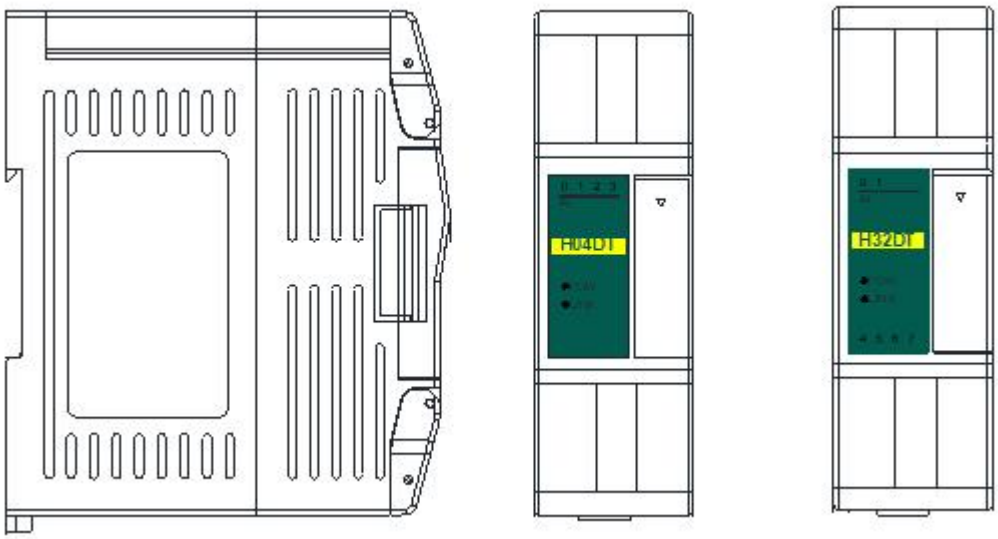
Haiwell 海为®

# Haiwell PLC User Manual

## Classic Programmable Logic Controller

Temperature & Humidity Module User Manual & Application Case

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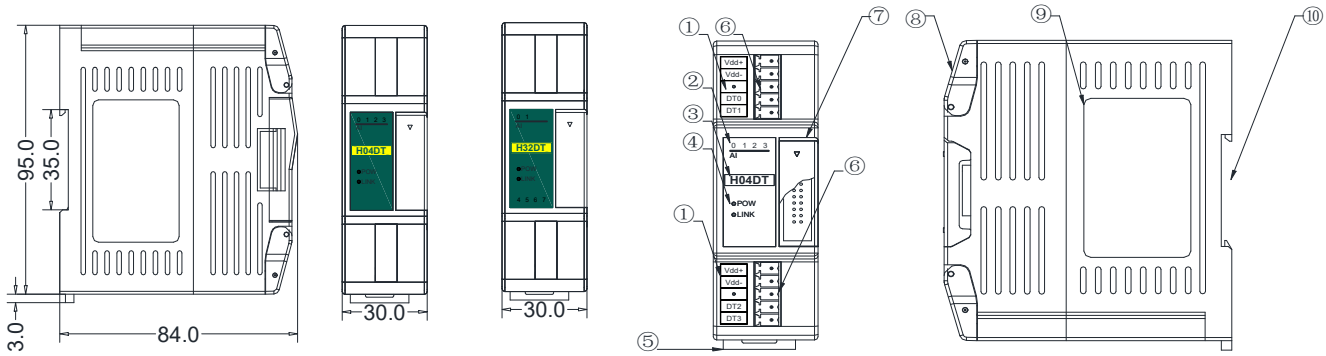
# Temperature & Humidity Module Use Manual

## 1. Product model list and dimension

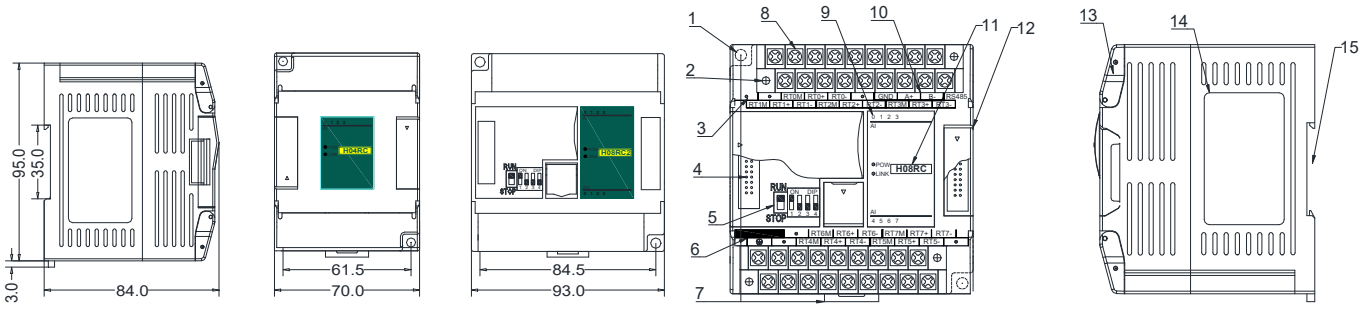
| Ethernet Model | 24V DC | Ethernet Model | 220V AC | Model | 24V DC | Model | 220V AC | Dimension |
|---|---|---|---|---|---|---|---|---|
| | | | | H04DT | 0.02A | | | 30×95×82mm |
| | | | | H32DT | 0.04A | | | |
| | | | | H04TC | 0.07A | H04TC2 | 2W | 70×95×82mm |
| | | | | H08TC | 0.07A | H08TC2 | 2.2W | |
| | | | | H04RC | 0.07A | H04RC2 | 2W | |
| H08RC-e | 0.1A | H08RC2-e | 2.9W | H08RC | 0.07A | H08RC2 | 2.3W | 93×95×82mm |

### Dimensions for H04DT / H32DT




| | |
|---|---|
| 1. Terminal definition | 6. Pluggable terminal |
| 2. Analog input channel indicator | 7. Module expansion port |
| 3. Model | 8. Transparent cover of module terminal |
| 4. PWR power indicator, LINK module communication indicator | 9. Module nameplate |
| 5. Guide rail buckle | 10. 35mm DIN guide rail |

### Dimensions for H04TC, H04RC, H08TC, H08RC




| | |
|---|---|
| 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 |

## 2. Indicator description

### 2.1 Indicator description of H04DT, H32DT

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 | MPU didn't identify the module and no communication | No light |
| | MPU has identified the module but no communication | Constant light in green |
| | Serial(H32DT) or parallel port in communication | Green jitter: indicator on 30ms and off 30ms |
| 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 |

### 2.2 Indicator description of H04TC, H04RC, H08TC, H08RC

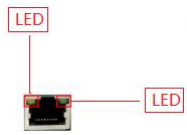
① PWR：Power indicator, green. Normally on-power normal; off - power abnormal.

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 RJ45 Ethernet indicator: there are two Ethernet LEDs, green and yellow, as shown on the right picture:

| Color | Status description |
|---|---|
| Green light is always on | 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 it, at this time, yellow light is long brignt. |
| Yellow light goes out | No data transmission communication of TCP module and external device |




## 3. Power supply specification

| Item | DC Power Supply | AC Power Supply |
|---|---|---|
| Power supply voltage | 24VDC -15%~+20% | 100~240VAC |
| Power supply frequency | —— | 50~60Hz |
| Instantaneous surge | MAX 20A 1.5ms @24VDC | 20A 1.5ms MAX @220VAC |
| Power loss time | 10ms or less | 20ms or less @220VAC |
| Fuse | 0.3A，250V | 2A, 250V |
| 24V Output voltage (for input and expansion) | None | 24V, -15%~+15%, 200mA (Max) |
| Isolation Type | No Electrical isolation | Transformer isolation or optoelectronic isolation,1500VAC/1 minute |
| Power Protection | DC input power polarity reverse, over voltage protection | DC 24V output over current 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 | 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 |

## 5. Main parameters for modules

## 5.1 Main parameters for digital temperature and humidity modules

| Item | H04DT | H32DT |
|---|---|---|
| Input interface | DS18B20, RW1820, DS1990, SHT1x, SHT3x, SHT7x, SHT8x sensor | DS18B20, RW1820, DS1990 sensor |
| Input Quantity | 4 Channels 4 points | 2 channels, each channel 16 points |
| Communication interface | None | RS485 |
| Communication speed | None | 2400~115200 Baud rate |
| Communication protocol | None | Standard Modbus |
| Power supply mode | PLC host internal power supply | PLC host internal power supply or independent external supply of 24VDC |
| Measured distance | ≤200m(Wire resistance 50Ω) | ≤200m(Wire resistance50Ω) |
| Measured range | DS18B20：-55~+125℃<br>SHT11：-40~+123.8℃ 0~100%RH | DS18B20：-55~+125℃ |
| Isolation mode | No isolation between channels,analog & digital optical isolation | |

