

Haiwell PLC User Manual

Programmable Logic Controller

Digital Module User Manual & Application Case



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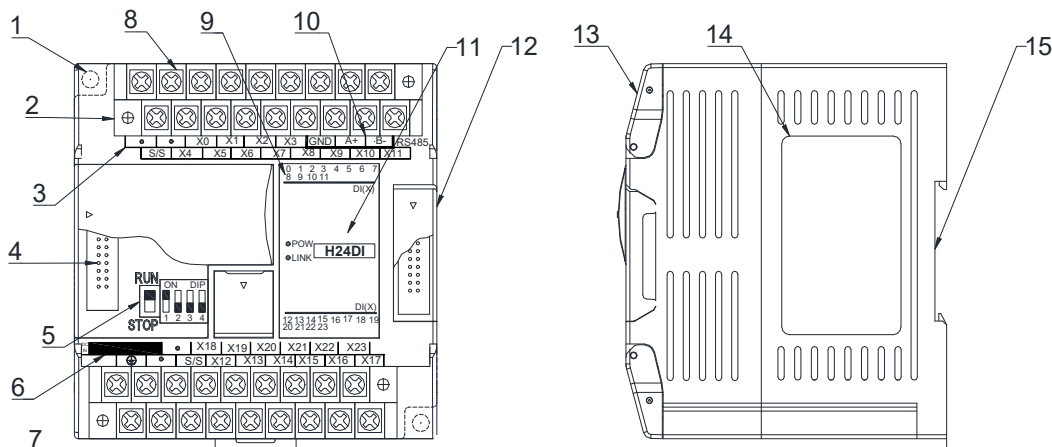
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Digital Module User Manual

1. Product Model List and Dimension

Ethernet Model	24VDC	Ethernet Model	220VAC	Model	24VDC	Model	220VAC	Dimension
				H08DI	0.02A			30×95×82mm
				H08DOR	0.08A			
				H08DOT/P	0.06A			
				H08XDR	0.05A			
				H08XDT/P	0.04A			70×95×82mm
				H16DI	0.03A			
				H16DOR	0.15A			
				H016DOT/R	0.1A			
				H16XDR	0.08A			93×95×82mm
				H16XDT/P	0.06A			
H24DI-e	0.06A	H24DI2-e	6.4W	H24DI	0.03A	H24DI2	5.8W	
H24XDR-e	0.16A	H24XDR2-e	8.9W	H24XDR	0.13A	H24XDR2	8.3W	
H24XDT/P-e	0.12A	H24XDT/P2-e	7.9W	H24XDT/P	0.09A	H24XDT/P2	7.3W	131×95×82mm
H40DI-e	0.07A	H40DI2-e	6.9W	H40DI	0.04A	H40DI2	6.3W	
H36DOR-e	0.34A	H36DOR2-e	8.6W	H36DOR	0.31A	H36DOR2	8W	
H36DOT/P-e	0.23A	H36DOT/P2-e	5.6W	H36DOT/P	0.2A	H36DOT/P2	5W	
H40XDR-e	0.18A	H40XDR2-e	9.4W	H40XDR	0.15A	H40XDR2	8.8W	177×95×82mm
H40XDT/P-e	0.16A	H40XDT/P2-e	8.9W	H40XDT/P	0.13A	H40XDT/P2	8.3W	
H64XDR-e	0.33A	H64XDR2-e	12.9W	H64XDR	0.3A	H64XDR2	12.3W	
H64XDT/P-e	0.23A	H64XDT/P2-e	10.4W	H64XDT/P	0.23A	H64XDT/P2	10.4W	



1. Fixed hole	8. Removable terminal
2. Removable terminal screw	9. Digital channel indicator
3. Terminal definition	10. RS485 communication port
4. Module expansion port	11. PWR power indicator, LINK module communication indicator
5. DIP switch (8/16-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

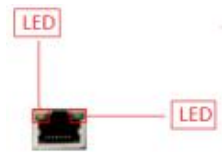
2. Indicator Description

- 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



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	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

