SAVCH Programmable Logic Controller

Analog Module

User Manual & Application Case

创 无限
Innovate for more
Win forever 赢 久 远
SAVCH

User Manual

Contents

Chapter 1 User Manual

1.1 Products Receiving

All products have been performed with strict test and inspection. After receiving the inverters, the following checks shall be performed.

- To check that SAVCH inverter, an instruction manual is inside of the package
- To check whether model number correspond with model your purchase order.
- To check whether there are damaged parts during transportation and delivering. If there are, do not connect with power supply.

If any of the above checkpoints are not satisfactory, contact your SAVCH ELECTRIC representative for a quick resolution.

1.2 Model Description

S M C - AD 04 E N

Product name

Output type
N（No digital I/O）

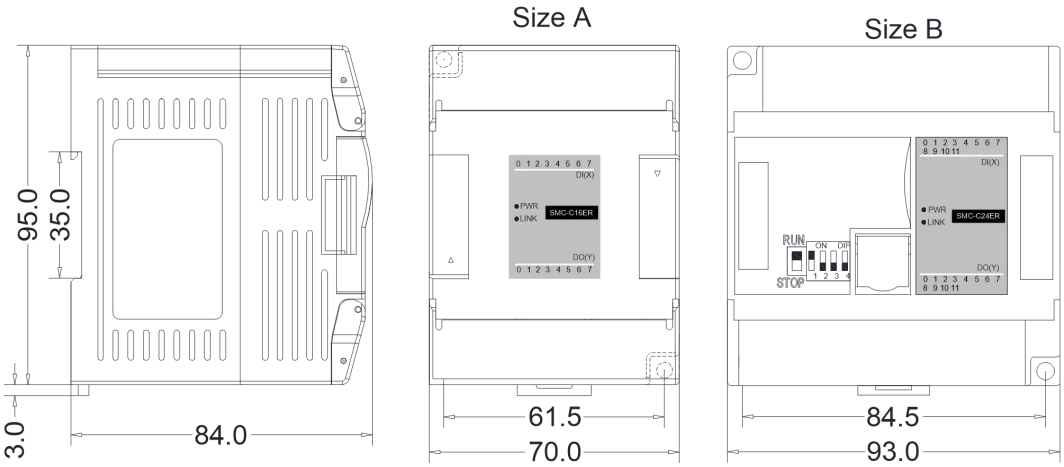
Module type
M (Main)
E (Extension module)

Product Series
AD (Analog expansion_AD input)
DA (Analog expansion_DA output)
AN (Analog expansion_AD/DA combination)
TR (Analog expansion_Thermal resistance input)
TC (Analog expansion_Thermocouple input)

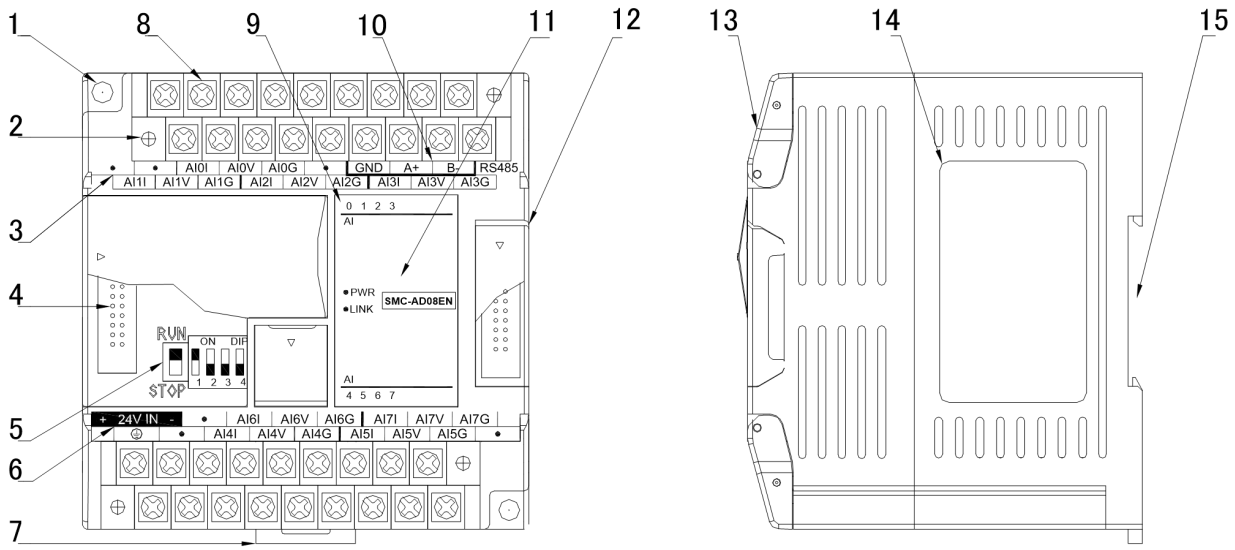
I/O point

1.3 Product Model List & Dimensions

Model	Power Consumption	Dimension	Figure No.
SMC-AD04EN	1.8 VA	70×95×82mm	Figure A
SMC-DA04EN	3.6 VA		
SMC-AN04EN	2.4 VA		
SMC-TR04EN	1.5 VA		
SMC-TC04EN	1.5 VA		
SMC-TC08EN	1.8 VA		
SMC-AD08EN	2.1 VA	93×95×82mm	Figure B
SMC-DA08EN	6.5 VA		
SMC-AN08EN	4.5 VA		
SMC-TR08EN	1.8 VA		



1.4 Front / Side View



1. Fixed hole	8. Removable terminal
2. Removable terminal screw	9. Analog input channel indicator
3. Terminal definition	10. RS485 communication port
4. Module expansion port	11. PWR power indicator, LINK module communication indicator
5. DIP switch(4-channel module without DIP switch)	12. Module expansion port
6. External power supply terminal (DC24V and AC220V, Generally powered by the host PLC)	13. Transparent cover of module terminal
7. Guide rail buckle	14. Module nameplate
	15. 35mm DIN guide rail

1.5 Indicator Description

(1) PWR: Power indicator. green, constant light -Power normal; Not light - Power abnormal.

(2) LINK: Multi-status indicator. three colors (Red. Yellow. Green), as follow:

Reference processing mode	Module bus state	LINK indicator state
Normal	No communication of module	No light
	MPU has identified the module but no communication	Constant light in green
	Serial or parallel port in communication	Green jitter: indicator on 30ms and off 30ms
Parallel power supply not enough, must connect to external power supply	Without serial or parallel port in communication	Yellow flicker: indicator on 0.5s and off 0.5s
	With serial or parallel port in communication	Yellow is darkened and jitter alternately: indicator off 0.5s and jitter 0.5s
Firmware upgrade failed, reupgrade the module firmware	Without serial or parallel port in communication	Red flicker: indicator on 0.5s and off 0.5s
	With serial or parallel port in communication	Red is darkened and jitter alternately: indicator off 0.5s and jitter 0.5s
Hardware failure and maintenance	Without serial or parallel port in communication	Constant light in red
	With serial or parallel port in communication	Red jitter quickly: indicator on 30ms and off 30ms

(3) RJ45 Ethernet indicator: There are two Ethernet LEDs, green and yellow, as shown on the picture:

Color	Status description
Green light is long bright	Physical connection of TCP module and external device is normal;
Green light goes out	TCP module fails to connect with external device or the module itself is abnormal
Yellow light blinks	TCP module is connected to an external device normally, and blinking frequency indicates the data transmission speed. When speed is fast, human eye is not easy to distinguish, at this time, yellow light is long bright.
Yellow light goes out	No data transmission communication of TCP module and external device

1.6 Power Supply Specification

Item	DC Power Supply
Power supply voltage	24VDC -15%~+20%
Power supply frequency	——
Instantaneous surge	MAX 20A 1.5ms @24VDC
Power loss time	10ms or less
Fuse	0.3A, 250V
24V Output voltage (for input and expansion)	None
Isolation Type	No Electrical isolation
Power Protection	DC input power polarity reverse, over voltage protection

1.7 Environmental Specifications for Product

Item	Environment Specification
Temperature/Humidity	Operating temperature:0~+55℃ Storage temperature:-25~+70℃ Humidity:5~95%RH, No condensation
Vibration Resistance	10~57 HZ, amplitude=0.075mm, 57HZ~150HZ acceleration=1G, 10 times each for X-axis, Y-axis and Z-axis
Impact Resistance	15G, duration=11ms, 6 times each for X-axis, Y-axis and Z-axis
Interference Immunity	DC EFT:±2500V Surge:±1000V
Over Voltage Resistance	1500VAC/1min between AC terminal and PE terminal, 500VAC/1min between DC terminal and PE terminal
Insulation Impedance	Between AC terminal and PE terminal @500VDC,>=5MΩ ,all input/output points to PE terminal @500VDC
Operating environment	Avoid dust, moisture, corrosion, electric shock and external shocks

1.8 Analog Input (AI) Specification

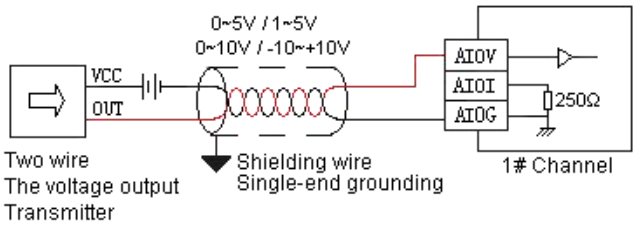
Item	Voltage input				Current input
Input range	-10V~+10V	0V~+10V	0V~+5V	1V~+5V	0~20mA 4~20mA
Resolution	5mV	2.5mV	1.25mV	1.25mV	5μA
Input impedance	6MΩ				250Ω
Maximum input range	±13V				±30mA
Input indication	LED light ON means normal ,OFF means external disconnect				
Response time	5ms/4 Channel				
Digital input range	12 bits,Code range:0~32000(H series module 16 bits A/D convert)				
Precision	0.2% F.S				
Power supply	MPU use internal power supply, extend module use external power supply 24VDC ±10% 5VA				
Isolation mode	Optoelectronic isolation,Non-isolation between Channels, between analog and digital is optoelectronic isolation				
Power consumption	24VDC ±20%,100mA(maximum)				

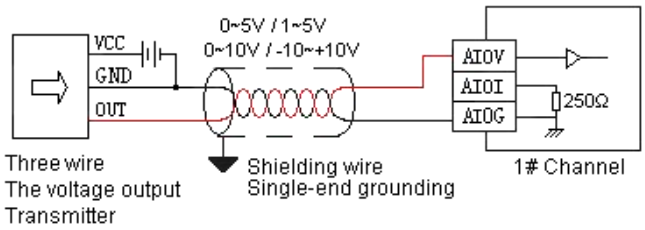
Item	RTD input	Thermocouple input
Input range	Pt100, Pt1000, Cu50, Cu100	S, K, E, J, B, N, R, Wre3/25, Wre5/26, [0，20]mV, [0，50]mV, [0，100]mV
Resolution	0.1℃	0.1℃
Input impedance	6MΩ	6MΩ
Maximum input range	±13V	±30mA
Input indication	LED light ON means normal ,OFF means external disconnection	
Response time	560ms/4 Channel, 880ms/8 Channel	
Digital input range	16 bits, code range:0~32000	
Precision	0.1% F.S	
Power supply	MPU use internal power supply, expansion modules use external power supply 24VDC ±10% 5VA	
Isolation mode	Optoelectronic isolation, no isolation between channels, analog & digital optical isolation	
Power consumption	24VDC ±20%,50mA(maximum)	

