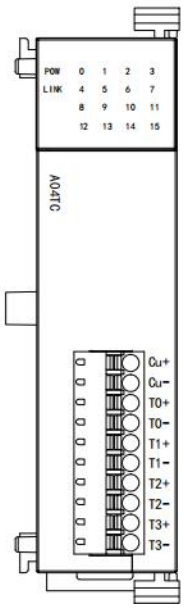
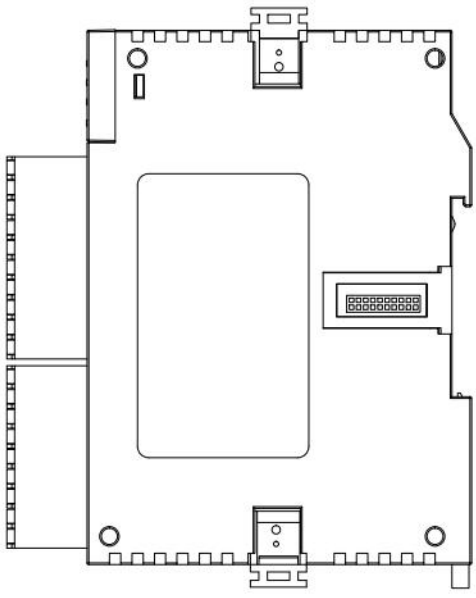
Haiwell 海为®

Haiwell PLC User Manual

A Series Card-type PLC

Temperature & Humidity Module User Manual & Application Case





Xiamen Haiwell Technology Co., Ltd www.haiwell.com

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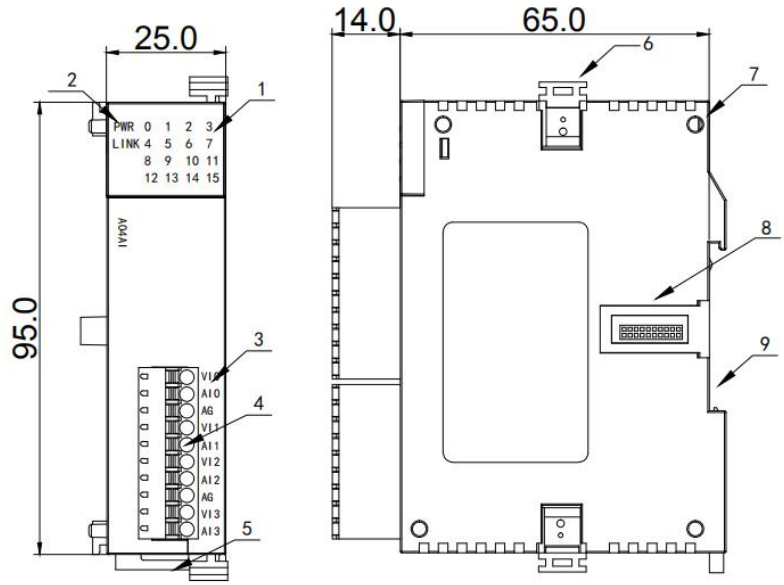
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Temperature & Humidity Module Use Manual

1. Product model list and dimension

Model	Power(24V)	Dimension
A04TC	DC24V~0.1A MAX	25*95*65 mm
A04RC	DC24V~0.1A MAX	
A08TC	DC24V~0.1A MAX	
A04DT	DC24V~0.1A MAX	



1.Analog input channel indicator	6.Module hook
2.PWR power indicator, LINK module communication indicator	7Module connection positioning hole
3.Terminal definition	8.Module expansion port
4.Pluggable terminal	9.35mm DIN guide rail
5.Guide rail buckle	

2. Indicator description

① PWR：Power indicator, green. Normally on-power normal; off - 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. 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	Within 10ms

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

4. 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 between AC terminal to ground terminal, 1 minute DC terminal to PE terminal 500VAC, 1 minute
Insulation impedance	500VDC between AC terminal and ground terminal, more than 5MΩ (All input/output points to ground 500VDC)
Operating environment	Avoid dust, moisture, corrosion, electric shock and external shocks

5. Main parameters for modules

5.1 Main parameters for digital temperature and humidity modules

Item	A04DTT
Input interface	DS18B20, RW1820, DS1990, SHT1x, SHT3x, SHT7x, SHT8x
Input Quantity	4 Channels 4 points
Communication interface	None
Communication speed	None
Communication protocol	None
Power supply mode	PLC host internal power supply
Measured distance	≤200m(Wire resistance 50Ω)
Measured range	DS18B20：-55~+125℃ SHT11：-40~+123.8℃ 0~100%RH
Isolation mode	No isolation between channels,analog & digital optical isolation