## 5.2 Main parameters for thermal resistance module

| Properties | H04RC/H08RC |
|---|---|
| Supported sensor types | Pt100, Pt1000, Cu50, Cu100 |
| Overall accuracy | Pt100 / Pt1000:<br>Room temperature (25±5℃): ±0.1%±1℃<br>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<br>No isolation between channels |
| Power supply | 24VDC ±20%，200mA（Max.） |

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

## 5.3 Main parameters for thermocouple module

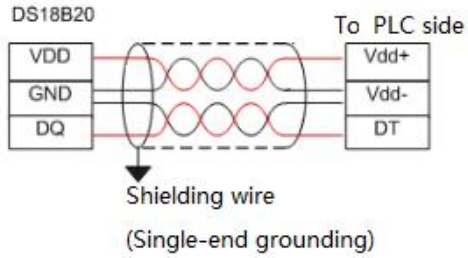
| Properties | H04TC/H08TC |
|---|---|
| Supported sensor types | Type S, Type K, Type T, Type E, Type J, Type B, Type N, Type R<br>Wre3/25, Wre5/26<br>0-20mV, 0-50mV, 0-100mV |
| Overall accuracy | Room temperature(25±5℃): ±0.2%±2℃ |
| | Full temperature range: ±0.5%±2℃ |
| Resolution | 0.1℃ |
| Response 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<br>No isolation between channels |
| Power supply | 24VDC ±20%，200mA（Max.） |

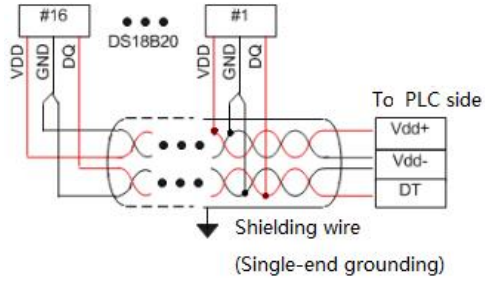
| | Functional specifications | |
|---|---|---|
| | Celsius (℃) | Input impedance |
| Rated input range | Type S: 0℃~1700℃ | -10mV~+100mV |
| | Type K: -200℃~1300℃ | |
| | Type T: -200℃~400℃ | |
| | Type E: -200℃~1000℃ | |
| | Type J: -200℃~1200℃ | |
| | Type B: 250℃~1820℃ | |
| | Type N: -200℃~1300℃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

| | |
|---|---|
| | Wre5/26 (Type C): 0℃~2300℃ |

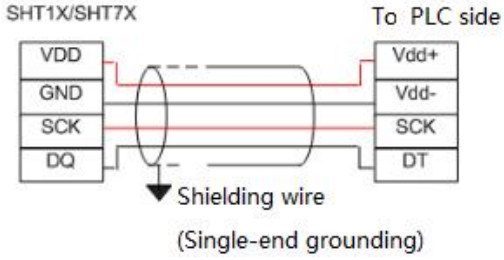
## 6. Wiring diagram

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




### SHT1X, SHT7X input wiring diagram



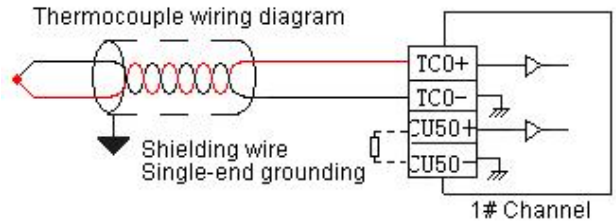

Note:

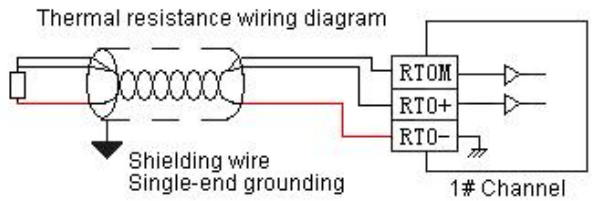
① VDD (Vdd +) and (Vdd-) are the sensor power terminals that can be wired nearby;

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

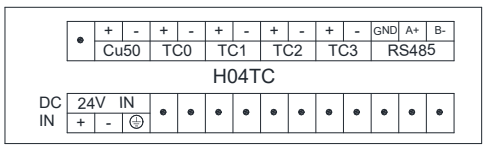
③ Cables between sensor DS18B20, RW1820, DS1990 and module are recommended to use shielded 4-core twisted pair; one set of cable can be connected to ground (Vdd-) and signal lines (DT), the other set of cable can be connected to power supply and ground (Vdd-), the shield is single-point grounded at the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

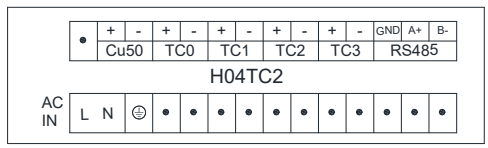
### 6.2 Thermal resistance and thermocouple module wiring diagram

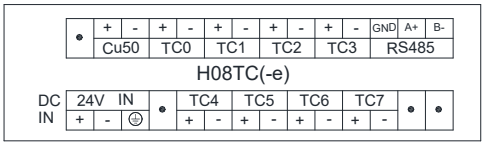


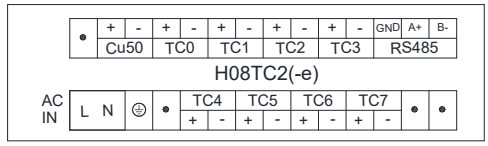



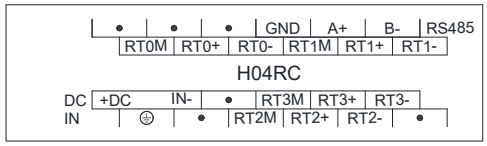

## 7. Terminal wiring diagram

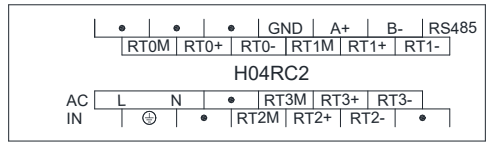


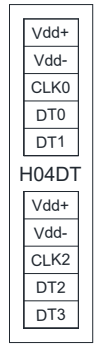



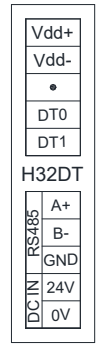



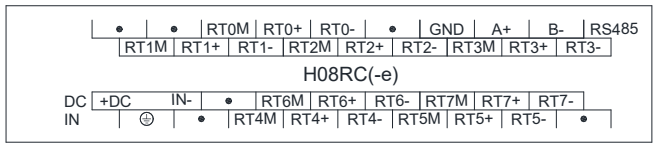



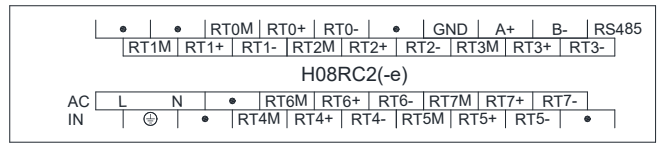






## 8. Module parameter table（CR code is corresponding to the Modbus register address）

### 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 | H04DT function description | CR code | H32DTfunction 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<br>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 | 10H~1FH | Temperature value in 1~16 path of channel 1 |
| 14H~17H | Humidity input value of channel 1~4 | 20H~2FH | Temperature value in 1~16 path of channel 2 |
| 18H~1BH | Signal type of channel 1~4（0-DS18B20、RW1820、DS1990, 1-SHT1x、SHT7x, 2-SHT3x、SHT8x） | 30H | A/D data bits of channel 1 |
| 1CH | Using identification of engineering value | 31H | A/D data bits of channel 2 |
| 1DH~20H | Data lower-limit of channel 1~4 | 32H | Temperature disconnection alarm in 1~16 path of channel 1, each bit indicates 1 channel, 0- normal, 1- disconnection |
| 21H~24H | Data upper-limit of channel 1~4 | 33H | Temperature disconnection alarm in 1~16 path of channel 2, each bit indicates 1 channel, 0- normal, 1- disconnection |
| 25H~28H | A/D data bit of channel 1~4 | 34H | Configuration number of channel 1 |
| 29H~2CH | Zero point correction of channel 1~4 | 35H | Configuration number of channel 2 |
| 2DH | Sensor disconnection alarm of channel 1~4, each bit indicates 1 channel, 0- normal, 1- disconnection | 36~75H | Serial numbers in 1~16 path of channel 1, each serial number occupies 4 registers |
| 2EH~2FH | Reserve | 76~B5H | Serial numbers in 1~16 path of channel 2, each serial number occupies 4 registers |
| 30H-3FH | Serial numbers of channel 1~4, each serial number occupies 4 registers | B6~C5H | Reserve |
| 40H-4FH | Reserve | C6H | Channel 1 clears the power-off counts in the configuration |
| | | C7H | Channel 2 clears the power-off counts in the configuration |