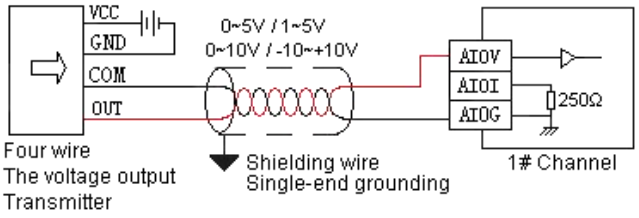
1.9 Analog Output (AQ) Specification

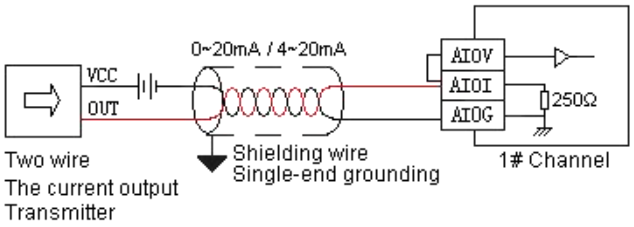
Item	Voltage output				Current output	
Output range	-10V~+10V	0V~ +10V	0V~+5V	1V~+5V	0~20mA	4~20mA
Resolution	5mV	2.5mV	1.25mV	1.25mV	5uA	5uA
Output load impedance	1KΩ@10V		≥500Ω@10V		≤500Ω	
Output indication	LED ON means normal					
Drive capability	10mA					
Response time	3ms					
Digital output range	12 bits,Code range:0~32000(H series module 16 bits D/A convert)					
Precision	0.2% F.S					
Power supply	MPU use internal power supply, expansion modules use external power supply 24VDC ±10% 5VA					
Isolation mode	Optoelectronic isolation, Non-isolation between Channels ,between analog and digital is optoelectronic isolation					
Power consumption	24VDC ±20%,100mA(maximum)					

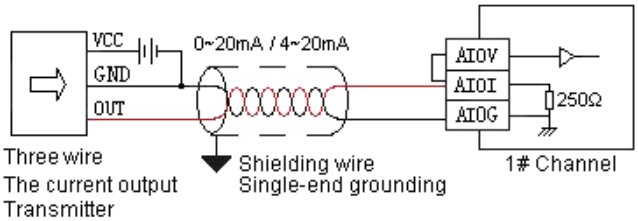
1.10 Analog Input (AI) Wiring Diagram

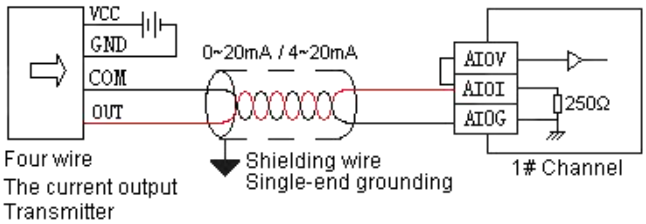


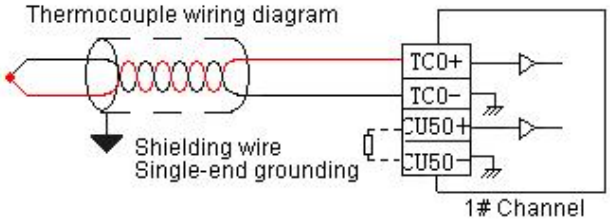


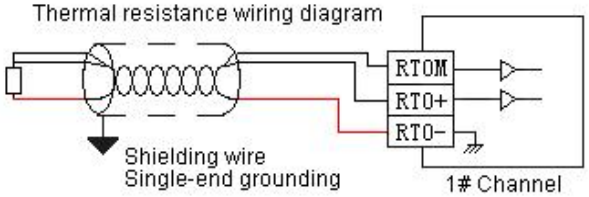




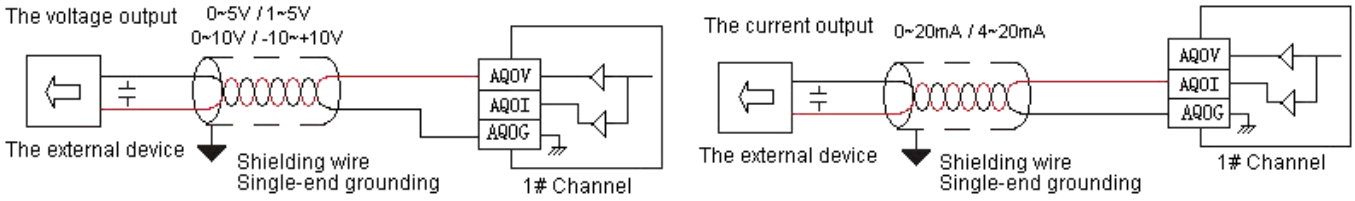




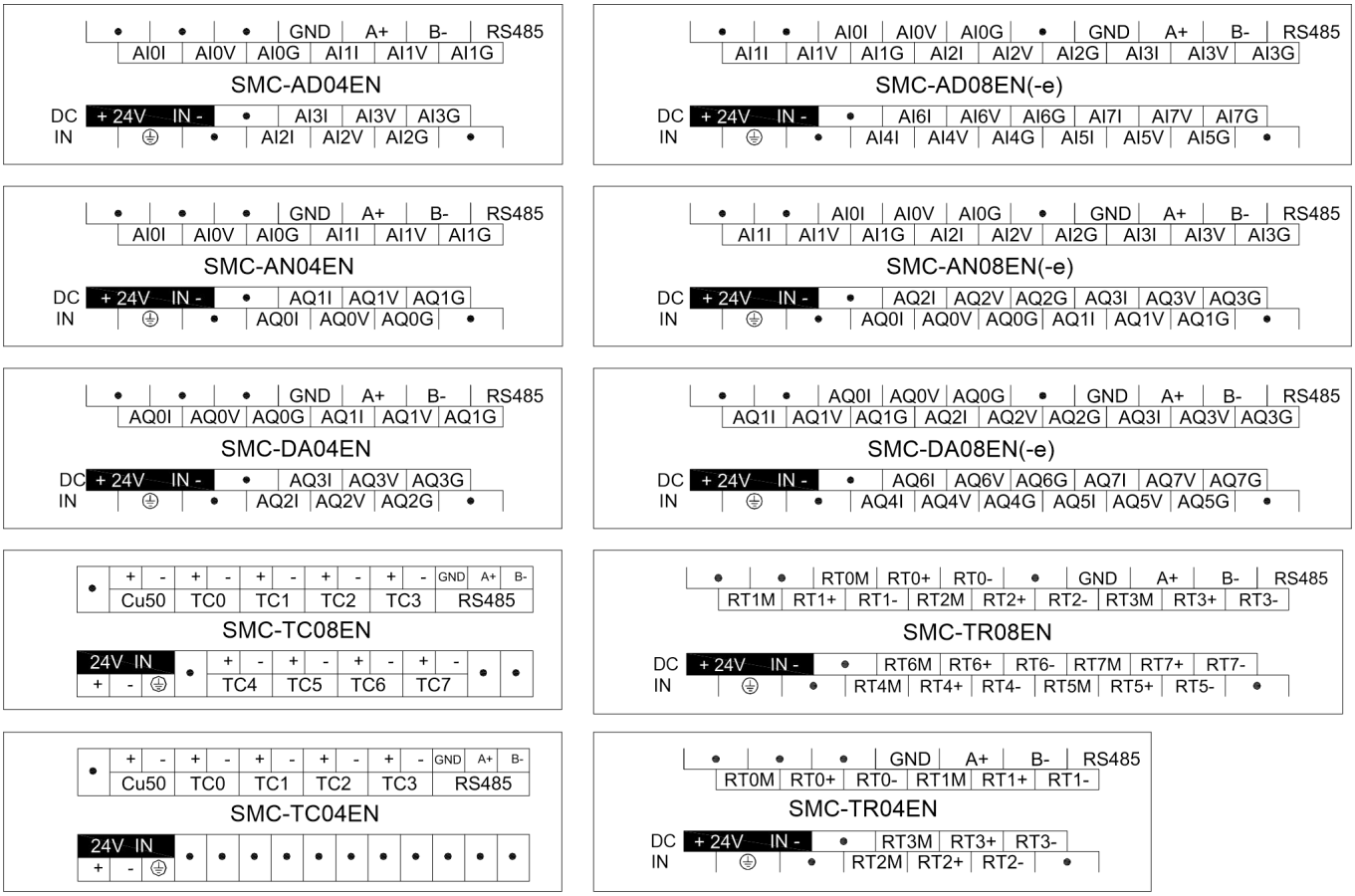




1.11 Analog Output (AQ) Wiring Diagram



1.12 Terminal Wiring Diagram



1.13 Module Parameter Table

Parameter table for 4-channel analog module

Note: CR code is corresponding to the Modbus register address, the ray parts are read-only, the white parts are readable and writable.

CR code	Function description		
	SMC-AD04EN	SMC-DA04EN	SMC-AN04EN
00H	Low byte for module code, and high byte for module version number.		
01H	Communication address		
02H	Communication protocol: The low 4-bit of the low byte: 0 - N,8,2 For RTU, 1 - E,8,1 For RTU, 2 - O,8,1 For RTU, 3 - N,7,2 For ASCII, 4 - E,7,1 For ASCII, 5 - O,7,1 For ASCII, 6 - N,8, 1 For RTU The high 4-bit of the low byte: 0 – 2400, 1 – 4800, 2 – 9600, 3 – 19200, 4 – 38400, 5 – 57600, 6 - 115200		
03H~06H	Module name		
07H~08H	Default IP address: 192.168.1.111		

CR code	Function description		
	SMC-AD04EN	SMC-DA04EN	SMC-AN04EN
09~0AH	Reserve		
0BH	High byte subnet mask (b3~b0,1 indicates 255, 0 indicates 0, for example subnet mask 255.255.255.0, b3~b0=1110), low byte reserved		
0CH-0EH	Reserve		
0FH	Error code: 0-Normal, 1-Illegal firmware identity, 2-Incomplete firmware, 3-System data access exception, 4-No external 24V power supply		
10H	channel 1 input value	channel 1 output value	input channel 1 input value
11H	channel 2 input value	channel 2 output value	input channel 2 input value
12H	channel 3 input value	channel 3 output value	input channel 1 signal type, note 2
13H	channel 4 input value	channel 4 output value	input channel 2 signal type, note 2
14H	channel 1 signal type, note 2	channel 1 signal type, note 2	Use the engineering value mark, note 4
15H	channel 2 signal type, note 2	channel 2 signal type, note 2	input channel 1 engineering lower limiting value
16H	channel 3 signal type, note 2	channel 3 signal type, note 2	input channel 2 engineering lower limiting value
17H	channel 4 signal type, note 2	channel 4 signal type, note 2	input channel 1 engineering upper limiting value
18H	Use the engineering value mark, note 4	Use the engineering value mark, note 4	input channel 2 engineering upper limiting value
19H	channel 1 engineering lower limiting value	channel 1 engineering lower limiting value	input channel 1 sampling frequency, note 1
1AH	channel 2 engineering lower limiting value	channel 2 engineering lower limiting value	input channel 2 sampling frequency, note 1
1BH	channel 3 engineering lower limiting value	channel 3 engineering lower limiting value	input channel 1 zero point correction value
1CH	channel 4 engineering lower limiting value	channel 4 engineering lower limiting value	input channel 2 zero point correction value
1DH	channel 1 engineering upper limiting value	channel 1 engineering upper limiting value	Channel 1~2 input disconnection alarm, note 3
1EH	channel 2 engineering upper limiting value	channel 2 engineering upper limiting value	output channel 1 output value
1FH	channel 3 engineering upper limiting value	channel 3 engineering upper limiting value	output channel 2 output value
20H	channel 4 engineering upper limiting value	channel 4 engineering upper limiting value	output channel 1 signal type, note 2
21H	channel 1 sampling frequency, note 1	power-off output mark, note 6	output channel 2 signal type, note 2
22H	channel 2 sampling frequency, note 1	channel 1 power-off output value	Use the engineering value mark, note 6
23H	channel 3 sampling frequency, note 1	channel 2 power-off output value	output channel 1 engineering lower limiting value
24H	Channel 4 sampling frequency, note 1	channel 3 power-off output value	output channel 2 engineering lower limiting value

CR code	Function description		
	SMC-AD04EN	SMC-DA04EN	SMC-AN04EN
25H	channel 1 zero point correction value	channel 4 power-off output value	output channel 1 engineering upper limiting value
26H	channel 2 zero point correction value	Channel indicator status, note 5	output channel 2 engineering upper limiting value
27H	channel 3 zero point correction value	Reserve	power-off output mark, note 6
28H	channel 4 zero point correction value		output channel 1 power-off output value
29H	Channel 1~4 input disconnection alarm, note 3		output channel 2 power-off output value
2AH	Reserve		output channel indicator, note 5
2BH~2FH			Reserve

Parameter table for 8-channel analog module

Note: CR code is corresponding to the Modbus register address, the gray parts are read-only, the white parts are readable and writable.

