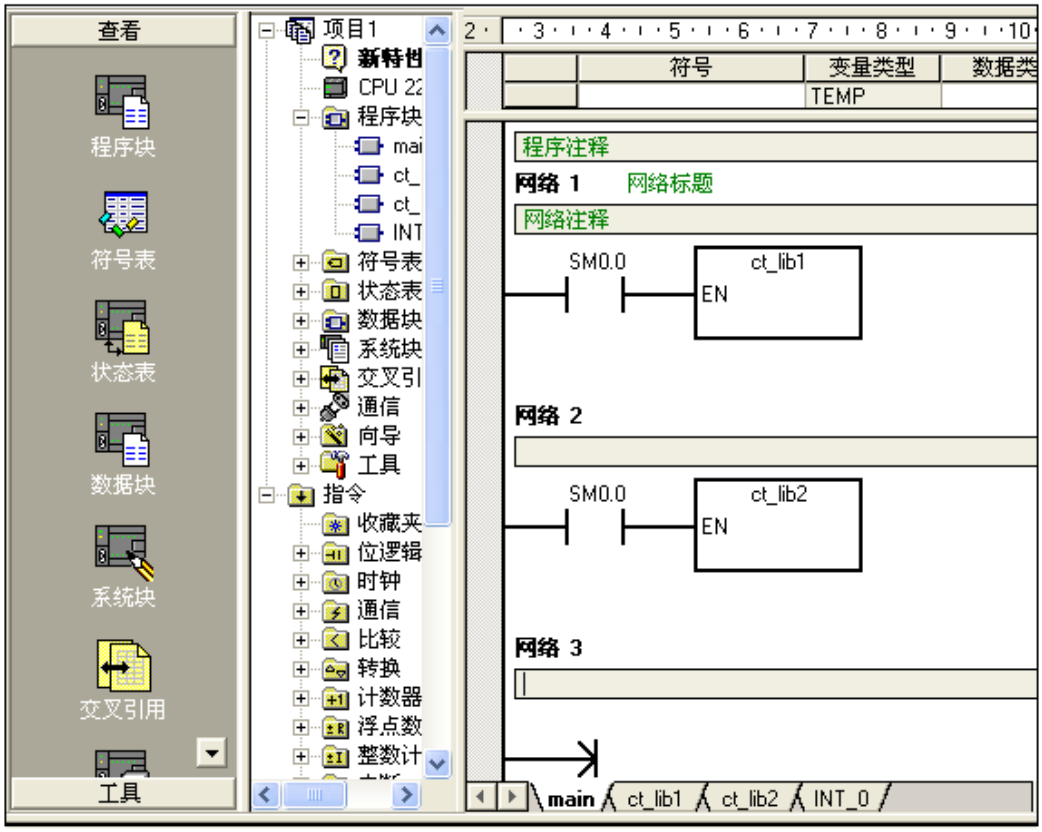
These procedures also suitable for ct_lib2.

【Using Dynamic Library】

In the project, create a subroutine which has identical name with dynamic library downloaded into PLC, like ct_lib1 oe ct_lib2, then call these block in project. After compiling and download, these blocks would replace the earlier ones.

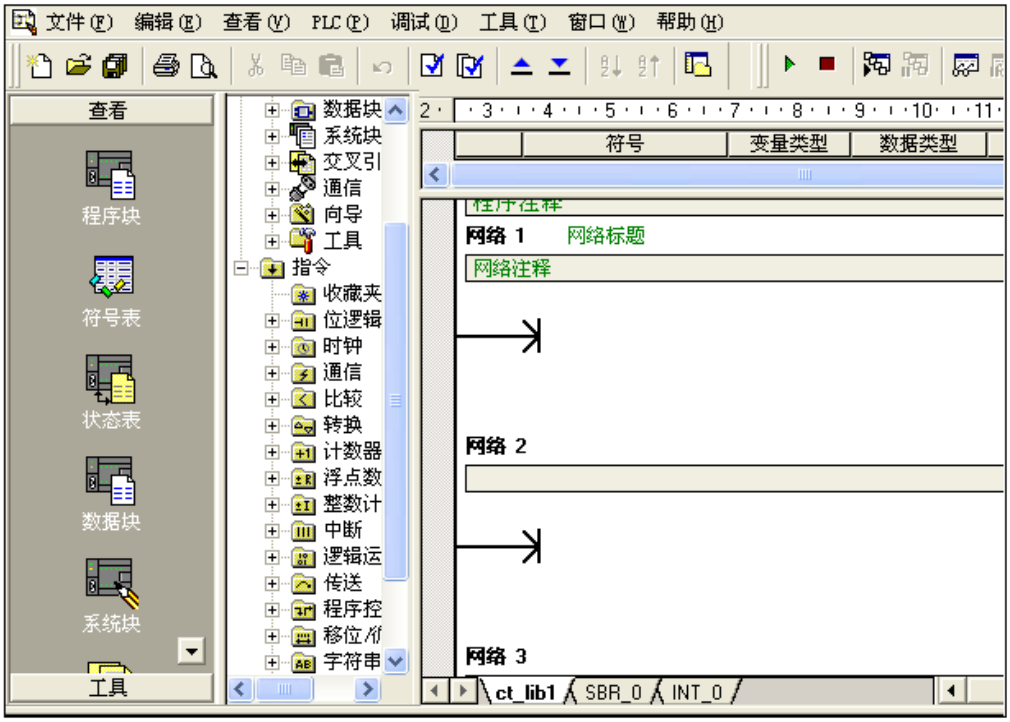
Notice

It’s recommend to Load the library first, then load programs which using this library.



【Clear the Library】

The previous library would be cleared when downloading new dynamic library. If an empty Main block named ct_lib1 or ct_lib2 be downloaded into PLC, the corresponding dynamic library in PLC would be cleared completely.



C 100K expansion DB Library for CTH200 PLC

C.1 Introduction

expansion DB is based on the current CTH200 CPU memory which has 100K data space for user access. It's Data retention equals to the V memory, which can retent data by super-capacitor in case of CPU powered off, up to 100hours and100KB data.

Dedicated library instructions have been provided for this DB, to realize data exchange between the expansion data space and other data space.

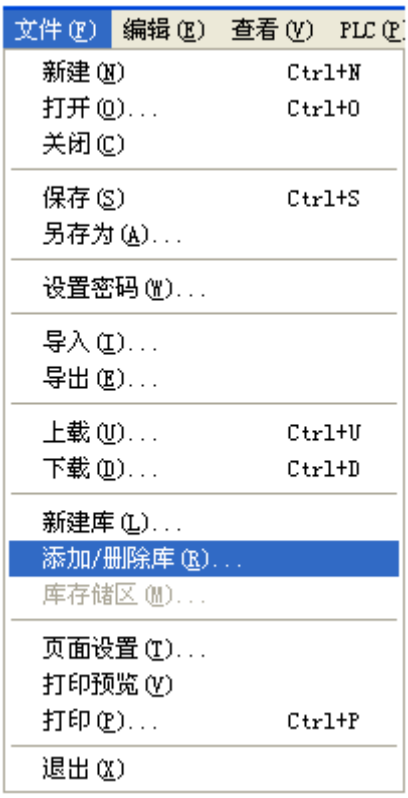
Notice

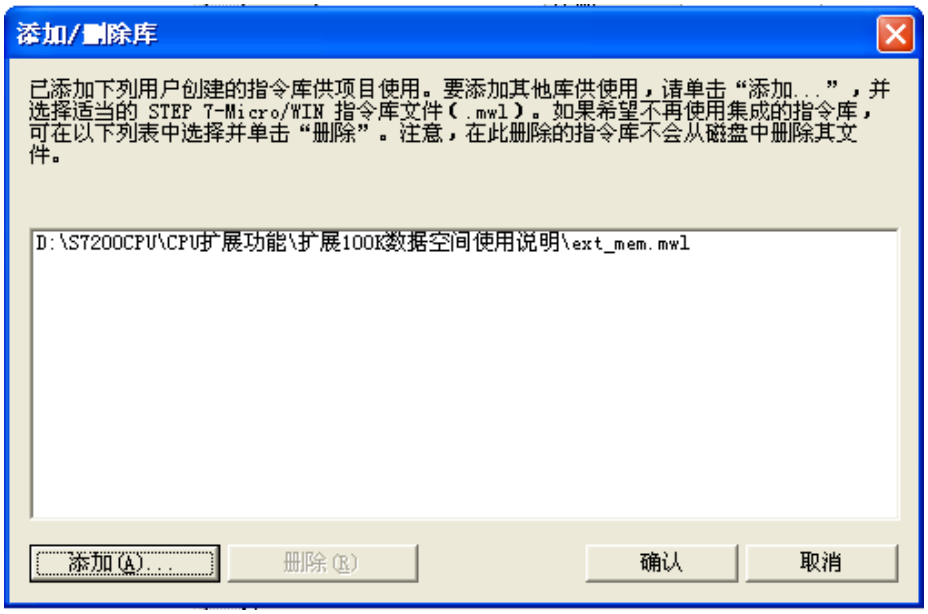
For this library, please visit : http://www.co-trust.com/cn/service_show.php?id=117

C.2 Installation

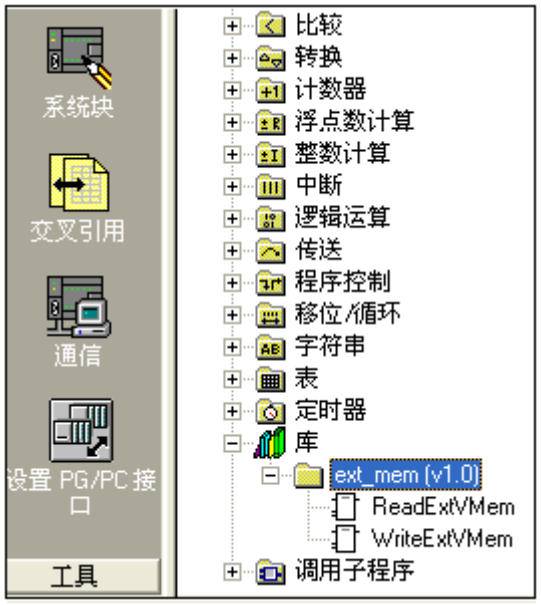
【Add library file】

Click "File"----"Add/Delete Library", find "pid_t.mwl" as shown in the following figure, then click Add(&A):



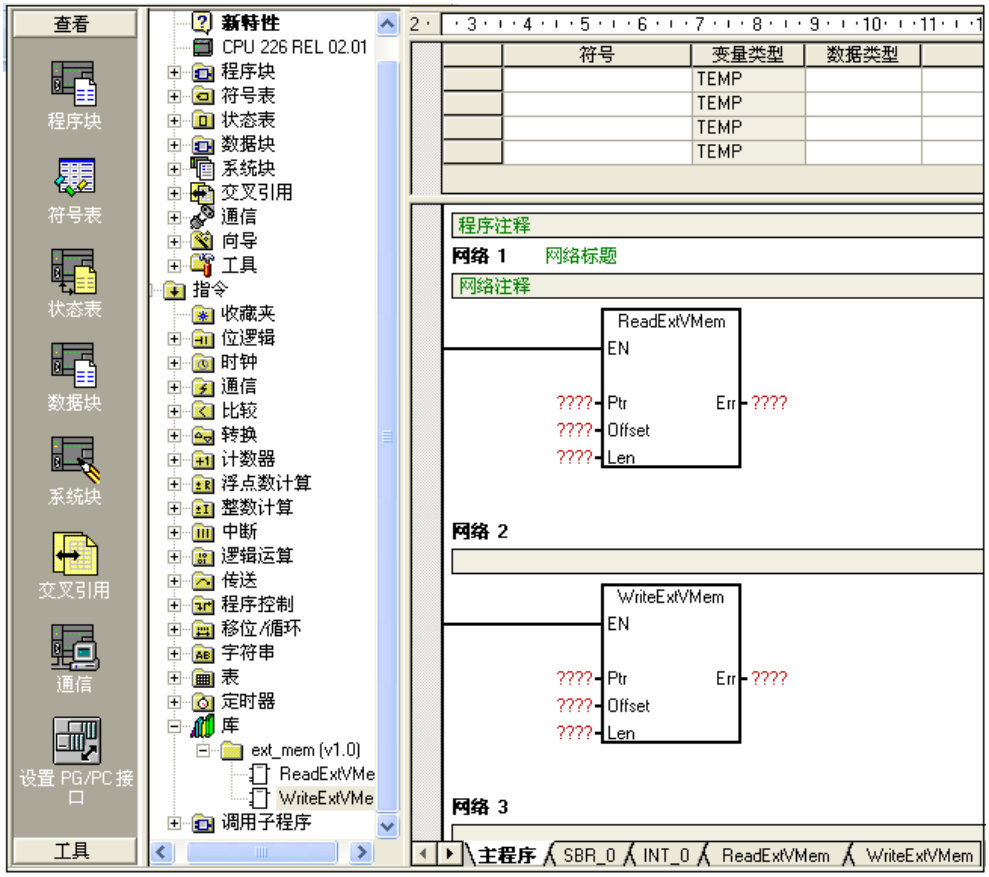


After installation, the new ext_mem would be added under Libraries of the Project Tree:



【Call ext_mem library】

Click the network to which need add function block, then double-click the “ReadExtVMem” and “WriteExtVMem”, they would be appeared in the network as shown below:



C.3 Ext_mem Description

【Read data from expansion memory by using ReadExtVMem】

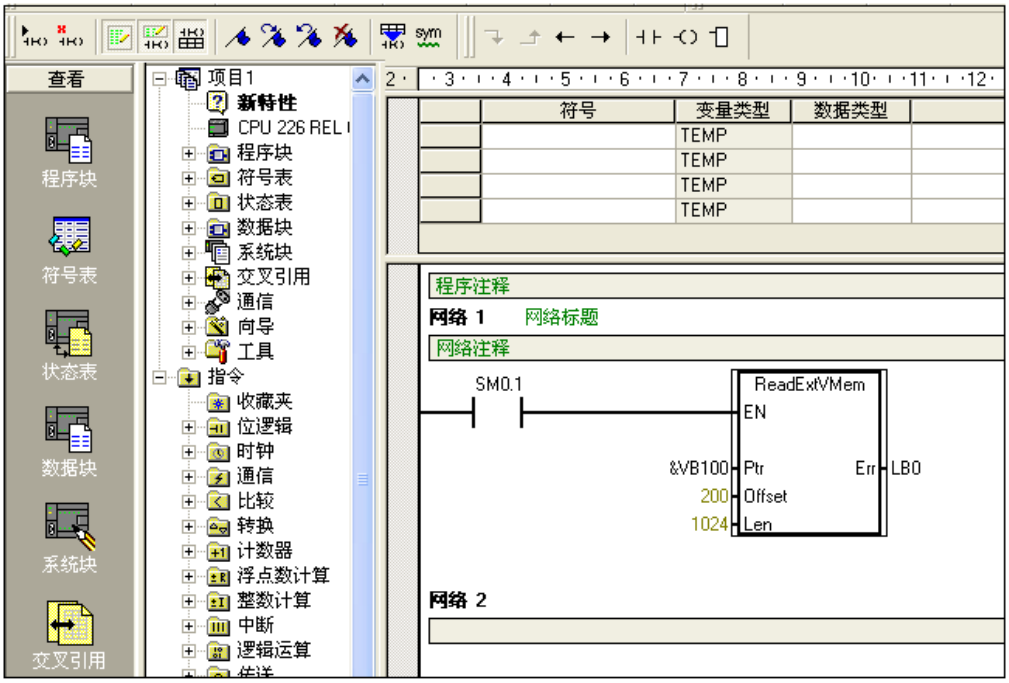
Parameter	Type	Value range	Description
Ptr	DWORD		The target memory address pointer to read Such as: &VB0,&IB0
Offset	DWORD	0-102399	the start offset address to read expansion memory
Len	DWORD		Memory length to read (in bytes)
Err	BYTE		Indicating the result of reading operation 0 - success, other - fail

【Write data into expansion memory by using WriteExtVMem】

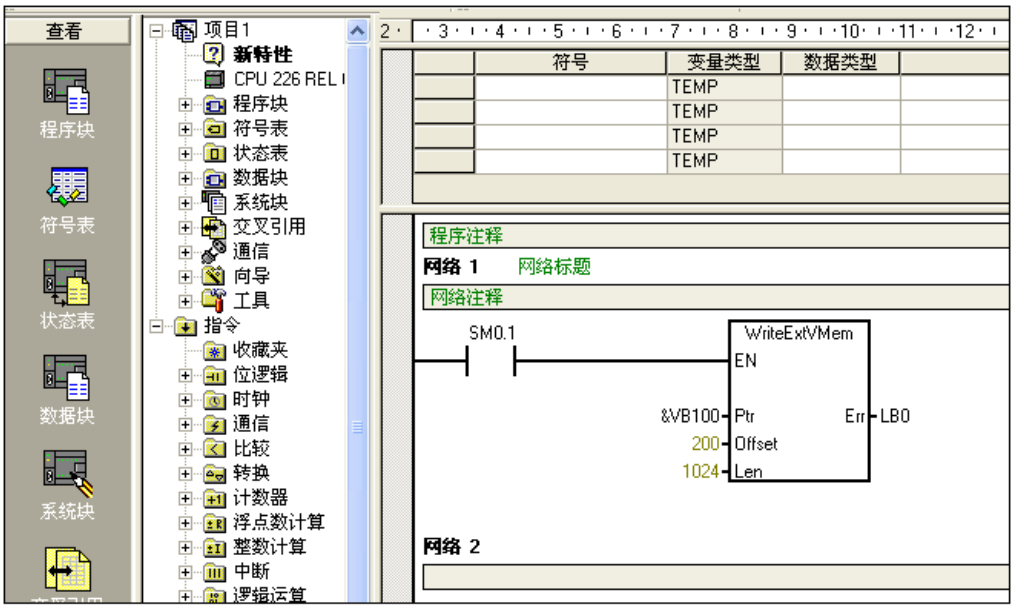
Parameter	Type	Value range	Description
Ptr	DWORD		The source memory address pointer to write Such as: &VB0,&IB0
Offset	DWORD	0-102399	the start offset address to write into expansion memory
Len	DWORD		Memory length to write (in bytes)
Err	BYTE		Indicating the result of writing operation 0 - success, other - fail

C.4 Application example

1, read the 1024 bytes started from offset 200 in expansion memory to the memory started from VB100



2, write the 1024 bytes started from VB100 into expansion memory started from offset 200



D CTH200 PLC PID Library

D.1 PID_T library

【Function Description】

PID_T is built in the CPU without occupying user data space, provided as a library for user. PID_T is mainly target for temperature control with intelligent PID function, it support auto-tune and self-adaption with no need for complex programming, only call or set a few parameters to achieve accuracy temperature control.

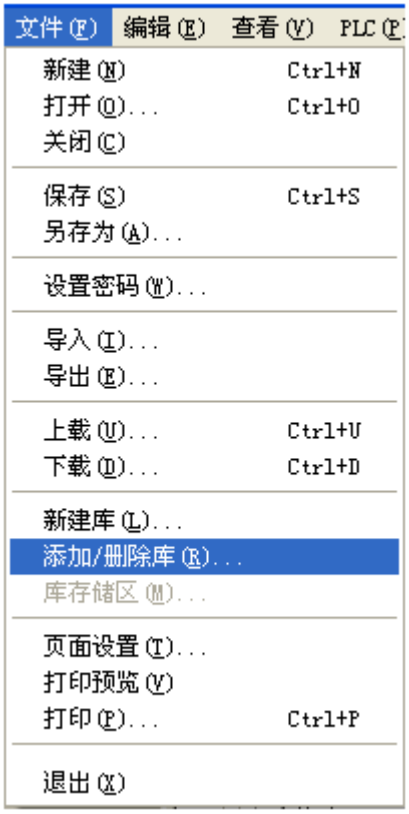
Notice

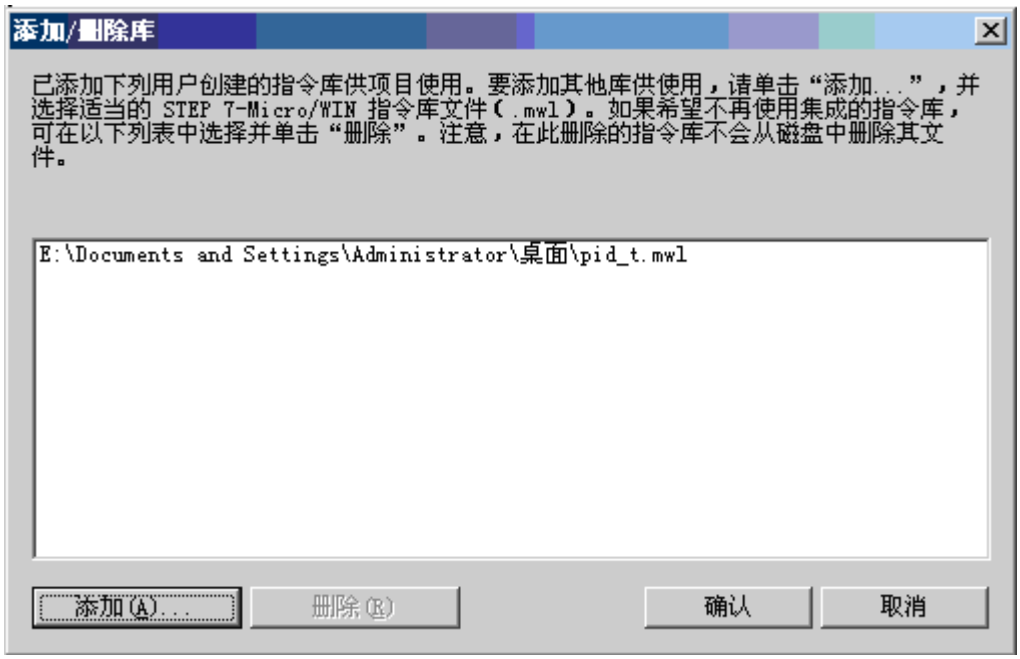
For this library, please visit: http://www.co-trust.com

【Installation Instructions】

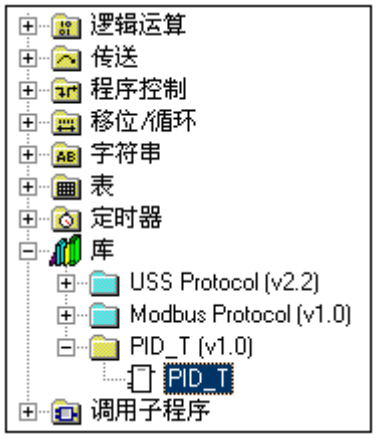
※ Add library file

Click “file”----“Add/Delete library”, find “pid_t.mwl” and click Add as shown below:



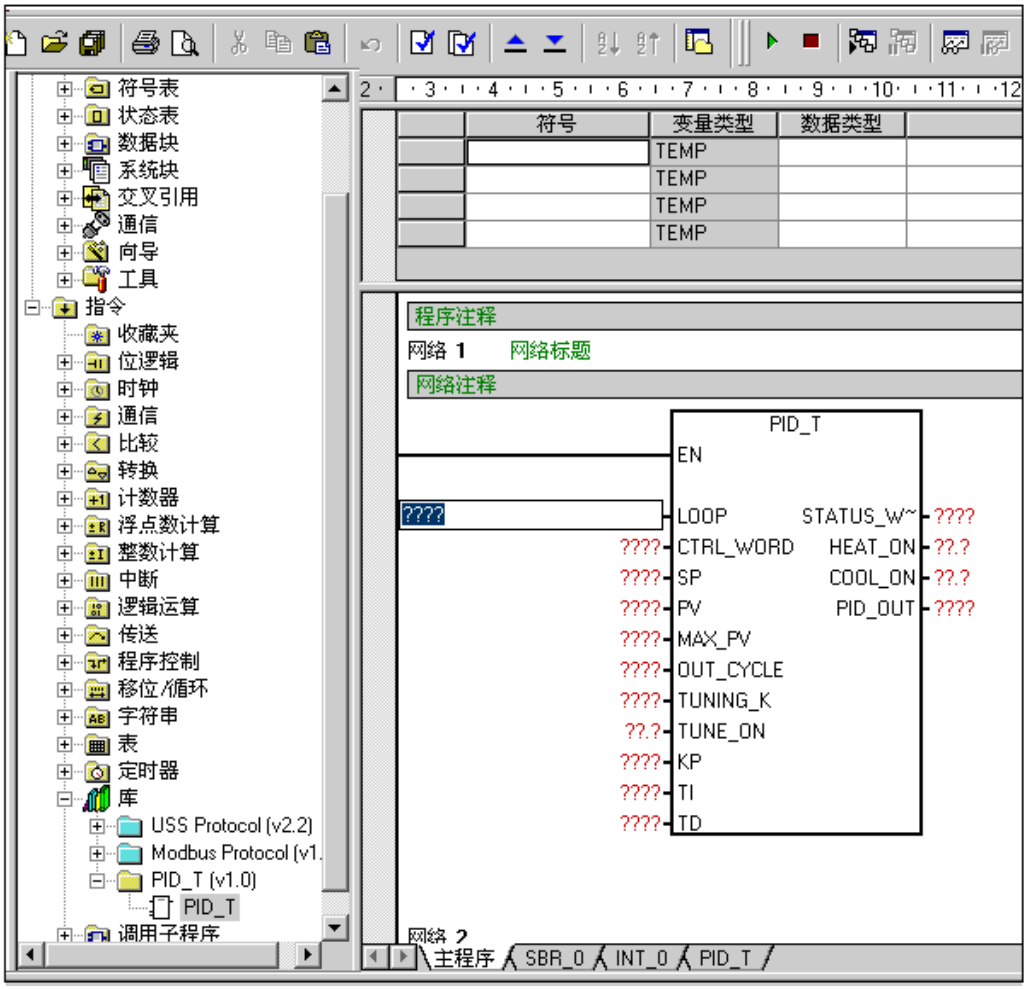


After installation, we can see new PID_T under Libraries:



※ Call PID_T

Click the target network in which to add new FB, double-click the PID_T under Libraries to add it into network:



【PID_T Function Description】

Parameter	Description	Type	Value range	Notes
LOOP	Specific PID loop number, start from 0 and cannot duplicate	Word, instant or variable	0-63	control loop ID
CTRL_WORD	Control word (PID operation)	Word, instant or variable		common: 1)16#03 (only for heat, with self-adaption) 2)16#07 (for heat andcold, with self-adaption)
SP	Setting value	Word, instant or variable	-32768-32767	Unit: 0.1℃
PV	Measured value (feedback value)	Word or variable	-32768-32767	Unit: 0.1℃
MAX_PV	Max measured value	Word, instant or variable	-32768-32767	Unit: 0.1℃
OUT_CYCLE	Pulse output period	Word, instant or variable	1-255	Unit: second
TUNING_K	Auto-tune coefficient	Dword, Float	0.5-2.0	0.5: require small overshoot for system

				control. 1.0: normal response 2.0:require large overshoot and fast response from system control
TUNING_ON	Start auto-tune	Bit, variable		Reset automatically after auto-tune
Kp	proportion coefficient	Word variable		Auto-tune cannot be executed when Kp was assigned as constant.
Ti	integral time	Word variable	1-3600	unit: seconds Auto-tune cannot be executed when Ti was assigned as constant.
Td	derivative time	Word variable	0-3600	unit: seconds Auto-tune cannot be executed when Td was assigned as constant.
STATUS_WORD	status word	Word or variable		Status for operation and alarm
HEAT_ON	Heat output	Bit		
COOL_ON	Cooling output	Bit		
PID_OUT	PID analog output	Word, instant or variable	0-32000 for only heat output -32000-32000 for cooling output	

Bit addresses for control word:

Control bit	Value	Notes
0	0	PID Stop
	1	PID Run
1	0	Integral always in use and Kp cannot automatic adjust
	1	integral separation and Kp can automatic adjust
2	0	PID uni-polar output
	1	PID bipolar output
3	0	Reserved
	1	Reserved
4	0	Integral in use
	1	Integral not in use

5	0	Derivative in use
	1	Derivative not in use
6		Reserved
7		Reserved

Bit addresses for status word:

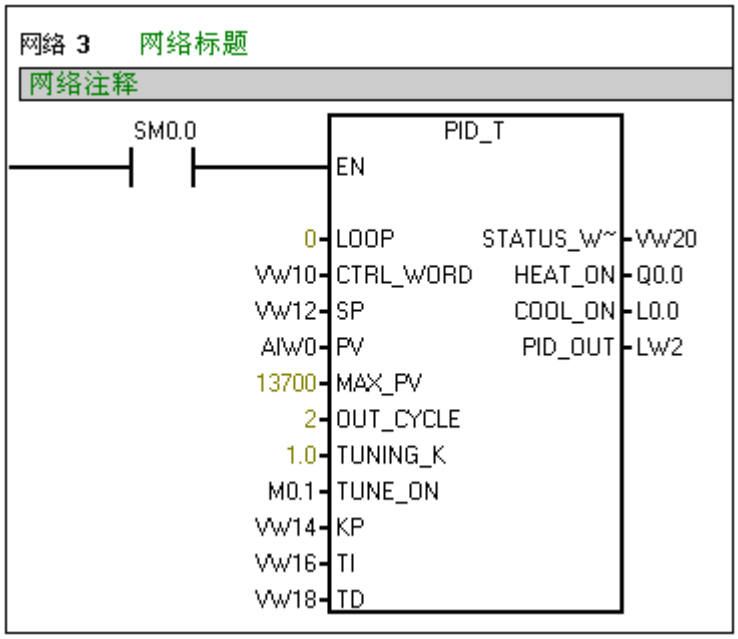
Status bit	Value	Notes
0	0	No break line fault
	1	break line fault
1	0	Auto-tuning not executed
	1	Auto-tuning
2	0	No Auto-tuning fault
	1	Auto-tuning fault
3	0	Not heating
	1	Heating
4	0	Not cooling
	1	Cooling
5	0	PID Stop status
	1	PID Run status
6		Reserved
7		Reserved

【Application Example】

System Requirements

System Configuration	CPU H226XL + 231-7PD32	Using a quad TC module	
Control Requirements	1, only heat output, no cooling 2, require auto-tune parameters 3, K type thermocouple		
I/O Distribution			
Q0.0	Heat output		
AIW0	Temperature input	K type thermocouple	
M0.0	PID Run/Stop		
M1.0	Start auto-tuning		

Program



The parameter description for PID_T is shown below:

Parameter	Address or value	Description	Notes
LOOP	0	0 for the first loop	
CTRL_WORD	VW10		
SP	VW12		
PV	AIW0		
MAX_PV	13700	Max input 13700 for the K type	
OUT_CYCLE	2	2s, the pulse output cycle	
TUNING_K	1.0		
TUNING_ON	M0.1	Set 1 to start tuning, and reset after tuning completely	
Kp	VW14	Proportion coefficient, the tuned value would be written into this variable for further adjust	
Ti	VW16	Integral time, the tuned value would be written into this variable for further adjust	
Td	VW18	derivative time, the tuned value would be written into this variable for further adjust	
STATUS_WORD	VW20	Status word	
HEAT_ON	Q0.0	Heat output	
COOL_ON	L0.0	Using a local variable instead	
PID_OUT	LW2	Using a local variable instead	

D.2 PID_setting library

【Function Description】

PID_setting Library is designed for TC type PID module (SM231-7TD, SM231-7TF). TC PID modules have integrated PID algorithm internally, users only need to set a few parameters to achieve accurate temperature control.

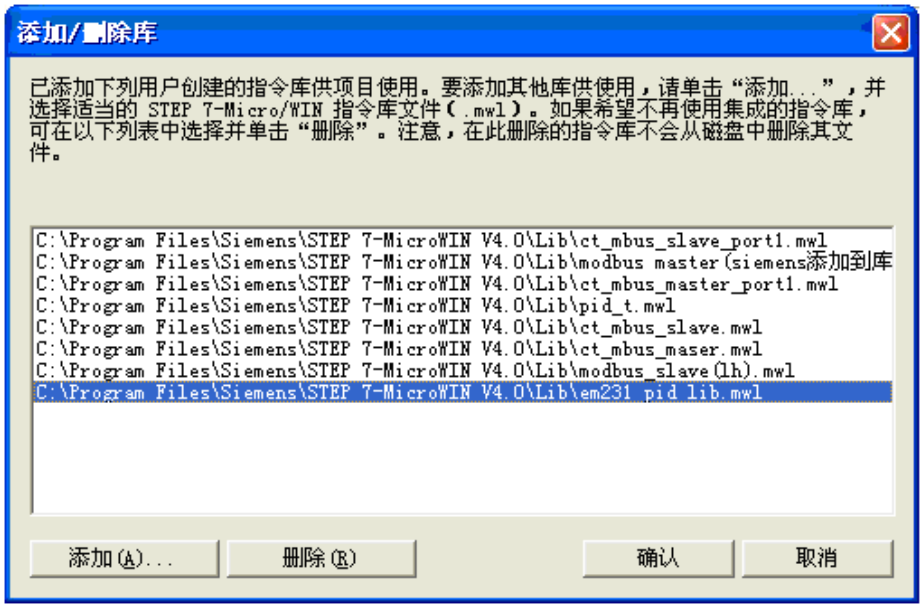
Notice

- For this library, please visit http://www.co-trust.com.
- It is suitable for CTH2 231-7TD32, CTH2 231-7TF32 modules;
- SM231-7TD32 and SM231-7TF32 would occupy part of V memory, which cannot be used when programming.
- This library cannot be used for Siemens CPU222, as there is space limitation.

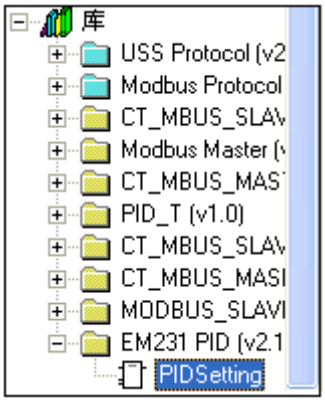
【Installation】

※ Add Libary file

Click “file”----“Add/Delete library”, find “sm231 pid lib.mwl” and click Add as shown below:

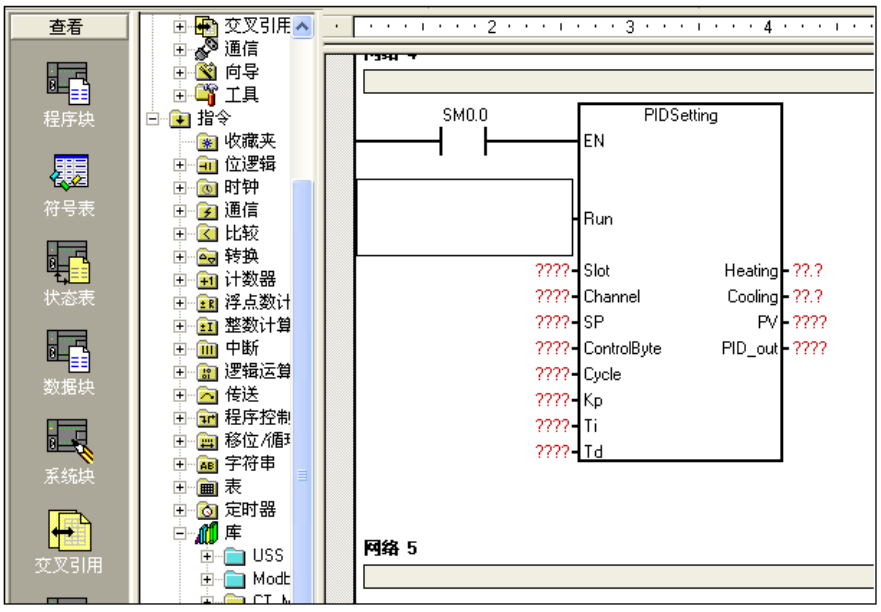


After installation, we can see new PID_setting under Libraries:



※ Call PID_Setting Library

Click the target network in which to add new FB, double-click the PID_Setting under Libraries to add it into network:



※ PID_setting 库功能说明

地址参数说明

parameter	Description	Type	Value range	Notes
Run	Running	Bit	0 or 1	
Slot	Slot no.	Word, constant or variable	0~6	Start from 0
Channel	Channel No.	Word, constant or variable	0~7	
SP	Setting value	Word, constant or variable	-2000~32767	Unit: 0.1℃
CTRLByte	Control byte, for PID operation	constant or variable		common: 1)16#03 (only for heat, with self-adaption) 2)16#07 (for heat andcold, with self-adaption)
Cycle	Pulse output cycle	Word, constant or variable	1~255	unit: s
Kp	proportion coefficient	Word, integer, constant or variable		
Ti	integral time	Word, integer, constant or variable	1~3600	unit: s
Td	derivative time	Word, integer, constant or variable	0~3600	unit: s
Heating	status word	Bit		
Cooling	Heat output	Bit		
PV	Measured value (feedback value)	Word, variable	-2000~32767	unit: 0.1℃
PID_out	PID analog output	Word, integer, or variable	0-32000 for only heat output -32000-32000 for cooling output	

Bit addresses for control word:

Control bit	Value	Notes
0	0	PID Stop
	1	PID Run
1	0	Integral always in use and Kp cannot automatic adjust
	1	integral separation and Kp can automatic adjust
2	0	PID uni-polar output
	1	PID bipolar output

3	0	Reserved
	1	Reserved
4	0	Integral in use
	1	Integral not in use
5	0	Derivative in use
	1	Derivative not in use
6		Reserved
7		Reserved

※ PID Address and Parameter Configuration

• PID Address Calculation

Address	计算公式	备注
PID parameter address	A=(2048+S*256)+16*C	S - slot number for the module (0～6) C - channel number
PID positive pulse output address	X=(2048+S*256)+12	
PID negative pulse output address	Y=(2048+S*256)+13	

• PID Parameter Output (module to CPU)

Content	Address	Value range	Actual value
Actual temperature	VW A	0～13000	0～1300 degree
Status word	VW A+2		
PID analog output	VW A+4	-32000～32000	

• PID Parameter Input (CPU to module)

Content	Address	Value range	Actual value
Set temperature	VW A+128	0～13000	0～1300degree
Control byte		VB A+130 bit = 0	VB A+130 bit = 1
	V(A+130).0	PID not run, no output	PID Run
	V(A+130).1	Integral in use, Kp cannot auto-adjust	Integral separation, Kp can auto-adjust
	V(A+130).2	PID uni-polar output, 0～32000	PID bi-polar output, -32000-32000, with heat and cooling function
	V(A+130).3	Not in use	
	V(A+130).4	Integral in use	Integral not in use
	V(A+130).5	Derivative in use	Derivative not in use
	V(A+130).6	Actual temperature filter with higher immunity from interference	Actual temperature without filter
PID pulse output cycle	VW A+132	1～255	1～255s

Kp	VW A+134	0～9999	0～999.9
Ti	VW A+136	0～3600	0～3600s
Td	VW A+138	0～3600	0～3600s

• pulse output address for Heat

Ch0 pulse output	V X.0
Ch1 pulse output	V X.1
Ch2 pulse output	V X.2
Ch3 pulse output	V X.3
Ch4 pulse output	V X.4
Ch5 pulse output	V X.5
Ch6 pulse output	V X.6
Ch7 pulse output	V X.7

• pulse output address for cooling

Ch0 pulse output	V Y.0
Ch1 pulse output	V Y.1
Ch2 pulse output	V Y.2
Ch3 pulse output	V Y.3
Ch4 pulse output	V Y.4
Ch5 pulse output	V Y.5
Ch6 pulse output	V Y.6
Ch7 pulse output	V Y.7

【Application Instance】

Here set parameters for the 1st PID loop (ch0) of SM231-7TD module (slot 0). when calling PID_setting, only need to input the slot and channel number of the loop,and enable Run, no need to calculate the PID parameter addresses.

Q0.0 - positive pulse output; Q0.1 - negative pulse output;

VW0 - actual temperature; VW2 - PID analog output;

Other PID parameter addresses:

Set temperature: VW120;

Control byte: VB122;

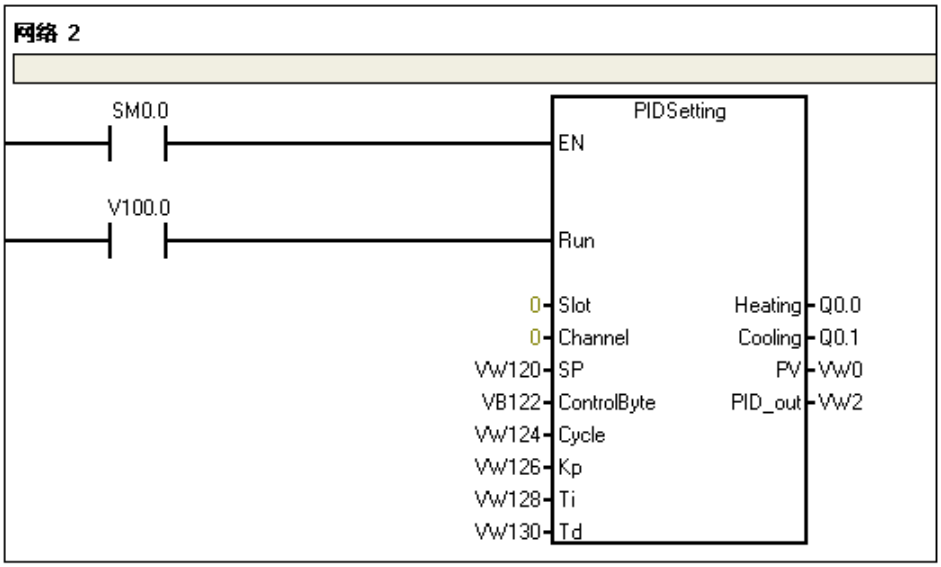
Pulse output cycle: VW124;

Kp: VW126;

Ti: VW128;

Td: VW130;

Program



Notice

To make sure the PID module can be used normally, the following V memory which would be used by PID cannot be used.

Module in slot 0: VW2048~VW2298

Module in slot 1: VW2304~VW2554

Module in slot 2: VW2560~VW2810

Module in slot 3: VW2816~VW3066

Module in slot 4: VW3072~VW3322

Module in slot 5: VW3328~VW3578

Module in slot 6: VW3584~VW3834

E motion_ctrl_lib for Motion Control

E.1 Description

motion_ctrl_lib can be used for CTH200PLC as a library. There is no need for complex program,just need to set and call a few simple parameters. CPU has built-in positioning control module, which supports Read Position, Relative Single Axis Motion, Speed Control and Home Control instructions.

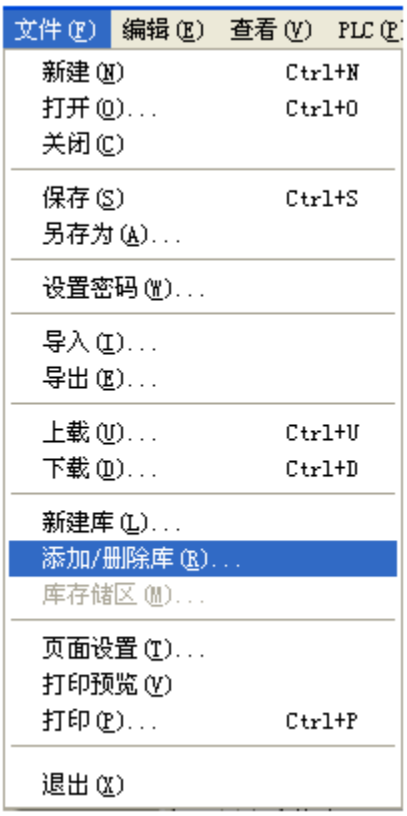
Notice

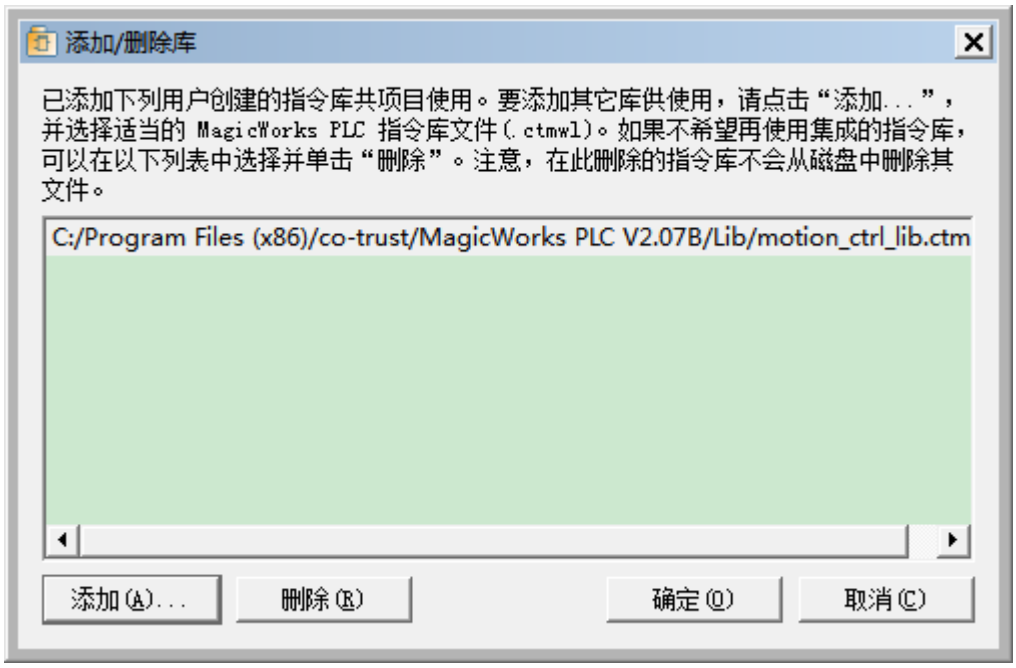
For this library, please visit http://www.co-trust.com/cn/service_show.php?id=145.

E.2 Installation

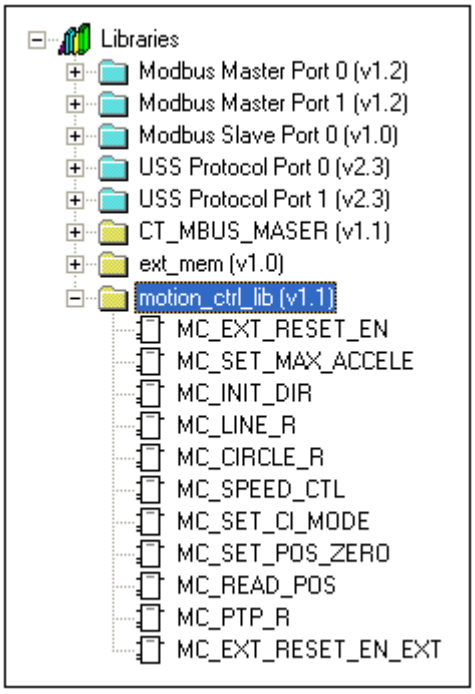
【Add library file】

Click “file”----“Add/Delete library”, find “motion_ctrl_lib.mw” and click Add as shown below:





After installation, we can see new PID_setting under Libraries:



【motion axis & CPU I/O】

CPU	CPU H224/H226L			CPU H224X/H226XL			
Normal output	Q0.0	Q0.1	Q0.2	Q0.0	Q0.1	Q0.2	Q0.3
Motion Axis I/O	Pulse_0	Pulse_1	Pulse_2	Pulse_0	Pulse_1	Dir_0	Dir_1

Notice

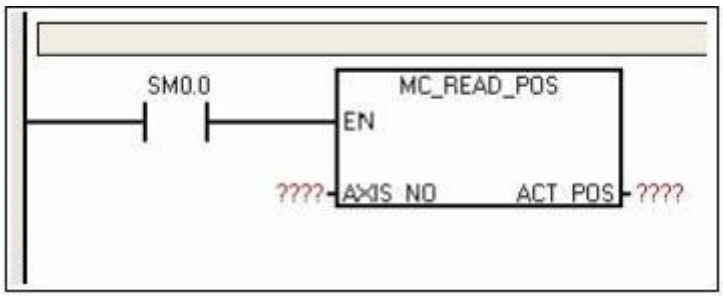
Pulse_0 --------0 axis pulse output; Dir_0 ------0 axis direction output;
Pulse_1 --------1 axis pulse output; Dir_1 ------1 axis direction output;
Pulse_2 --------2 axis pulse output;

【motion_ctrl_lib Instructions】

Name	Function	CTH200 CPU			
		H224	H226L	H224X	H226XL
MC_EXT_RESET_EN	External Reset Coordinate Enable	N		Y	
MC_INIT_DIR	Config Motor Direction	N		Y	
MC_READ_POS	Read Position	N		Y	
MC_PTP_R	Single axis relative motion	Y		Y	
MC_CIRCLE_R	Two axis circular interpolation motion	N		N	
MC_SPEED_CTL	Speed Control	Y		Y	
MC_SET_POS_ZERO	Software Home	N		Y	
MC_LINE_R	Two axis linear interpolation motion	N		N	
MC_EXT_RESET_EN_EXT	External Reset Coordinate Enable II	N		Y	
MC_SET_MAX_ACCELE	Set the max acceleration	N		Y	
MC_SET_CI_MODE	Set Continuous interpolation function	N		N	
MC_PTP_A	Absolute position for single axis	N		Y	
MC_SET_POS_PV	Set the target position	N		N	
MC_HOMING	Homing	N		Y	

【Read Position】

① Name: MC_READ_POS



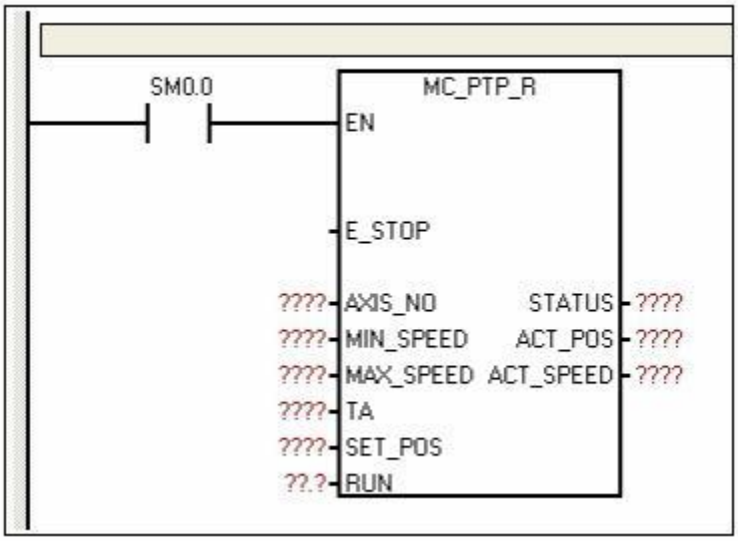
② Function: read the absolute coordinate of each axis. Once the origin has been set, this value would be calculated based on pulse input and direction: Forward output 1 pulse ＋1, backward output 1 pulse －1, finally obtain the absolute coordinate which refer the set point as origin.

③ Parameters

Name	I/O	Description	Type	Value range	Notes
AXIS_NO	IN	Axis number, 0/1/2/3	Byte	0～3	
ACT_POS	OUT	Absolute coordinate of the current axis (1 pulse = 1 coordinate unit)	DINT	-2147483647~ +2147483647	This instruction has no error status output, axis no. must set correctly

【Single axis relative motion】

① Name: MC_PTP_R



② Function: used for single axis peer-to-peer control (single axis fixed-length drive). Once called, it can output fixed pulse and accelerate to the max speed by setting max/min speed and accel time. When the pulses down, the frequency would be decrease to prevent vibration or jam caused by too large inertia.