### 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 | |
|---|---|---|
| | H04RC | H04TC |
| 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<br>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 | |

| CR code | Function description | |
|---|---|---|
| | H04RC | H04TC |
| 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 |
| 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 | |
|---|---|---|
| | H08RC | H08TC |
| 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<br>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 |

| CR code | Function description | |
|---|---|---|
| | H08RC | H08TC |
| 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 |
| 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 5. Use the engineering value mark：Each bit indicates 1 channel, 0-No, 1-Yes

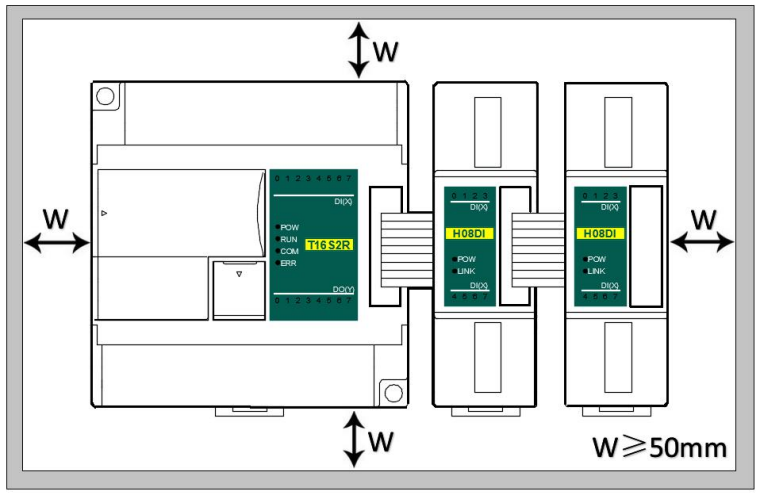
## 9. Expansion modules installation

The PLC should be secured to an enclosed cabinet while mounting. For heat dissipation, make sure to provide a minimum space 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 extension 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.

**Module Wiring:** Connections between extension modules and connections between module and MPU are achieved through bus.A extension cable will be configured to every extension module, for the connection between two different modules.Connection methods: turn the right side of extended interface(the last MPU or extension module) over, plug the extension 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 extension of the next module. Connect all extension modules in turn in the same way.



# Temperature & Humidity modules Application Case

## 1. Expand module through the host PLC parallel port

### 1.1 Module power supply

Haiwell temperature and humidity 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:

① When 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.

② When the host PLC is connected 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.

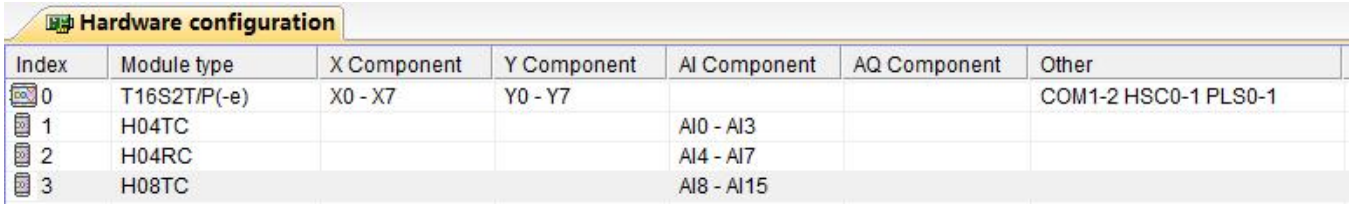
### 1.2 Temperature modules need't be written any conversion program, read the current temperature value directly when access the sensor

For example, the host PLC T16S2T, respectively, is expanded with three modules of H04TC, H04RC and H08TC through the parallel port from left to right, assuming the scene:

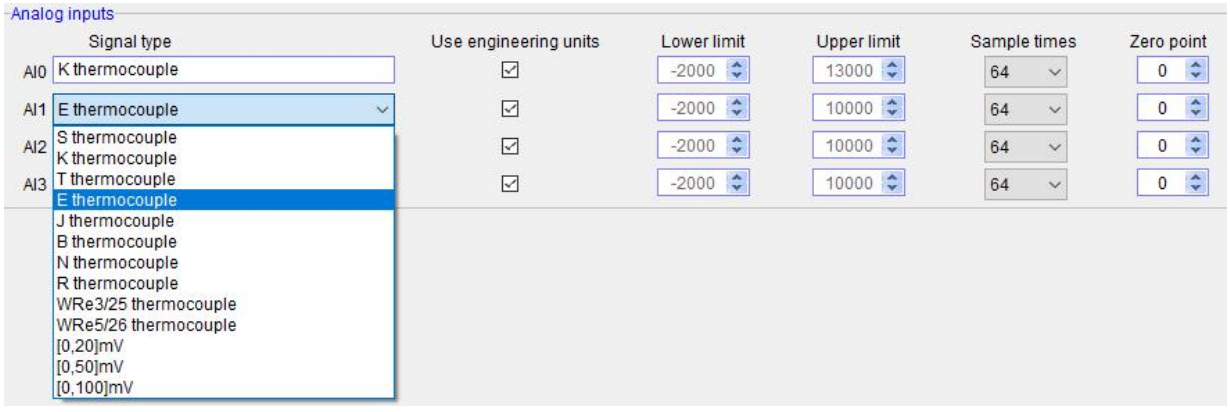
Thermocouple module H04TC input channel 1, signal type is K, input channel 2, signal type is E;

Thermal resistance module H04RC input channel 1, signal type is PT100, H04RC 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:




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 H04TC 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 ℃.

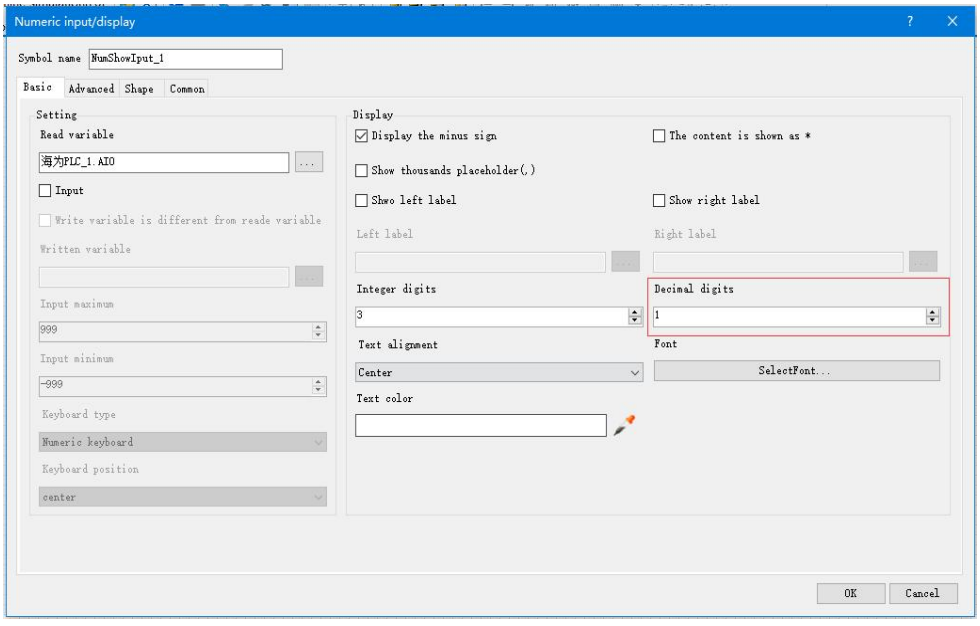
As we know that Haiwell temperature and humidity modules can be set the signal type of each channel arbitrarily, so for the H04RC module, after configuration, we can read the temperature value directly when connecting the corresponding sensor to the channel.

## 1.3 Programming skills for PLC

① 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:

## 1.4 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℃.

## 1.5 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.

### 1.6 Module CR code application example: Read module channel disconnection alarm

In this example, in order to read the external sensor disconnection information of H04TC 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, H04TC 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).

## 2. Module used as remote IO

Haiwell 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 of modules used as remote IO.