CR code	Function description		
	SMC-AD08EN	SMC-DA08EN	SMC-AN08EN
00H	Low byte for module code, and high byte for module version number.		
01H	Communication address		
02H	Communication protocol: The low 4-bit of the low byte: 0 - N,8,2 For RTU, 1 - E,8,1 For RTU, 2 - O,8,1 For RTU, 3 - N,7,2 For ASCII, 4 - E,7,1 For ASCII, 5 - O,7,1 For ASCII, 6 - N,8, 1 For RTU The high 4-bit of the low bytes: 0 – 2400, 1 – 4800, 2 – 9600, 3 – 19200, 4 – 38400, 5 – 57600, 6 - 115200		
03H~06H	Module name		
07H~08H	Default IP address: 192.168.1.111		
09~0AH	Reserve		
0BH	High byte subnet mask(b3~b0,1 indicates 255,0 indicates 0 , for example, subnet mask 255.255.255.0, b3~b0=1110), low byte Reserved		
0CH~0EH	Reserve		
0FH	Error code: 0-Normal, 1-Illegally firmware identity, 2-Incomplete firmware, 3-System data access exception, 4-No external 24V power supply		
10H	channel 1 input value	channel 1 output value	input channel 1 input value
11H	channel 2 input value	channel 2 output value	input channel 2 input value
12H	channel 3 input value	channel 3 output value	input channel 3 input value
13H	channel 4 input value	channel 4 output value	input channel 4 input value
14H	channel 5 input value	channel 5 output value	input channel 1 signal type, note 2
15H	channel 6 input value	channel 6 output value	input channel 2 signal type, note 2
16H	channel 7 input value	channel 7 output value	input channel 3 signal type, note 2
17H	channel 8 input value	channel 8 output value	input channel 4 signal type, note 2

CR code	Function description		
	SMC-AD08EN	SMC-DA08EN	SMC-AN08EN
18H	channel 1 signal type, note 2	channel 1 signal type, note 2	Use the engineering value mark, note 4
19H	channel 2 signal type, note 2	channel 2 signal type, note 2	input channel 1 engineering lower limiting value
1AH	channel 3 signal type, note 2	channel 3 signal type, note 2	input channel 2 engineering lower limiting value
1BH	channel 4 signal type, note 2	channel 4 signal type, note 2	input channel 3 engineering lower limiting value
1CH	channel 5 signal type, note 2	channel 5 signal type, note 2	input channel 4 engineering lower limiting value
1DH	channel 6 signal type, note 2	channel 6 signal type, note 2	input channel 1 engineering upper limiting value
1EH	channel 7 signal type, note 2	channel 7 signal type, note 2	input channel 2 engineering upper limiting value
1FH	channel 8 signal type, note 2	channel 8 signal type, note 2	input channel 3 engineering upper limiting value
20H	Use the engineering value mark, note 4	Use the engineering value mark, note 4	input channel 4 engineering upper limiting value
21H	channel 1 engineering lower limiting value	channel 1 engineering lower limiting value	input channel 1 sampling frequency, note 1
22H	channel 2 engineering lower limiting value	channel 2 engineering lower limiting value	input channel 2 sampling frequency, note 1
23H	channel 3 engineering lower limiting value	channel 3 engineering lower limiting value	input channel 3 sampling frequency, note 1
24H	channel 4 engineering lower limiting value	channel 4 engineering lower limiting value	input channel 4 sampling frequency, note 1
25H	channel 5 engineering lower limiting value	channel 5 engineering lower limiting value	input channel 1 zero point correction value
26H	channel 6 engineering lower limiting value	channel 6 engineering lower limiting value	input channel 2 zero point correction value
27H	channel 7 engineering lower limiting value	channel 7 engineering lower limiting value	input channel 3 zero point correction value
28H	channel 8 engineering lower limiting value	channel 8 engineering lower limiting value	input channel 4 zero point correction value
29H	channel 1 engineering upper limiting value	channel 1 engineering upper limiting value	Channel 1~4 input disconnection alarm, note 3
2AH	channel 2 engineering upper limiting value	channel 2 engineering upper limiting value	output channel 1 output value
2BH	channel 3 engineering upper limiting value	channel 3 engineering upper limiting value	output channel 2 output value
2CH	channel 4 engineering upper limiting value	channel 4 engineering upper limiting value	output channel 3 output value
2DH	channel 5 engineering upper limiting value	channel 5 engineering upper limiting value	output channel 4 output value
2EH	channel 6 engineering upper limiting value	channel 6 engineering upper limiting value	output channel 1 signal type, note 2

CR code	Function description		
	SMC-AD08EN	SMC-DA08EN	SMC-AN08EN
2FH	channel 7 engineering upper limiting value	channel 7 engineering upper limiting value	output channel 2 signal type, note 2
30H	channel 8 engineering upper limiting value	channel 8 engineering upper limiting value	output channel 3 signal type, note 2
31H	channel 1 sampling frequency, note 1	power-off output mark, note 8	output channel 4 signal type, note 2
32H	channel 2 sampling frequency, note 1	channel 1 power-off output value	Use the engineering value mark, note 4
33H	channel 3 sampling frequency, note 1	channel 2 power-off output value	output channel 1 engineering lower limiting value
34H	channel 4 sampling frequency, note 1	channel 3 power-off output value	output channel 2 engineering lower limiting value
35H	channel 5 sampling frequency, note 1	channel 4 power-off output value	output channel 3 engineering lower limiting value
36H	channel 6 sampling frequency, note 1	channel 5 power-off output value	output channel 4 engineering lower limiting value
37H	channel 7 sampling frequency, note 1	channel 6 power-off output value	output channel 1 engineering upper limiting value
38H	channel 8 sampling frequency, note 1	channel 7 power-off output value	output channel 2 engineering upper limiting value
39H	channel 1 zero point correction value	channel 8 power-off output value	output channel 3 engineering upper limiting value
3AH	channel 2 zero point correction value	Channel indicator status, note 5	output channel 4 engineering upper limiting value
3BH	channel 3 zero point correction value	Reserve	power-off output mark, note 6
3CH	channel 4 zero point correction value		output channel 1 power-off output value
3DH	channel 5 zero point correction value		output channel 2 power-off output value
3EH	channel 6 zero point correction value		output channel 3 power-off output value
3FH	channel 7 zero point correction value		output channel 4 power-off output value
40H	channel 8 zero point correction value		output channel indicator, note 5
41H	Channel 1~8 input disconnection alarm, note 3		Reserve
42H~4FH	Reserve		

Note:

① Sampling frequency:0 - 2 times, 1 - 4 times, 2 - 8 times, 3 - 16 times, 4 - 32 times, 5 - 64 times, 6 - 128 times, 7 - 256 times

② Signal type: 0 - [4,20]mA, 1 - [0,20]mA, 2 - [1,5]V, 3 - [0,5]V, 4 - [0,10]V, 5 - [-10,10]V

③ Disconnection alarm:Each bit indicates 1 channel, 0-normal, 1-disconnection

④ Use the engineering value mark:Each bit indicates 1 channel, 0-No, 1-Yes

⑤ Channel indicator status:Each bit indicates 1 channel, 0-off, 1-on

⑥ Power-off output mark:Each bit indicates 1 channel, 0-No, 1-Yes

Parameter table for 4-channel thermal resistance and thermocouple modules

Note: CR code is corresponding to the Modbus register address, the gray parts are read-only ,the white parts are readable and writable.

CR code	Function description	
	SMC-TR04EN	SMC-TC04EN
00H	Low byte for module code, and high byte for module version number	
01H	Communication address	
02H	Communication protocol: The low 4-bit of the low byte: 0 - N,8,2 For RTU，1 - E,8,1 For RTU，2 - O,8,1 For RTU，3 - N,7,2 For ASCII，4 - E,7,1 For ASCII，5 - O,7,1 For ASCII，6 - N,8, 1 For RTU The high 4-bit of the low byte: 0 – 2400，1 – 4800，2 – 9600，3 – 19200，4 – 38400，5 – 57600，6 - 115200	
03H~06H	Module name	
07H~08H	Default IP address: 192.168.1.111	
09~0AH	Reserve	
0BH	High byte subnet mask(b3~b0,1 indicates 255, 0 indicates 0, for example, subnet mask 255.255.255.0, b3~b0=1110), low byte reserved	
0CH-0EH	Reserve	
0FH	Error code: 0-Normal, 1-Illegal firmware identity, 2-Incomplete firmware, 3-System data access exception, 4-No external 24V power supply	
10H	channel 1 input value	channel 1 input value
11H	channel 2 input value	channel 2 input value
12H	channel 3 input value	channel 3 input value
13H	channel 4 input value	channel 4 input value
14H	channel 1 signal type, note 2	channel 1 signal type, note 3
15H	channel 2 signal type, note 2	channel 2 signal type, note 3
16H	channel 3 signal type, note 2	channel 3 signal type, note 3
17H	channel 4 signal type, note 2	channel 4 signal type, note 3
18H	Use the engineering value mark, note 5	Use the engineering value mark, note 5
19H	channel 1 engineering lower limiting value	channel 1 engineering lower limiting value
1AH	channel 2 engineering lower limiting value	channel 2 engineering lower limiting value
1BH	channel 3 engineering lower limiting value	channel 3 engineering lower limiting value
1CH	channel 4 engineering lower limiting value	channel 4 engineering lower limiting value
1DH	channel 1 engineering upper limiting value	channel 1 engineering upper limiting value
1EH	channel 2 engineering upper limiting value	channel 2 engineering upper limiting value
1FH	channel 3 engineering upper limiting value	channel 3 engineering upper limiting value
20H	channel 4 engineering upper limiting value	channel 4 engineering upper limiting value
21H	channel 1 sampling frequency, note 1	channel 1 sampling frequency, note 1
22H	channel 2 sampling frequency, note 1	channel 2 sampling frequency, note 1
23H	channel 3 sampling frequency, note 1	channel 3 sampling frequency, note 1
24H	channel 4 sampling frequency, note 1	channel 4 sampling frequency, note 1
25H	channel 1 zero point correction value	channel 1 zero point correction value
26H	channel 2 zero point correction value	channel 2 zero point correction value
27H	channel 3 zero point correction value	channel 3 zero point correction value
28H	channel 4 zero point correction value	channel 4 zero point correction value

CR code	Function description	
	SMC-TR04EN	SMC-TC04EN
29H	Channel 1~4 input disconnection alarm, note 4	Channel 1~4 input disconnection alarm, note 4
2AH	Reserve	Reserve
2BH~2FH		