③ Parameters

Name	I/O	Description	Type	Value range	Notes
E_STOP	IN	Emergency Stop 1: valid 0: invalid	Bool	0/1	1, run only when Run==1 & E_Stop==0. 2, when E_STOP = 1, RUN reset internally.
AXIS_NO	IN	Set axis number, 0/1/2/3	Byte	0～3	Cannot modify during running.
MIN_SPEED	IN	Min speed at start or end. Unit: HZ	Dword	500~200000	1, Min < Max. 2, can be modified during operation.
MAX_SPEED	IN	Max speed during operation. Unit: HZ	Dword	500~200000	
TA	IN	Accel /decel time, Unit: ms	Dword	0～10000 (refer to **Note 3**)	Can be modified during operation. (refer to **note 1** in this section)
SET_POS	IN	Output Pulses (signed) Positive pulses - X direction, Negative pulses - X negative direction	Dint	-2147483647 ~ +2147483647	modifiable, when the new set value > output pulses, the last pulse would be subject to the value, or else the pulse output stop.
RUN	IN/OUT	Run enable 1: valid 0: invalid	Bool	0/1	1, Run only when RUN ==1 & E_STOP ==0 2, RUN reset internally

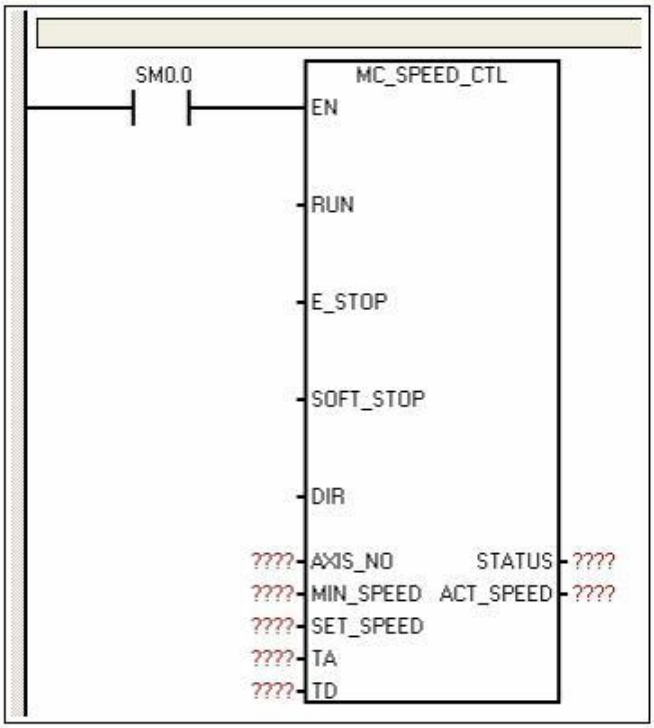
<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>after running completely.
3, RUN reset internally when E_STOP = 1</td></tr>
<tr><td>STATUS</td><td>OUT</td><td>Output status byte:
<table><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr></table>Bit0: Parameter configuration error
1 - error
0 - normal
Bit1: Run
1 - Running, it’s outputting pulses.
0 - Not Run, for resources has been occupied by other instructions; or it has been executed.
Bit2: Done
1 - Done, instruction complete.
0 - not done, not execute or not complete yet.
Bit3: Busy
1: valid, the axis being occupied by other instruction.
0: invalid, executing or done.</td><td>Byte</td><td>0～255</td><td>Bit0 : Only for axis parameters; MIN_SPEED/MAX_SPEED/TA no error, a nearest valid value set automatically.</td></tr>
<tr><td>ACT_POS</td><td>OUT</td><td>Current relative coordinate or outputted pulses</td><td>Dint</td><td>-2147483647
~
+2147483647</td><td></td></tr>
<tr><td>ACT_SPEED</td><td>OUT</td><td>Actual running speed</td><td>Dword</td><td>500~200000</td><td>There can be Deviation from actual value (no more than 5K), related with accel time and set speed.</td></tr>
</table>

Note 1:

Theoretically, TA ≤ (MAX_SPEED) - (MIN_SPEED), If TA > (MAX_SPEED) - (MIN_SPEED), calculated as TA=(MAX_SPEED) - (MIN_SPEED)

【Speed Control】

① Name: MC_SPEED_CTL



② Function: pulse frequency (Speed) can be changed any time by controlling the frequency of output pulses. When the Soft Stop instruction received, it would ramp down to stop automatically. When the Emergency Stop received, it would stop pulse output immediately without ramping.

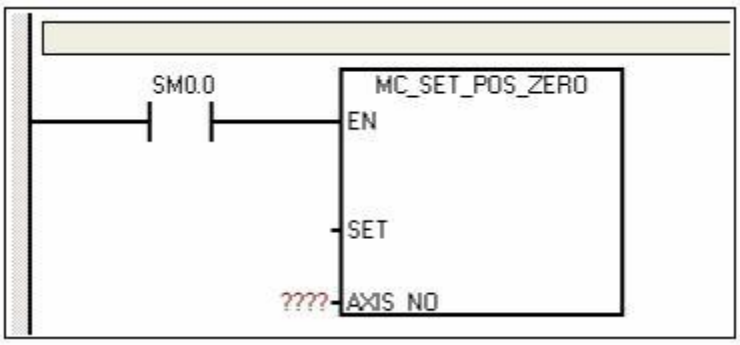
③ Parameter

Parameter	I/O	Description	Type	Value range	Note
RUN	IN	RUN enbale 1: Valid 0: Invalid	Bool	0/1	Run only when RUN =1 & E_Stop=0 & SOFT_STOP=0.
E_STOP	IN	Emergency Stop, 1-valid, 0-invalid. Stop without decel when receiving valid E-Stop instruction.	Bool	0/1	Run only when RUN =1 & E_Stop=0 & SOFT_STOP=0.
SOFT_STOP	IN	Soft Stop, 1: valid, 0: invalid. Stop with decel when receiving valid Soft-Stop instruction.	Bool	0/1	
DIR	IN	Pulse direction	Bool	0/1	Cannot modify during operation
AXIS_NO	IN	Axis number, 0/1/2/3	Byte	0～3	Cannot modify during operation
MIN_SPEED	IN	Min Speed, at start or stop Unit: HZ	Dword	0~200000	1, Min < Set Speed; 2, modifiable during operation.
SET_SPEED	IN	Set Speed, to which the output pulse would accel/decel before receiving Stop instruction.	Dword	0~200000	
TA	IN	Accel Time, from the MIN_SPEED to SET_SPEED, unit: ms	Dword	0~10000 (**note 3**)	modifiable during operation
TD	IN	Decel Time, from the SET_SPEED to MIN_SPEED, unit: ms	Dword	0~10000 (**note 3**)	
STATUS	OUT	Output status byte:	Byte	0～255	Bit0 : Only for axis

		7 6 5 4 3 2 1 0 Bit0: Parameter configuration error 1 - error 0 - normal Bit1: Run 1 - Running, it's outputting pulses. 0 - Not Run, for resources has been occupied by other instructions; or it has been executed. Bit2: Done 1 - Done, instruction complete. 0 - not done, not execute or not complete yet. Bit3: Busy 1: valid, the axis being occupied by other instruction. 0: invalid, executing or done.			parameters; MIN_SPEED/MAX_SPEED/TA no error, a nearest valid value set automatically.
ACT_SPEED	OUT	Actual Speed (Frequency) output	Dword	500~200000	There can be Deviation from actual value (no more than 5K), related with accel time and set speed.

【软件回零指令】

① Name: MC_SET_POS_ZERO



② Function: reset the absolute coordinate。

Note: when the machine reach a position and call this instruction, thus can set the origin of the axis to this position. For later calling Read Absolute Coordinate instruction, we can obtain the relative coordinates for this point.

③ Parameters

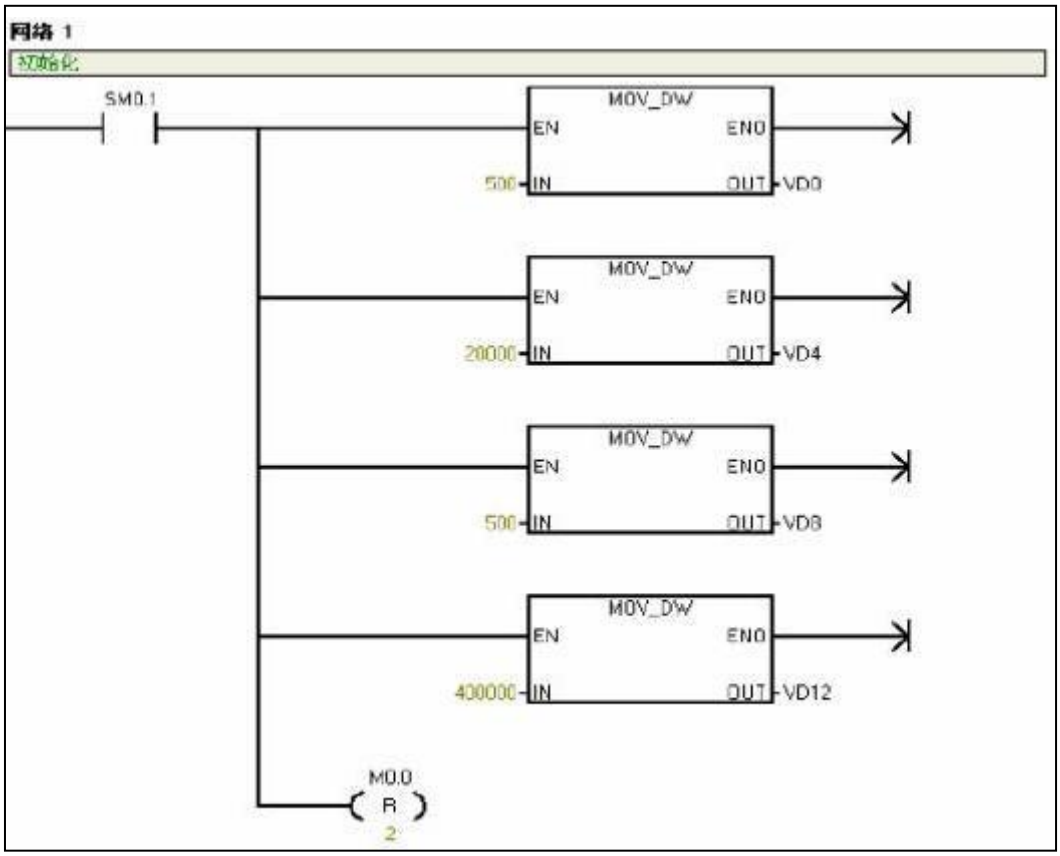
Name	I/O	Description	Type	Value range	Note
SET	IN	Reset Enable Reset the absolute coordinate upon rising edge of SET. Reset and then Set to 1 each time calling this instruction.	Bool	0~1	
AXIS_NO	IN	Axis Number, 0/1/2/3	Byte	0～3	

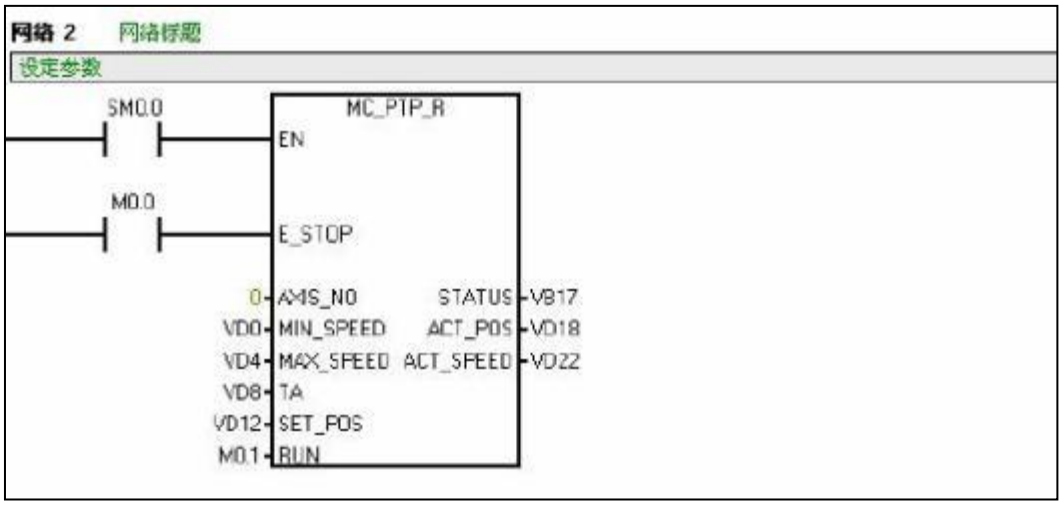
E.3 Application Example

1) **Single axis Relative Motion**

```
程序注释
功能：用作单轴点对点控制（单轴定长驱动）。
调用一次可输出固定脉冲，通过最大、最小速度和加减速时间的设定，输出的脉冲在启动时会逐渐的加速到最大的速度，当脉冲数快要跑完时，脉冲的频率会自动减下来，以防止在启动或停止时的机器的惯性太大而引起振动或卡死。

M0.0 ------------ 紧急停止位；
轴号为0-------Q0.0脉冲输出、Q0.1方向输出；
VD0 -------------启动/停止速度
VD4 -------------加速完成后的正常速度；
VD8 -------------加速时间（ms）；
VD12------------要输出的脉冲数；
VB17------------输出状态字节；
VD18------------输出脉冲个数；
VD22------------当前输出脉冲速度（频率）。
```

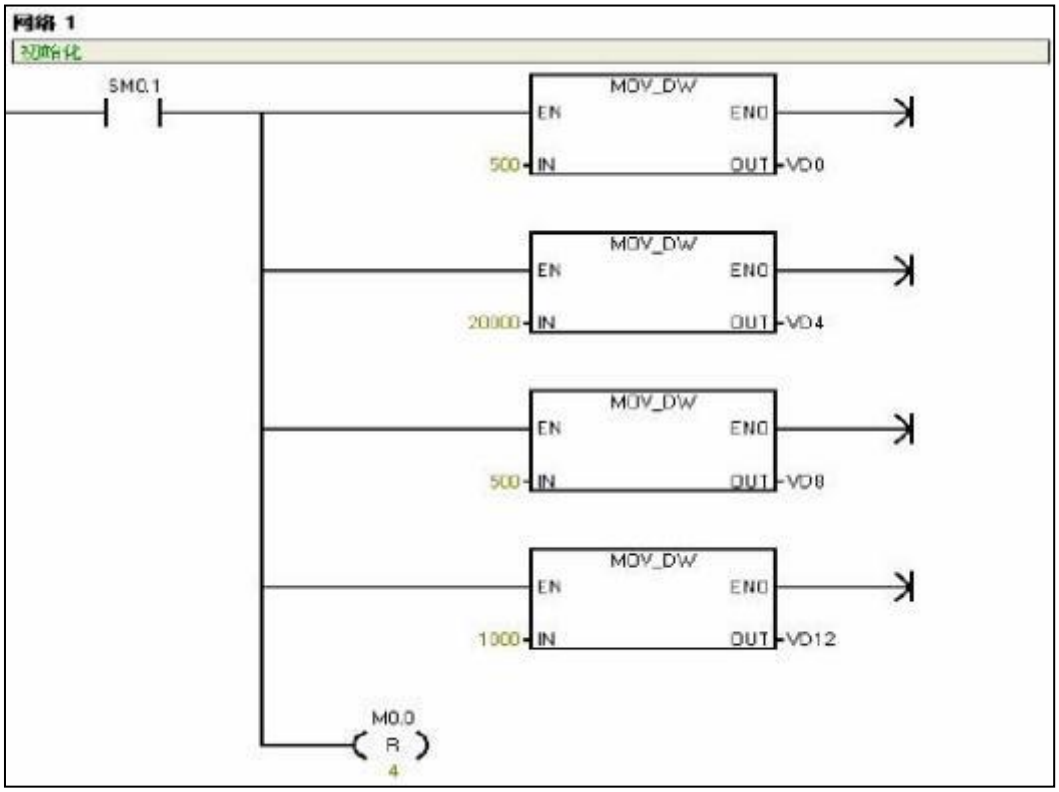


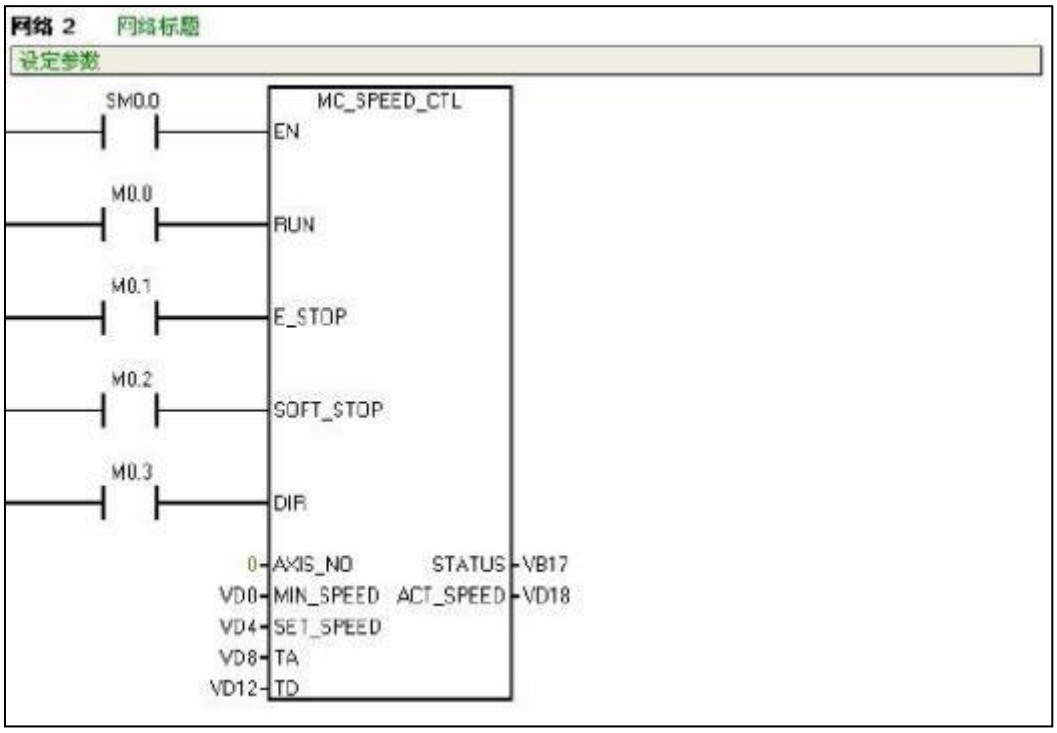


2)**Single axis Speed Motion**

```
程序注释
功能：控制单轴输出脉冲的频率，可任意时候改变输出脉冲的频率（速度）。
当接收到软停止命令时，会自动减速停止。当收到紧急停止命令时，会马上停止脉冲输出，不经过减速。

M0.0 ----------运行使能位；
M0.1 ----------紧急停止位；
M0.2 ----------软停止位；
M0.3 ----------脉冲方向位（0为反方向，1为正方向）；
轴号为0------Q0.0脉冲输出、Q0.1方向输出；
VD0 ----------启动/停止速度
VD4 ----------加速完成后的正常速度；
VD8 ----------加速时间（ms）；
VD12----------减速时间（ms）；
VB17----------输出状态字节；
VD18----------当前输出脉冲速度（频率）。
```




网络 2 网络标题
设定参数
SM0.0
M0.0
M0.1
M0.2
M0.3
MC_SPEED_CTL
EN
RUN
E_STOP
SOFT_STOP
DIR
0 AXIS_NO
VD0 MIN_SPEED
VD4 SET_SPEED
VD8 TA
VD12 TD
STATUS VB17
ACT_SPEED VD18

F Weighing library for SM231 7WA module

The SM231 7WA module can transform the voltage signal from load cell to digital AIW, then convert the AIW to actual weight by using SM231 weighing library.

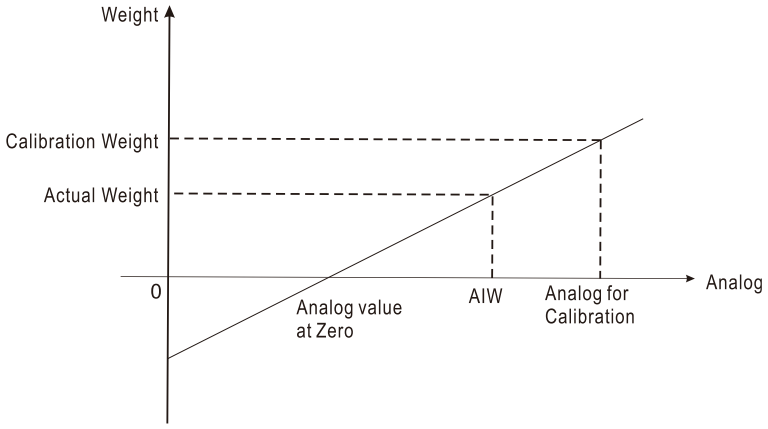


Figure F-1 Weighing principle

As shown in above figure, linear relationship between weight and analog value can be achieved based on a/b points, thus as the actual weight for the AIW. For accurate coordinates, Zero and Calibration must be performed.

Zero and Calibration

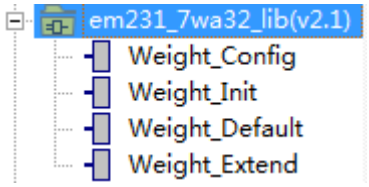
First assume the load cell is fixed horizontally, the stock has been fixed on the load cell.

For Zero, put no weight on the stock and obtain analog value on 0 after settling down.

For calibration, put calibration weights on the stock and obtain calibrated analog value after settling down.

F.1 Library Function description

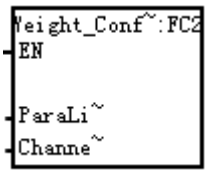
EM231_7WA32_LIB(V2.1) is used for SM231-7WA Weighing module, for related library file and user guide, please visit http://www.co-trust.com. The library contains following parameters:



Weight configuration

① Name: Weight_Config

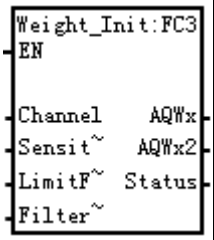
② Function: set the channel numbers and start address for each channel

Function	Name	I/O	Type	Value range	Description
	EN	IN	BYTE	--	Chanel Number
	ParaListBase	IN	Dword	--	Start Address Pointer for the parameter list
	ChannelNum	IN	BYTE	--	Total channel number for connected SM231

Weight initialization

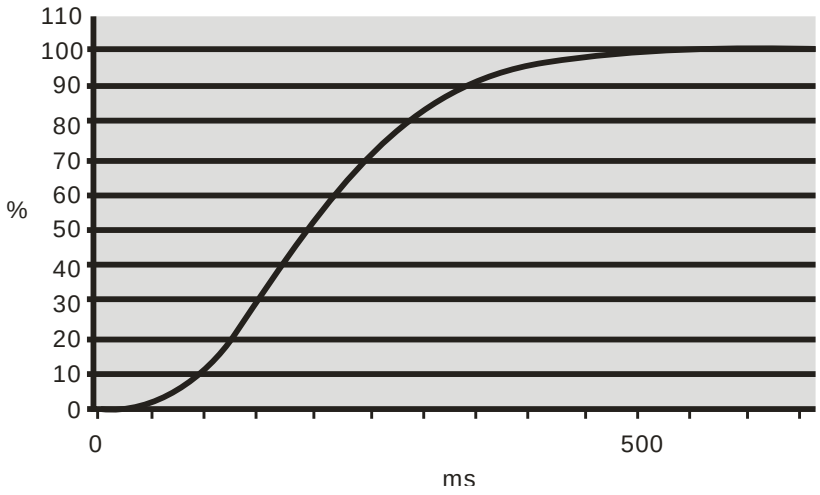
① Name: Weight_Init

② Function: configure the Sensor sensitivity, Cut-off frequency for low-pass filter, average filtering depth.

Function	Name	I/O	Type	Value range	Description
	Channel	IN	BYTE	0~6	Channel number
	Sensitivity	IN/ OUT	BYTE	1: 1mV/V 2: 2mV/V 4: 4mV/V No other definition	Sensor sensitivity (default as 2)
	LimitFreq	IN/ OUT	BYTE	3: fg = 5Hz 4: fg = 2Hz 5: fg = 1Hz 6: fg = 0.5Hz 7: fg = 0.2Hz 8: fg = 0.1Hz 9: fg = 0.05Hz No other definition	Cut-off frequency for low-pass filter (default as 4)
	FilterDepth	IN/ OUT	BYTE	0~255, 0 or 1 indicates no average filtering	average filtering depth (default as 15)
	AQWx	OUT	WORD	Format: "0x53" + "Sensitivity"	Corresponding for the 1st Analog output
	AQWx2	OUT	WORD	Format: "LimitFreq" + "FilterDepth"	Corresponding for the 2nd Analog output
	Status	OUT	BYTE	Bit0: eigenvalue error Bit1: low-pass filter frequency error Bit2: invalid channel number Bit3: factory settings loading done	Status byte

Note: This instruction must be called by SM0.0.