### 1.1 Module power supply

When the module is used as remote IO, there are two optional models of 24VDC and 220VAC, such as H08RC model for the DC 24V power supply. H08RC2 for AC 220V power supply. If the module is powered normally, the PWR indicator will light.

### 1.2 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.

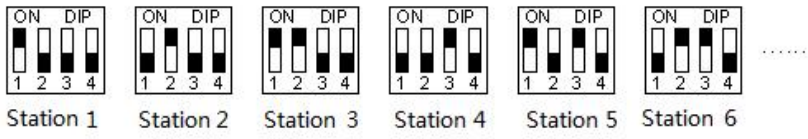
③ RS485 communication port and Ethernet port can be used at the same time, for example, the RS485 of module communicates with PLC, Ethernet port can also communicates with multiple host computers (up to 7).

### 1.3 Communication protocols and default parameters

① RS485: Support standard Modbus RTU / ASCII protocol, it can communicate with the configuration, touch screen, text display, 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.

② 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

## 1.4 Introduce module parameter configuration method 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.

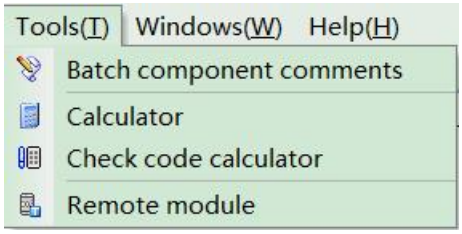
## 1.5 Parameter configuration example: Configurate module by programming software remote module tool

### 1.5.1 Hardware connection:

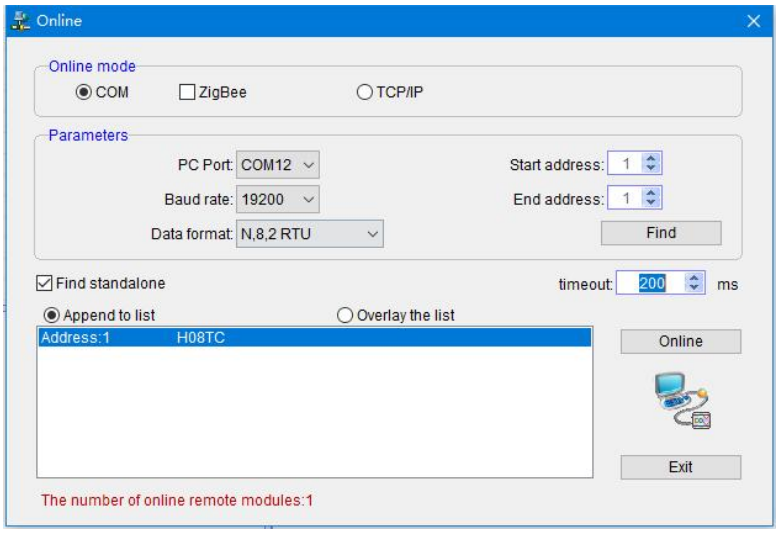
① Through the RS485 communication port (the terminals of A +,B- on the module) connection: If the computer has a serial port, you can use the converter of 232 to 485 connecting with the module; if it has one USB interface, you can use the converter of USB to 485 connecting with the module.
② Through 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.

### 1.5.2 Software operation steps:

① Click on the the menu bar tool of programming software- "remote module":

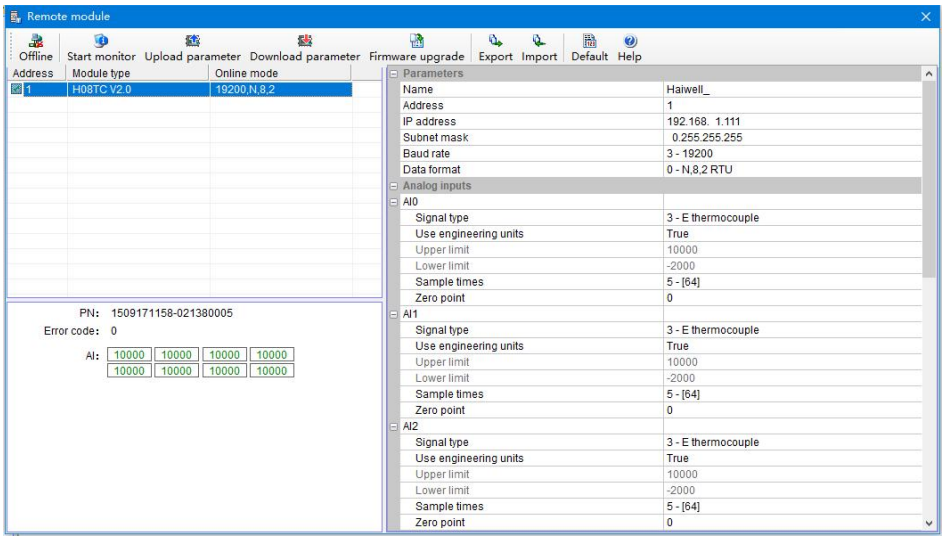



Click the button in the pop-up window to open the "Online" window. The module default address is 1,19200, N 8 2 RTU, the online success is as follows:

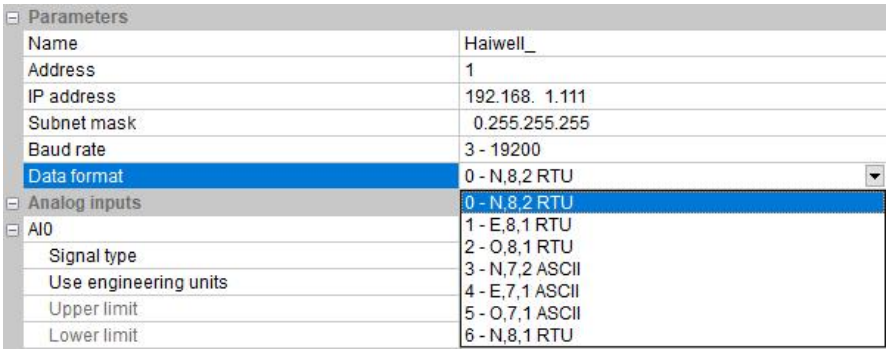



If there is only one machine connected with 485 line, then check "stand-alone search"; if there are more than one, then remove the button of "stand-alone search", and set the start address and end address, so that all the machines connected with 485 line can be found and achieve parameter configuration.

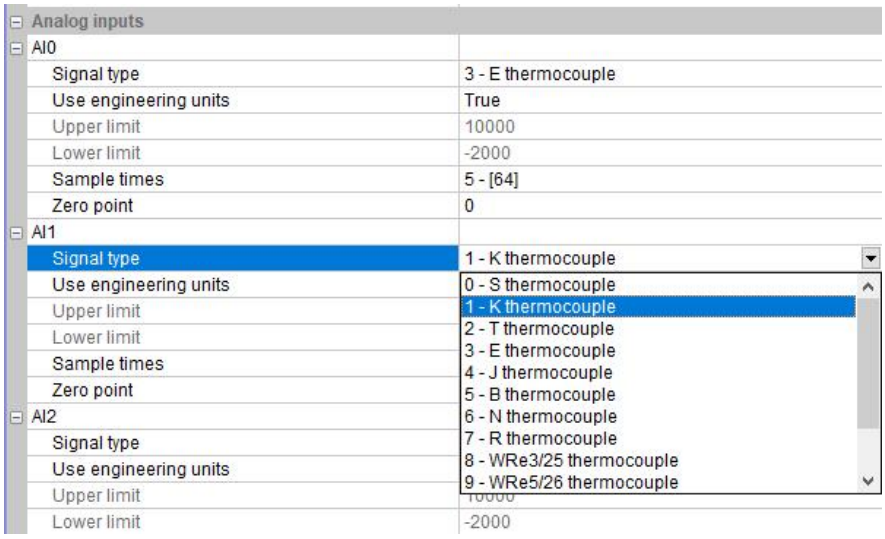
Click to exit, enter the configuration interface, as shown below:



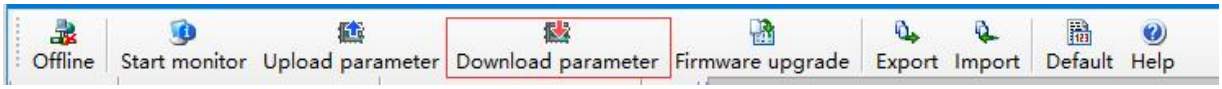

We can change the module name, address, IP, subnet mask, baud rate, data format and other communication parameters in the communication parameter area.