Parameter table for 8-channel thermal resistance and thermocouple modules

CR code	Function description	
	SMC-TR08EN	SMC-TC08EN
00H	Low byte for module code, and high byte for module version number	
01H	Communication address	
02H	Communication protocol: The low 4-bit of the low byte: 0 - N,8,2 For RTU，1 - E,8,1 For RTU，2 - O,8,1 For RTU，3 - N,7,2 For ASCII，4 - E,7,1 For ASCII，5 - O,7,1 For ASCII，6 - N,8, 1 For RTU The high 4-bit of the low byte: 0 – 2400，1 – 4800，2 – 9600，3 – 19200，4 – 38400，5 – 57600，6 - 115200	
03H~06H	Module name	
07H~08H	Default IP address:192.168.1.111	
09~0AH	Reserve	
0BH	High byte subnet mask(b3~b0,1indicates 255, 0 indicates 0, for example subnet mask 255.255.255.0, b3~b0=1110), low byte reserved	
0CH~0EH	Reserve	
0FH	Error code: 0-Normal, 1-Illegal firmware identity, 2-Incomplete firmware, 3-System data access exception, 4-No external 24V power supply	
10H	channel 1 input value	channel 1 input value
11H	channel 2 input value	channel 2 input value
12H	channel 3 input value	channel 3 input value
13H	channel 4 input value	channel 4 input value
14H	channel 5 input value	channel 5 input value
15H	channel 6 input value	channel 6 input value
16H	channel 7 input value	channel 7 input value
17H	channel 8 input value	channel 8 input value
18H	channel 1 signal type, note 2	channel 1 signal type, note 3
19H	channel 2 signal type, note 2	channel 2 signal type, note 3
1AH	channel 3 signal type, note 2	channel 3 signal type, note 3
1BH	channel 4 signal type, note 2	channel 4 signal type, note 3
1CH	channel 5 signal type, note 2	channel 5 signal type, note 3
1DH	channel 6 signal type, note 2	channel 6 signal type, note 3
1EH	channel 7 signal type, note 2	channel 7 signal type, note 3
1FH	channel 8 signal type, note 2	channel 8 signal type, note 3
20H	Use the engineering value mark, note 5	Use the engineering value mark, note 5
21H	channel 1 engineering lower limiting value	channel 1 engineering lower limiting value
22H	channel 2 engineering lower limiting value	channel 2 engineering lower limiting value
23H	channel 3 engineering lower limiting value	channel 3 engineering lower limiting value

CR code	Function description	
	SMC-TR08EN	SMC-TC08EN
24H	channel 4 engineering lower limiting value	channel 4 engineering lower limiting value
25H	channel 5 engineering lower limiting value	channel 5 engineering lower limiting value
26H	channel 6 engineering lower limiting value	channel 6 engineering lower limiting value
27H	channel 7 engineering lower limiting value	channel 7 engineering lower limiting value
28H	channel 8 engineering lower limiting value	channel 8 engineering lower limiting value
29H	channel 1 engineering upper limiting value	channel 1 engineering upper limiting value
2AH	channel 2 engineering upper limiting value	channel 2 engineering upper limiting value
2BH	channel 3 engineering upper limiting value	channel 3 engineering upper limiting value
2CH	channel 4 engineering upper limiting value	channel 4 engineering upper limiting value
2DH	channel 5 engineering upper limiting value	channel 5 engineering upper limiting value
2EH	channel 6 engineering upper limiting value	channel 6 engineering upper limiting value
2FH	channel 7 engineering upper limiting value	channel 7 engineering upper limiting value
30H	channel 8 engineering upper limiting value	channel 8 engineering upper limiting value
31H	channel 1 sampling frequency, note 1	channel 1 sampling frequency, note 1
32H	channel 2 sampling frequency, note 1	channel 2 sampling frequency, note 1
33H	channel 3 sampling frequency, note 1	channel 3 sampling frequency, note 1
34H	channel 4 sampling frequency, note 1	channel 4 sampling frequency, note 1
35H	channel 5 sampling frequency, note 1	channel 5 sampling frequency, note 1
36H	channel 6 sampling frequency, note 1	channel 6 sampling frequency, note 1
37H	channel 7 sampling frequency, note 1	channel 7 sampling frequency, note 1
38H	channel 8 sampling frequency, note 1	channel 8 sampling frequency, note 1
39H	channel 1 zero point correction value	channel 1 zero point correction value
3AH	channel 2 zero point correction value	channel 2 zero point correction value
3BH	channel 3 zero point correction value	channel 3 zero point correction value
3CH	channel 4 zero point correction value	channel 4 zero point correction value
3DH	channel 5 zero point correction value	channel 5 zero point correction value
3EH	channel 6 zero point correction value	channel 6 zero point correction value
3FH	channel 7 zero point correction value	channel 7 zero point correction value
40H	channel 8 zero point correction value	channel 8 zero point correction value
41H	Channel 1~8 input disconnection alarm, note 4	Channel 1~8 input disconnection alarm, note 4
42H~4FH	Reserve	Reserve

Note:

① Sampling frequency: 0 - 2 times, 1 - 4 times, 2 - 8 times, 3 - 16 times, 4 - 32 times, 5 - 64 times, 6 - 128 times, 7 - 256 times

② RTD signal type: 0 - Pt100, 1 - Pt1000, 2 - Cu50, 3 - Cu100

③ Thermocouple signal type: 0 - S, 1 - K, 2 - T, 3 - E, 4 - J, 5 - B, 6 - N, 7 - R, 8 – Wre3/25, 9- Wre5/26, 10 - [0,20]mV, 11 - [0,50]mV, 12 - [0,100]mV

④ Disconnection alarm：Each bit indicates 1 channel, 0-normal, 1-disconnection

⑤ Use the engineering value mark: Each bit indicates 1 channel, 0-No, 1-Yes

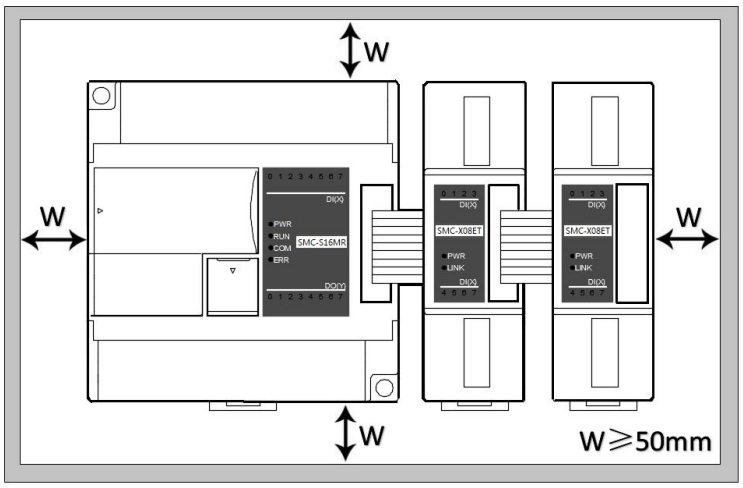
1.14 Mounting and Installation

The PLC should be secured to an enclosed cabinet while mounting. For heat dissipation, make sure to provide a minimum clearance of 50mm between the unit and all sides of the cabinet. (See the figure.)

Rail Mounting: Use standard 35 mm rail.

Screw Mounting: Each MPU or expansion module has two positioning screw holes, the diameter of the hole is 4.5mm. Please refer to the dimension figure for the location of the positioning holes and their spacing.
To avoid over temperature and for a better heat dissipation, do not mount PLC to a position near to the bottom/top of the cabinet. Do not mount PLC in vertical direction.

Expansion Module Wiring: Connections between expansion modules and connections between module and MPU are achieved through bus. One expansion cable will be configured to every expansion module, for the connection between two different modules.Connection methods: turn the right side of extended interface(the last MPU or expansion module) over, plug the expansion cable in the extended interface, then press down the cover of the extended interface to reset the interface, the extended interface at the right side of the module will be reserved for expansion of the next module. Connect all expansion modules in turn in the same way.



Chapter 2 Application Case

2.1 Expand Module Through the Host PLC Parallel Port

2.1.1 Module power supply

Analog module can be the expansion module for any host PLC; When the module is directly hung behind the host PLC by parallel bus, no need to take external power supply, the module is powered by host PLC' parallel port, if the power supply of module is insufficient (the PWR power indicator does not light), then according to different models, the module can be powered by 24VDC or 220VAC. When the module is extended through the parallel port, it is recommended to use 24VDC module. Module power supply example:

①When the host PLC can be expanded to 7 modules, the PWR indicators of frist five modules are long bright, indicating the modules power supply are normal, and if the PWR indicators of the 6th and 7th modules are not light, appearing insufficient power supply, as long as the 6th and 7th modules are taken external power supply.

②When the host PLC with 1 expansion module, because the host PLC provides power supply through the parallel port, the PWR indicator of modue will light; If the module is added external power supply, it can still work, this time the module will automatically determine and give priority to external power supply.

2.1.2 The analog need't be written any conversion program, read the analog register value directly.

For example, the host PLC SMC-S16MT, respectively, is expanded with three modules of SMC-AD04EN, SMC-DA04EN and SMC-AN08EN through the parallel port from left to right, assuming the scene:

Analog module SMC-AD04EN input channel 1, signal type is 4-20mA, used to measure the pressure, the pressure range of 0.0~3.0Mpa;

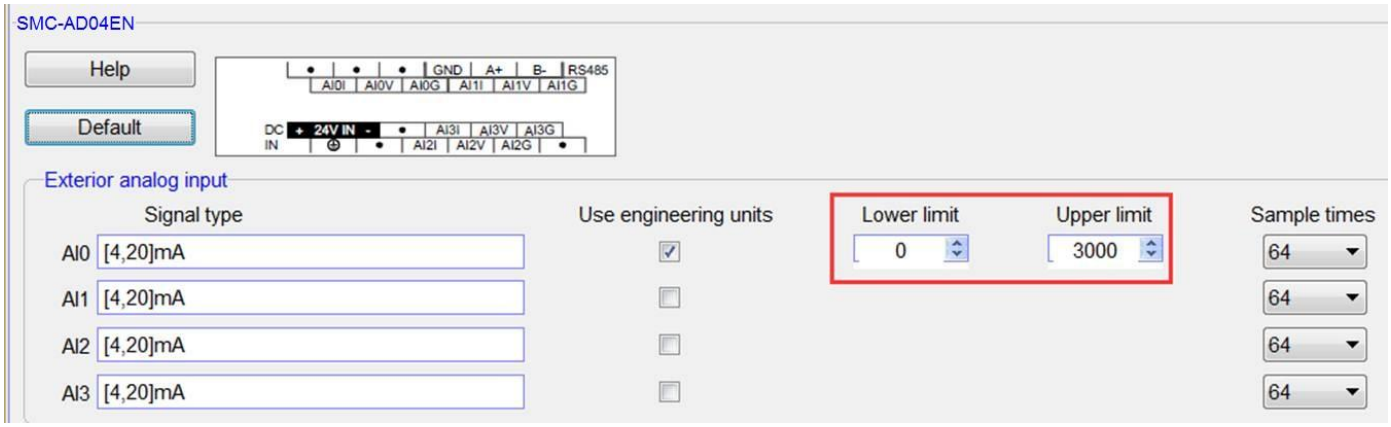
Analog module SMC-DA04EN input channel 1, signal type is 0-10V, used to control the inverter frequency of 0.0~50.0Hz;

First enter the PLC programming software menu bar - view - hardware configuration, in accordance with the external order of actual modules to add the module models, after added, the analog address will be automatically arranged, as shown below:

PGB: Hardware configure

Module type	X Component	Y Component	AI Component	AQ Component	Other
SMC-S16MT(-e)	X0 - X7	Y0 - Y7			COM1-2 HSC0-1 PLS0-1
SMC-AD04EN			AI0 - AI3		
SMC-DA04EN				AQ0 - AQ3	
SMC-AN08EN			AI4 - AI7	AQ4 - AQ7	

SAVCH analog module need't be written any conversion program, as for above pressure measurement, we only need to check the use of engineering value, set the lower limit value of 0 corresponding 0.0Mpa, set the upper limit value of 3000 indicating 3.000Mpa, the upper limit value 3000 hidden three decimal places can achieve magnification times and improve accuracy. Then we read the value of the analog input register AI0, if AI0 = 1234, then the actual value is 1.234Mpa.