The following figure shows the step response for digital low-pass filter at fg=2Hz:

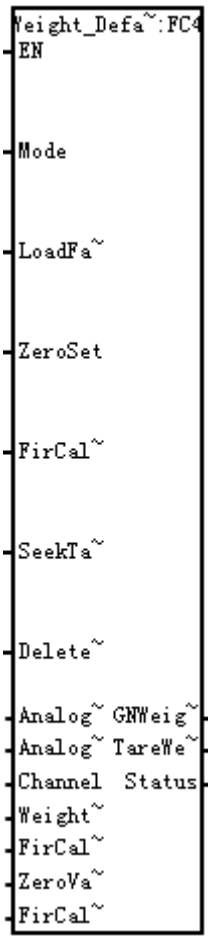


Set Weighing Standard

①Name: Weight_Default

②Function: calibration and measure (tared)

③Parameters

Function	Name	I/O	Type	Value range	Description
	Mode	IN	BOOL	--	Mode selection 0: basic mode, 1: extend mode
	LoadFacSetting	IN	BOOL	--	Load factory settings, valid for rising edge
	ZeroSet	IN	BOOL	--	Set Zero, valid for rising edge
	FirCalibrate	IN	BOOL	--	1st calibration, valid for rising edge
	SeekTare	IN	BOOL	--	Tare weight, valid for rising edge
	DeleteTare	IN	BOOL	--	Delete tare, valid for rising edge
	AnalogValueInit	IN	WORD		Analog before filter, corresponding for the 1st analog input
	AnalogValue	IN	WORD		Analog after filter, corresponding for the 2nd analog input
	Channel	IN	BYTE	0-6	channel number
	WeightRange	IN/OUT	INT		Max scale range (default as 2000)
	FirCalWeight	IN/OUT	INT	> 5% of scale	Calibration weights for 1st calibration (default as

					2000)
	ZeroValue	IN/OUT	WORD		Sampling value at Zero (default as 5461)
	FirCalValue	IN/OUT	WORD		Sampling value a 1st calibration (default as 60074)
	GNWeight	OUT	INT		Gross weight/net weight
	TareWeight	OUT	INT		Tare weight
	Status	OUT	WORD		Status

Load factory settings

Parameters	Factory	Note
Sensitivity	2	Sensitivity (eigenvalue) 2mv/v
LimitFreq	4	Low-pass filter frequency 2Hz
FilterDepth	15	
WeightRange	2000	
FirCalWeight	2000	
ZeroValue	5461	
FirCalValue	60074	
TWProcessValue	0	
SecCalWeight	0	
MinWeight	20	20d, d for digital step
Step	1	
StandstillTime	1000	Unit: ms
StandstillRange	10	
TareInput	0	
SecCalValue	0	

Status :

Bit	Status	Mode	Description
Bit0	Power down alarm	Basic/Extend mode	0: power normal, 1: no power. When Bit0 = 1, sampling value 0xFFFF.
Bit1	Break-line alarm	Basic/Extend mode	0: sensor connection normal, 1: load cell break line When Bit0 = 1, sampling value 0xFFFE
Bit2	Over-scale alarm	Basic mode	1: Gross weight ≥ rated weight, sampling value 0xFFFD.
	Max+9e	Extend mode	1: Gross weight ≥ rated weight+9e, e for digital step.
Bit3	Fixed tare	Basic/Extend mode	1: tare memory been occupied (tare process value≠0)
Bit4	Pre-set tare	Extend mode	1: Preset tare
Bit5	1/4d	Extend mode	1: Gross weight < ±0.25d, d for digital step.
Bit6	still	Extend mode	1: standstill determined

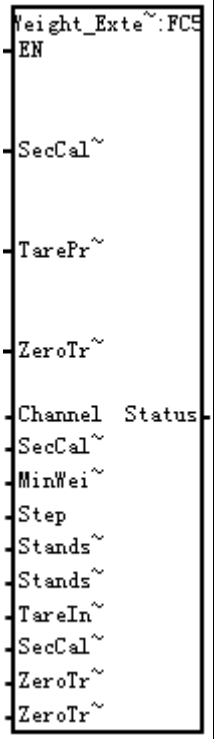
Bit7	Found Zero	Basic/Extend mode	1: Found Zero
Bit8	Calibrated	Basic mode	1: 1st calibration done
		Extend mode	1: 1st calibration done (weight for 2nd calibration is 0) or 1st and 2nd calibration done
Bit9	Low weight	Extend mode	1: current weight < min scale range
Bit10	Execute only for still status	Extend mode	1: Zero and Tare must be standstill at this mode
Bit11	Allowed only for Zero status	Basic/Extend mode	1: Zero must be performed before 1st and 2nd calibration
Bit12	Allowed only for Calibrated status	Basic/Extend mode	1: calibration must had been performed when tared and preset tare
Bit13	Calibration weight is too small	Basic/Extend mode	1: deviation between FirCalweight & Zero and SecCalweight & FirCalweight cannot < 5% FS
Bit14	Illegal tare value	Basic/Extend mode	1: tare value must ≥ 0 or > max scale range
Bit15	Illegal channel number	Basic/Extend mode	--

Weight extend

① Weight_Extend

② Function: used for 2nd calibration, set min weight, digital step, standstill detect , preset tare and zero-tracking.

③ Parameters

Function	Name	I/O	Type	Value range	Description
	SecCalibrate	IN	BOOL	--	2nd calibration, valid for rising edge
	TarePreset	IN	BOOL	--	Preset tare
	Channel	IN	BYTE	0-6	Channel number
	SecCalWeight	IN/OUT	INT	0	Weight for 2nd calibration (default as 0, indicating no 2nd calibration)
	MinWeight	IN/OUT	INT		Min weight (default as 20), only used for calibration record with specified digital step > min weight. Depend on the type and version of used sensor.
	Step	IN/OUT	BYTE	1/2/5/10/20, no other definition	Digital step (default: 1)
	StandstillTime	IN/OUT	INT		Standstill time (default: 1000), Unit: ms
	StandstillRange	IN/OUT	INT		standstill range (default as 10)
	TareInput	IN/OUT	INT		Tare input, ie. preset tare

					(default as 0)
	SecCalValue	IN/OUT	WORD		Analog value for 2nd calibration (default as 0)
	ZeroTraceEn	IN	BOOL		Enable zero-tracking
	ZeroTraceRange	IN/OUT	INT	1~3	zero-tracking range (default: 1)
	ZeroTraceTime	IN/OUT	INT	1000	zero-tracking time (default: 1000), unit: ms
	Status	OUT	BYTE	--	Status byte

Status definition:

Bit	Function	Note
Bit0	Too small Weight for 2nd calibration	The Deviation between weight mass for 2nd and 1st calibration is less than 5% of scale.
Bit1	Digital step not correct	Digital step can only be 1, 2, 5, 10, 20
Bit2	Standstill time not correct	Standstill time must > 0
Bit3	Standstill range not correct	Standstill range must > 0
Bit4	Preset tare out of range	Preset tare cannot be negative or over the rated scale range
Bit5	Reserved	--
Bit6	Standstill	Standstill determined
Bit7	Illegal channel number	--

F.2 Description

Modes illustration

SM231-7WA provides two modes for using the weighing library, you can select the Basic mode or Extend mode by configuring the “Mode” in Weight_Default.

1) Basic mode (Mode=0)

(1) only need to call "Weight_Init" and "Weight_Default" instructions;

(2) support the following features:

• set the sensor sensitivity, low-pass cut-off frequency, filter depth;

• load the factory parameters;

• set the max scale range;

• set Zero;

• 1st calibration;

• obtain Tare;

• delete Tare;

• read the sampling values before and after filtering;

• indicate power down/break line/over scale alarms, Zero, Calibrated, preset tare;

2) Extend mode (Mode=1)

(1) calling "Weight_Init", "Weight_Default" and "Weight_Extend" instructions;

(2) support the following features:

• all features in Basic mode;

• set the min scale range;

• 2nd calibration;

• preset tare;

• set digital step (set the min range scale, represented in 1×10^k, 2×10^k or 5×10^k);

• Standstill determined (standstill is required when setting Zero and obtaining Tare);

• New status: Max+9e(GB/T 7724-2008), preset tare, 1/4d(GB/T 23111-2008), Standstill, low weight;

• zero tracking;

Parameter List

When calling this library, each channel needs 72 bytes memory, in which the detail parameter definition is shown in the following table (for example, Channel 0 starting from VB0):

Name	Address	Description	Note
Mode	VB0	Mode	Basic/Extend
Sensitivity	VB1	Sensor sensitivity	
LimitFreq	VB2	Low-pass filter frequency	
FilterDepth	VB3	Filter depth	0-255, 0 or 1 indicating not filter for the average value
WeightRange	VW4	Max scale range	
FirCalWeight	VW6	1st calibration weight	
SecCalWeight	VW8	2nd calibration weight	
TareInput	VW10	Tare input	
MinWeight	VW12	Min scale range	Generally 20d, d is digital step
Step	VB14	Digital step	range: 1, 2, 5, 10, 20
StandstillTime	VW15	Standstill time	Unit: ms
StandstillRange	VW17	Standstill Range	
ZeroValue	VW19	Sampling value at zero	
FirCalValue	VW21	Sampling value for 1st calibration	
SecCalValue	VW23	Sampling value for 2nd calibration	
GWProcessValue	VW25	Gross weight process value	Before round-off
NWProcessValue	VW27	Net weight process value	Before round-off
TWProcessValue	VW29	Tare process value	Before round-off
AnalogValueInit	VW31	Sampling value before filtering	
AnalogValue	VW33	Sampling value after filtering	
GrossWeight	VW35	Gross weight	
NetWeight	VW37	Net weight	
TareWeight	VW39	Tare weight	

Status_I	VB41	Status byte for Weight_Init	
Status_D	VW42	Status byte for Weight_Default	
Status_E	VB44	Status byte for Weight_Extend	
InternalVariable1	VB45	Internal variable 1	
AQWx	VW46	L Memory backup	
AQWx2	VW48	L Memory backup	
LB21_D	VB50	Weight_Default L Memory backup	
LB57_D	VB51	Weight_Default L Memory backup	
LB58_D	VB52	Weight_Default L Memory backup	
LB59_D	VB53	Weight_Default L Memory backup	
LB59_E	VB54	Weight_Extend L Memory backup	
LW36_E	VW55	Weight_Extend L Memory backup	
LD40_E	VD57	Weight_Extend L Memory backup	
Reserved	VB61		
ZeroTraceTime	VD62	Zero tracking timing	
StandBeginTime	VD66	Start time for standstill status	
ZeroTraceValue	VW70	Adjust value for zero tracking	

For more details about instructions, please visit http://www.co-trust.com to download the related CTH200 Weighing Module SM231-7WA32 User Manual.

G SM277A Module

Features:

- Photoelectric isolation, high immunity from interference and robust reliability
- Integrated terminal resistance, using line connection instead of special network connection
- Reverse connect protection and Surge absorption are provided for Power supply, suitable for harsh industry environment.

Application notice:

- STP with both ends earth must be used for signal line.
- The module earth must be connected to the ground while in good ground, otherwise it's not ground.
- The terminal resistance must be ON for the last station.

PROFIBUS-DP Network

【Communication】

PROFIBUS-DP Network connects with SM277A DP slave module via it's DP port, while SM277A DP connects with CTH200 CPU via serial I/O bus. SM277A connects with PROFIBUS network by using block terminal instead of standard connector.

【Function】

SM277A is a slave device used for modular of PROFIBUS DP network, up to 6 I/O expansion modules can be connected.

SM277A supports 9.6Kbps ~ 12Mbps baud rate as a PROFIBUS slave. It can receive and send various I/O configurations and I/O data with master, also read/write the defined Variable data block in CTH200 CPU, thus users can exchange any type of data with master.

MPI Network

【Communication】

SM277A can communicate with other masters like PG/PC station, Copanel HMI or S7-300 / S7-400 CPU on the same network as a MPI slave. It uses XGET/XPUT instructions from S7-300/400 to provide communication for MPI master and CTH200 CPU. When the SM277A is used for MPI, the master must use the station address of SM277A module to send information for CTH200 CPU.

【Function】

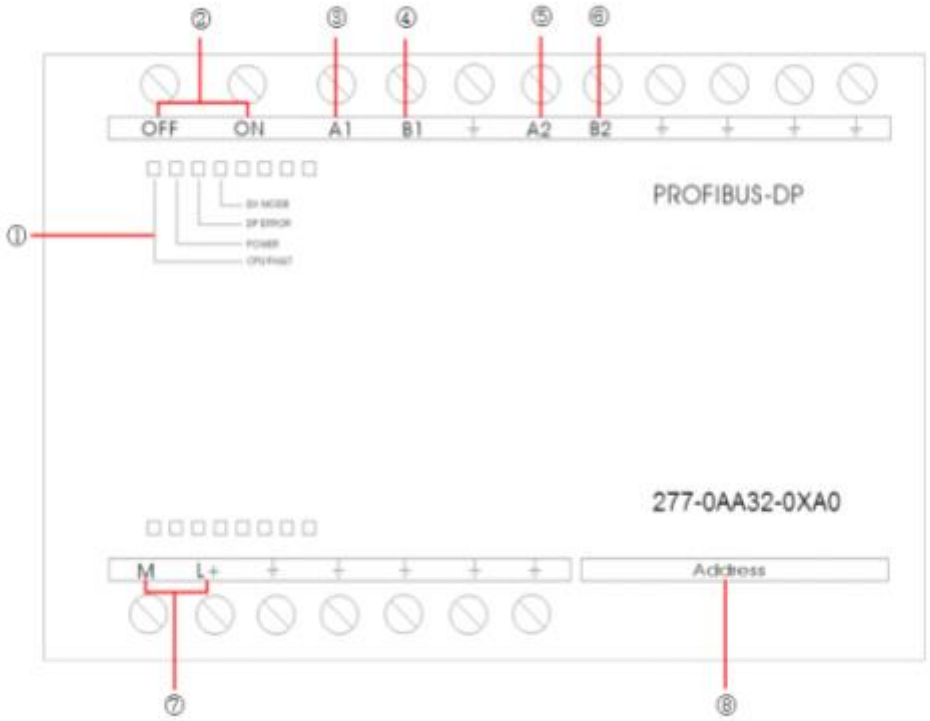
SM277A is a slave device used for MPI network to connect up to 6 Digital or Analog I/O modules.

SM277A support baud rate of 9.6K ~12M, it can receive and send various I/O configuration and different amount of data with master, then read/write the defined data block in CTH200 CPU.

Thus users can exchange any type of data with master.

SM277A Structure

LED indicators are located on the front of module and the address switch, Terminal resistance switch, Interface terminal and Power supply are shown as below:



① LED indicators

② Terminal switch: ON - with Terminal resistance, OFF - without Terminal resistance

③ Isolated signal A1

④ Isolated signal B1

⑤ Isolated signal A2

⑥ Isolated signal B2

⑦ Power supply

⑧ Address switch: 8-bit DIP switch, in binary, valid range 0~126.

Notice

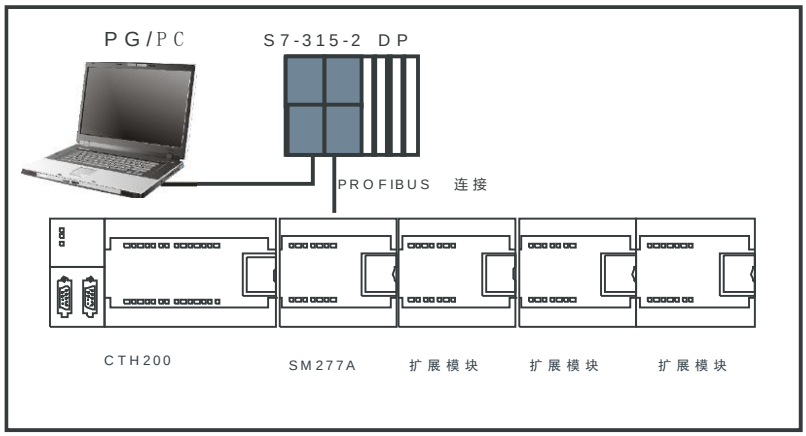
A1/B1 and A2/B2 are RS485 electrical interfaces with identical electrical characteristic, users can select either combinations of connection or both.

PROFIBUS DP communication between S7-300 and SM277A module

PROFIBUS DP communication between S7-300 and SM277A module require configuration in STEP-7, no need for configuration and programming in CTH200 system, just correspond the communication data in V memory with the hardware I/O address configured in SM277A slave for the S7-300 system.

Program the FC1(DP_SEND) and FC2(DP_RECV) in OB1, then the DP master can read/write slave data to accomplish the communication between S7-300 and CTH200 CPU. The DP_SEND Instruction can output memory data from CTH200 CPU to expansion modules for SM277A; the DP_RECV instruction can input the data from expansion modules for SM277A into the memory of CTH200.

Figure G-1 shows the PROFIBUS network for CTH200 CPU and SM277A DP slave module.



- CPU 315-2 as DP master, with STEP 7 for configuration.
- CTH200 CPU is a slave for CPU 315-2 DP master
- CPU 315-2 DP master use the instructions DP_SEND & DP_RECV in the program to read /write data with CTH200.

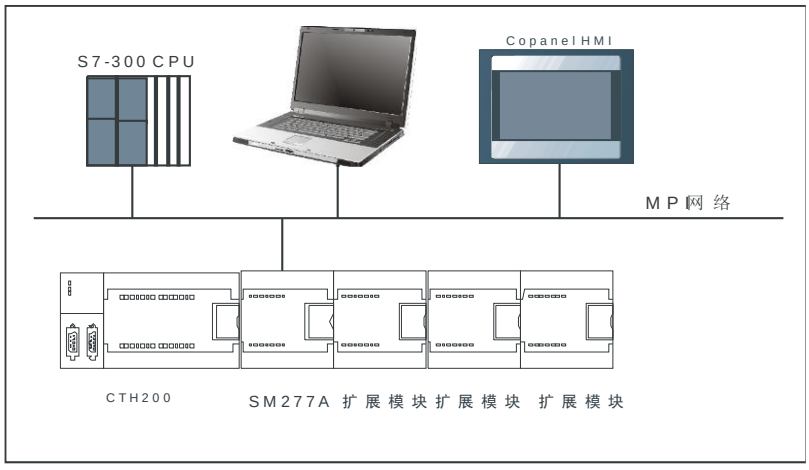
Figure G-1 PROFIBUS network example

Note: the DP port address is set by DIP switch on the SM277A, which must match the address of master.

MPI communication between S7-300 and CTH200

The MPI communication between CTH200 CPU and S7-300 CPU don't need any program in CTH200 PLC, just arrange the data to exchange into a continuous V memory. While S7-300 needs to call the system functions X_GET(SFC67) and X_PUT(SFC68) in OB1 (or the time interrupt OB35), to achieve the communication between S7-300 and CTH200 CPU. When calling the SFC67 and SFC68 to use VAR_ADDR filling into data address area of CTH200 CPU, the P#DB1.××× BYTE n is corresponding with the data area VB×× to VB(××＋n) in the CTH200 CPU V memory.

Figure G-2 shows the MPI network consisting of CTH200 and SM277A DP slave module.



- S7-300 CPU, PG\PC and Copanel HMI as MPI master
- CTH200 used as MPI slave.
- Using the instructions XGET / XPUT from S7-300/400 to read /write data with CTH200.

Figure G-2 MPI network example

Note: NEST_ID must set to match the DIP address on the SM277A module.

H SM277B Module

SM277B is a modular slave device on the PROFIBUS DP network which used for communication with DP master. SM277B can connect up to 6 Digital or Analog I/O expansion modules. It use terminals instead of standard connector to connect with the PROFIBUS network, the baud rate would be adjust to match the master.

【Main features】

- Photoelectric isolation, high immunity from interference and robust reliability
- Reverse connect protection and Surge absorption are provided for Power supply, suitable for harsh industry environment.

【使用规范】

- STP with both ends earth must be used for signal line.
- The module earth must be connected to the ground while in good ground, otherwise it's not ground.
- The terminal resistance must be ON for the last station.

H.1 PROFIBUS-DP Network Architecture

Distributed I/O system contains active (master) and passive (slave) nodes, they connect with each other by PROFIBUS-DP.

The following figure shows a typical PROFIBUS-DP network configuration consist of SM277B:

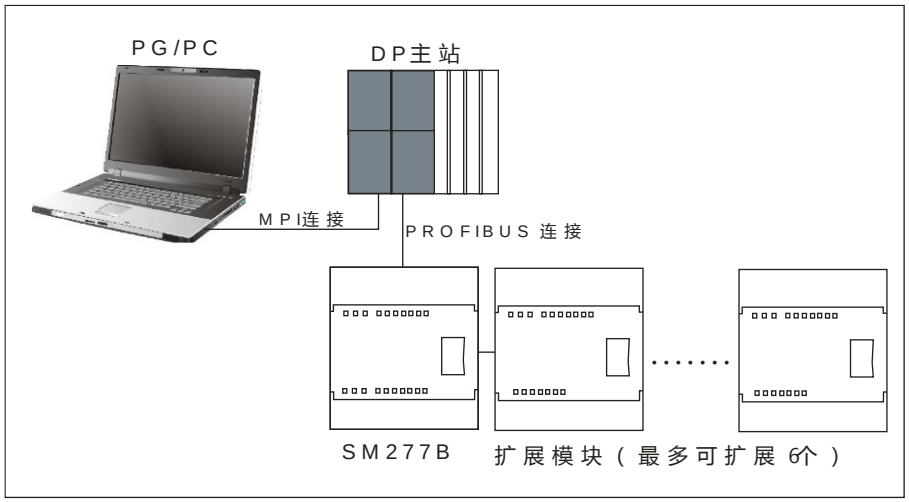


Figure H-1 PROFIBUS-DP network architecture

H.2 SM277B Structure

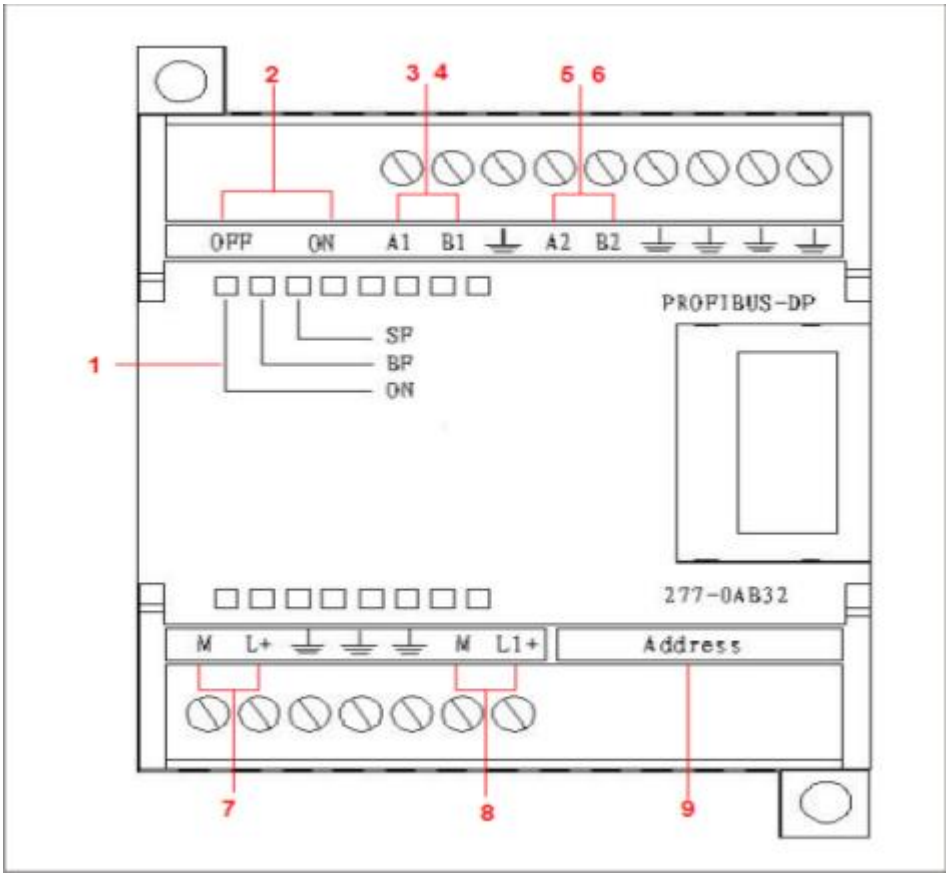


Figure H-2 SM277B structure

① LED indicators

② Terminal switch: ON - with Terminal resistance, OFF - without Terminal resistance

③ Isolated signal A (network input)

④ Isolated signal B (network output)

⑤ Isolated signal A (network parallel input)

⑥ Isolated signal B (network parallel output)

⑦ User Power supply

⑧ Sensor supply

⑨ Address switch: 8-bit DIP switch, in binary, valid range 1~125.

H.3 Application

This section introduces the application of SM277B with hardware configuration, user program and debug, system diagnose to communicate with CPU312-1AE13.

The network architecture is shown below:

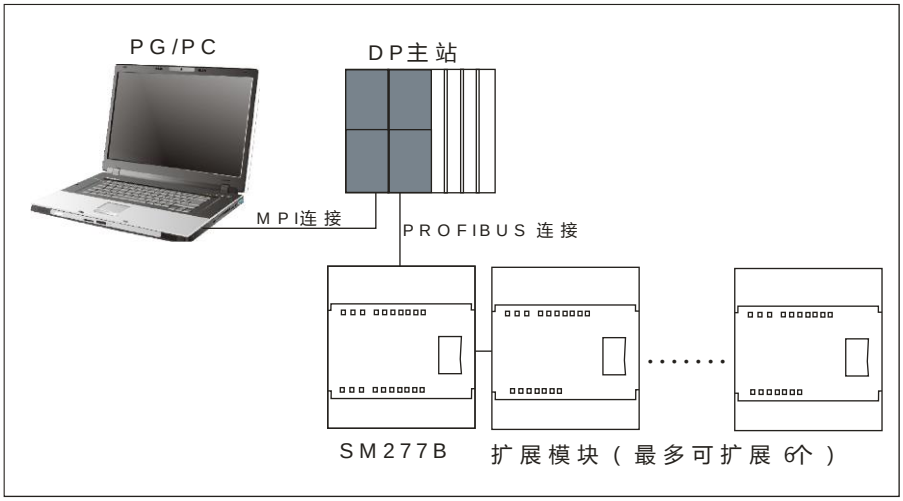


Figure H-3 SM277B network architecture

Components	Description
PG/PC with STEP7	STEP 7 version must support DP master configuration
MPI programming cable	Used for downloading hardware configuration and program, monitoring data
DP master system	One CPU312-1AE13, one CP 342-5 (as slave)
SM277B	As DP slave device
PROFIBUS communication cable	PROFIBUS cable must have a standard PROFIBUS connector to connect with DP master.
CTH200 expansion modules	To connect with SM277B

H.3.1 Hardware Configuration

Procedures:

1) Start SIMATIC Manager

Select “File”->“New”, input a project name and select a directory to save the project.