In the external analog input area, we can set the signal type of each channel, choose whether to use engineering value or not((for temperature module, the default use of engineering value)), 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 "Download parameter" to download the parameter into the module.




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

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

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

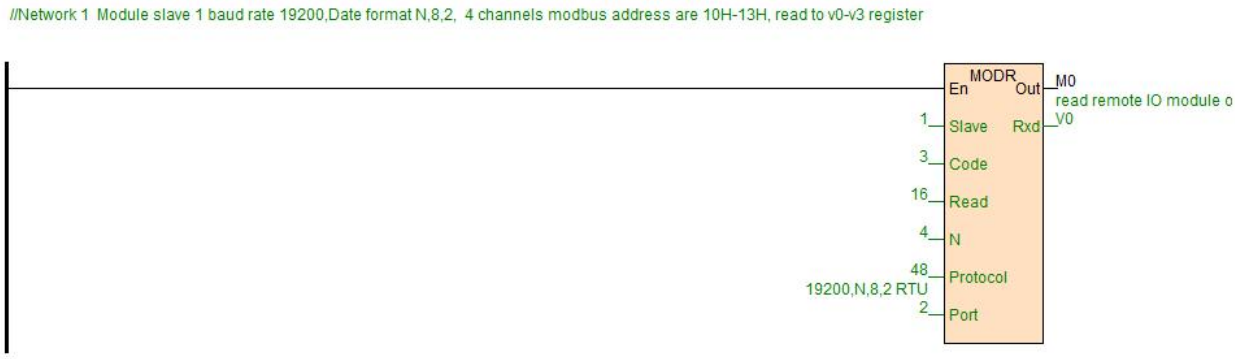
③ It can export the module configuration to save or import and restore the default value.

## 1.6 Remote IO appliciation example(RS485 mode): PLC reads 4-channel temperature value of H04RC 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 H04RC module.

③ PLC program: Host PLC wants to read the 4-channel temperature values of remote IO module H04RC, 4-channel temperature sensors for PT100, -2000 ~ 8500 indicates -200.0 ~ 850.0 ℃. In this example, H04RC 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 temperature values is as follows:




The host PLC reads the 4-channel temperature values of H04RC 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 temperature values which are read back will be stored in V0-3, V0=235, indicating that the actual temperature of the first channel is 23.5℃, the same as V3=867, indicating that the actual temperature of the fourth channel is 86.7℃.

## 1.7 Remote IO appliciation example (Ethernet mode): PLC reads and writes every channel input values of H08RC-e module

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

or through the switch.

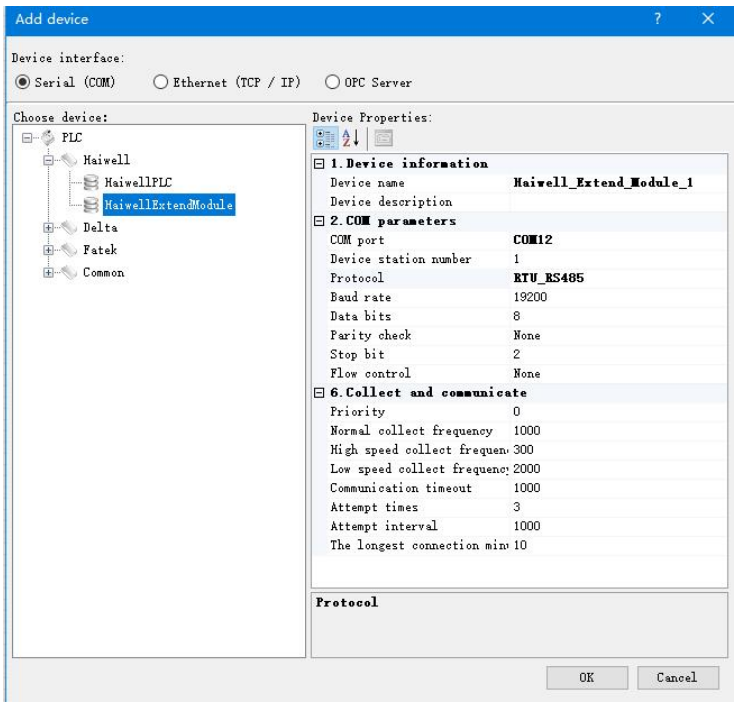
② Modbus address: From the above H08RC-e analog module CR parameter table shows that the input values of 8-channel thermal resistance module input channel 1 ~ 8 are stored in the address 10H ~ 17H.

③ PLC program: Read the 8-channel measurements of remote Ethernet module H08RC-e, if the module IP address is 192.168.1.112, station number address is 1, the read results are stored in the V10 ~ V17, as follows:

## 1.8 Remote IO appliciation example: Haiwell Cloud configuration communicates directly with H08TC module

① 1, Open Haiwell 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 COM12, as shown below:

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

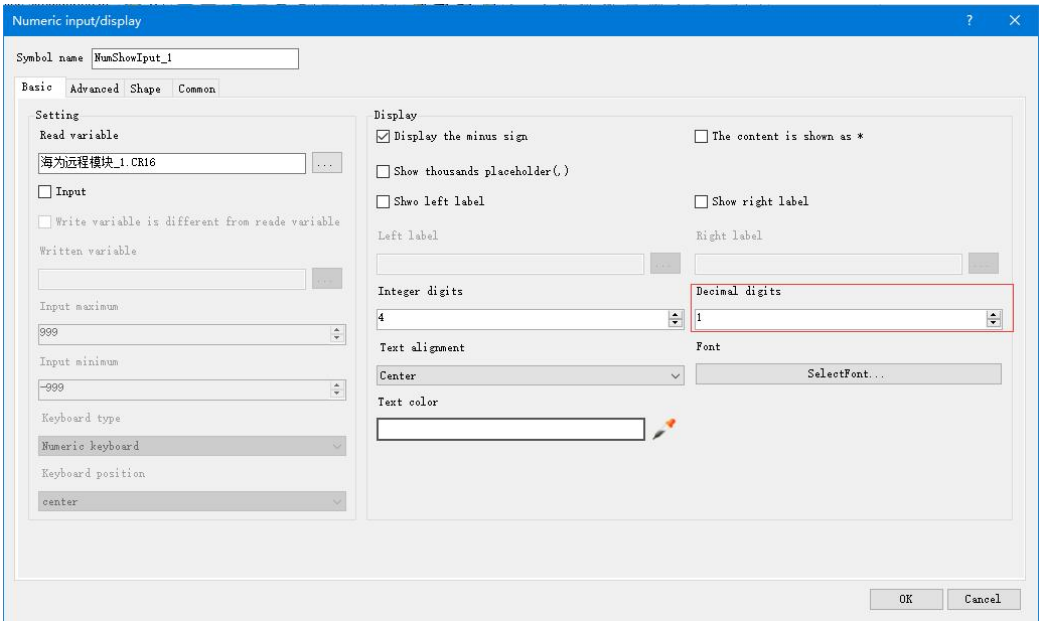



Click OK, then we are prompted to start set up variables, the establishment of eight variables indicates 8 channels:

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 | |

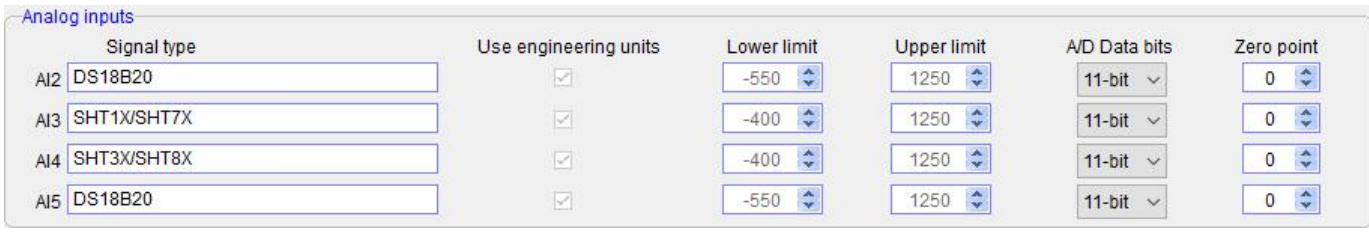
Then set up the screen, we can use the display primitives to bind the corresponding channel variable values. If you need to display the decimal places, it can set the corresponding decimal places on the display primitive. As shown below:




## 1.9 H04DT module usage features introduction

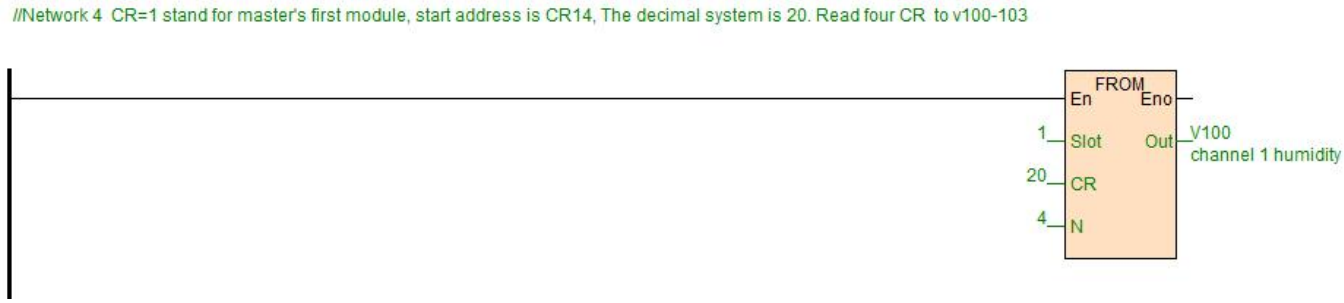
H04DT module supports digital temperature sensors: DS18B20, RW1820, DS1990 and temperature & humidity sensors SHT1x, SHT7x.