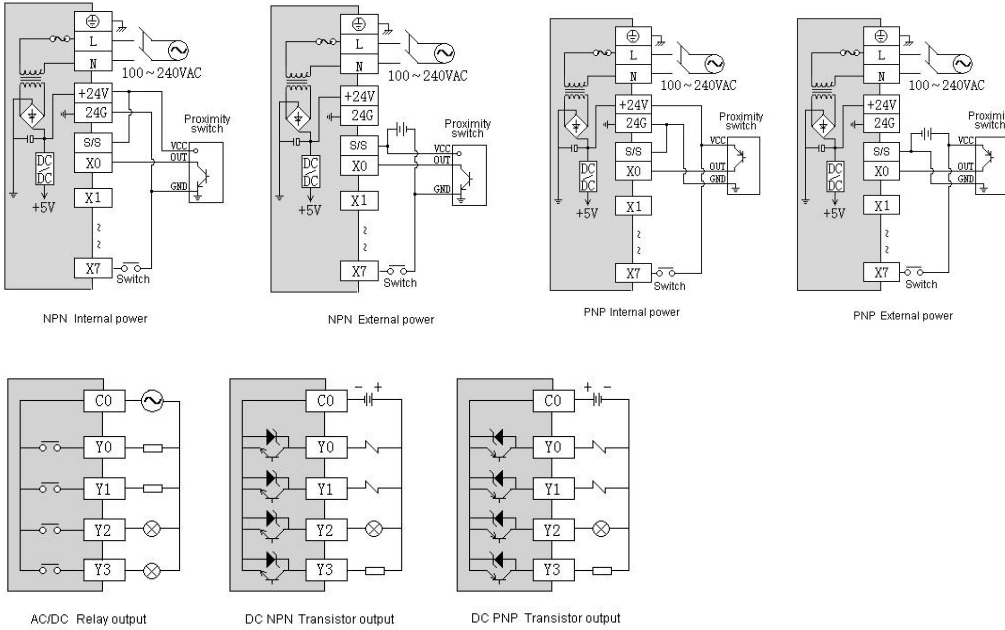
5. Digital Input (DI) Specification

Item	Digital Input (DI)
Input signal	No voltage contact or NPN/PNP
Action driving	ON>3.5mA OFF<1.5mA
Input impedance	Input Impedance≈4.3KΩ
Maximum input current	10mA
Reaction time	6.4ms DEFAULT, can be configured to 0.8~51.2ms
Isolation type	Independent optoelectronic isolation for each channel
Input indication	LED's lighting indicates ON, no light indicates OFF
Power supply	MPU internal power supply:DC power supply (SINK or SOURCE) 5.3mA@24VDC