Similarly, for the analog output, check the use of engineering value, set the lower limit value of 0 indicating 0.0Hz, set the upper limit value of 500 indicating 50.0Hz, if you want the inverter frequency output is 25.6Hz, as long as force the AQ0 value as 256 or through other logic instructions to output the AQ0 value of 256. As shown below:

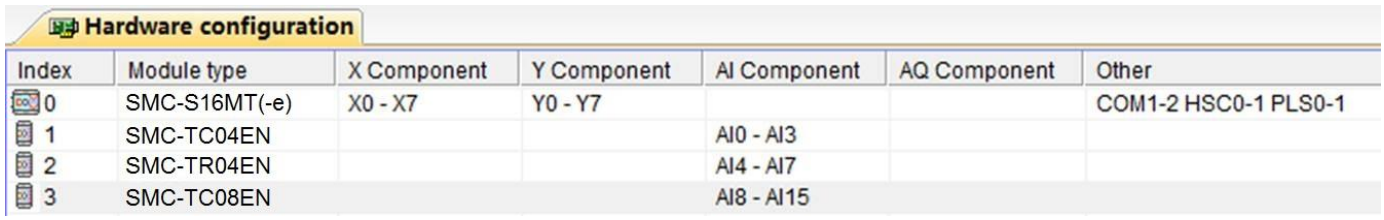
2.1.3 Temperature modules need't be written any conversion program, read the current temperature value directly when access the sensor

For example, the host PLC SMC-S16MT, respectively, is expanded with three modules of SMC-TC04EN, SMC-TR04EN and SMC-TC08EN through the parallel port from left to right, assuming the scene:

Thermocouple module SMC-TC04EN input channel 1, signal type is K, input channel 2, signal type is E;

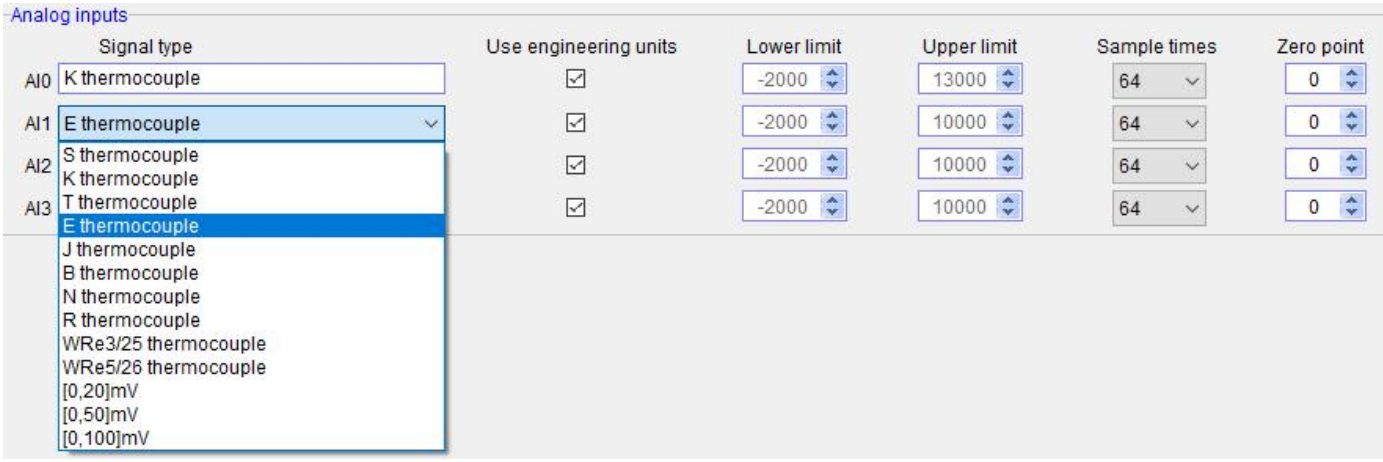
Thermal resistance module SMC-TR04EN input channel 1, signal type is PT100, SMC-TR04EN input channel 2, signal type is PT1000;

First enter the PLC programming software menu bar - view - hardware configuration, in accordance with the external order of actual modules to add the module models, after added, the analog addresses will be automatically arranged, as shown below:



Index	Module type	X Component	Y Component	AI Component	AQ Component	Other
0	SMC-S16MT(-e)	X0 - X7	Y0 - Y7			COM1-2 HSC0-1 PLS0-1
1	SMC-TC04EN			AI0 - AI3		
2	SMC-TR04EN			AI4 - AI7		
3	SMC-TC08EN			AI8 - AI15		

SAVCH temperature and humidity module need't be written any conversion program, for the above measuring temperature, we only need to select the corresponding channel signal type, check the use of engineering value and full index number by default, for example, the above module SMC-TC04EN input channel 1, the signal type is K; the input channel 2, the signal type is E, as long as we set the hardware configuration:

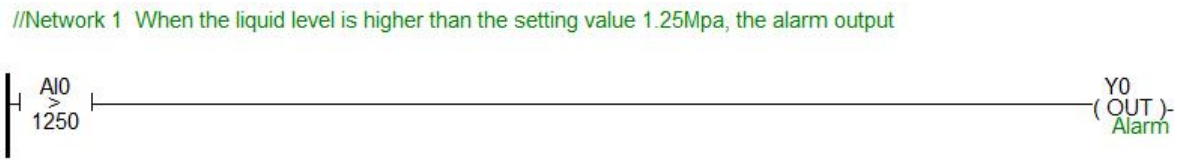


In this way, after configuration, as long as connect the K-type thermocouple to channel 1, then directly read AI0 register value, AI0 = 123, that is the actual value of 12.3 ℃. In the same way, connect E-type thermocouple to channel 2, read AI2 value, such as AI2 = 3456, that is the actual value of 345.6 ℃.

As we know that SAVCH temperature and humidity modules can be set the signal type of each channel arbitrarily, so for the SMC-TR04EN module, after configuration, we can read the temperature value directly when connecting the corresponding sensor to the channel.

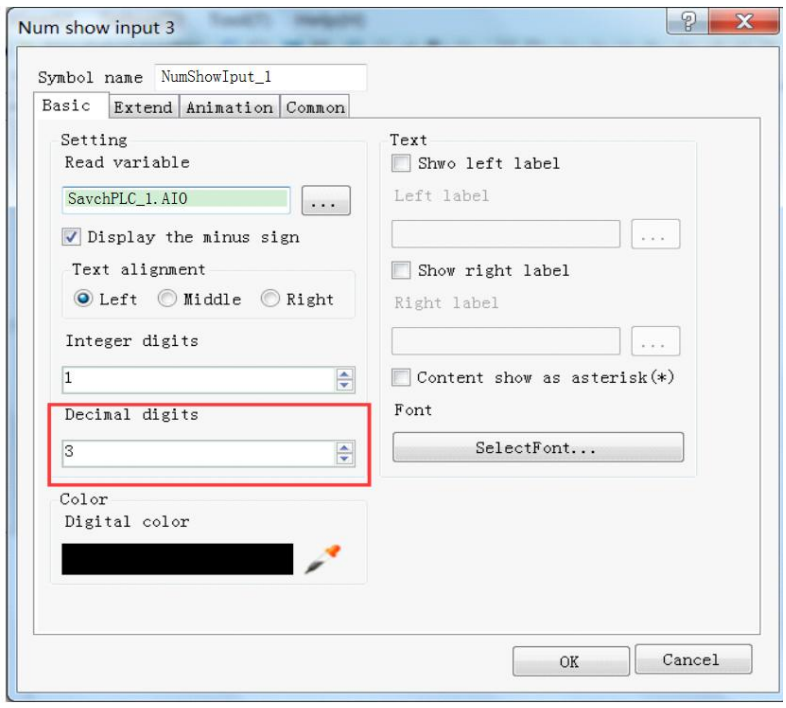
2.1.4 Programming skills

If you want to write the alarm program that pressure exceeds the setting value,for example, when the pressure is more than 1.25Mpa, it will alarm, the program of PLC can be written as follows:



2.1.5 Display analog value/ temperature value on SCADA, HMI

If the configuration, touch screen, text and other PC software want to display the current pressure, only need to set three decimal places on the numerical display primitive, then the read value will be automatically reduced 1000 times in the configuration, that is the actual temperature value, for example, you can set 3 on decimal places of SAVCH Cloud SCADA settings.



So that when the PLC read AI0 value, AI0=1234, that is the actual value of 1.234Mpa, there is no need to have data processing in PLC and configuration, only set the 3 decimal places on the numerical display primitive, then it will be automatically reduced by 1000 times, displaying value of 1.234, that is the actual value of 1.234Mpa.

Note: the temperature module only needs to set 1 decimal place. So that when the PLC read AI0 value, AI0=123, that is the actual value of 12.3℃, there is no need to have data processing in PLC and configuration, only set the 1 decimal places on the numerical display primitive, then it will be automatically reduced by 10 times, displaying value of 12.3, that is the actual value of 12.3℃.

2.1.6 When the engineering value is not used, the default code value is 0 ~ 32000

When using the engineering value, the linear transformation is specified by the lower limit and the upper limit value, and the program is automatically transformed. When the engineering value is not used, all types are unified to correspond with 0 ~ 32000 code value.The same case of pressure measurement, this time can according to the linear transformation formula: Out = (In - InDw) * (OutUp- OutDw) / (InUp- InDw) + OutDw to write the conversion program, or use the SC linear transformation instructions to calculate directly.

SAVCH analog used easily, it is recommended to check the use of engineering value, so that the analog will be very convenient without writing any program.

2.1.7 Module CR code application example: Read the module channel disconnection alarm

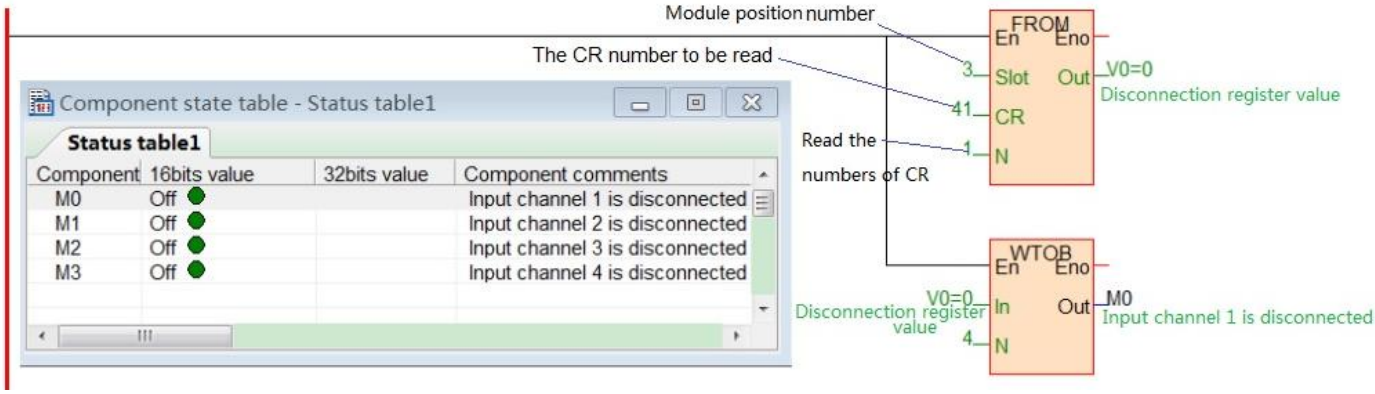
In this example, in order to read the external sensor disconnection information of SMC-AN08EN module, the disconnection alarm data of SMC-AN08EN module input channel 1-4 is stored in CR29, that is, 29H (hexadecimal), decimal 41. (More CR contents can be found in the software online help - hardware manual - expansion module parameters within the corresponding model).