In the process of program configuration, for sensors DS18B20, RW1820, DS1990, they all select the signal type of DS18B20, for temperature & humidity sensors SHT1x, SHT7x, select the signal type of SHT1X/SHT7X, for temperature & humidity sensors SHT3x, SHT8x, select the signal type of SHT3X/SHT8X , as follows:




In addition, we can see that when choosing to measure the temperature and humidity, the analog input register does not appear two consecutive addresses, such as the above channel 2 and 3 are connected to temperature & humidity sensor SHT11 , but only one AI1 and AI2 indicates the measured temperature value. So how to read the humidity value?

Way to read the humidity value: First of all, we refer to the online help of programming software - hardware manual - expansion module parameters - digital temperature module parameter table shows that H04DT humidity value is stored in the CR register CR14 ~ 17, it indicates the humidity value of channel 1 ~ 4 when the channel is selected as a temperature and humidity sensor, so we can read humidity value through the FROM instruction, in this case, H04DT is the first module near the host PLC, so Slot = 1. The program is as follows:




In this way, we can read back the humidity value of the DT module.

## 1.10 H32DT module usage features introduction

H32DT supports sensor signal types: DS18B20, RW1820, DS1990.

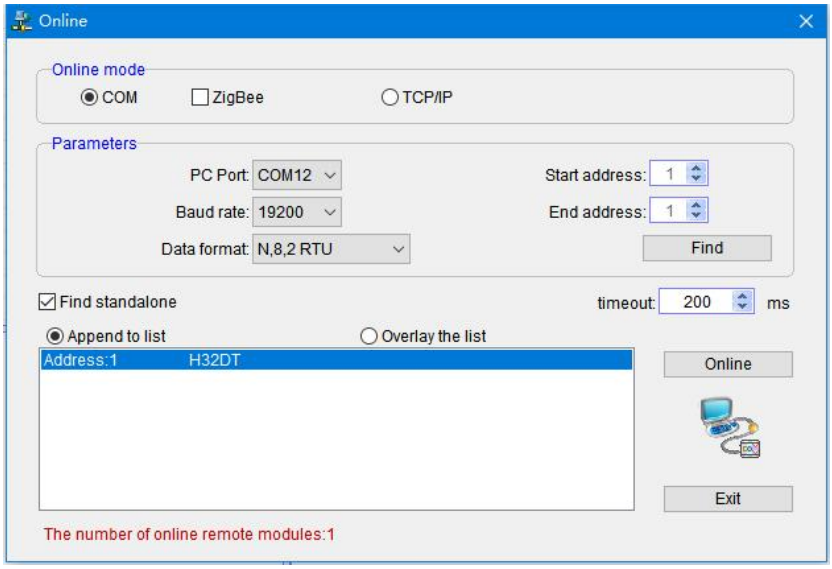
Module parameters: H32DT module has 2 channels, each channel can measure the maximum 16 points of temperature, a total of 32 temperature points can be measured. Measuring temperature range: -55 ~ +125 ℃, ≤ 200m distance to per channel (line resistance 50Ω). So, how to use the H32DT module properly?

The following are the main points of this section:

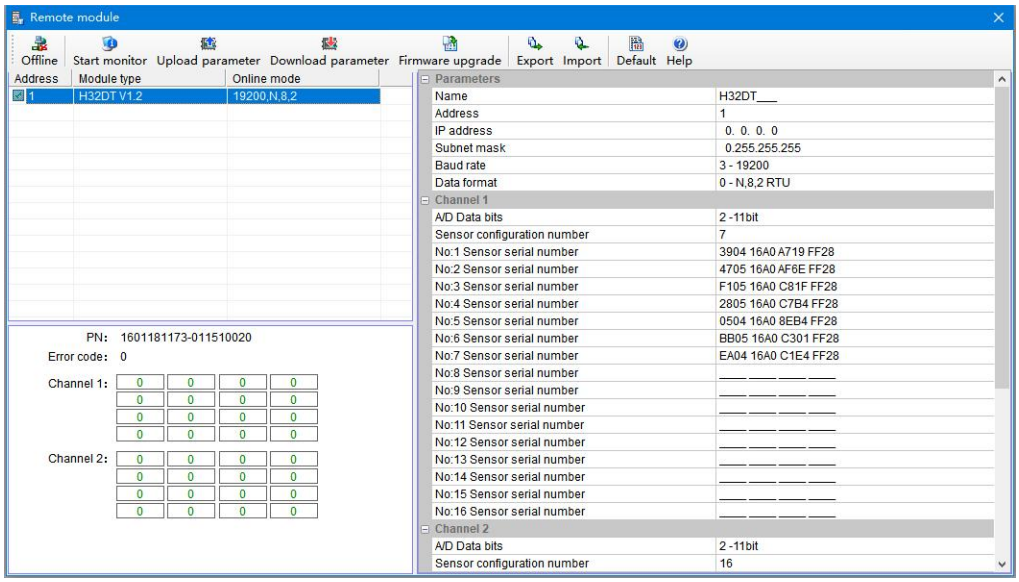
① Remote module tool usage;
② How to wire sensor?
③ how to replace broken sensor?
④ how to replace broken module?

First, let's look at the hardware wiring. How to connect H32DT with the remote module tools of PLC software?

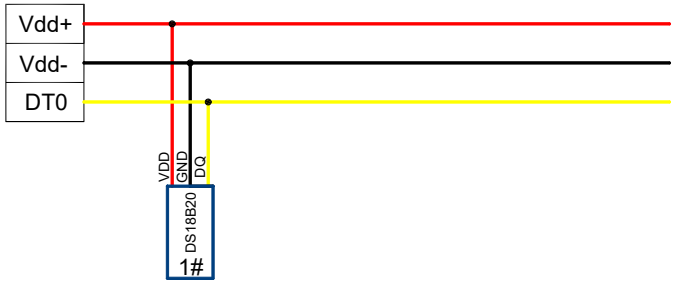
Hardware connection and power supply: PC-side USB transferred to 485 (PC with serial port can also use 232-to-485 converter), then connected to the communication port A + B- of 485 in H32DT module. H32DT module is powered by DC24V switching power supply. After the module is powered on, then click the menu bar tools - Remote module - Online, when online successfully, you will see:




Click "exit", or "×" to exit. In the absence of sensors, the default parameters of the module are shown below:




Then, we start to access sensors (the strict wiring diagram please refer to the above digital module wiring diagram), as shown in the following figure, we access the first sensor # 1:

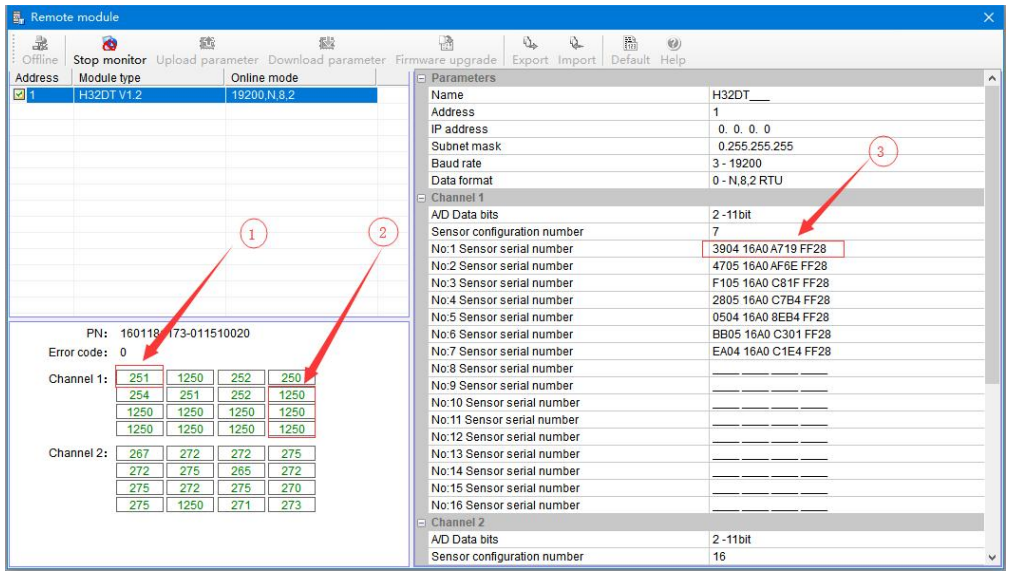



Click on "monitor", we can see 1 # sensor temperature value of channel 1 in the software, exit "monitor", click the "parameter upload", then you can view the serial numbers of the sensor. Read 1 # sensor temperature value and serial number as shown below:

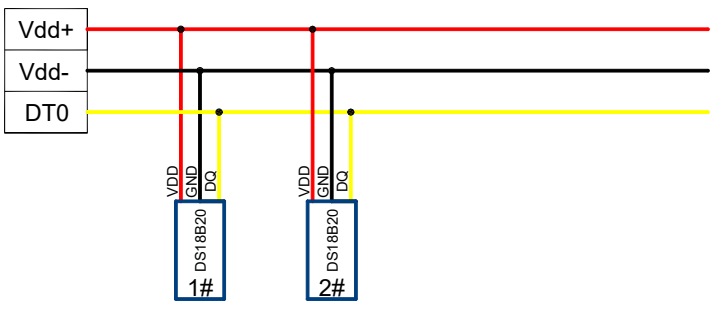
① Numerical 251 indicates that the current temperature is 25.1℃;

② No: 1 sensor serial number: 3904 16A0 A719 FF28, that is, 1# sensor serial number;

③ Numerical 1250 indicates that the maximum value of engineering quantity displayed by the channel (-55 ~ + 125℃, that is, -550 ~ 1250) when the sensor is not connected.




Then we access the second sensor (for the strict wiring diagram, please refer to the above digital module wiring diagram), the access interval time of adjacent sensors should be greater than 10 seconds. Wiring diagram is as follows:

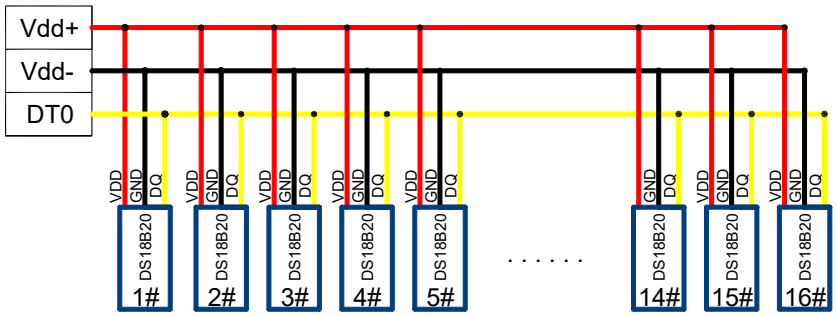



The read temperature and serial number as follows:

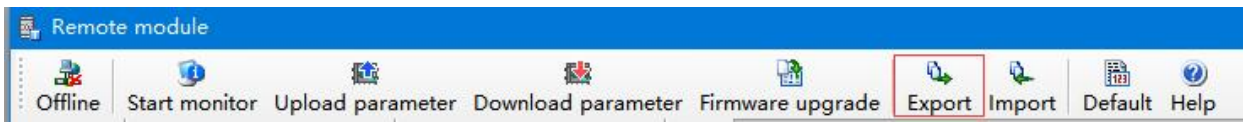
| | | | | |
|---|---|---|---|---|
| Channel 1: | 248 | 253 | 253 | 247 |
| | 254 | 250 | 255 | 1250 |
| | 1250 | 1250 | 1250 | 1250 |
| | 1250 | 1250 | 1250 | 1250 |

| Channel 1 | |
|---|---|
| A/D Data bits | 2 -11bit |
| Sensor configuration number | 7 |
| No:1 Sensor serial number | 3904 16A0 A719 FF28 |
| No:2 Sensor serial number | 4705 16A0 AF6E FF28 |

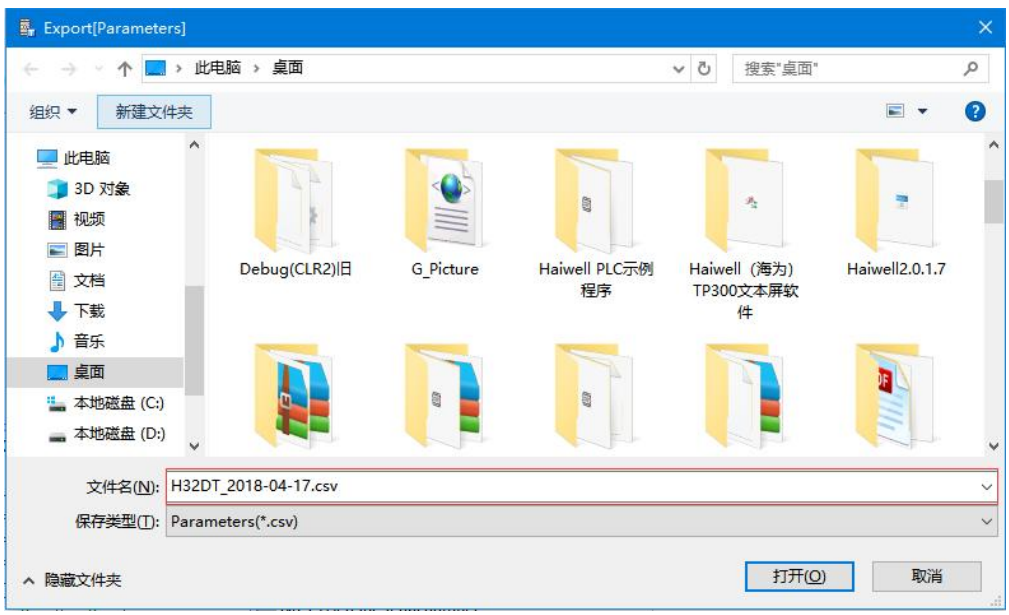
And so on, then we follow the order, from left to right continue to install sensors (adjacent sensors access interval needs more than 10 seconds), until the 16th sensor, which will record the temperature of each channel and the serial number.




After the 16 sensors of channel 1 accessed, channel 2 is accessed in the same way, when accessed, we follow the way from near to far or from far to near. After finishing the access of all sensors, we have to save the configuration parameters of H32DT module, this step is very important! (The back will introduce the application occasions). The specific operation is as follows, in the menu bar of remote module tool has an export function, we click export:




After export, click save：



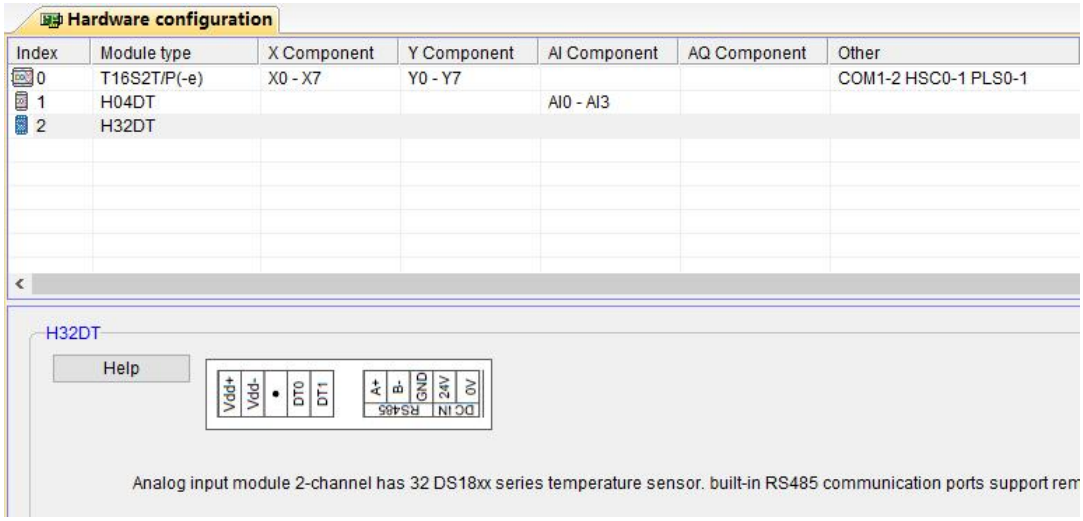

The above operation, the module line is connected, the parameters are also saved. Next host PLC needs to read the temperature from the module.