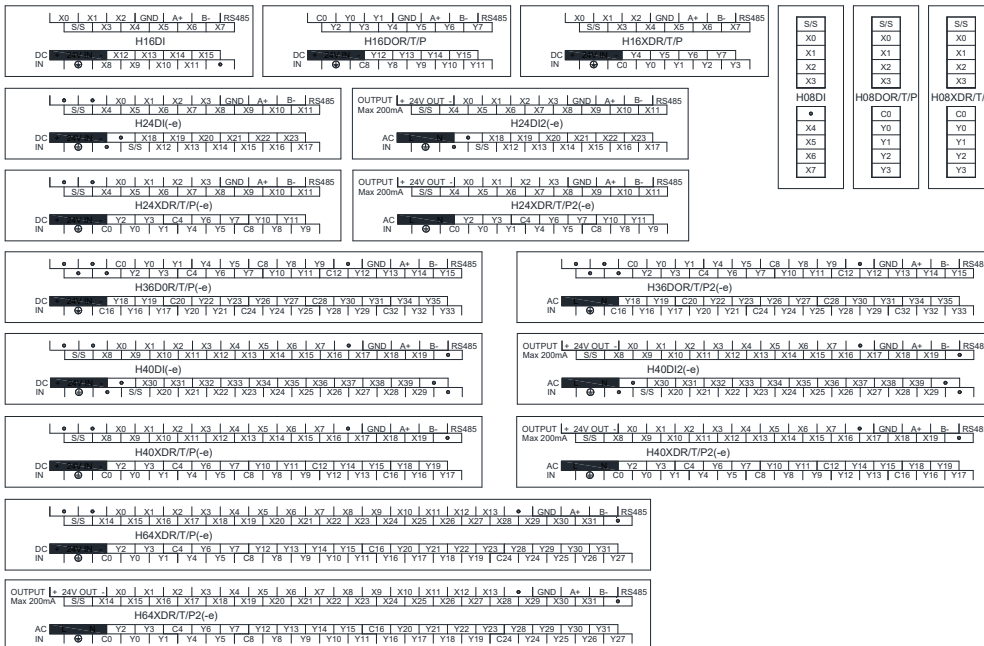
6. Digital Output (DO) Specification

Item	Output point type : Relay - R		NPN or PNP transistor output T/P
Maximum load	Resistive Load	2A/1 point, 8A/4 points COM	0.5A/1 point, 2A/4 points COM
	Inductive Load	50VA	5W/DC24V
	Lamp load	100W	12W/DC24V
Minimum Load		10mA	2mA
Voltage Specification		Below 250VAC, 30VDC	30VDC
Drive Capability		Maximum contact capacity: 5A/250VAC	1A MAX, 10 seconds
Reaction Time		Off→On 10ms, On→off 5ms	Off→On 10μs, On→Off 120μs
Isolation Type		Mechanical isolation	Independent optoelectronic isolation for each channel
Output Indication		LED's lighting indicates ON, no light indicates OFF	
Power Supply		MPU internal 24VDC power supply	

7. Digital Input/Output (DI/DO) Wiring Diagram



8. Terminal Wiring Diagram



9. Module Parameter Table (CR code is corresponding to the Modbus register address)

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
	H16DI, H16DOR, H16DOT, H16XDR, H16XDT, H24DI, H24XDR, H24XDT, H40DI, H36DOR, H36DOT, H40XDR, H40XDT, H64XDR, H64XDT
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 mask255.255.255.0, 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~4FH	DI channel 1~64 input value
50H~8FH	DO channel 1~64 output value
90H	DI filter time ms, 0 - 0.8、 1 - 1.6、 2 - 3.2、 3 - 6.4、 4 - 12.8、 5 - 25.6、 6 - 51.2
91H~9FH	Reserve

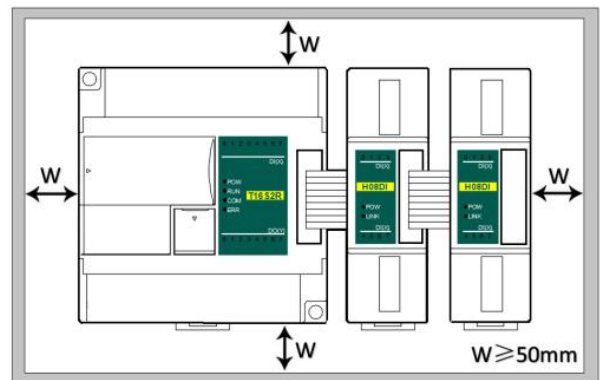
10. Mounting and Installation

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.

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.



Extension Module Wiring: Connections between extension modules and connections between module and MPU are achieved through bus. An 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.

Digital Module Application Case

1. Expand module through the host PLC parallel port

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:

- ① When the host PLC can be expanded to 7 modules, the PWR indicators of first 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 module 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. Set the module digital input filter time and whether the digital output is downtime output or not through hardware configuration. The hardware configuration determines the corresponding address of the input and output points on the module

For example, the host PLC T48S2T connects with two digital module of H24XDT/P and H08DOT/P through the parallel port, when the hardware configuration is completed, the address of the module input and output points will be immediately determined.

First, enter the PLC programming software menu bar - view - hardware configuration, add the module model according to the external actual order, after adding, the switching points address will be automatically arranged, as shown below:

Hardware configuration						
Index	Module type	X Component	Y Component	AI Component	AQ Component	Other
0	T48S2T/P(-e)	X0 - X27	Y0 - Y19			COM1-2 HSC0-1 PLS0-1
1	H24XDT/P	X32 - X43	Y24 - Y35			
2	H08DOT/P		Y40 - Y47			

Set the filtering time of the external switch input points in the hardware configuration, and set whether the each output point of the module is downtime output or not. In this example, in order to set Y24 and Y25 as downtime output, just select the corresponding boxes of Y24 and Y25 .