This program is as follows:

Slot: Position number, SMC-AN08EN is the third module, so fill in 3;

CR: Module disconnection alarm CR41, that is, 29H (hexadecimal) = 41 (decimal), it can be directly input 41 or 0x29 into the instruction CR terminal;

N: Number for readings, 1 register for 16 bits, low 4 bits corresponding channel 1-4, disconnection for 1 (ON), normal for 0 (OFF).



2.2 Module Used as Remote IO

SAVCH PLC expansion module is built-in one RS485 communication port(Some models with Ethernet communication port), which not only supports parallel bus(Use the expansion bus to connect with the parallel interface of host PLC), but also supports serial bus(Use the RS485 communication port of module networking with communication port of host PLC, and host PLC controls the remote module by communication instructions), when using the serial bus to expand (that is, remote IO module), it doesn't have expansion limit of system points and can be distributed installation.

Distributed installation is very important for the system which needs to collect and monitor a large number of decentralized digital or analog signals(temperature, humidity, differential pressure, blowing rate, flow, fan speed, valve opening, etc.), it can easily achieve distributed installation control and unlimited points of expansion, greatly improving the control system configuration flexibility and future control expansion capabilities, reducing the number of signal wiring, also reducing the interference problem of too long analog signal line, saving the project investment costs.

The following will introduce the operation key points and techniques.

2.2.1 Module power supply

When the module is used as remote IO, independent power supply is needed for the module. If the module is powered normally, the PWR indicator will light.

2.2.2 Communication port introduction

① All analog modules are built-in RS485 port.

② As for 8-point analog module, you can choose the Ethernet port.

③ RS485 communication port and Ethernet port can be used at the same time, for example, the RS485 of module communicates with PLC, Ethernet port can also communicates with multiple host computers (up to 7).

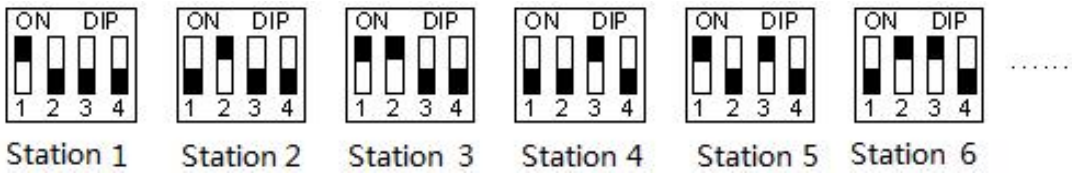
2.2.3 Communication protocols and default parameters

RS485: Support standard Modbus RTU / ASCII protocol, it can communicate with the configuration, touch screen, text, PLC and other third-party host computer, which must support Modbus protocol. Among them:

Address: 1 ~ 254 can be set; module address is divided into soft address and hard address, hard address has the highest priority.

Soft address: The address set through programming software - remote tool, address range 1-254;

Hard address:The address set through the 4-bit DIP switch of module hardware, address range 1-15. Hardware address setting example:



Baud rate: 2400, 4800, 9600, 19200, 38400, 57600, 115200 optional;

Data format : N, 8, 2 RTU, E, 8, 1 RTU, O, 8, 1 RTU, N, 8, 1 RTU, E, 7, 1 ASCII, O, 7, 1 ASCII, N, 7, 2 ASCII optional.

RS485 default parameter: 19200, N 8 2 RTU, station number is 1.

Ethernet +: Support the standard Modbus TCP protocol, it can communicate with the configuration, touch screen, PLC and other third-party host computers, which must support Modbus TCP protocol.

Among them:

Ethernet default parameters:

IP: 192.168.1.111

Subnet mask: 255.255.255.0

Gateway: 192.168.1.1

2.2.4 Module parameter configuration method introduction, when the module is used as remote IO

There are three ways to configure remote IO parameters:

① It can be configured via programming software - tools - remote modules (recommended);

② It can be configured via the hardware configuration and TO instructions, when the module is hung behind the host PLC through the parallel port;

③ It can be configured via MODW instructions through the serial communication.

2.2.5 Parameter configuration example: The module is configured by programming software remote module tool

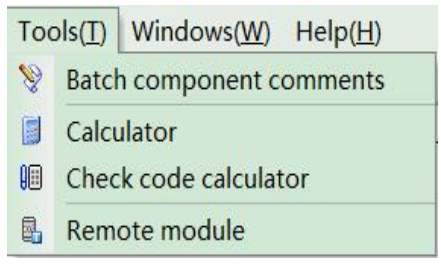
Hardware connection

① Through the RS485 communication port (the terminals of A +,B- on the module) connection: If the computer has a serial port, you can use the converter of 232 to 485 connecting with the module; if it has one USB interface, you can use the converter of USB to 485 connecting with the module.

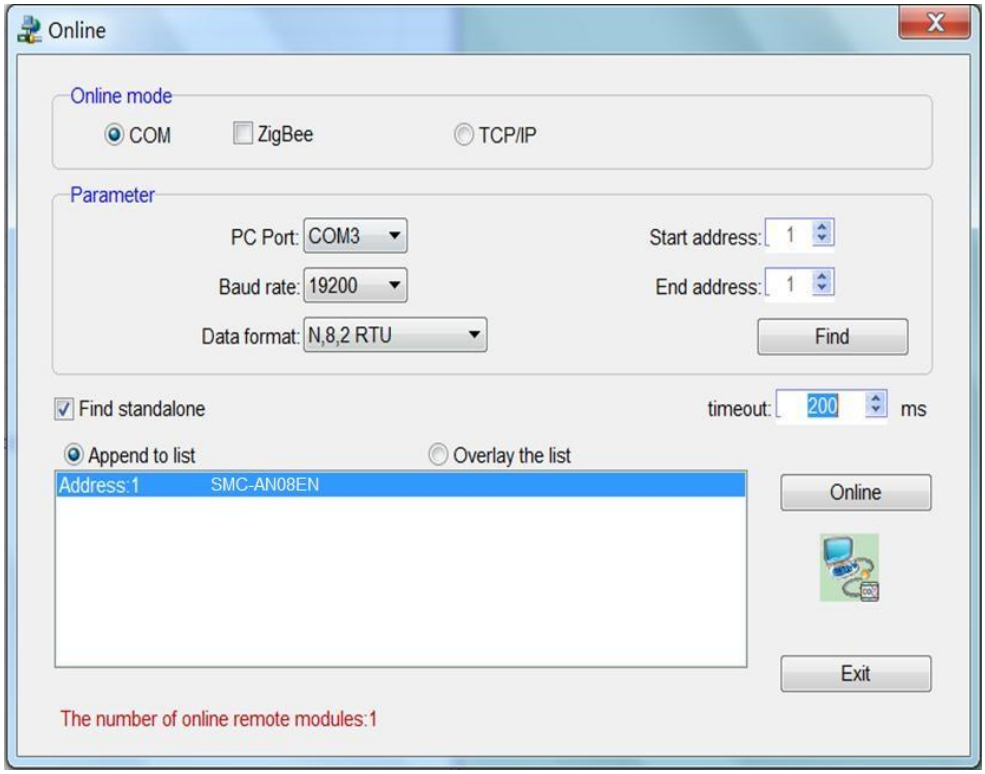
② Through the connection of Ethernet + communication interface: You can connect the module with the computer's network port directly by the standard network cable, or take the computer and module connected to the switch.

Software operation steps

Click on the the menu bar tool of programming software- "remote module":

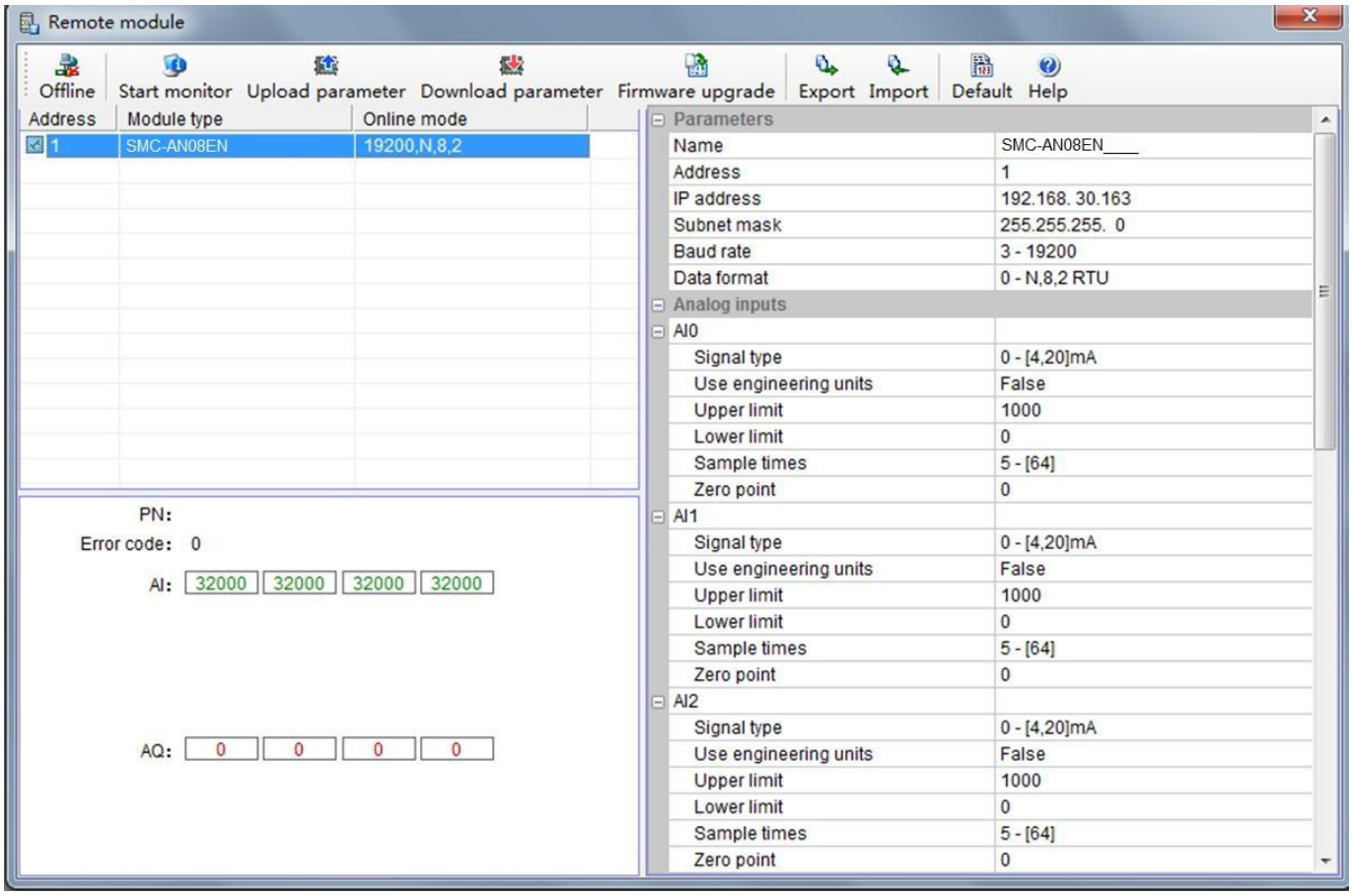


Click the button  in the pop-up window to open the "Online" window. The module default address is 1,19200, N 8 2 RTU, the online success is as follows:

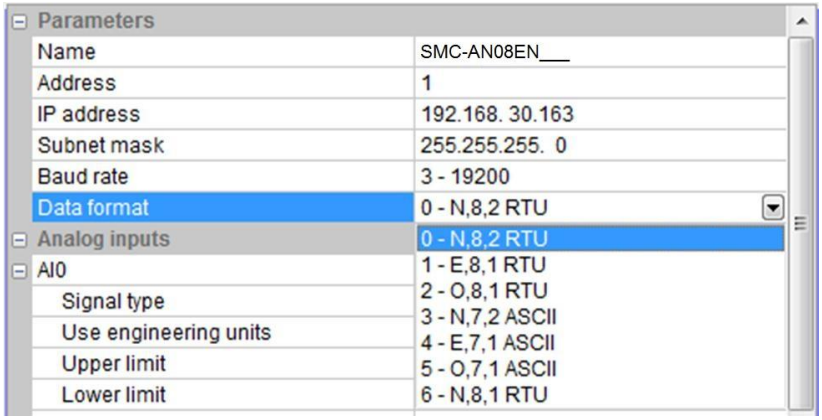


If there is only one machine connected with 485 line, then check "stand-alone search"; if there are more than one, then remove the button of "stand-alone search", and set the start address and end address, so that all the machines connected with 485 line can be found and achieve parameter configuration.