H32DT can communicate with the host PLC through the parallel port, also through the 485 port, H32DT used as the remote IO, it can communicate with the host PLC.

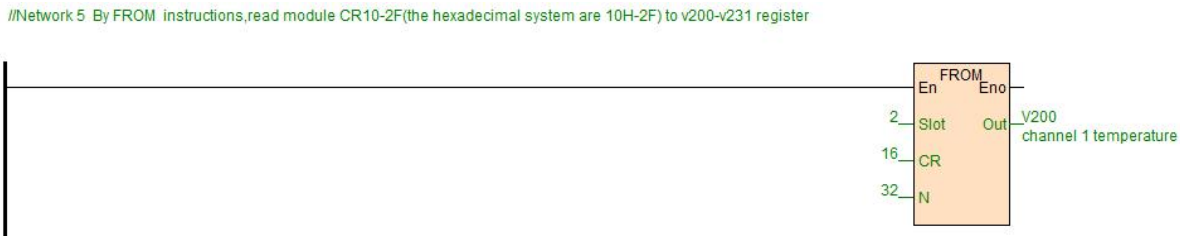
We can see according to the online help of PLC software - Hardware Manual - Expansion Module Parameters - Digital Temperature And Humidity Module Parameter Table, or the above《8.1 Digital Temperature and Humidity Module Parameter Table》, the temperature values of channels 1 and 2 exist in the module CR register.

Channel 1: 10H ~ 1FH; Channel 2: 20H ~ 2FH.

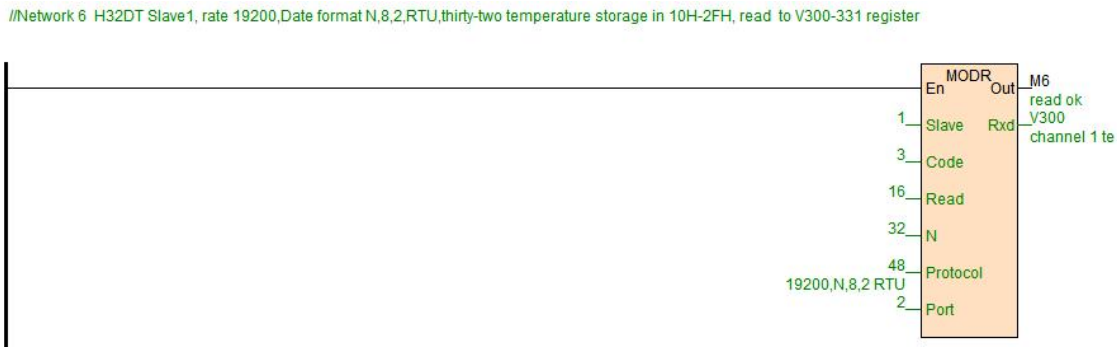
When the module communicates with the host PLC through the parallel port, the hardware configuration in this example is as follows:




At this time we can use FROM instruction to read the module's temperature value, because the module is in the second module position of hardware configuration, in the FROM instruction, we set Slot = 2, hex 10H, that is, the decimal 16, so the program as follows:




When the module is used for remote IO, the module is connected to the host PLC through the A + B- of serial RS485. The module default baud rate is 19200, data format is N 8 2 RTU, the default station number defaults to 1 and supports Modbus protocol. So communication program is as follows:




The above introduce the normal use steps and methods for H32DT. Then we will introduce how to deal with the common problems and on-site problems when using H32DT.

## FAQ for H32DT module

① If multiple sensors are connected before the H32DT module is powered on, then what will happen if the H32DT module is powered on again?

A: If multiple sensors are connected before the H32DT module is powered on, at this time, power on the H32DT module, then the H32DT module will automatically search all the sensors and randomly write them into the registers (CR10H ~ 2FH), that is, the order is out of order. So we can see the sequence of operation steps is very important. First, give the module power supply, and then according to the sequence from near to far, or from far to near to access sensors.

② If in the process of using, one of the temperature sensors is broken(any position), how to replace the sensor at this time?

A: The module does not need to be powered down, simply remove the damaged sensor, put a new one, then H32DT module will automatically identify and determine it. The temperature read by new sensor will automatically replace the damaged sensor, without affecting the other normal sensors' temperature acquisition.

③ If in the process of using, multiple temperature sensors are broken(any position, such as 3), how to replace these sensors at this time?

A: Just remove these damaged sensors and replace them with new ones in order.

The sequence here that is described earlier, it means the sequence of access sensors at the beginning, from near to far or from far to near. For example, the 16 sensors of channel 1 begin to be accessed from near to far in order, when using, the 2 #, 7 # and 13 # sensors are broken. At this point, the module need't power off, remove the 2 #, 7 #, 13 # sensors, put on new ones, according to the sequence, first access to the original position 2 # sensor, then 7 #, and finally the sensor position 13 #. In this way, the H32DT module will automatically identify and determine, the temperature values read by new sensors will automatically replace the damaged sensor, without affecting the other normal sensors' temperature acquisition.

In a similar way, if accessing to sensors according to from far to near, then when replacing them also from far to near.

④ If in the process of using, H32DT module itself is damaged, at this time, how to deal with to make sure that the sensors configured in front of are still the same order and can work normally?

A: The method for saving the module parameters was introduced in the previous section. Here you can use this configuration parameter to reflect the importance of the H32DT module configuration parameters.

H32DT module is damaged, at this moment, we only need to import the previously saved module parameters to new H32DT module through the remote module tool, import the previous configuration table, and finally click parameters download to download the parameters into the module.

The each position's temperature value and the sequence of the module will be consistent with the previous module.This can be very convenient to solve the replacement damaged modules problems.

⑤ The 4th point introduces the inportance of H32DT module parameter table, so does it mean that we should re-save a parameter table every time after replacing the probe?

A: Yes. After replacement each time, save a copy, this is a very rigorous and safe operation.

⑥ In the actual application, how to clear the H32DT module parameter configuration?

A: There are two ways, one for software removal configuration and one for hardware removal configuration. The following introduction:

Software removal configuration, click the default value in the channel without accessing any sensor, then click the parameter download to clear the configuration (sensor serial number).

Hardware removal configuration, configuration can be cleared (sensor serial number) by powering off and powering on the module for three times without accessing any sensor in the channel. The times of channel removal power-down configuration can be viewed in CRC6H and CRC7H.

⑦ H32DT channel indicator on the module is 0 and 1, what are the states of always-on and flashing?

A: 0 and 1 always-on means that the channel is working normally, flashing indicates that the sensor is disconnected.

⑧ For H32DT module, how to do the channel sensor communication break alarm?

A: The digital temperature module parameter table shows, H32DT module communication break alarm register are CR32H channel 1 and CR33H channel 2. So when extending through the parallel port, we can write the program as follows:

This example, the module is in the second lacation of hardware configuration, so in FROM instruction, we set Slot = 2, hexadecimal 32H, that is, decimal 50, the V30V31 in the program respectively indicates channel 1 break alarm register and channel 2 break alarm register . Through WTOB, we know that M100 ~ 115 as the break alarm status bits corresponding to 16 sensors in channel 1. M116 ~ 131 is the break alarm status bits corresponding to 16 sensors in channel 2, so the program is as

follows:

When the module is used as remote IO, the module and the host PLC are connected via RS485 serial port of A+B-. The default baud rate of module is 19200, the data format is N 8 2 RTU, the default station number is 1, supporting Modbus protocol. Disconnected alarm of CR32~33 channels are read back in V32V33. Through WTOB, we know that M300~315 are obtained as the disconnected alarm status bits corresponding to the 16 sensors in channel 1. M316~331 are the disconnected alarm status bits corresponding to the 16 sensors in channel 2, so the communication program is as follows:

⑨ What is the role of configuring the number of sensors?

A: If the number of sensors in the H32DT channel is less than the number of configured sensors, then the corresponding indicator of channel 0 and channel 1 will flash and alarm. When the actual number of sensors is greater than or equal to this configuration number, no alarm is issued.

⑩ What does numerical value of 850 mean when monitoring?

A: Check the manual of DS18B20 chip, find that the ground wire of the 850th-bit chip is dangling, so check the sensor wiring.

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