2) Create a SIMATIC 300 station.

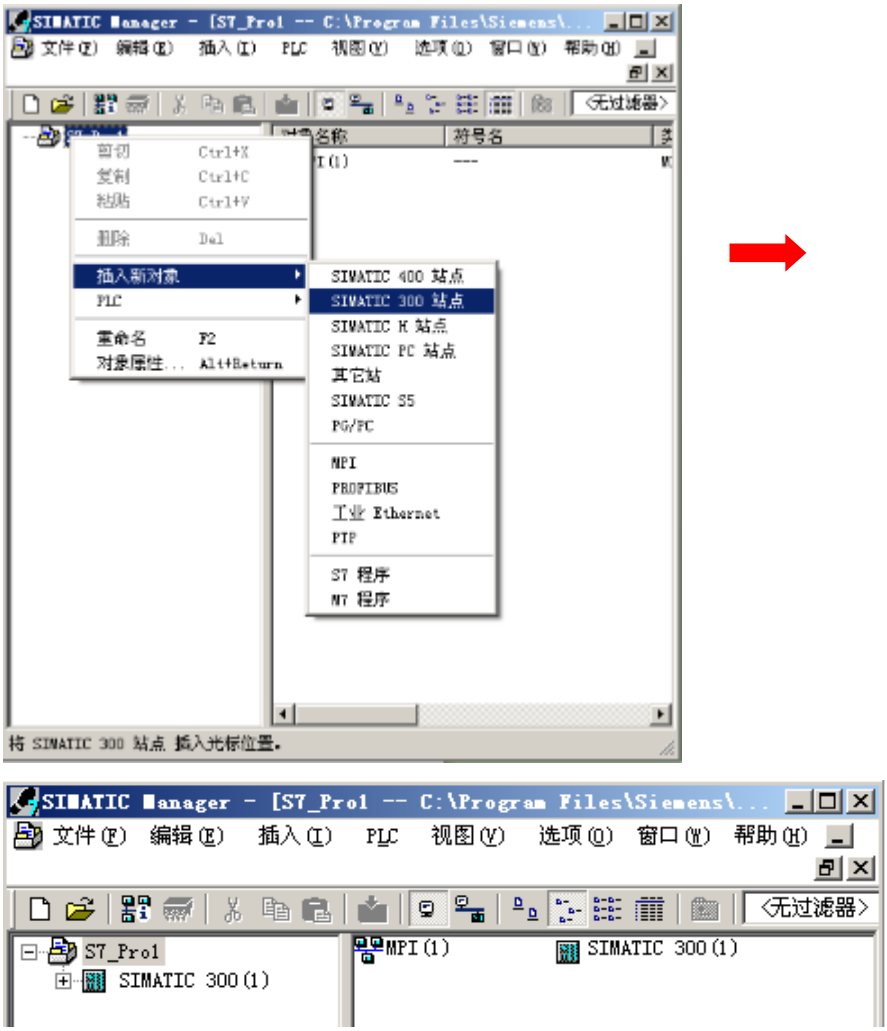


Figure H-4 Insert SIMATIC 300 station

3) Open HW-Config to operate the hardware configuration

Double-click the inserted “SIMATIC 300(1)” in step 2, as shown below:

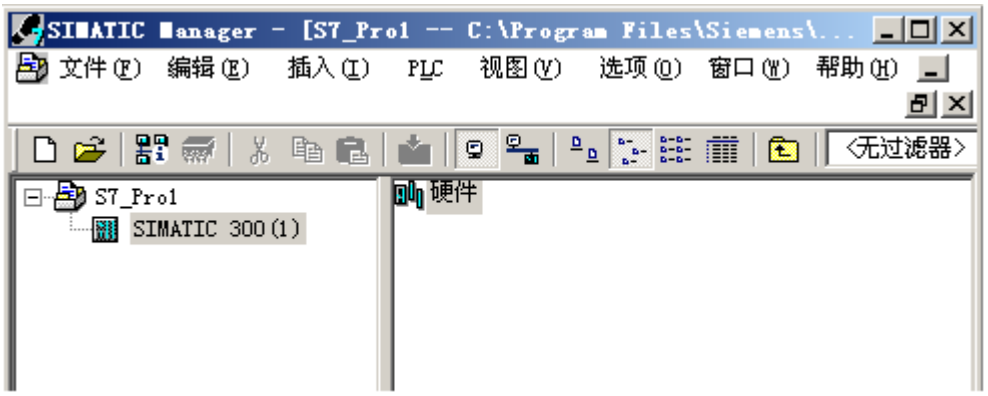


Figure H-5 open the HW-Config interface

Double-click the “Hardware” to open HW-config interface, set the distributed I/O(DP) stack, modules and PROFIBUS connection.

4) Add a Rail

All station mast have corresponding rail to mount DP master.

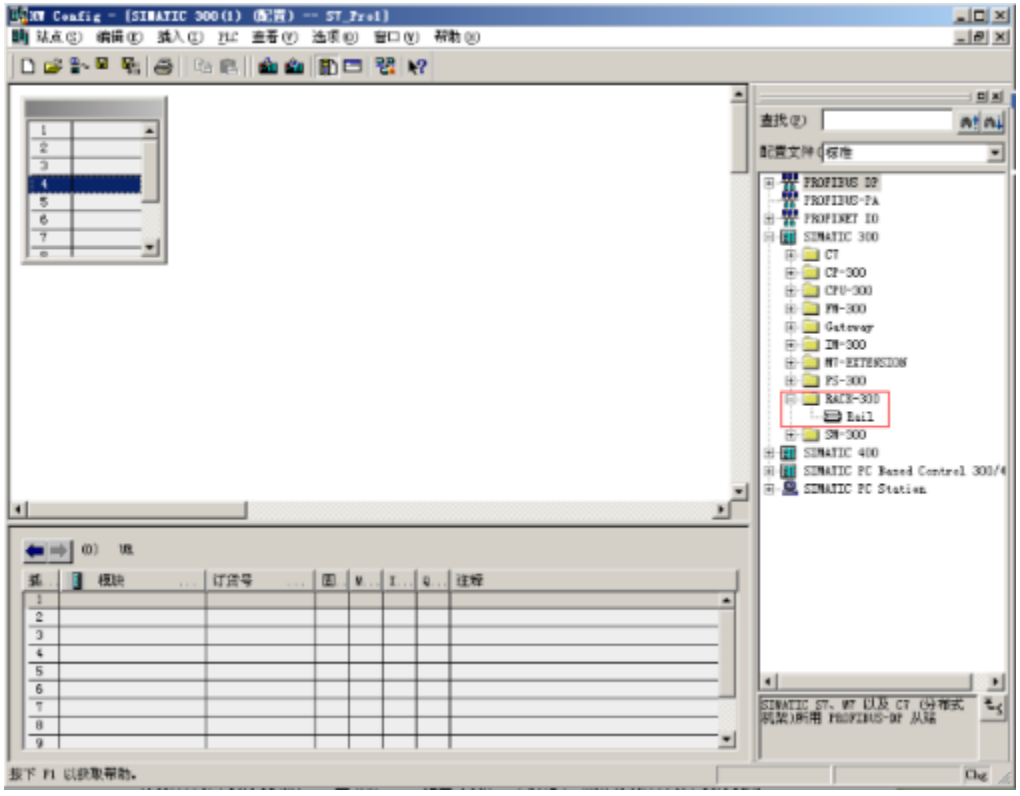


Figure H-6 Add Rail

5) Add Power Supply (optionally)

Add the power supply required by rail, which must be placed into the 1st slot.

6) Add CPU and PROFIBUS connection (CP 342-5) for DP master

Drag and drop the actual CPU used for DP master from Hardware Catalog to the 2nd slot, so as for the CP 342-5 to the 4th slot, as shown below:

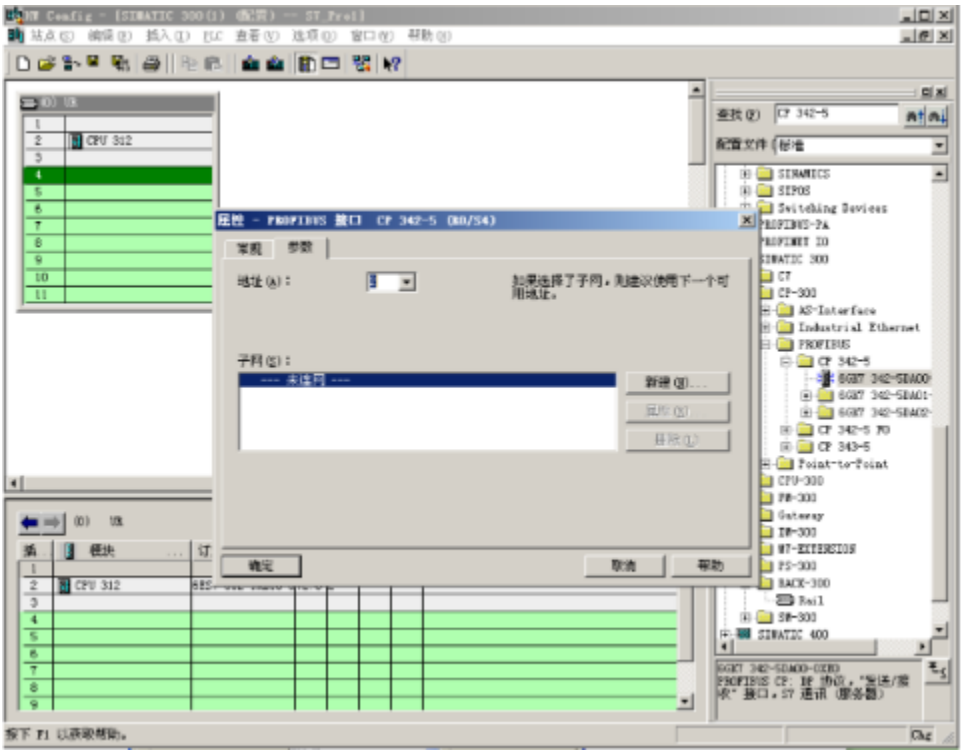


Figure H-7 Add CPU for DP master

In the above dialog, set the interface address for PROFIBUS CP 342-5 (Here 2), click New button to add a PROFIBUS connection for DP master and set the required network parameters in Properties dialog, including Transfer Rate (default as 1.5Mbps) and Profile (select DP), as shown below:

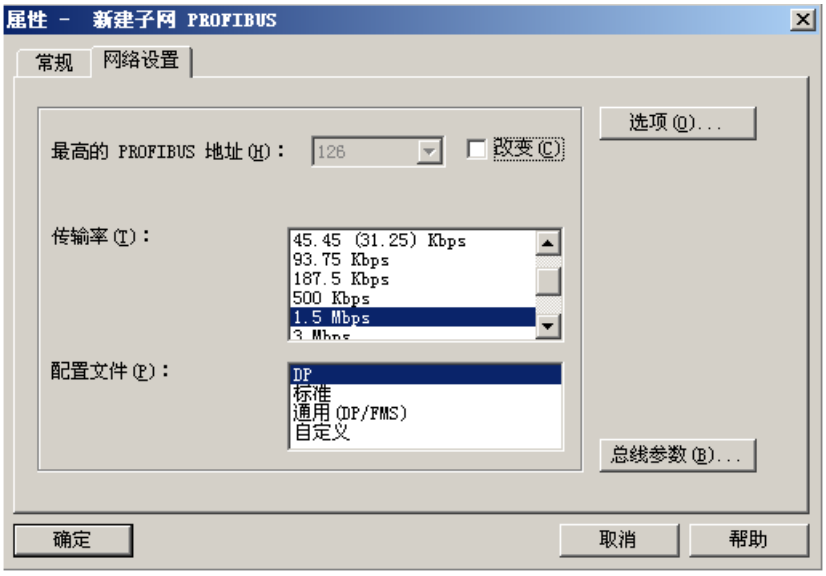


Figure H-8 Network settings for Master

Click OK to affirm the new added CPU and PROFIBUS connection. Then set the data I/O addresses for CP 342-5D, working mode, etc. Double click CP342-5 on the rail, set the corresponding I/O addresses:

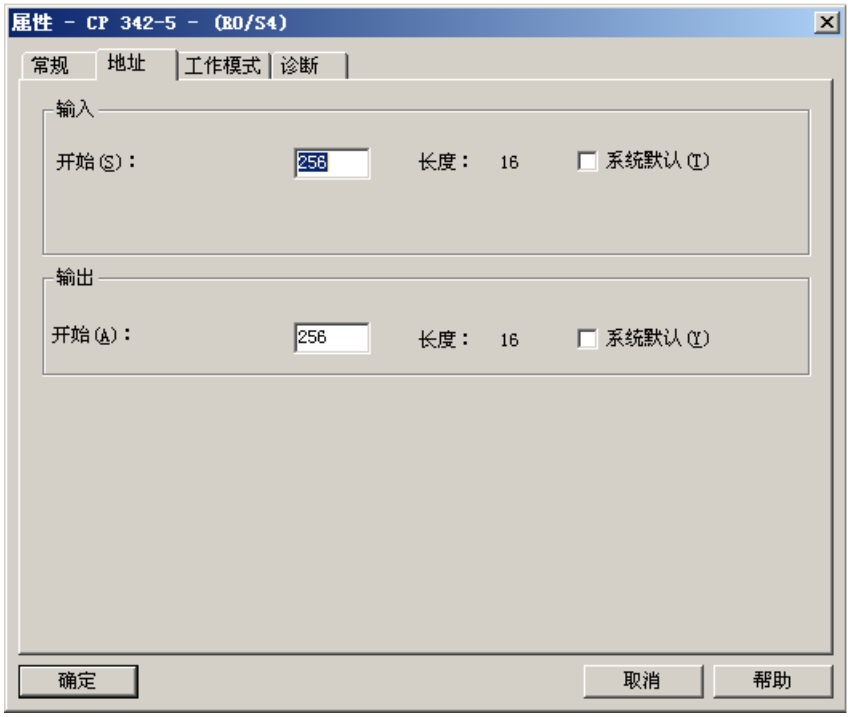


Figure H-9 Set I/O addresses for CP 342-5D

Set the Start addresses for Input and Output (default as 256 - 16#100, which is required for CPLADDR parameter in subroutine).

Set the working mode for CP 342-5 as DP Master, as shown below:

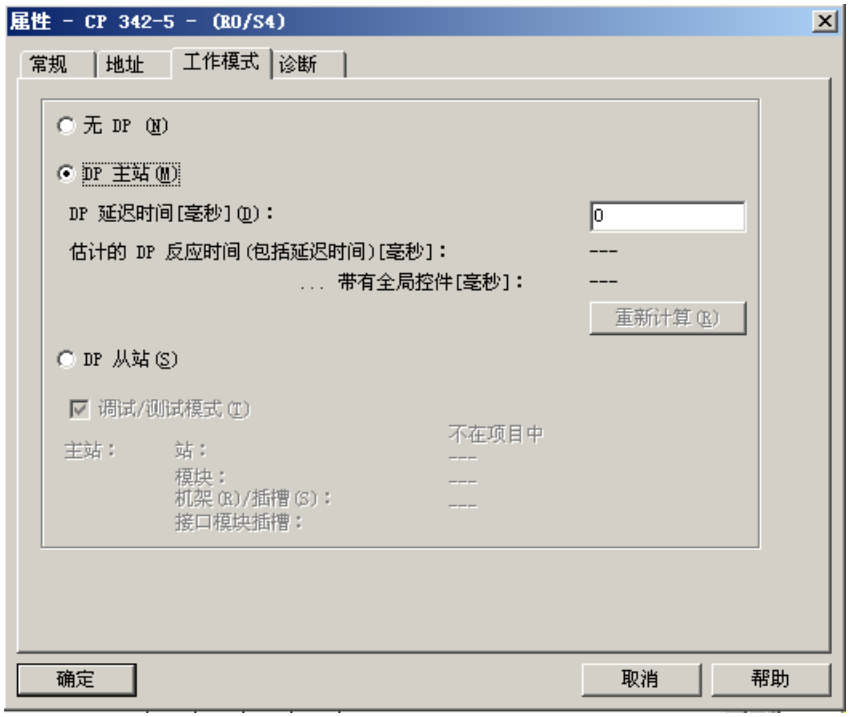


Figure H-10 CP 342-5D Working Mode

Once the above settings completed, the PROFIBUS DP master system would be added into the right side automatically,as shown below:

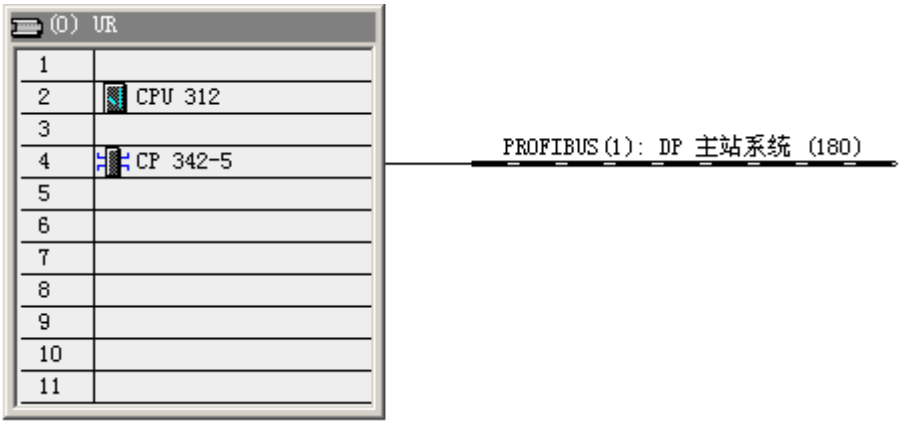


Figure H-11 CP 342-5D Properties setting

Hardware Configuration

1) Import the GSD file for SM277B

The GSD file must be installed into STEP 7 before you can use SM277B.

Installation Method:

In the HW-config interface, select menu command [Options]->[Install GSD file], the Install GSD File dialog pop-up, users can click Navigate button to open the directory for SM277B GSD file, then click OK to choose SM277B.gsd, Click Install button to start installation and click Close to finish.

Figure H-12 Import GSD file

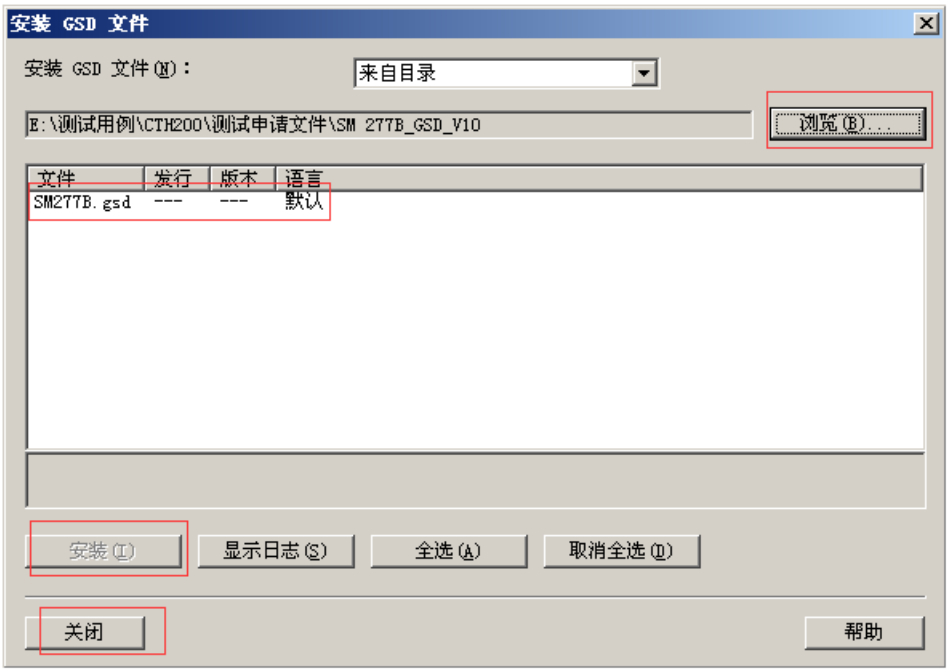


Figure H-13 Install GSD file

Notice

Note: for GSD file of SM277B (SM277B.GSD), please visit http://www.co-trust.com.

After installation, we can see the SM277B and it's expandable modules in the HW-Config hardware catalog, as shown below:

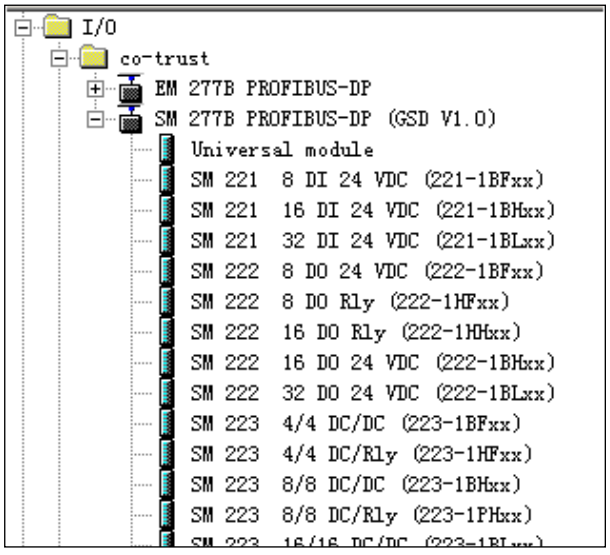


Figure H-14 Hardware Catalog

2) Add SM277B DP slave

Drag and drop the SM277 PROFIBUS-DP from hardware catalog into PROFIBUS(1): DP master segment. Then a Properties dialog pops-up, in which you can set the the SM277B slave and network connection.

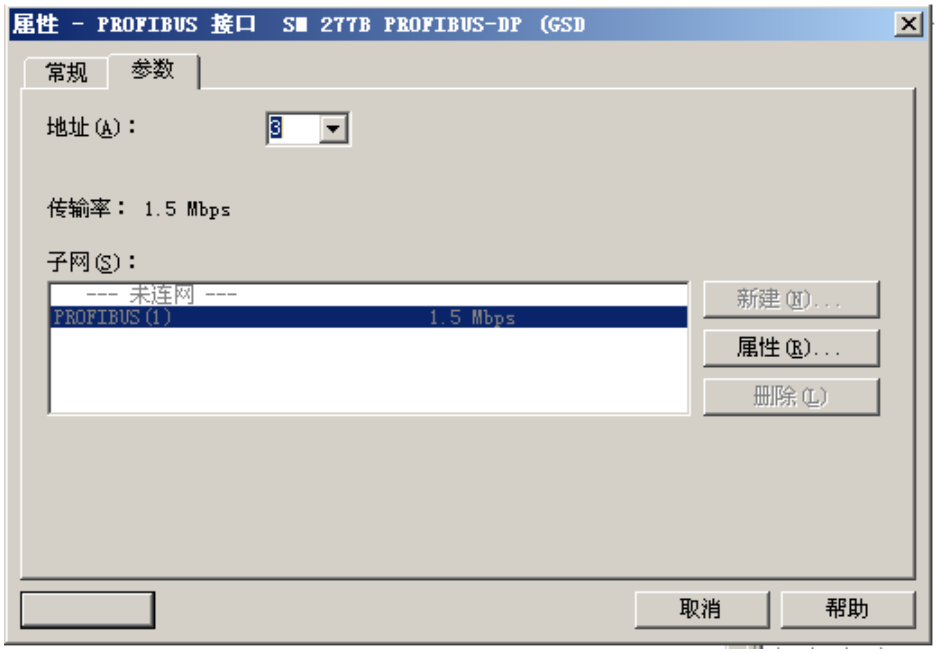


Figure H-15 Add SM277B DP slave

Set the Slave Address

Set the SM277B slave address under the Parameter item in the Properties dialog.

Notice

The valid address range for slave is 1 to 125, which is required to be unique on PROFIBUS DP network, this address must be set as the DIP address on SM277B module.