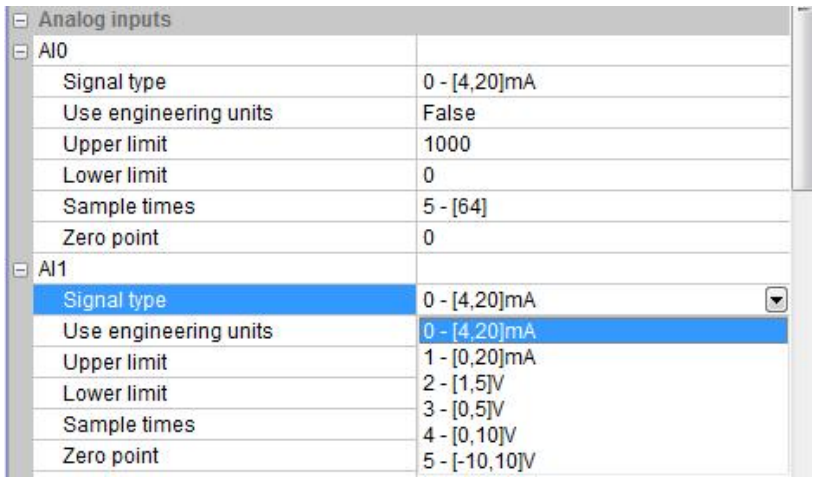
Click to exit, enter the configuration interface, as shown below:



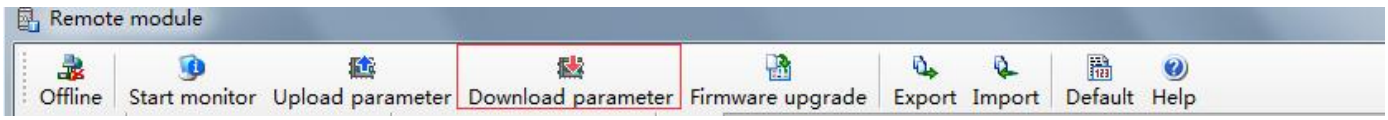
We can change the module name, address, IP, subnet mask, baud rate, data format and other communication parameters in the communication parameter area.



In the external analog input area, we can set the signal type of each channel, choose whether to use engineering value or not, the upper and lower limits of engineering value(it can be set if you check the use of engineering value), sampling times and zero correction.



After setting, select the "parameter download" to download the parameter into the module.



In addition, we can do the following operations through the remote module tool:

① Online monitoring the channel value of module, error code.

② Upload the module paramater, upgrade the module firmware, then make the module support new features.

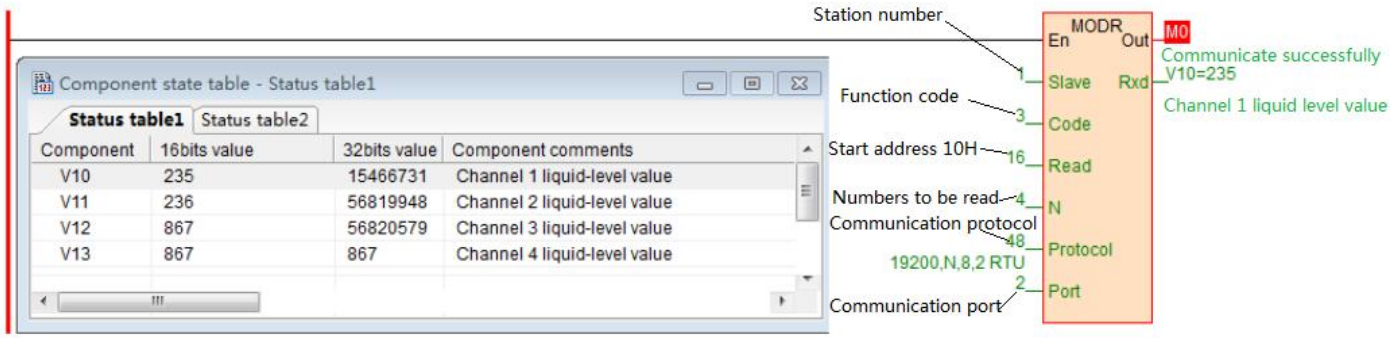
③ It can export the module configuration to save or import and restore the default value.

2.2.6 Remote IO application example (RS485 mode): The PLC read the 4 communication temperature values of SMC-AD04EN module

① Hardware wiring: PLC connects to 485 port of module by shielded twisted pair, A + connects to A +, B- connects to B-, if the PLC connects to multiple remote IO modules, it needs to use Hand in hand way to connect.

② Modbus address: From the above 4-channel analog CR parameter table shows that, the channel 1 ~ 4 input values are stored in 10H ~ 13H of SMC-AD04EN module.

③ PLC program: Host PLC wants to read the 4-channel liquid level values of remote IO module SMC-AD04EN, 0 ~ 1000 indicates that 0 ~ 1.0m. In this example, SMC-AD04EN communication is the default parameter: Station number address is 1, baud rate is 19200, data format is N 8 2 RTU. The program of PLC reads the 4-channel liquid level value is as follows:



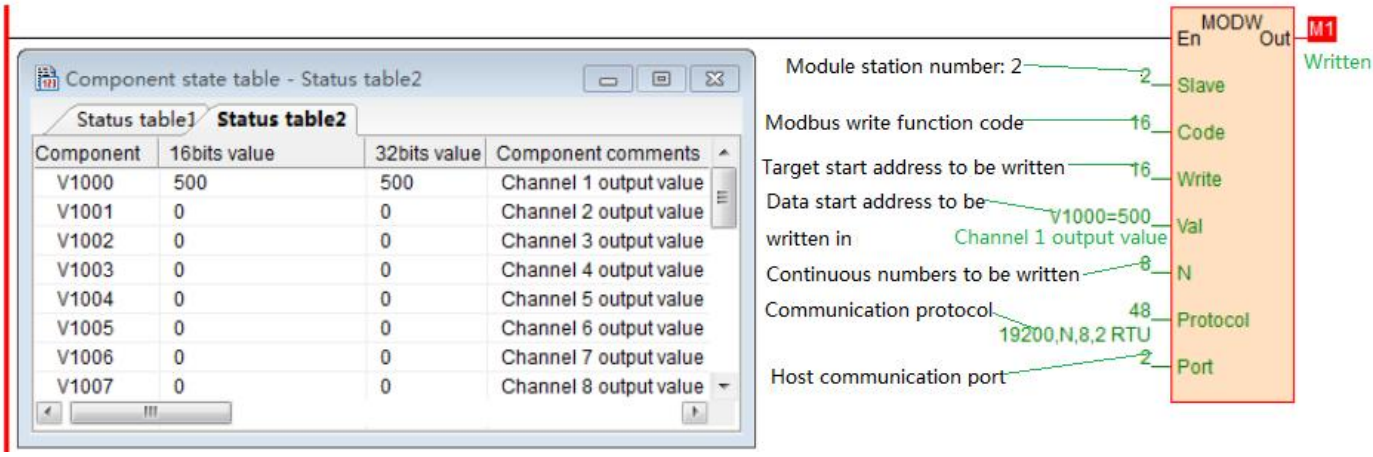
The host PLC reads the 4-channel liquid level values of SMC-AD04EN by Modbus read instruction MODR, the start address is 10H (hexadecimal), that is, the decimal value is 16. When the communication is successful, M0 is ON, the liquid level values which are read back will be stored in V0-3, V0=235, indicating that the actual temperature of the first channel is 0.235m, the same as V3=867, indicating that the actual temperature of the fourth channel is 0.867m.

2.2.7 Remote IO application example (RS485 mode): The PLC writes the 8-channel output values of SMC-DA08EN module

① Hardware wiring: PLC connects to 485 port of module by shielded twisted pair, A + connects to A +, B- connects to B-, if the PLC connects to multiple remote IO modules, it needs to use Hand in hand way to connect.

② Modbus address: From the above 8-channel analog CR parameter table shows that, the channel 1 ~ 8 output values of SMC-DA08EN module are stored in address 10H~17H .

③ PLC program: Host PLC wants to write the 8-channel analog output values of remote IO module SMC-DA08EN. In this example, SMC-DA08EN communication parameters: Station number address is 2 (set by DIP switch), baud rate 19200, data format N 8 2 RTU. The program of writing 8-channel analog output values is as follows:



Host PLC writes the 8-channel analog output values of SMC-DA08EN by Modbus write instruction MODW, the start address is 10H (hexadecimal), that is, the decimal value is 16. When writing successfully, M1 is ON, the 8-channel values which will be written into are stored in V1000-1007.

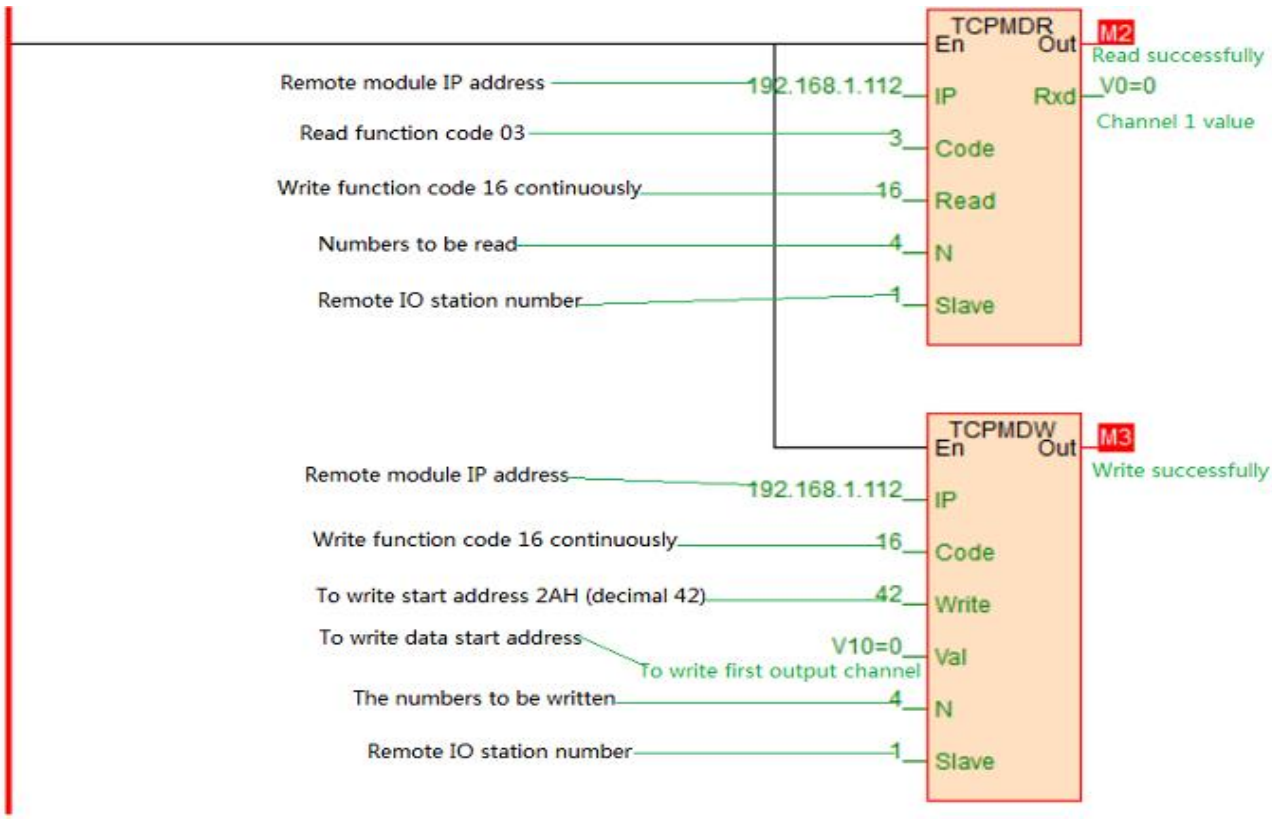
In this example, for the channel 1 of analog output, check the use of engineering value, the lower limit value is 0, the upper limit value is 3600, indicating that the valve opening is 0.0~360.0°, this case V1000=500, so the first output channel value is 500, that is, the valve opening is 50.0°.