The screenshot displays the configuration for an H24XDT/P module. At the top, there are 'Help' and 'Default' buttons. Below them is a terminal strip diagram with two rows of points: X0-X11 and Y0-Y11. The 'Digital inputs' section is configured with a component range of X32-X43 and a filter time of 6.4 ms. The 'Digital outputs' section is configured with a component range of Y24-Y35 and includes checkboxes for 'Keep output' and 'Select all'.

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.

2.1. Module power supply

When the module is used as remote IO, there are two optional models of 24VDC and 220VAC, such as H24DI model for the DC 24V power supply. H24DI2 for AC 220V power supply. If the module is powered normally, the PWR indicator will light.

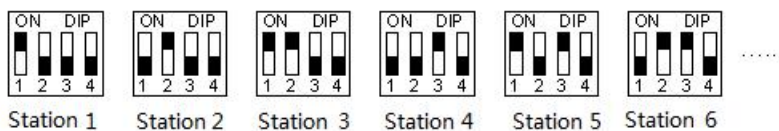
2.2. Communication port introduction

- ① All digital modules are built-in RS485 port.
- ② As for 8-point digital 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).

2.3. Communication protocols and default parameters

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.

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

2.4. 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.

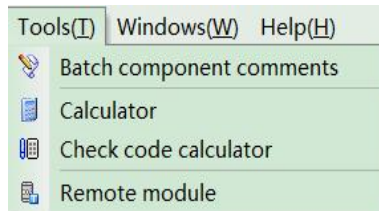
2.5. Parameter configuration example: The module is configured by programming software remote module tool


Hardware connection

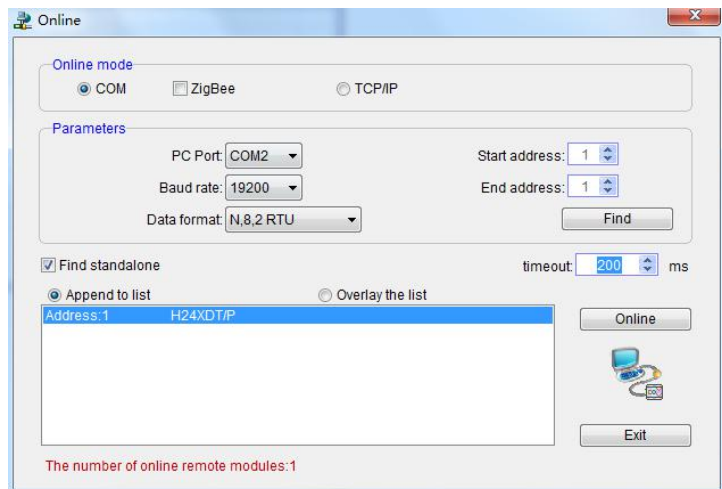
- ① Through the RS485 communication port (the terminals of A +,B- on the module) connection: If the computer has a serial port, you can use the converter of 232 to 485 connecting with the module; if it has one USB interface, you can use the converter of USB to 485 connecting with the module.
- ② Through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