Network Settings for DP slave

Click the Properties button under Parameter item in the Properties dialog, the following dialog appears:

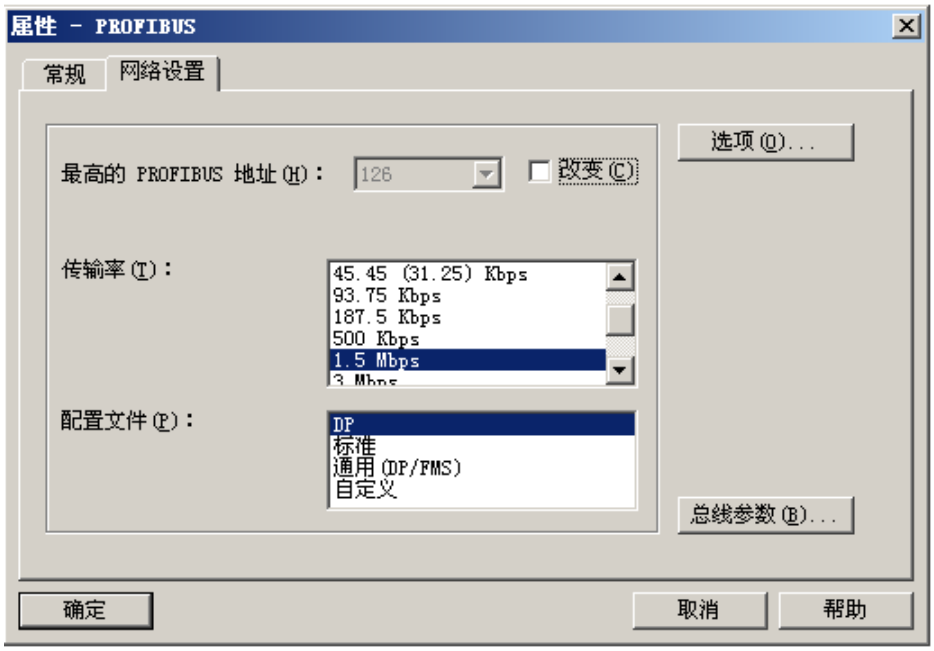


Figure H-16 Slave Properties

Click the Network Settings item, Set Transfer Rate (Default 1.5Mbps) and Profile (Set as DP), then the SM277B slave configuration completed:

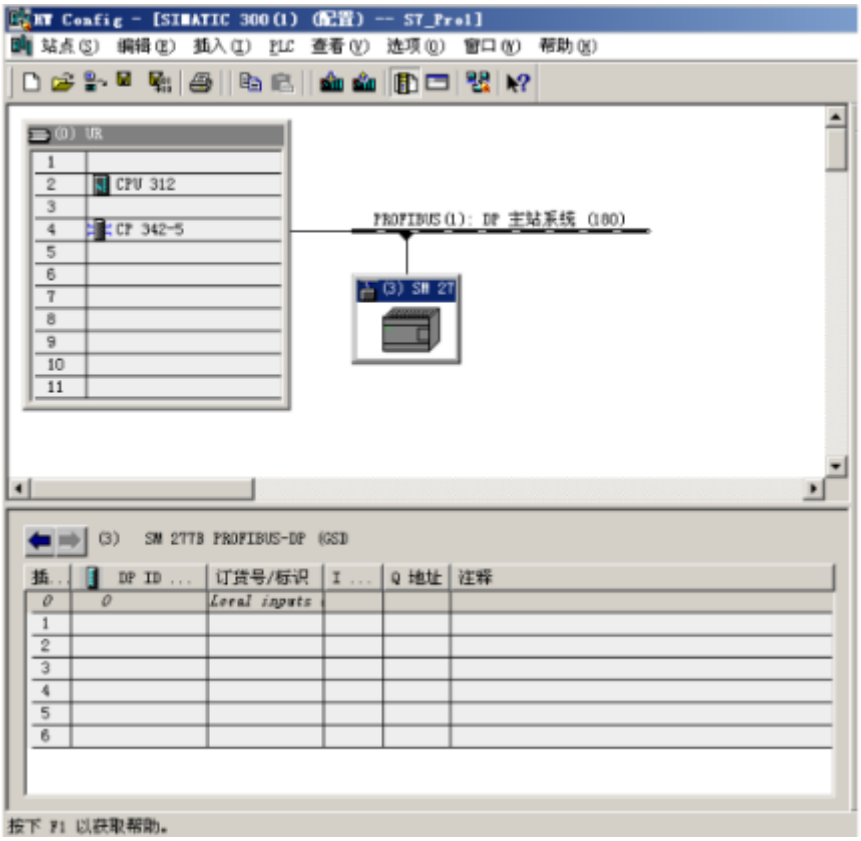


Figure H-17 Slave Properties configuration

Note: Make sure the Hex for Parameter Assignment in SM277B slave properties has default setting as shown below (00,00,00) (Double-click SM277B icon to check), otherwise the communication would be failed.

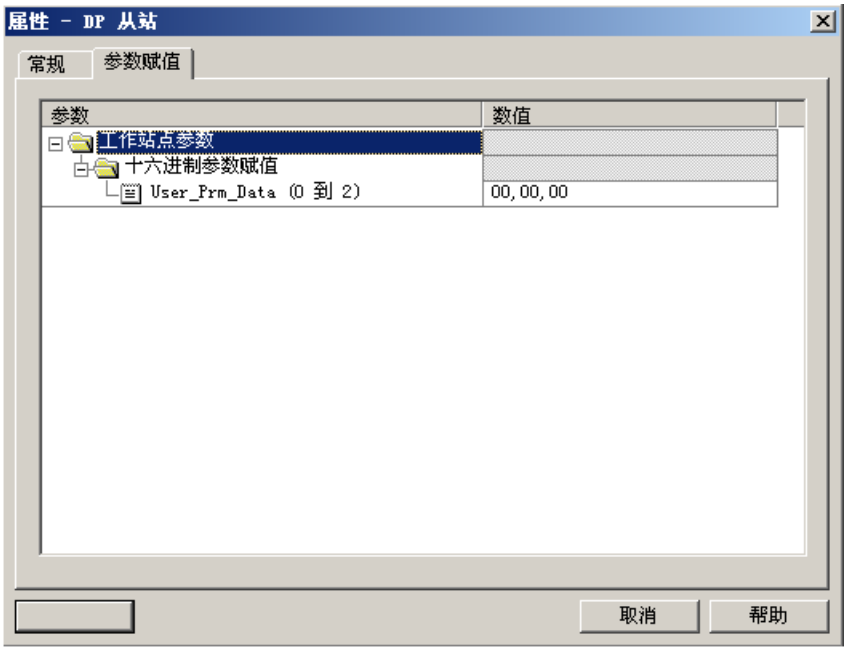


Figure H-18 Parameter Assignment for DP slave

※ Add expansion Module for SM277B Slave

Drag the expansion modules from Hardware Catalog SM277B PROFIBUS-DP into blank slots of SM277B, as shown below:

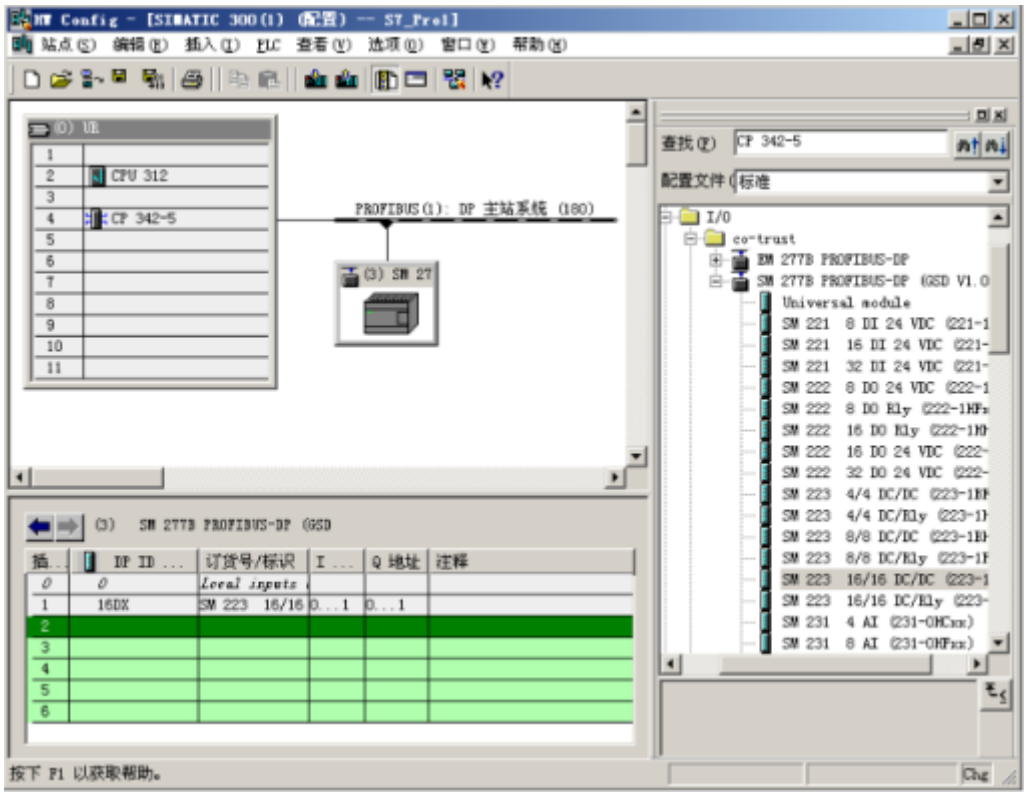


Figure H-19 Add expansion modules for SM277B

※ Download hardware configuration into DP Master CPU

In the HW-config interface, execute the menu command “Station”->“Save and Compile” to complete the hardware configuration.

Here we have done the whole configuration in STEP 7, and make sure the connection between DP master and PC/PG (MPI connection) had been established, then click PLC -> Download to download the hardware configuration into DP master CPU.

H.3.2 Program and Debug

SM277B can read the input of expansion modules and provide then for DP master, while the DP master provides output information for SM277B, then write these information into its expansion modules. For this purpose, users can create program in the LAD/STL/FBD editor and download it into main CPU.

【Program】

1) Call the FC1(DP_SEND) and FC2(DP_RECV) in OB1, to read/write 16 bytes of data from DP master, as shown below:

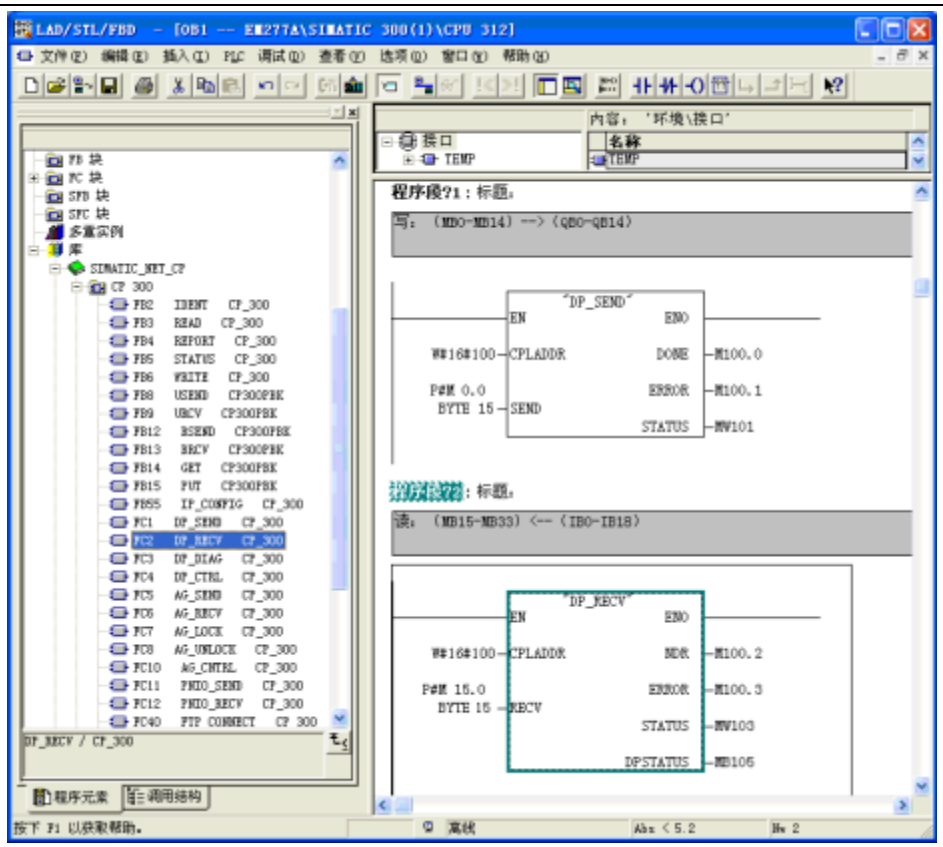


Figure H-20 Program interface

Description of program function:

FC1(DP_SEND): to output the memory data MB0-MB14 for CPU312 to QB0-QB14 for SM277B ;

FC2(DP_RECV): to input data form IB0-IB14 of SM277B into memory MB15-MB29 for CPU312.

CPLADDR: the address 256(16#100) for CP342-5.

Notice

For the CPU with DP port (like CPU313C-2DP), no need for FC1 and FC2, it can access the address assigned by SM277B module (like IB0-IB14, QB0-QB14).

2) Save the user program.

【Debug】

Procedures as following:

1) using communication cable to connect CP 342-5 and SM277B, set the terminal resistance and address for SM277B, plug in power for all devices.

2) STEP7 connect with master and download program into CPU.

3) Set the master to RUN.

4) Set and monitor the I/O data to be transfer and the result of program execution in the Variable Table of STEP7, watch the output status and LEDs for SM277B expansion modules.

There may appears some faults during debugging, for diagnostics, please refer to Section H.3.3.

H.3.3 Diagnose

Users can diagnose for PROFIBUS DP network through LED status of SM277B or fault message and specific program diagnose in STEP 7.

SM277B

LED for SM277B can be used for diagnose with master connection and SM277B firmware.
After the SM277B powered on, ON LED lights on (Green).
If the BF and SF LEDs keep off, SM277B operates normally.
If the BF and SF LEDs light on, it indicates the addresses for expansion modules are overrange, or wire connection and program configuration has error.
Descriptions for LEDs of SM277B is shown in the below table:

LED	Color	Function description
ON	Green	Light on when SM277B powered on, controlled by hardware of SM277B.
SF (system fault)	Red	SF lights on when expansion modules faulted or addresses overrange for SM277B.
BF (bus fault)	Red	Flash when no mater exchange with DP slave.

Possible causes when no fault in system operation:

- Hardware configuration in STEP 7 not match with network devices. You need to modify the hardware configuration and download it into CP master CPU.
- Error parameter configured in STEP 7.
- Address configured in STEP7 not identical with actual PROFIBUS address for SM277B, or the later was set invalid like 126 or 127. If the actual address is set correctly for SM277B, you need to modify the slave address in STEP 7, then download configuration into DP master CPU; if the actual address is set incorrectly for SM277B, it need to be modified and powered off and re-up.
- Terminal resistance is set incorrectly for PROFIBUS network. For the last node in network, it must set ON, or else need to be OFF.
- PROFIBUS wiring incorrectly or PROFIBUS cable damaged. Check the wiring and cable.

STEP7

【Read Diagnostic Information in HW-Config】

S7 diagnose applys for all SIMATIC S7/M7 series modules, users can read the diagnostic information from the buffer of Master or from SM277B.

【Identify Fault】

Procedures as below in the HW-Config:

- Select the menu Station >Open ONLINE, open the ONLINE window of the project.
- Check the symbols indicating device status and fault condition. Press F1 to open the Help page of this symbol for related comments.
- Select the menu PLC >Faulty Modules to display faulted module list. The View would not

update automatically after opening the ONLINE view if there exists any fault.

【Read the diagnose information from master and slave】

In HW-Config, open the relate module information for detailed diagnostics:

- For DP master: select Diagnostic Buffer tag, check the diagnose information for modules.
- For SM277B slave devices: select General tab to check the module status. Select DP Slave diagnostics tab and click Hex. button to shown the diagnose bytes for SM277B.

H.3.4 Power Budget for module diagnosing

Power Budget for SM277B is to supply enough power for connected expansion modules.

SM227B power	5VDC	24VDC
Power supply	SM277B provides a 5VDC logical power for all expansion modules in the system.	SM277B provides a 24VDC sensor power for inputs of expansion modules.
Max available DC power	extra current for all SM277B expansion modules cannot exceed 660mA	Not exceed 400mA.

警告

- It's not allowed to use the DC power of SM277B and any other external power supply for the same device simultaneously.
- Two power supplies for each device is not allowed.
- Connecting an external 24VDC power for SM277B would lead to conflict which results power lifetime reduced or both powers faulted. Unexpected operation can result in serious injured or death and device damage.

I V Memory library CT_savevmem

Function description

CT_SAVEVMEM is supplied as a function library for users. It's used for saving data of V memory segment into nonvolatile memory, to retain them for a long time (about 1 year).

Notice

Suitable for saving parameter, but not too frequently.

Don't set hold at power failure for required nonvolatile V memory.

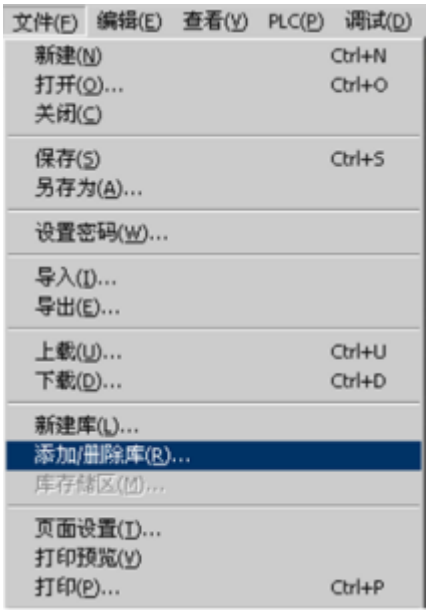
All CTH200 CPUs support CT_savevmem currently, the specific data storage is shown in below table:

CPU	Data storage
H224	8KB, not expandable
H224X	8KB, expand up to 108KB
H226L	8KB, not expandable
H226XL	10KB, expand up to 110KB
H228XL	10KB, expand up to 110KB

Installation

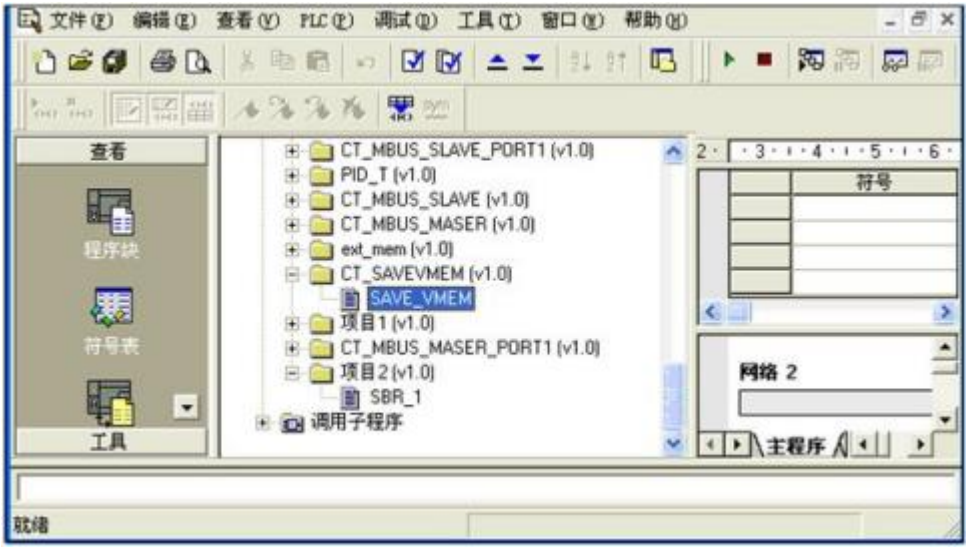
1) Add library file

Click "File"--"Add/Delete Library":



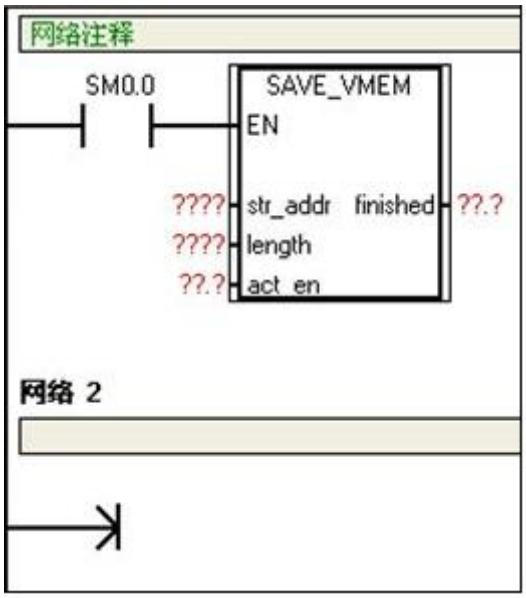
Click Add in the pop-up dialog, find ct_savevmem.mwl, then select and click Save.

After installation, we can see the new added ct_savevmem under Libraries of the project tree:



2) Call CT_SAVEVMEM

Click the network to add function block and double click the SAVE_VMEM under Libraries, then the corresponding block would be in the network as shown below:



Notice

Make sure the EN always ON before write operation done, which means it's better to user sm0.0 or act_en calling the function.

3) Function description for CT_SAVEVMEM\

Name	Description	Type	Note
str_addr	Start address for V memory	WORD	Instant or variable Such as the str_addr for VW500 is 500.
length	In bytes	WORD	Length for the nonvolatile V memory Such as the length for VB500-VB4499 is 2000.
act_en	Write operation enable	BOOL	Set when start writing; Reset after writing finished. This bit must retain to 1 during writing.
finished	Write operation finish	BOOL	Reset automatically when start writing; Set to 1 after writing finished.
Note: total length for writing is integer multiples of words.			

J Programming Cable

Programming cable with USB-485 port is used for CTH200 CPU programming, uploading /downloading, monitoring.

Table K-1 Physical characteristics for Program Cable

	Item	Content
	Order number	CTS7 191-USB10
	Supported OS	Windows2000/Windows XP/Windows 7
	Baud rate	300bps ～ 1Mbps, self-adaptive
	Working temperature	0 ～ +55 ℃
	Cable length	2.5m
	Cables for each PC	1 item

Notice

CTH200 CPUs support the following programming cable: 191-USB10, 191-USB20, 191-USB30. Each one has corresponding drive file which can be download from CO-TRUST website: http://www.co-trust.com/cn/service.php?dlm=11&xlm=17

Cable structure:

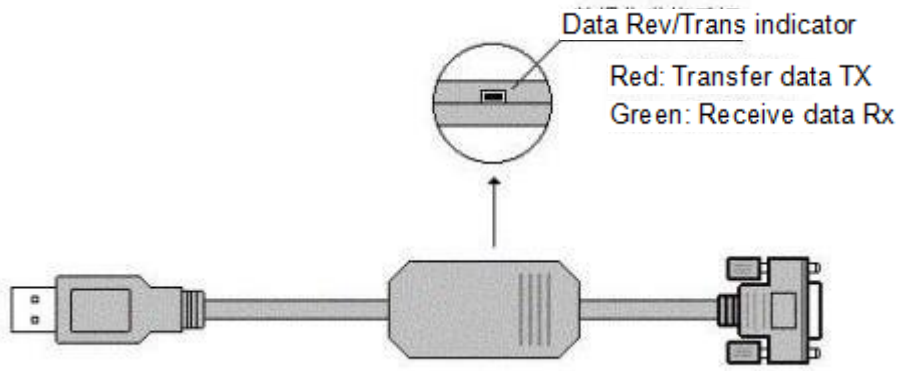


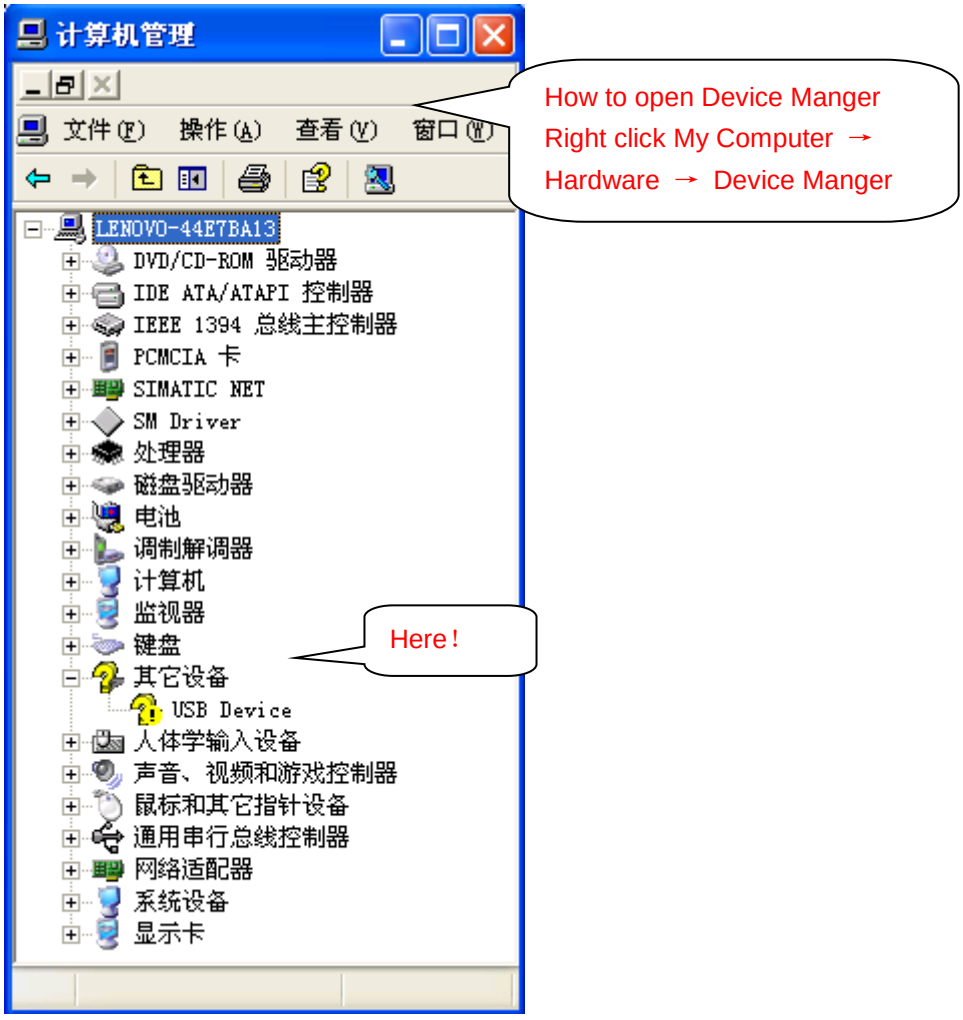
Figure J-1 Programming Cable Structure

J.1 Install Drive

【Step 1】 Put the Driver Disk into PC or save the drive file from CO-TRUST website into PC, then you can plug the cable CTS7 191-USBX0 into PC, it would be recognized and a Setup Wizard would pop up.