5.2 Main parameters for thermal resistance module

Properties	A04RC
Supported sensor types	Pt100, Pt1000, Cu50, Cu100
Overall accuracy	Pt100 / Pt1000: Room temperature (25±5℃): ±0.1%±1℃ Full temperature range: ±0.5%±1℃
	Cu50: ±4℃ at room temperature (25±5℃)
	Cu100: ±2℃ at room temperature (25±5℃)
Resolution	0.1℃
Response time	560ms/4ch
Range of digital value	16 bits, 0-32000
Input impedance	6MΩ
Status display	If the channel is normal, the indicator light will be on.
Diagnostics function	If disconnection is detected, the indicator light will be off.
Isolation	Isolation between an analog circuit and a digital circuit No isolation between channels
Power supply	24VDC ±20%，200mA（Max.）

Functional specifications		
	Celsius (℃)	Input impedance
Rated input range	Pt100: -180℃~800℃	0~300Ω 0~3000Ω
	Pt1000: -180℃~800℃	
	Cu50: -50℃~150℃	
	Cu100: -50℃~150℃	

5.3 Main parameters for thermocouple module

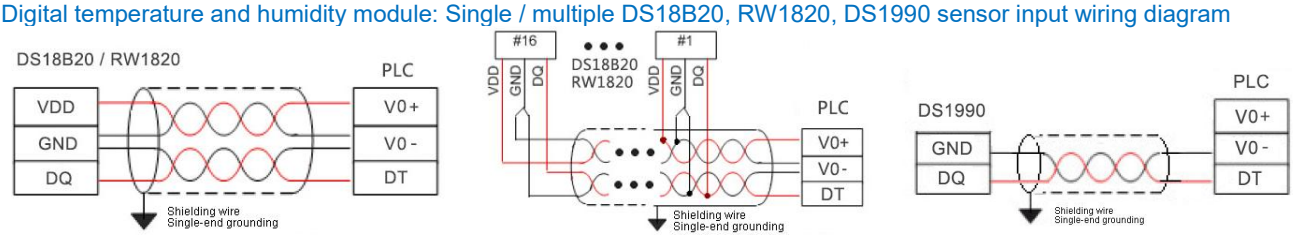
Properties	A04TC/A08TC
Supported sensor types	Type S, Type K, Type T, Type E, Type J, Type B, Type N, Type R Wre3/25, Wre5/26 0-20mV, 0-50mV, 0-100mV
Overall accuracy	Room temperature(25±5℃): ±0.2%±2℃
	Full temperature range: ±0.5%±2℃

Properties	A04TC/A08TC
Resolution	0.1℃
Response time	560ms/4ch
Range of digital value	16 bits, 0-32000
Input impedance	6MΩ
Status display	If the channel is normal, the indicator light will be on.
Diagnostics function	If disconnection is detected, the indicator light will be off.
Isolation	Isolation between an analog circuit and a digital circuit No isolation between channels
Power supply	24VDC ±20%，200mA（Max.）

	Functional specifications	
	Celsius (℃)	Input impedance
Rated input range	Type S: 0℃~1700℃	-10mV~+100mV
	Type K: -200℃~1300℃	
	Type T: -200℃~400℃	
	Type E: -200℃~1000℃	
	Type J: -200℃~1200℃	
	Type B: 250℃~1820℃	
	Type N: -200℃~1300℃	
	Type R: 0℃~1700℃	
	Wre3/25 (Type D): 0℃~2300℃	
	Wre5/26 (Type C): 0℃~2300℃	

6. Wiring diagram

6.1 Digital temperature and humidity module: Single / multiple DS18B20, RW1820, DS1990 sensor input wiring diagram



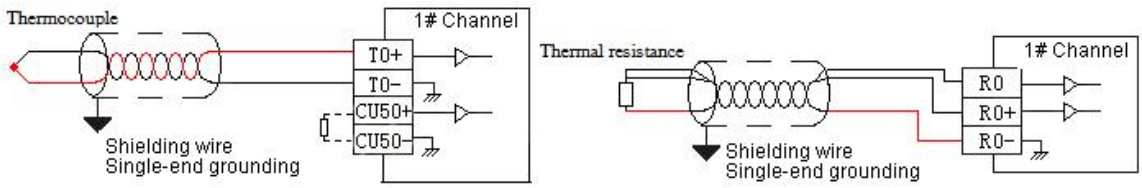
Note:

① VDD (Vdd +) and (V0-) are the sensor power terminals that can be wired nearby;

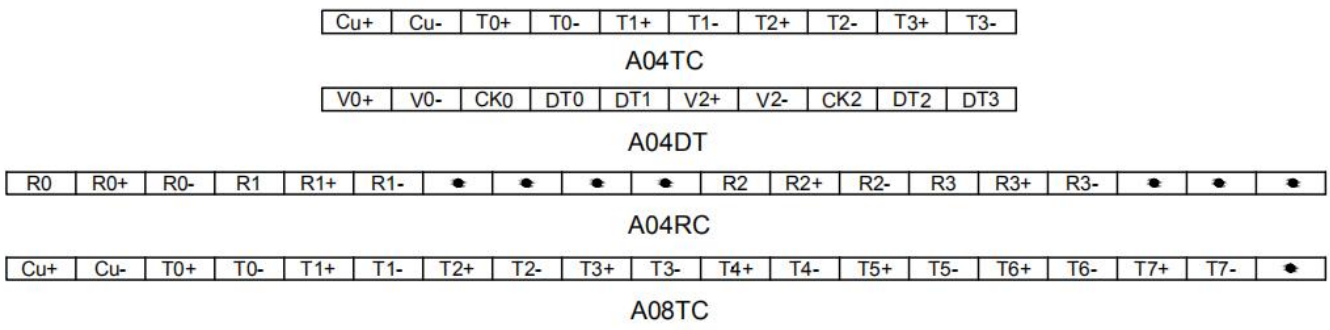
② Pin connection definition of DS18B20, RW1820, DS1990, SHT1X, SHT3X, SHT7X, SHT8X sensors can be seen in respective technical information;

③ Cables between sensor DS18B20, RW1820, DS1990 and module are recommended to use shielded 4-core twisted pair; one set of cable can be connected to ground wire (V0-) and signal lines (DT), the other set of cable can be connected to power supply（V0+) and ground wire (V0-), the shield is single-point grounded at the source.

6.2 Thermal resistance and thermocouple module wiring diagram



7. Terminal wiring diagram



8. Module parameter table

8.1 Parameter table for digital temperature and humidity 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	A04DT function description
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~13H	Temperature input value of channel 1~4
14H~17H	Humidity input value of channel 1~4
18H~1BH	Signal type of channel 1~4（0-DS18B20、RW1820、DS1990, 1-SHT1x、SHT7x, 2-SHT3x、SHT8x）
1CH	Using identification of engineering value
1DH~20H	Data lower-limit of channel 1~4
21H~24H	Data upper-limit of channel 1~4
25H~28H	A/D data bit of channel 1~4
29H~2CH	Zero point correction of channel 1~4
2DH	Sensor disconnection alarm of channel 1~4, each bit indicates 1 channel, 0- normal, 1- disconnection
2EH~2FH	Reserve
30H-3FH	Serial numbers of channel 1~4, each serial number occupies 4 registers
40H-4FH	Reserve

8.2 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	
	A04RC	A04TC
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

CR code	Function description	
	A04RC	A04TC
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
29H	Channel 1~4 input disconnection alarm, note 4	Channel 1~4 input disconnection alarm, note 4
2AH	Reserve	Reserve
2BH~2FH		

8.3 Parameter table for 8-channel thermal resistance and thermocouple modules

CR code	Function description
	A08TC
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
11H	channel 2 input value
12H	channel 3 input value
13H	channel 4 input value
14H	channel 5 input value
15H	channel 6 input value
16H	channel 7 input value
17H	channel 8 input value
18H	channel 1 signal type, note 2
19H	channel 2 signal type, note 2
1AH	channel 3 signal type, note 2
1BH	channel 4 signal type, note 2
1CH	channel 5 signal type, note 2
1DH	channel 6 signal type, note 2
1EH	channel 7 signal type, note 2
1FH	channel 8 signal type, note 2
20H	Use the engineering value mark, note 5
21H	channel 1 engineering lower limiting value
22H	channel 2 engineering lower limiting value
23H	channel 3 engineering lower limiting value
24H	channel 4 engineering lower limiting value
25H	channel 5 engineering lower limiting value
26H	channel 6 engineering lower limiting value
27H	channel 7 engineering lower limiting value
28H	channel 8 engineering lower limiting value
29H	channel 1 engineering upper limiting value
2AH	channel 2 engineering upper limiting value
2BH	channel 3 engineering upper limiting value
2CH	channel 4 engineering upper limiting value
2DH	channel 5 engineering upper limiting value
2EH	channel 6 engineering upper limiting value
2FH	channel 7 engineering upper limiting value