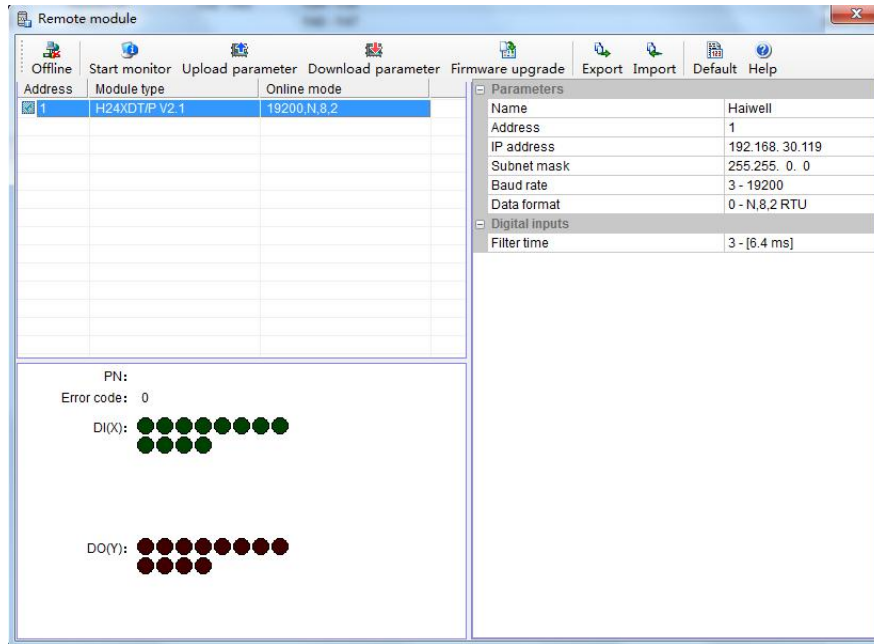


Click the button  in the pop-up window to open the "Online" window. The module default address is 1,19200, N 8 2 RTU, the online success is as follows:

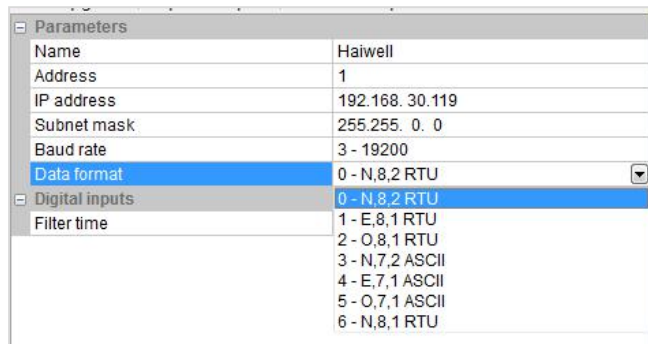


If there is only one machine connected with 485 line, then check "stand-alone search"; if there are more than one, then remove the button of "stand-alone search", and set the start address and end address, so that all the machines connected with 485 line can be found and achieve parameter configuration.

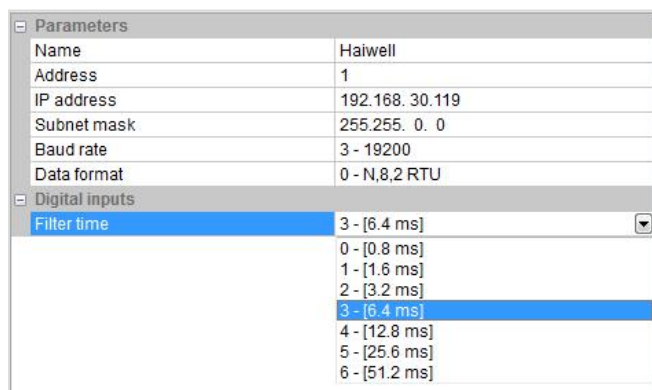
Click to exit, enter the configuration interface, as shown below:



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 switch input area, we can set the channel filter time.



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



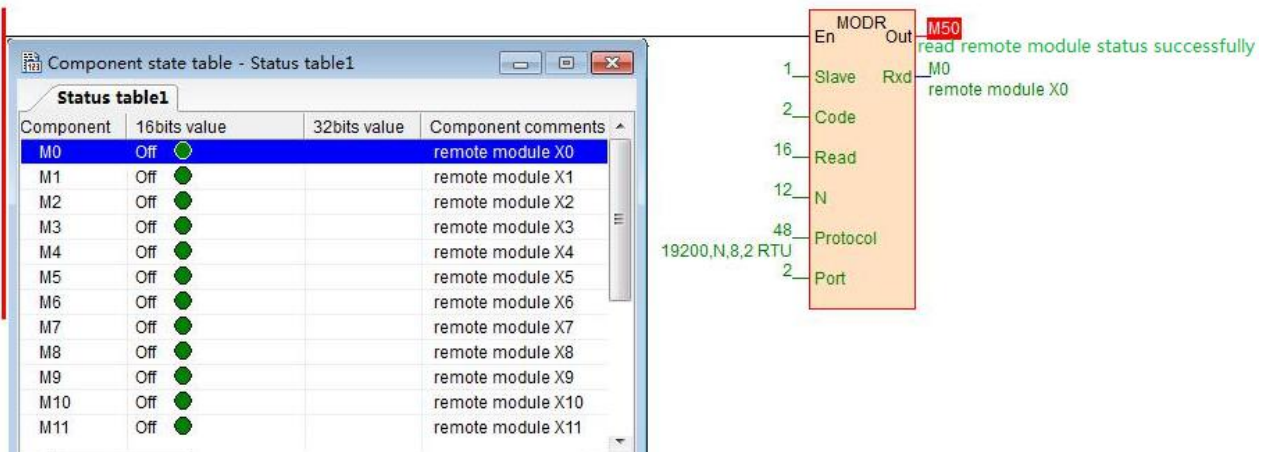
In addition, we can do the following operations through the remote module tool:

- ① Online monitoring the channel value of module, error code.
- ② Upload the module parameter, 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.