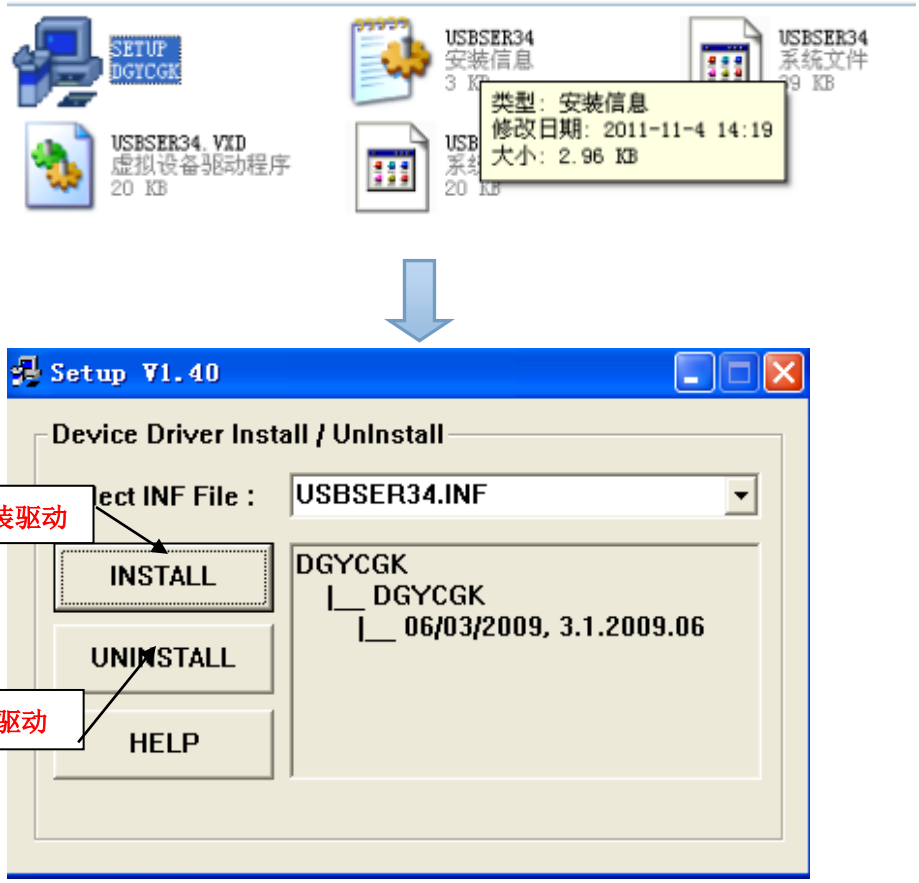
Note: Step 2-5 only suitable for Drive of the General Serial Bus Controller when it's not exist, it's better to proceed these steps.

【**Step 2**】 if either screen doesn't show up, Device Manger would appear a yellow exclamation mark as shown below:



【**Step 3**】Situations in Step 1 indicate that the cable has been recognized by computer, you

need to open drive disk or RS-232 Driver folder, click SETUP.EXE to install the drive, as shown in step 2.

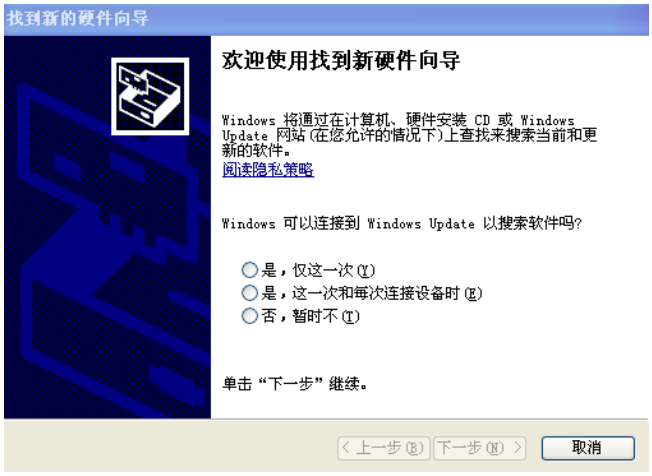


【**Step 4**】Click  and wait for the following screen, it indicates setup successfully.

【**Step 5**】Click OK.

【**Step 6**】In the Device Manager, right-click Update Driver.

【**Step 7**】Select No → Install from list or specified location.



【**Step 8**】Click Next and check Search the Disk and Search specified location, click Navigate to find the corresponding RS485Drivers and affirm with OK.

【**Step 9**】The above screen would appear during setup, click Continue.

【**Step 10**】The above dialog indicates setup successfully, click OK.

J.2 Modify COM Port Number

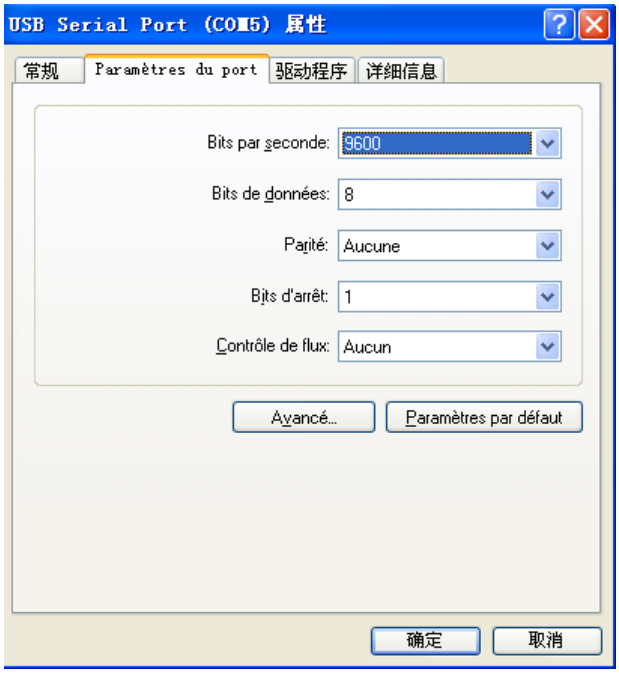
Port numbers are limited in some earlier application software, if a PLC program software supports port number COM1～COM4, but the cable address shown in Device Manager is COM5 after the USB Driver in Chapter J.1 installed due to other USB transformer has been installed before, thus the program software cannot access this COM port. Here we need to modify the COM number for Cable, procedures as below:

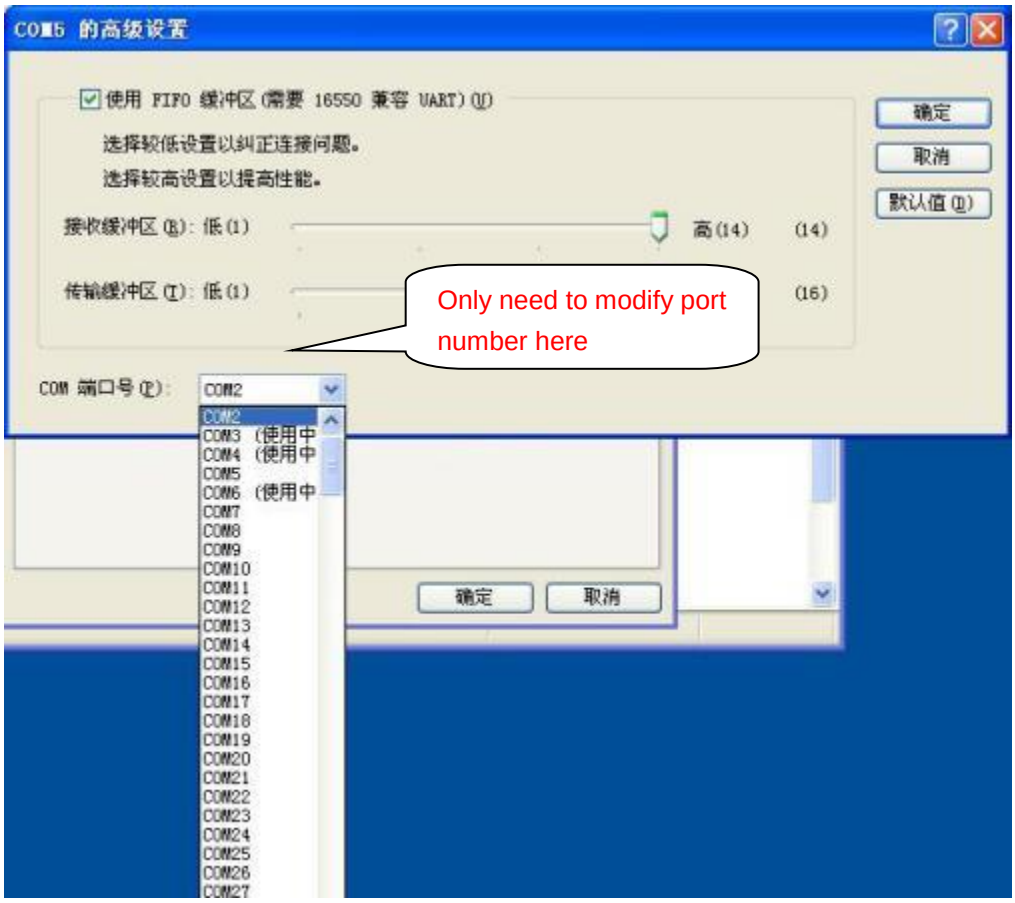
1, Find Port Location

COM number can be modified directly in Windows2000/XP system: after installing the above driver, right-click My Computer → Hardware → Device Manager → Port。

2, Modify Port

1 Here with COM2 as example: Find the port, click COM2 → Properties→ Port Setting → Advance", Select required idol COM Port.



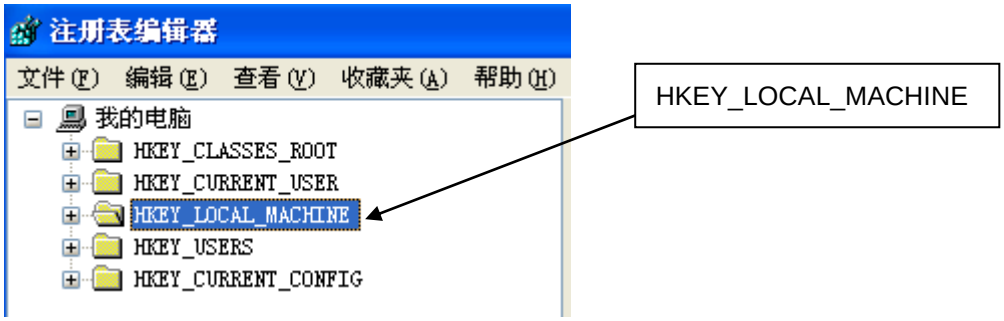


Note：if the PC has built in COM2 port, you cannot change the Port as duplicated COM.

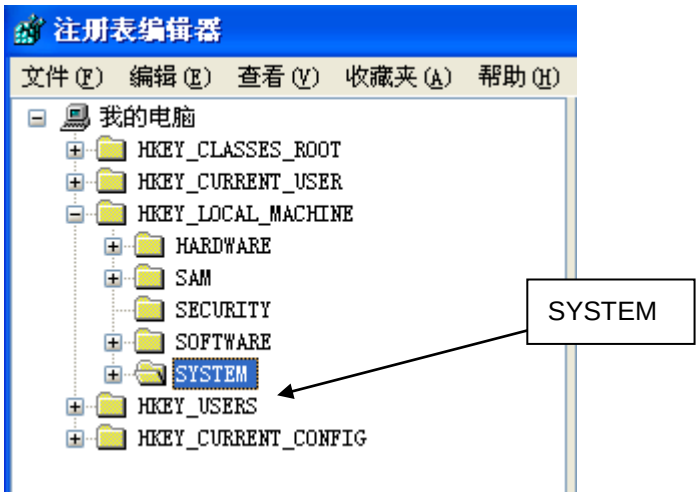
J.3 Release COM Port

If COM1 to COM8 are all prompted in use (actually not), you may need to release the occupied COM port, procedures: Start - Run - input regedit to enter registry editor;

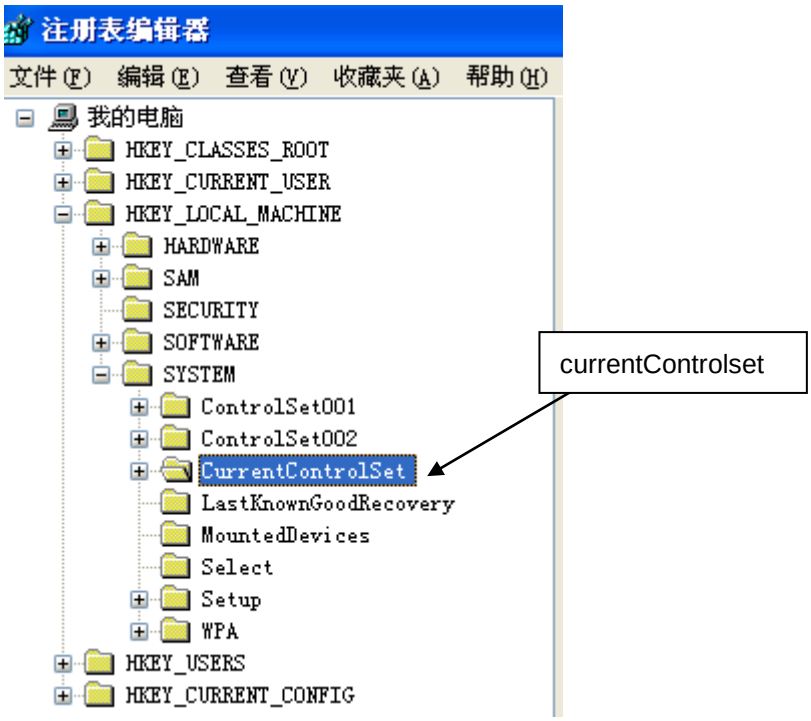
1, Open HKEY_LOCAL_MACHINE



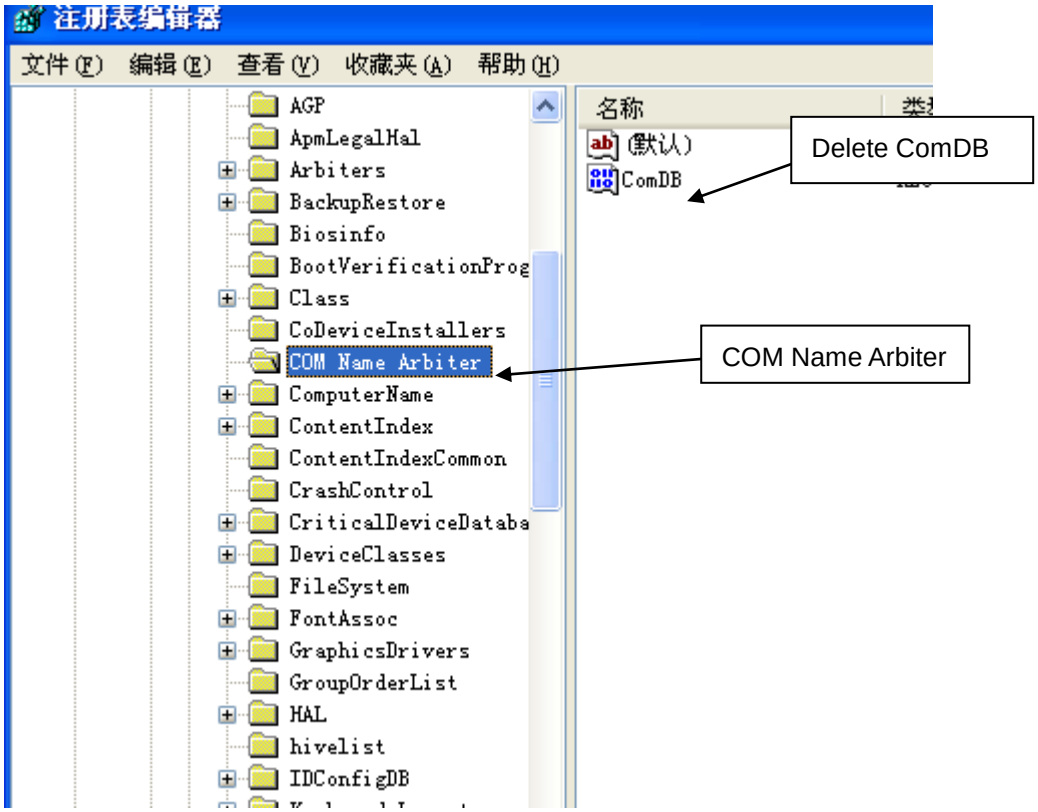
2, Open SYSTEM:



3, Open currentControlset



4, Open COM Name Arbiter, delete ComDB, or restart the computer;


注册表编辑器
文件(F) 编辑(E) 查看(V) 收藏夹(A) 帮助(H)
AGP
ApmLegalHal
Arbiters
BackupRestore
Biosinfo
BootVerificationProg
Class
CoDeviceInstallers
COM Name Arbiter
ComputerName
ContentIndex
ContentIndexCommon
CrashControl
CriticalDeviceDataba
DeviceClasses
FileSystem
FontAssoc
GraphicsDrivers
GroupOrderList
HAL
hivelist
IDConfigDB
名称
(默认)
ComDB
Delete ComDB
COM Name Arbiter

K Special Memory (SM)

SMB0: System Status Bits

SMB0 contains eight status bits that are updated by the PLC at the end of each scan cycle.

SMB0	Function Description (Read-only)
SM0.0	This bit is always on.
SM0.1	This bit is on for the first scan cycle. One use is to call an initialization subroutine.
SM0.2	This bit is turned on for one scan cycle if retentive data was lost. This bit can be used as either an error memory bit or as a mechanism to invoke a special startup sequence.
SM0.3	This bit is turned on for one scan cycle when RUN mode is entered from a power-up condition. This bit can be used to provide machine warm-up time before starting an operation.
SM0.4	This bit provides a clock pulse that is on for 30 seconds and off for 30 seconds, for a duty cycle time of 1 minute. It provides an easy-to-use delay, or a 1-minute clock pulse.
SM0.5	This bit provides a clock pulse that is on for 0.5 seconds and then off for 0.5 seconds, for a duty cycle time of 1 second. It provides an easy-to-use delay or a 1-second clock pulse.
SM0.6	This bit is a scan cycle clock which is on for one scan cycle and then off for the next scan cycle. This bit can be used as a scan counter input.
SM0.7	This bit reflects the position of the Mode switch (off is TERM position, and on is RUN position). If you use this bit to enable Freeport mode when the switch is in the RUN position, normal communications with the programming device can be enabled by switching to the TERM position.

SMB1: Status Bits for Command Execution

SMB1 contains various potential error indicators. These bits are set and reset by instructions at execution time:

SMB1	Function Description (Read-only)
SM1.0	This bit is turned on by the execution of certain instructions when the result of the operation is zero.
SM1.1	This bit is turned on by the execution of certain instructions either when an overflow results or when an illegal numeric value is detected.
SM1.2	This bit is turned on when a negative result is produced by a math operation.
SM1.3	This bit is turned on when division by zero is attempted.
SM1.4	This bit is turned on when the Add to Table instruction attempts to overfill the table.
SM1.5	This bit is turned on when either LIFO or FIFO instructions attempt to read from an empty table.

SM1.6	This bit is turned on when an attempt to convert a non-BCD value to binary is made.
SM1.7	This bit is turned on when an ASCII value cannot be converted to a valid hexadecimal value.

SMB2: Freeport Receive Character

SMB2 is the Freeport receive character buffer. As described in Table below, each character received while in Freeport mode is placed in this location for easy access from the ladder logic program:

SM byte	Function Description (Read-only)
SMB2	This byte contains each character that is received from Port 0 or Port 1 during Freeport communications.

SMB3: Freeport Parity Error

SMB3 is used for Freeport mode and contains a parity error bit that is set when a parity error is detected on a received character. As shown in Table D-4, SM3.0 turns on when a parity error is detected. Use this bit to discard the message.

SMB3	Function Description (Read-only)
SM3.0	Parity error from Port 0 or Port 1 (0 = no error; 1 = error was detected)
SM3.1～SM3.7	Reserved

SMB4: Queue Overflow

SMB4 contains the interrupt queue overflow bits, a status indicator showing whether interrupts are enabled or disabled, and a transmitter-idle memory bit. The queue overflow bits indicate either that interrupts are happening at a rate greater than can be processed, or that interrupts were disabled with the global interrupt disable instruction

SMB4	Function Description (Read-only)
SM4.0	This bit is turned on when the communications interrupt queue has overflowed.
SM4.1	This bit is turned on when the input interrupt queue has overflowed.
SM4.2	This bit is turned on when the timed interrupt queue has overflowed.
SM4.3	This bit is turned on when a run-time programming problem is detected.
SM4.4	This bit reflects the global interrupt enable state. It is turned on when interrupts are enabled.
SM4.5	This bit is turned on when the transmitter is idle (Port 0).
SM4.6	This bit is turned on when the transmitter is idle (Port 1).
SM4.7	This bit is turned on when something is forced.

Note: Use status bits 4.0, 4.1, and 4.2 only in an interrupt routine. These status bits are reset when the queue is emptied, and control is returned to the main program.

SMB5: I/O status

SMB5 contains status bits about error conditions that were detected in the I/O system. These bits

provide an overview of the I/O errors detected.:

SM5	Function Description (Read-only)
SM5.0	This bit is turned on if any I/O errors are present.
SM5.1	This bit is turned on if too many digital I/O points have been connected to the I/O bus.
SM5.2	This bit is turned on if too many analog I/O points have been connected to the I/O bus.
SM5.3	This bit is turned on if too many intelligent I/O modules have been connected to the I/O bus.
SM5.4～SM5.7	Reserved.

SMB6: CPU ID Register

SMB6 is the identification register for the CPU. SM6.4 to SM6.7 dentify the type of CPU. SM6.0 to SM6.3 are reserved for future use:

SM6	Function Description (Read-only)
SMB6	CPU ID Register
SM6.0～SM6.3	Reserved
SM6.4～SM6.7	Identify the CPU type 0000: CPU212, CPU222; 0010: CPU214, CPU224; 0110: CPU221; 1000: CPU215; 1001: CPU216, CPU226, CPU226XM; 1110: H35-00;

SMB6 format:

MSB LSB

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
x	x	x	x	r	r	r	r
0000: CPU212, CPU222; 0010: CPU214, CPU224; 0110: CPU221; 1000: CPU215; 1001: CPU216, CPU226, CPU226XM; 1110: H35-00				Reserved			

SMB8~SMB21: I/OModule ID and Error Registers

SMB8~SMB21 are organized in byte pairs for expansion modules 0 to 6. As described in Table D-8, the even-numbered byte of each pair is the module-identification register. These bytes identify the module type, the I/O type, and the number of inputs and outputs. The odd-numbered byte of each pair is the module error register. These bytes provide an indication of any errors detected in the I/O for that module:

SM	Function Description (Read-only)
SMB8	Module 0 ID register
SMB9	Module 0 error register
SMB10	Module 1 ID register
SMB11	Module 1 error register

SMB12	Module 2 ID register
SMB13	Module 2 error register
SMB14	Module 3 ID register
SMB15	Module 3 error register
SMB16	Module 4 ID register
SMB17	Module 4 error register
SMB18	Module 5 ID register
SMB19	Module 5 error register
SMB20	Module 6 ID register
SMB21	Module 6 error register

Even-Number Byte: (module ID register) format:

MSB LSB

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
m	t	t	a	i	i	q	q
m: Module present 0--Yes 1--No	tt: Module type 00 Non-intelligent I/O module 01 Intelligent module 10 Reserved 11 Reserved		a: I/O type 0 = Discrete 1 = Analog	ii: Inputs 00 No inputs 01 2 AI or 8 DI 10 4 AI or 16 DI 11 8 AI or 32 DI		qq: Outputs 00 No outputs 01 2 AQ or 8 DQ 10 4 AQ or 16 DQ 11 8 AQ or 32 DQ	

Odd-Number Byte (module error register) format:

MSB LSB

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
c	0	0	b	r	p	f	t
c: Configuration error b: Bus fault or parity error r: Out-of-range error p: No user power error f: Blown fuse error t: Terminal block loose error 0 = no error 1 = error							

SMW22~SMW26: Scan Times

SSMW22, SMW24, and SMW26 provide scan time information: minimum scan time, maximum scan time, and last scan time in milliseconds.:

SM	Function Description (Read-only)
SMW22	Scan time of the last scan cycle in milliseconds
SMW24	Minimum scan time in milliseconds recorded since entering the RUN mode
SMW26	Maximum scan time in milliseconds recorded since entering the RUN mode

SMB28~SMB29: Analog Adjustment

SMB28 and SMB29 respectively hold the digital value that represents the position of analog adjustment 0 and 1. The analog adjustment is located on front of CPU, you can adjust it with a screwdriver (increase in clockwise, decrease in anticlockwise.

SM	Function Description (Read-only)
SMB28	This byte stores the value entered with analog adjustment 0. This value is updated once per scan in STOP/RUN.
SMB29	This byte stores the value entered with analog adjustment 1. This value is updated once per scan in STOP/RUN.

SMB30 and SMB130: Freeport Control Registers

SMB30 controls the Freeport communications for port 0; SMB130 controls the Freeport communications for port 1. You can read and write to SMB30 and SMB130. As described in Table below, these bytes configure the respective communications ports for Freeport operation and provide selection of either Freeport or system protocol support.

SM	Function Description (Read-only)
SMB30	Freeport 0 control register
SMB130	Freeport 1 control register
SM30.0～SM30.1	Port 0 Protocol selection
SM130.0～SM130.1	Port 1 Protocol selection
SM30.2～SM30.4	Freeport 0 Baud rate
SM130.2～SM130.4	Freeport 1 Baud rate
SM30.5	Freeport 0 Data bits per character
SM130.5	Freeport 1 Data bits per character
SM30.6～SM30.7	Freeport 0 Parity select
SM130.6～SM130.7	Freeport 1 Parity select

Freeport mode control byte SMB30 format:

MSB LSB

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
p	p	d	b	b	b	m	m

pp: Parity select 00 =no parity
10 =odd parity
01 =even parity
11 =odd parity

d: Data bits per character
0--8 bits per character
1--7 bits per character

bbb: Freeport Baud rate
000--38400 bps
001--19200 bps
010--9600 bps
011--4800 bps
100--2400 bps
101--1200 bps
110--115200 bps
111--57600 bps

mm: Protocol selection
00--Point-to-Point Interface protocol (PPI/slave mode)
01 -- Freeport protocol
10--PPI/master mode
11--Reserved (defaults to PPI/slave mode)

<Note> When you select code mm = 10 (PPI master), the PLC will become a master on the network and allow the NETR and NETW instructions to be executed. Bits 2 through 7 are ignored in PPI modes.