CR code	Function description
	A08TC
30H	channel 8 engineering upper limiting value
31H	channel 1 sampling frequency, note 1
32H	channel 2 sampling frequency, note 1
33H	channel 3 sampling frequency, note 1
34H	channel 4 sampling frequency, note 1
35H	channel 5 sampling frequency, note 1
36H	channel 6 sampling frequency, note 1
37H	channel 7 sampling frequency, note 1
38H	channel 8 sampling frequency, note 1
39H	channel 1 zero point correction value
3AH	channel 2 zero point correction value
3BH	channel 3 zero point correction value
3CH	channel 4 zero point correction value
3DH	channel 5 zero point correction value
3EH	channel 6 zero point correction value
3FH	channel 7 zero point correction value
40H	channel 8 zero point correction value
41H	Channel 1~8 input disconnection alarm, note 4
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 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 5. Use the engineering value mark： Each bit indicates 1 channel, 0-No, 1-Yes

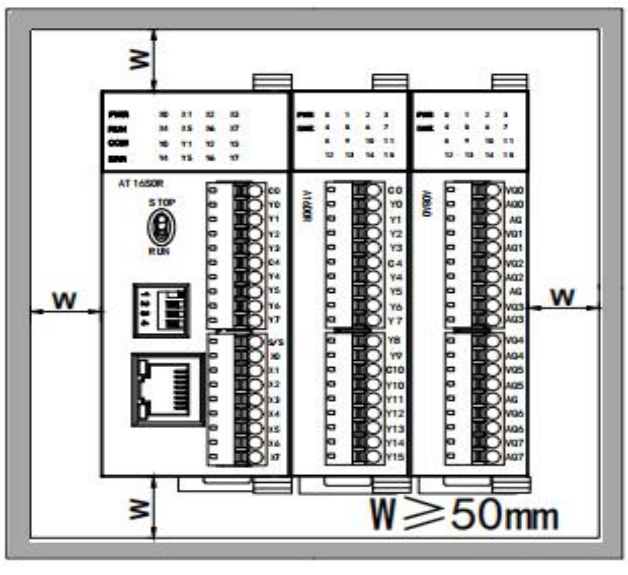
9. Expansion modules installation

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

Rail Mounting: Use standard 35 mm rail.

Expansion module connection method

The parallel interface on the lower right side of the last module (MPU or expansion module) is inserted into the parallel interface on the lower left side of the next module and hooked with small cards on both sides. The parallel interface on the right side of this module is used as the next expansion module. Connect all expansion modules in this way in sequence.



Temperature & Humidity modules Application Case

1. Module power supply

It can be used as the extension module of A series PLC MPU; when the module is hung behind the host through the expansion port,, the external power supply is not required, and the module is powered by the parallel port of the main engine. If the power supply of the module is insufficient (the PWR power indicator on the module is not on).

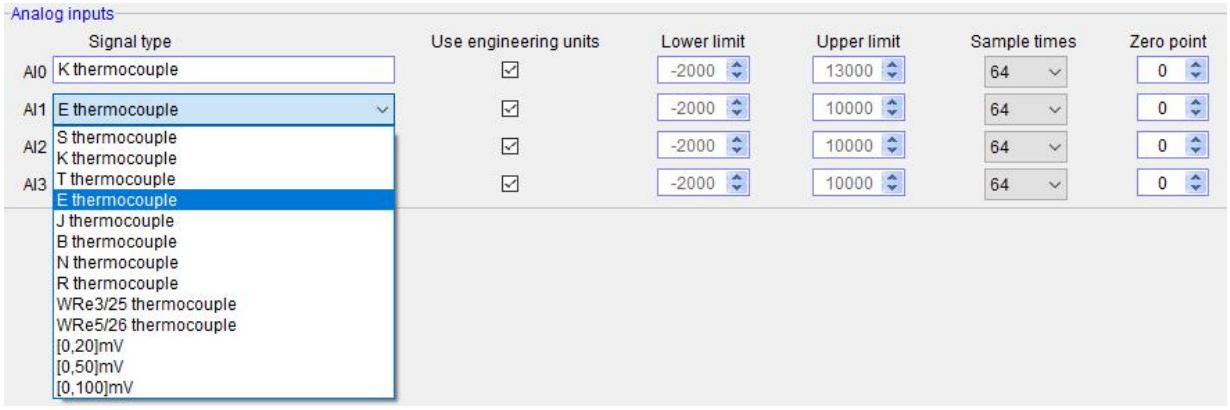
2. Temperature modules need't be written any conversion program, read the current temperature value directly when access the sensor