2.2.8 Remote IO application example (Ethernet mode): PLC read and write each channel input and output values of SMC-AN08EN-e

① Hardware wiring: PLC and module Ethernet port connected with a shielded network cable, they can be connected directly or through the switch.

② Modbus address: From the above SMC-AN08EN-e analog module CR parameter table shows that the input values of module input channel 1 ~ 4 are stored in the address 10H ~ 13H. The output values of module output channel 1-4 are stored in 2AH ~ 2DH.

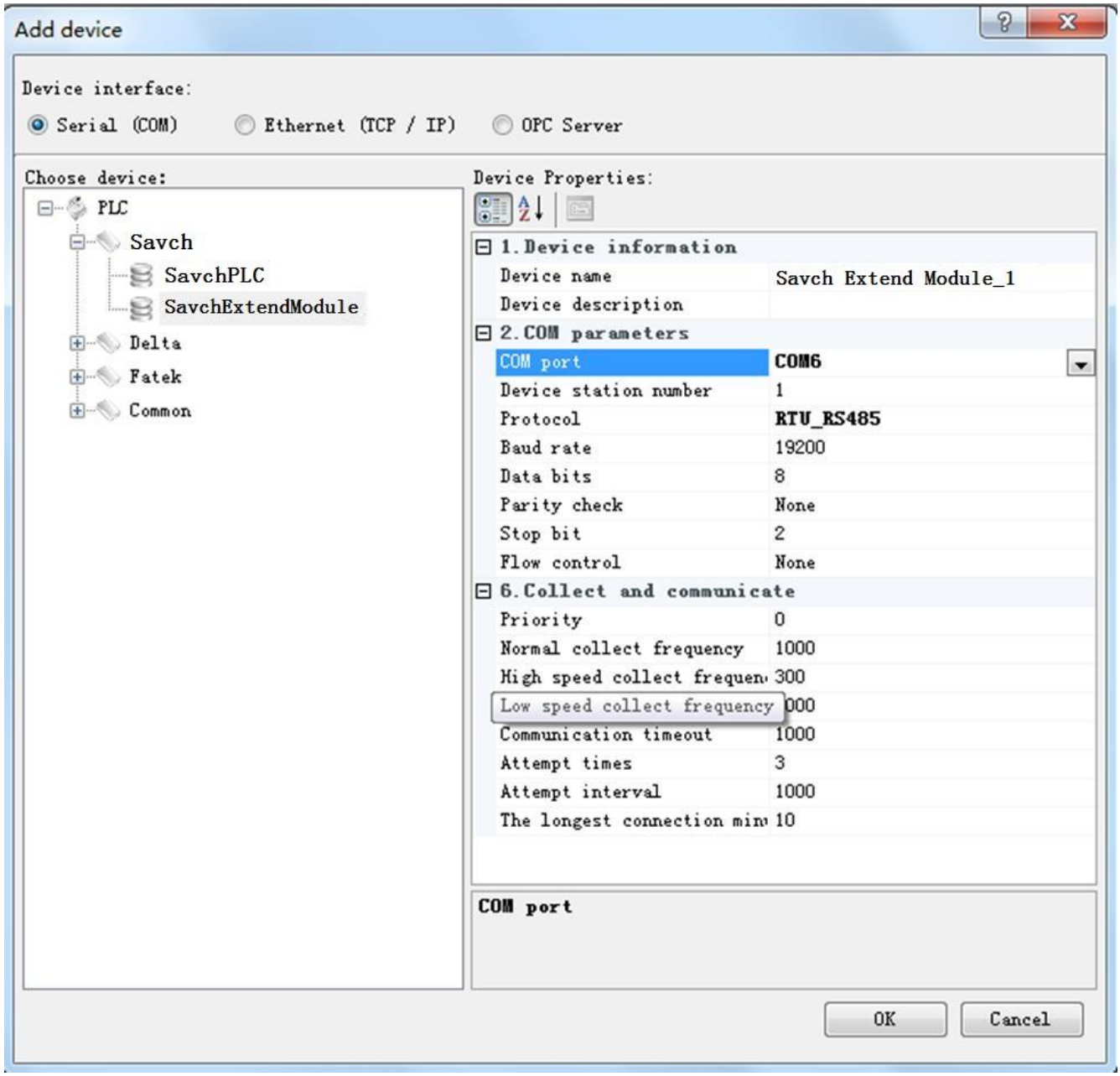
③ PLC program: Read the 4-channel measurements of remote Ethernet module SMC-AN08EN-e and write the 4-channel output values of SMC-AN08EN-e, if the module IP address is 192.168.1.112, station number address is 1, the read results are stored in the V0 ~ V3, the values to be written are stored in the register V10-V13. As follows:



2.2.9 SAVCH Cloud configuration communicates directly with SMC-AD08EN module example

Open SAVCH SCADA software, select the "new project", choose to add the device in the "device", then choose serial port or Ethernet according to the module which supports the Ethernet or RS485, this example for serial port, the serial port number of USB to 485 is COM6, as shown below:

Default parameter 19200 N 8 2 RTU for the module, station number address is 1. And directly select SAVCH remote module driver in serial port：

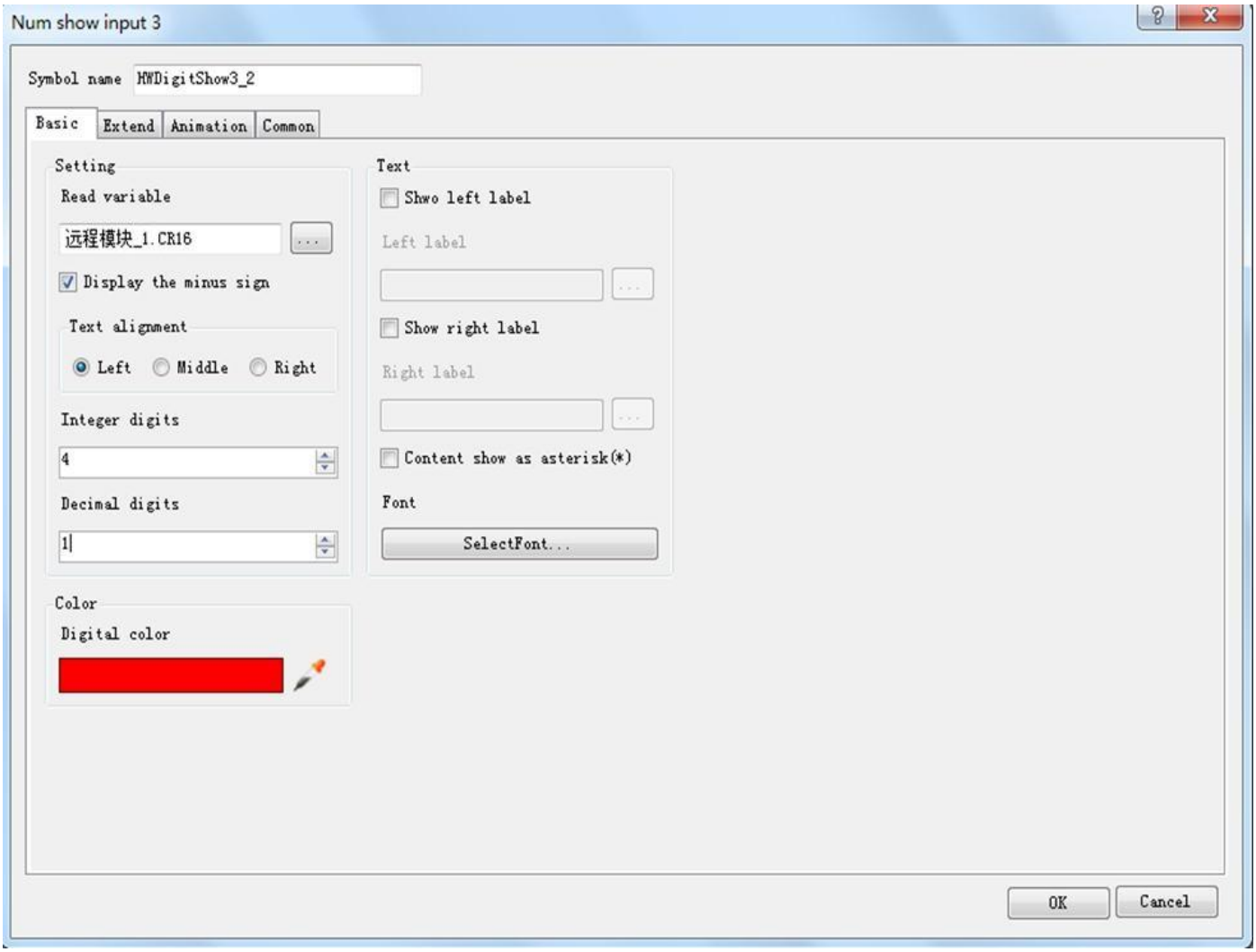


Click OK, then we are prompted to start set up variables, the establishment of eight variables indicates 8 channels:

Device properties | Add | Batch add | Delete | Online | Off

	Variable name	Register type	Register address	Address length	Data type	Read-write mode	Acquisition frequency	Variable description
1	CR16	CR	16	1	Integer	Read and write	Normal	
2	CR17	CR	17	1	Integer	Read and write	Normal	
3	CR18	CR	18	1	Integer	Read and write	Normal	
4	CR19	CR	19	1	Integer	Read and write	Normal	
5	CR20	CR	20	1	Integer	Read and write	Normal	
6	CR21	CR	21	1	Integer	Read and write	Normal	
7	CR22	CR	22	1	Integer	Read and write	Normal	
8	CR23	CR	23	1	Integer	Read and write	Normal	
*								

Then set up the screen, we can use the display primitives to bind the corresponding channel variable values. If you need to display the decimal places, it can set the corresponding decimal places on the display primitive. As shown below:



■ Innovate for more | Win forever

■ Industry intelligence | Energy saving | Green power

Qualification

Designed by Taiwan savch electric

Received ISO9001 and CE certificate