SMB31 and SMW32: Permanent Memory (EEPROM) Write Control

You can save a value stored in V memory to permanent memory under the control of your program. To do this, load the address of the location to be saved in SMW32. Then, load SMB31 with the command to save the value. Once you have loaded the command to save the value, you do not change the value in V memory until the S7-200 resets SM31.7, indicating that the save operation is complete. At the end of each scan, the S7-200 checks to see if a command to save a value to permanent memory was issued. If the command was issued, the specified value is saved to permanent memory.

As described in Table below, SMB31 defines the size of the data to be saved to permanent memory and provides the command that initiates a save operation. SMW32 stores the starting address in V memory for the data to be saved to permanent memory.

SM	Function Description
SMB31	Permanent memory instruction register
SM31.0～SM31.1	Size of the data 00 =byte 10 =word 01 =byte 11 =double word
SM31.2～SM31.6	Reserved , always 00000
SM31.7	Save to permanent memory, PLC resets this bit after each save operation. 0 =No request for a save operation to be performed 1 =User program requests to save data
SMW32	The V memory address for the data to be saved is stored in SMW32. This value is entered as an offset from V0. When a save operation is executed, the value in this V memory address is saved to the corresponding V memory location in the permanent memory.

SMB34 and SMB35: Time Interval Registers for Timed Interrupts

SMB34 specifies the time interval for timed interrupt 0, and SMB35 specifies the time interval for timed interrupt 1. You can specify the time interval (in 1-ms increments) from 1 ms to 255 ms. The time-interval value is captured by the S7-200 at the time the corresponding timed interrupt event is attached to an interrupt routine. To change the time interval, you must reattach the timed interrupt event to the same or to a different interrupt routine. You can terminate the timed interrupt event by detaching the event.。

SM	Function Description
SMB34	This byte specifies the time interval (in 1-ms increments from 1 ms to 255 ms) for timed interrupt 0.
SMB35	This byte specifies the time interval (in 1-ms increments from 1 ms to 255 ms) for timed interrupt 1.

SMB36~SMB65: HSC0, HSC1 and HSC2 registers

SMB36~SMB65 are used for monitoring and controlling operations for high speed counter HSC0, HSC1 and HSC2:

SM	Function Description
HSC0	
SMB36	HSC0 counter status
SM36.0 ～ SM36.4	Reserved
SM36.5	HSC0 current counting direction status bit: 1 = counting up
SM36.6	HSC0 current value equals preset value status bit: 1 = equal
SM36.7	HSC0 current value is greater than preset value status bit: 1 = greater than
SMB37	HSC0 control byte
SM37.0	Active level control bit for Reset: 0= Reset is active high, 1 = Reset is active low
SM37.1	Reserved
SM37.2	Counting rate selection for quadrature counters:0=4x counting rate; 1=1 x counting rate
SM37.3	HSC0 direction control bit: 1 = count up
SM37.4	HSC0 update the direction: 1 = update direction
SM37.5	HSC0 update the preset value: 1 = write new preset value to HSC0 preset
SM37.6	HSC0 update the current value: 1 = write new current value to HSC0 current
SM37.7	HSC0 enable bit: 1 = enable
SMD38	HSC0 new current value
SMD42	HSC0 new preset value
HSC1	
SMB46	HSC1 counter status
SM46.0 ～ SM46.4	Reserved
SM46.5	HSC1 current counting direction status bit: 1 = counting up
SM46.6	HSC1 current value equals preset value status bit: 1 = equal
SM46.7	HSC1 current value is greater than preset value status bit: 1 = greater than
SMB47	HSC1 control byte
SM47.0	HSC1 active level control bit for reset: 0 = active high, 1 = active low
SM47.1	HSC1 active level control bit for start: 0 = active high, 1 = active low
SM47.2	HSC1 quadrature counter rate selection: 0 = 4x rate, 1 = 1x rate
SM47.3	HSC1 direction control bit: 1 = count up
SM47.4	HSC1 update the direction: 1 = update direction
SM47.5	HSC1 update the preset value: 1 = write new preset value to HSC1 preset
SM47.6	HSC1 update the current value: 1 = write new current value to HSC1 current
SM47.7	HSC1 enable bit: 1 = enable
SMD48	HSC1 new current value
SMD52	HSC1 new preset value
HSC2	

SMB56	HSC2 counter status
SM56.0 ～ SM56.4	Reserved
SM56.5	HSC2 current counting direction status bit: 1 = counting up
SM56.6	HSC2 current value equals preset value status bit: 1 = equal
SM56.7	HSC2 current value is greater than preset value status bit: 1 = greater than
SMB57	HSC2 control byte
SM57.0	HSC2 active level control bit for reset: 0 = active high, 1 = active low
SM57.1	HSC2 active level control bit for start: 0 = active high, 1 = active low
SM57.2	HSC2 quadrature counter rate selection: 0 = 4x rate, 1 = 1x rate
SM57.3	HSC2 direction control bit: 1 = count up
SM57.4	HSC2 update the direction: 1 = update direction
SM57.5	HSC2 update the preset value: 1 = write new preset value to HSC2 preset
SM57.6	HSC2 update the current value: 1 = write new current value to HSC2 current
SM57.7	HSC2 enable bit: 1 = enable
SMD58	HSC2 new current value
SMD62	HSC2 new preset value

<Comment>

1）The counter status bit is only valid when executing the interrupt program triggered by HSC event.

2）When using the HSC external reset interrupt event, don't reset the current new value and re-enable the counter in the interrupt program related with this event, this would cause serious error.

SMB66~SMB85: PTO/PWM register

SMB66~SMB85are used to monitor and control the pulse train output and pulse width modulation functions.

SM	Function Description
PTO0	
SMB66	PTO0 status byte
SM66.0 ～ SM66.3	Reserved
SM66.4	PTO0 profile aborted: 0 = no error, 1 = aborted due to a delta calculation error
SM66.5	PTO0 profile aborted: 0 = not aborted by user command, 1 = aborted by user command
SM66.6	PTO0 pipeline overflow (cleared by the system when using external profiles, otherwise must be reset by user): 0 = no overflow, 1 = pipeline overflow
SM66.7	PTO0 idle bit: 0 = PTO in progress, 1 = PTO idle
SMB67	Pulse train output control and PWM for Q0.0
SM67.0	PTO0/PWM0 update the cycle time value: 1 = write new cycle time
SM67.1	PWM0 update the pulse width value: 1 = write new pulse width

SM67.2	PTO0 update the pulse count value: 1 = write new pulse count
SM67.3	PTO0/PWM0 time base: 0 = 1 μs/tick, 1 = 1 ms/tick
SM67.4	Update PWM0 synchronously: 0 = asynchronous update, 1 = synchronous update
SM67.5	PTO0 operation: 0 = single segment operation (cycle time and pulse count stored in SM memory), 1 = multiple segment operation (profile table stored in V memory)
SM67.6	PTO0/PWM0 mode select: 0 = PTO, 1 = PWM
SM67.7	PTO0/PWM0 enable bit: 1 = enable
SMW68	PTO0/PWM0 cycle time value (2 to 65,535 units of time base);
SMW70	PWM0 pulse width value (0 to 65,535 units of the time base);
SMD72	PTO0 pulse count value (1 to 232 --1);
PTO1	
SMB76	PTO1 status byte
SM76.0 ～ SM76.3	Reserved
SM76.4	PTO1 profile aborted: 0 = no error, 1 = aborted because of delta calculation error
SM76.5	PTO1 profile aborted: 0 = not aborted by user command, 1 = aborted by user command
SM76.6	PTO1 pipeline overflow (cleared by the system when using external profiles, otherwise must be reset by the user): 0 = no overflow, 1 = pipeline overflow
SM76.7	PTO1 idle bit: 0 = PTO in progress, 1 = PTO idle
SMB77	Pulse train output control and PWM for Q0.1
SM77.0	PTO1/PWM1 update the cycle time value: 1 = write new cycle time
SM77.1	PWM1 update the pulse width value: 1 = write new pulse width
SM77.2	PTO1 update the pulse count value: 1 = write new pulse count
SM77.3	PTO1/PWM1 time base: 0 = 1 μs/tick, 1 = 1 ms/tick
SM77.4	Update PWM1 synchronously: 0 = asynchronous update, 1 = synchronous update
SM77.5	PTO1 operation: 0 = single segment operation (cycle time and pulse count stored in SM memory), 1 = multiple segment operation (profile table stored in V memory)
SM77.6	PTO1/PWM1 mode select: 0 = PTO, 1 = PWM
SM77.7	PTO1/PWM1 enable bit: 1 = enable
SMW78	PTO1/PWM1 cycle time value (2 to 65,535 units of the time base);
SMW80	PWM1 pulse width value (0 to 65,535 units of the time base);
SMD82	PTO1 pulse count value (1 to 232 --1);

SMB86~SMB94 and SMB186~SMB194: receive Message control

SMB86~SMB94 and SMB186~SMB194 are used to control and read the status of the Receive Message instruction.

SM	Function description
P0 receive Message	
SMB86	P0 Receive Message status byte
SMB87	P0 Receive Message control byte
SMB88	P0 Start of message character
SMB89	P0 End of message character
SMW90	Idle line time period given in milliseconds. The first character received after idle line time has expired is the start of a new message.
SMW92	Inter-character/message timer time-out value (in milliseconds). If the time period is exceeded, the receive message is terminated.
SMB94	Maximum number of characters to be received (1 to 255 bytes). **<Note>** This range must be set to the expected maximum buffer size, even if the character count message termination is not used.
P1 receive Message	
SMB186	P1 Receive Message status byte
SMB187	P1 Receive Message control byte
SMB188	P1 Start of message character
SMB189	P1 End of message character
SMW190	Idle line time period given in milliseconds. The first character received after idle line time has expired is the start of a new message.
SMW192	Inter-character/message timer time-out value (in milliseconds). If the time period is exceeded, the receive message is terminated.
SMB194	Maximum number of characters to be received (1 to 255 bytes). **<Note>** This range must be set to the expected maximum buffer size, even if the character count message termination is not used.

Receive Message status byte format:

MSB LSB

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
n	r	e	0	0	t	c	p

n = 1: Receive message terminated by user disable command

r = 1: Receive message terminated: error in input parameters or missing start or end condition

e = 1: End character received

t = 1: Receive message terminated: timer expired

c = 1: Receive message terminated: maximum character count achieved

p = 1: Receive message terminated because of a parity error

Receive Message control byte format:

MSB LSB

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

en	sc	ec	il	c/m	tmr	bk	0

en: 0 =Receive Message function is disabled.
1 =Receive Message function is enabled.
The enable/disable receive message bit is checked each time the RCV instruction is executed.

sc: 0 =Ignore SMB88 or SMB188.
1 =Use the value of SMB88 or SMB188 to detect start ofmessage.

ec: 0 =Ignore SMB89 or SMB189.
1 =Use the value of SMB89 or SMB189 to detect end ofmessage.

il: 0 =Ignore SMW90 or SMW190.
1 =Use the value of SMW90 or SMW190 to detect an idle line condition.

c/m: 0 =Timer is an inter-character timer.
1 =Timer is a message timer.

tmr: 0 =Ignore SMW92 or SMW192.
1 =Terminate receive if the time period in SMW92 or SMW192 is exceeded.

bk: 0 =Ignore break conditions.
1 =Use break condition as start of message detection.

SMW98: Errors on the Expansion I/O Bus

SMW98 gives you information about the number of errors on the expansion I/O bus.:

SM	Function description
SMW98	This location is incremented each time a parity error is detected on the expansion I/O bus. It is cleared upon power up, and can be cleared by the user.

SMB110~SMB112: Upload control for Program Card

SMB110~SMB111 are used for Program Card control

SM	Function description
SMB110	Start forced upload protection
SMB111	Overwrite options for Program Card: 0 - overwrite program block and data block; 1 - overwrite data block, not for program block; 2 -overwrite program block, not for data block; 3 -not overwrite program block and data block; 4 -same as with option 0

SMB112~SMB113: Display the current CPU information

SMB112~SMB113 lists the current CPU information:

SM	Function description
SMB112	Display the current CPU version correctly (SMB112=16#83, indicates CTH200 series)
SMB113	Display the current CPU type correctly H224/H224X RLY: 16#02; H224/H224X PNP: 16#03 H226X/H226XL RLY: 16#08; H226X/H226XL PNP: 16#09 H228XL RLY: 16#18

SMB114~SMB115: Expansion board information

SMB114: Expansion board module type

SMB114 = 0x20: CAN

0x19: 2AI/1AQ

0x1E: 4AI/2AQ

Bit definition is shown below

Bti7	Bit6	Bti5	Bit4	Bit3	Bit2	Bti1	Bit0
	E	**TT**		**t**	**II**		**OO**
E Module presence	1: No 0: Yes						
TT (Module type)	00	Non-intelligent module					
	01	Intelligent module					
	10	Special Non-intelligent module (like 7PF)					
	11	Intelligent module from COTRUST (like PID modules)					
t (module sub-type)	Non-intelligent	0: Digital					
		1: Analog					
	Intelligent	0: Normal intelligent					
		1: Intelligent module from COTRUST (PID)					
II (Inputs)	Non-intelligent	00	None				
		01	AI/8DI				
		10	2AI/16DI				
		11	4AI/32DI				
	Intelligent	Reserved					
OO (Outputs)	Non-intelligent	00	None				
		01	1AO/8DO				
		10	2AO/8DO				
		11	4AO/32DO				
	Intelligent	Reserved					

SMB115: expansion board status

SMB115 = 0x0: module has no error

0x255: expansion board access error

other: expansion board internal diagnose

SMW116~SMW126: Analog Mapping area for expansion board

Mapping area correspondence:

Expansion board	Analog Mapping area
2AI/1AQ	Expansion board: AIW0 for SMW116; AIW2 for SMW118; AQW0 for SMW124
4AI/2AQ	Expansion board: AIW0 for SMW116; AIW2 for SMW118; AIW4 for SMW124, AIW6 for SMW122; AQW0 for SMW124; AQW2 for SMW126

SMB131 CAN expansion board access cycle setting

CAN expansion board access cycle (ms), default as 1ms when set to 0

SMB136~SMB165: HSC3, HSC4 and HSC5 registers

SMB136~SMB165 are used to monitor and control the operation of high-speed counters HSC3, HSC4, and HSC5:

SM	Function description
HSC3	
SMB136	HSC3 counter status
SM136.0～4	Reserved
SM136.5	HSC3 current counting direction status bit: 1 = counting up
SM136.6	HSC3 current value equals preset value status bit: 1 = equal
SM136.7	HSC3 current value is greater than preset value status bit: 1 = greater than
SMB137	HSC3 control byte
SM137.0～2	Reserved
SM137.3	HSC3 direction control bit: 1 = count up
SM137.4	HSC3 update direction: 1 = update direction
SM137.5	HSC3 update preset value: 1 = write new preset value to HSC3 preset
SM137.6	HSC3 update current value: 1 = write new current value to HSC3 current
SM137.7	HSC3 enable bit: 1 = enable
SMD138	HSC3 new current value
SMD142	HSC3 new preset value
HSC4	
SMB146	HSC4 counter status
SM146.0～4	Reserved
SM146.5	HSC4 current counting direction status bit: 1 = counting up
SM146.6	HSC4 current value equals preset value status bit: 1 = equal
SM146.7	HSC4 current value is greater than preset value status bit: 1 = greater than
SMB147	HSC4 control byte
SM147.0	Active level control bit for Reset: 0 = Reset is active high, 1 = Reset is active low
SM147.1	Reserved
SM147.2	Counting rate selection for quadrature counters: 0 = 4x counting rate,

	1 = 1x counting rate
SM147.3	HSC4 direction control bit: 1 = count up
SM147.4	HSC4 update direction: 1 = update direction
SM147.5	HSC4 update preset value: 1 = write new preset value to HSC4 preset
SM147.6	HSC4 update current value: 1 = write new current value to HSC4 current
SM147.7	HSC4 enable bit: 1 = enable
SMD148	HSC4 new current value
SMD152	HSC4 new preset value
HSC5	
SMB156	HSC5 counter status
SM156.0～4	Reserved
SM156.5	HSC5 current counting direction status bit: 1 = counting up
SM156.6	HSC5 current value equals preset value status bit: 1 = equal
SM156.7	HSC5 current value is greater than preset value status bit: 1 = greater than
SMB157	HSC5 control byte
SM157.0～2	Reserved
SM157.3	HSC5 direction control bit: 1 = count up
SM157.4	HSC5 update direction: 1 = update direction
SM157.5	HSC5 update preset value: 1 = write new preset value to HSC5 preset
SM157.6	HSC5 update current value: 1 = write new current value to HSC5 current
SM157.7	HSC5 enable bit: 1 = enable
SMD158	HSC5 new current value
SMD162	HSC5 new preset value

<Note>

1, The counter status bit is only valid when executing the interrupt program triggered by HSC event.

2, When using the HSC external reset interrupt event, don’t reset the current new value and re-enable the counter in the interrupt program related with this event, this would cause serious error.

SMB166~SMB185: PTO0, PTO1 Profile Definition Table

SMB166~SMB194 are used to show the number of active

profile steps and the address of the profile table in V memory (H224/H226L not support; H224X/H226XL/H228XL support):

SM	Function description

PTO0	
SMB166	Current entry number of the active profile step for PTO0
SMB167	Reserved
SMW168	V memory address of the profile table for PTO0 given as an offset from V0.
SMB170	Linear PTO0 status byte
SMB171	Linear PTO0 result byte
SMD172	Specifies the frequency to be generated when the Linear PTO0 generator is operated in manual mode. The frequency is specified as a double integer value in Hz. SMB172 is MSB and SMB175 is LSB
PTO1	
SMB176	Current entry number of the active profile step for PTO1
SMB177	Reserved
SMW178	V memory address of the profile table for PTO1 given as an offset from V0.
SMB180	Linear PTO1 status byte
SMB181	Linear PTO1 result byte
SMD182	Specifies the frequency to be generated when the Linear PTO1 generator is operated in manual mode. The frequency is specified as a double integer value in Hz. SMB182 is MSB and SMB178 is LSB

SMB200~SMB549: Intelligent Module Status

SMB200~SMB549 are reserved for information provided by intelligent expansion modules, such as the EM 277 PROFIBUS--DP module:

Intelligent Module in Slot 0	Intelligent Module in Slot 1	Intelligent Module in Slot 2	Intelligent Module in Slot 3	Intelligent Module in Slot 4	Intelligent Module in Slot 5	Intelligent Module in Slot 6	Description
SMB200～215	SMB250～265	SMB300～315	SMB350～365	SMB400～415	SMB450～465	SMB500～515	Module name (16 ASCII characters)
SMB216～219	SMB266～269	SMB316～319	SMB366～369	SMB416～419	SMB466～469	SMB516～519	S/W revision number (4 ASCII characters)
SMW220	SMW270	SMW320	SMW370	SMW420	SMW470	SMW520	Error code
SMB222～249	SMB272～299	SMB322～349	SMB372～399	SMB422～449	SMB472～499	SMB522～549	Information specific to the particular module type

L Order information

Product Name and Specification	Or. Number
CPU modules	
CPU H224 12KB program/8KB data,24VDC supply,14DI/10DO transistor-source outputs, 0.5A, 1 PPI port, 1 freeport, 1 Ethernet port,3 50KHz motion outputs	CTH2 214-1AD33-0X24
CPU H224 12KB program/8KB data, 220VAC supply, 14DI/10DO relay outputs, 2A,1 PPI port, 1 freeport, 1 Ethernet port	CTH2 214-1BD33-0X24
CPU H226L 12KB program/8KB data,24VDC supply,24DI/16DO transistor-source outputs,0.5A, 2 PPI/freeports,1 Ethernet port,3 50KHz motion outputs	CTH2 216-2AD33-0X40
CPU H226L 12KB program/8KB data, 220VAC supply, 24DI/16DO relay outputs, 2A, 2 PPI/freeports,1 Ethernet port	CTH2 216-2BD33-0X40
CPU H224X 16KB program/108KB data, 24VDC supply, 14DI/10DO transistor-source outputs, 0.5A,1 PPI port, 1 freeport, 1 Ethernet port, 2 50KHz outputs (Pulse/Dir or PTO/PWM)	CTH2 214-1AX33-0X24
CPU H224X 16KB program/108KB data, 220VAC supply, 14DI/10DO relay outputs, 2A, 1 PPI port, 1 freeport, 1 Ethernet port	CTH2 214-1BX33-0X24
CPU H226XL 72KB program/110KB data, 24VDC supply, 24DI/16DO transistor-source outputs, 0.5A, 2 PPI/freeports,1 Ethernet port, 2 50KHz outputs (Pulse/Dir or PTO/PWM)	CTH2 216-2AX33-0X40
CPU H226XL 72KB program/110KB data, 220VAC supply, 24DI/16DO relay outputs, 2A, 2 PPI/freeports, 1 Ethernet port	CTH2 216-2BX33-0X40
CPU H228XL 96KB program/110KB data, 220VAC supply, 36DI/24DO relay outputs, 2A, 2 PPI/freeports, 1 Ethernet port	CTH2 218-3BX33-0X60
Expansion modules	
SM221 Digital Input module with 8 Inputs, 24VDC	CTH2 221-1BF32
SM221 Digital Input module with 16 Inputs, 24VDC	CTH2 221-1BH32
SM221 Digital Input module with 32 Inputs, 24VDC	CTH2 221-1BL32
SM222 Digital Output module with 8 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 222-1BF32
SM222 Digital Output module with 16 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 222-1BH32
SM222 Digital Output module with 32 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 222-1BL32
SM222 Digital Output module with 8 relay outputs, 2A	CTH2 222-1HF32
SM222 Digital Output module with 16 relay outputs, 2A	CTH2 222-1HH32
SM223 Digital Input/Output module with 4 24VDC inputs, 4 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 223-1BF32
SM223 Digital Input/Output module, 8 24VDC inputs, 8 transistor outputs, 24VDC, 0.5A (with Output Protection)	CTH2 223-1BH32
SM223 Digital Input/Output module, 16 24VDC inputs, 16 transistor	CTH2 223-1BL32

outputs, 24VDC, 0.5A (with Output Protection)	
SM223 Digital Input/Output module, 4 24VDC inputs, 4 relay outputs, 2A	CTH2 223-1HF32
SM223 Digital Input/Output module, 8 24VDC inputs, 8 relay outputs, 2A	CTH2 223-1PH32
SM223 Digital Input/Output module, 16 24VDC inputs, 16 relay outputs, 2A	CTH2 223-1PL32
SM231 Analog Input module with 4 inputs, 0～20 mA current input or ±5V, ±2.5V, 0～10V, 0～5V voltage input, isolated 12 bit resolution	CTH2 231-0HC32
SM231 Analog Input module with 8 inputs, ±2.5V, 0～10V, 0～5V voltage input or optional 0～20 mA current input, isolated 12 bit resolution	CTH2 231-5HF32
SM231 Thermal resistance Temperature Input module, 2 RTDs, isolated 16 bit resolution	CTH2 231-7PB32
SM231 Thermal resistance Temperature Input module, 4 RTDs, isolated 16 bit resolution	CTH2 231-7PC32
SM231 Thermocouple Temperature Input module, 4 TCs, J/K/R/S/T/E/N, isolated 16 bit resolution	CTH2 231-7PD32
SM231 Thermocouple Temperature Input module, 8 TCs, J/K/R/S/T/E/N, isolated 16 bit resolution	CTH2 231-7PF32
SM231 Thermocouple PID module, 4-points J/K model with intelligent PID, isolated 16 bit resolution	CTH2 231-7TD32
SM231 Thermocouple PID module, 8-points J/K model with intelligent PID, isolated 16 bit resolution	CTH2 231-7TF32
SM231 Hybrid temperature Input module, 2-points NTC or PT100, dual 0～20mA current or ±5V/±10V/0～10V/0～5V voltage inputs, isolated 16 bit resolution	CTH2 231-7ND32
SM231 Thermal resistance temperature Input Module, 8NTC/PT100, isolated 16 bit resolution	CTH2 231-7NF32
SM231 Weighing Module, single sensor input, 50Hz sample frequency, 0.01% accuracy, 6VDC, 150mA excitation power output per channel, isolated 16 bit resolution	CTH2 231-7WA32
SM232 Analog Output Module, dual ±10V supply or 0～20mA current outputs, isolated 12 bit voltage or 11 bit current resolution	CTH2 232-0HB32
SM232 Analog Output Module, quad ±10V supply or 0～20mA current outputs, isolated 12 bit voltage or 11 bit current resolution	CTH2 232-0HD32
SM235 Analog Input/Output Module, quad voltage/current inputs, single voltage/current output, isolated 12 bit voltage or 11 bit current resolution	CTH2 235-0KD32
SM253 Positioning module, two uniphase or AB phase HSC inputs, 2-axis PTO/PWM output, 200KHz, Co-trust motion ctr lib.	CTH2 253-1BH32
SM277A Profibus DP Slave Interface Module, 12Mbps traffic rate, photoelectric isolated	CTH2 277-0AA32
SM277B Profibus DP Slave module, 1.5Mbps traffic rate, photoelectric isolated	CTH2 277-0AB32

SM277C CAN Slave module, 8DI/6DO, photoelectric isolated, up to 7 extendable modules	CTH2 277-0AC32
Expansion Boards	
EBH AMS-03 Analog I/O Expansion Board, 2*12 bit resolution inputs, 1*12 bit resolution voltage/current output	CTH2 AMS-03S1-EB
EBH AMS-06 Analog I/O Expansion Board, 4*12 bit resolution inputs, 2*12 bit resolution voltage/current output	CTH2 AMS-06S1-EB
EBH CAN-01 CAN Master communication Expansion Board, 1Mbps, photoelectric isolated	CTH2 CAN-01S1-EB

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