For example, the host PLC A16S0T respectively, is expanded with three modules of A04TC、A04RC and a08TC through the parallel port from left to right, assuming the scene:

Thermocouple module A04TC input channel 1, signal type is K, input channel 2, signal type is E;
Thermal resistance module A04RC input channel 1, signal type is PT100, A04RC 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	AT16S0T/P	X0 - X7	Y0 - Y7			COM1-2 HSC0-1 PLS0-1
1	A04TC			AI0 - AI3		
2	A04RC			AI4 - AI7		
3	A08TC			AI8 - AI15		

Haiwell 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 a04TC 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 Haiwell temperature and humidity modules can be set the signal type of each channel arbitrarily, so for the A04RC module, after configuration, we can read the temperature value directly when connecting the corresponding sensor to the channel.

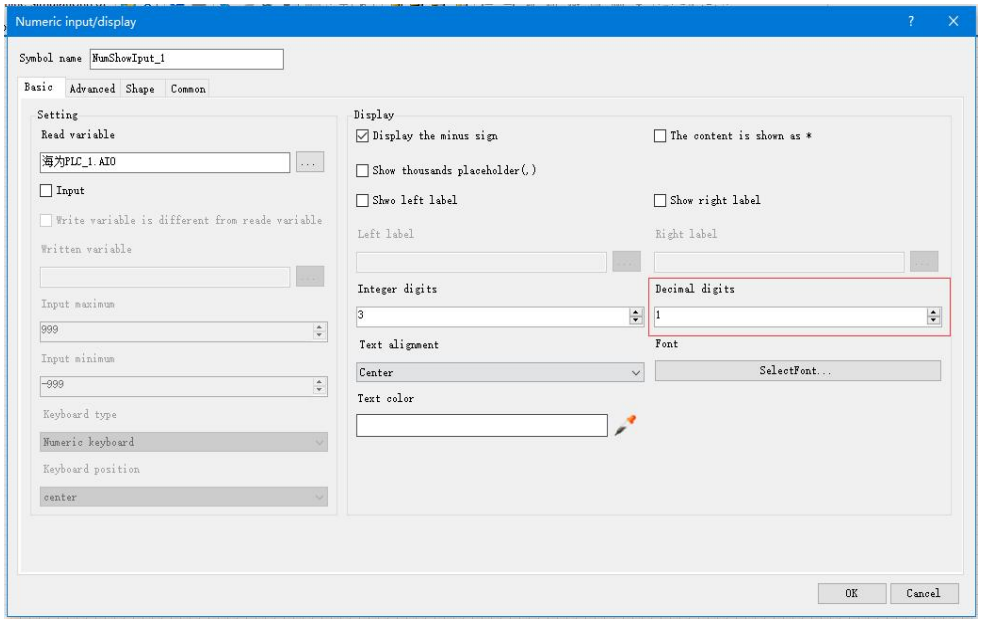
3. Programming skills for PLC

If you want to write the alarm program that temperature exceeds the setting value, for example, when the temperature is more than 125℃, it will alarm, the program of PLC can be written as follows:



4. Display temperature value on SCADA, HMI

If the configuration, touch screen, text and other PC softwares want to display the current temperature, only need to set 1 decimal place on the numerical display primitive, then the read value will be automatically reduced 10 times in the configuration, that is the actual temperature value, for example, you can set 1 on decimal places of Haiwell Cloud SCADA settings:



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℃.

5. Default for using engineering, 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 temperature 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.

Haiwell 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.

6. Module CR code application example: Read module channel disconnection alarm

In this example, in order to read the external sensor disconnection information of A04TC module, the disconnection alarm data of H04TC 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, A04TC is the first module, so fill in 1;

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 is corresponding channel 1-4, disconnection for 1 (ON), normal for 0 (OFF).



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