2.6. Remote IO application example(RS485 mode): The PLC reads the 12 input channels status of the H24XDT 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: It can be seen from the above CR parameter list of digital module that the CR code 10H ~ 1CH of H24XDT module stores the input status of channels 1 ~ 12.
- ③ PLC program: Host PLC wants to read the 12 channels input status of remote IO module H24XDT. In this example, H24XDT communication is the default parameter: Station number address is 1, baud rate is 19200, data format is N 8 2 RTU. The PLC reads the 12 channels input status of H24XDT module:

//Network 1



The host PLC reads the 12 channels input status of H24XDT by Modbus read instruction MODR, the start address is 10H (hexadecimal), that is, the decimal value is 16. When the communication is successful, M50 is ON, the input points status which are read back will be stored in M0-M11.

2.7. Remote IO application example (RS485 mode): The PLC writes the 12-channel output values of H24XDT 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 digital module CR parameter table shows that, the output channel 1 ~ 12 output values of 12-channel module are stored in address 50H~5CH.
- ③ PLC program: Host PLC wants to write the 12-channel output values of remote IO module H24XDT. In this example, H24XDT communication parameters: Station number address is 1, baud rate 19200, data format N 8 2 RTU. The program of writing 12-channel output values of H24XDT is as follows:

//Network 2

The screenshot shows a 'Component state table - Status table1' window with the following data:

Component	16bits value	32bits value	Component comments
M20	On		remote module output channel 1
M21	Off		remote module output channel 2
M22	Off		remote module output channel 3
M23	Off		remote module output channel 4
M24	Off		remote module output channel 5
M25	Off		remote module output channel 6
M26	Off		remote module output channel 7
M27	Off		remote module output channel 8
M28	Off		remote module output channel 9
M29	Off		remote module output channel 10
M30	Off		remote module output channel 11
M31	Off		remote module output channel 12

To the right, a ladder logic diagram shows a 'MODW' instruction block with the following parameters:

- En: M51 (write remote module successfully)
- Out: M51 (write remote module successfully)
- 1: Slave
- 15: Code
- 80: Write
- M20: Val (remote module output channel 12)
- N: 12
- 48: Protocol (19200,N,8,2 RTU)
- Port: 2

Host PLC writes the 12-channel output values of H24XDT by Modbus write instruction MODW, the start address is 50H(hexadecimal), that is, the decimal value is 80. When writing successfully, M51 is ON, the 12-channel values which will be written into are stored in M20-M31.

2.8. Remote IO application example(Ethernet mode): PLC read and write each channel input and output values of H64XDT-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 H64XDT-e digital module CR parameter table shows that the input values of module input channel 1 ~ 32 are stored in the address 10H~30H. The output values of module output channel 1-32 are stored in 50H~70H.
- ③ PLC program: Read the 32-channel input status of remote Ethernet module H64XDT-e and write the 32-channel output values of H64XDT-e, if the module IP address is 192.168.1.112, station number address is 1, the read results are stored in the M100~M131, the values to be written are stored in the register M200-M231. As follows:

The diagram shows two 'TCPMDR' and 'TCPMDW' instruction blocks connected to a network address of 192.168.1.111.

The top block is a 'TCPMDR' instruction with parameters:

- En: M52 (read module successfully)
- Out: M100 (read module successfully)
- IP: 192.168.1.111
- Rxd: M100
- 2: Code
- 16: Read
- 32: N
- 1: Slave

The bottom block is a 'TCPMDW' instruction with parameters:

- En: M53 (write module successfully)
- Out: M53 (write module successfully)
- IP: 192.168.1.111
- 15: Code
- 80: Write
- M200: Val
- 32: N
- 1: Slave