

CS-IO1616 Modbus RTU I/O Module Manual



OneFex

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Notice

- ❖ Please read this manual carefully before use and save it for reference.
- ❖ Please follow to the operating procedures and precautions in this manual.
- ❖ Please open the package carefully and check whether the device and accessories have been damaged due to transportation when you receive the device. Please contact us for return processing once damage occurs.
- ❖ Please do not repair it yourself, and contact our technical support department directly if the device fails.

OneFex Industrial IoT

1 Product Introduction

CS-IO series products are Serial I/O module using standard Modbus-RTU protocol, supporting RS485/232. Support wide voltage power supply, multi-channel input and output control, which can be widely used in various application scenarios such as industrial production, agriculture, smart city and office buildings.

1.1 Features

- ◆ DC 9-28V wide voltage power supply, support anti-reverse connection;
- ◆ 16-way DO contact isolation, normally ON and normally OFF, 10A 250VAC / 10A 30VDC;
- ◆ 16-way DI, with optocoupler isolation, used for switch detection, supports dry and wet contacts;
- ◆ 2*LED indication: 1 for power status, 1 for work status; 16 for relay status;
- ◆ Supports RS485+RS232 Communication interface, RS485 power isolation plus signal isolation, reliable communication;
- ◆ Communication baud rate: 300bps~38400bps (, It is 9600 by default and can be modified by software);
- ◆ Support standard Modbus RTU protocol, read and write by register address;
- ◆ 253 device addresses can be set. The 5-bit address DIP switch can set 1-31 address codes, and those greater than 31 can be set by software;
- ◆ Support input and output linkage, such as local linkage or dual-computer linkage, which is convenient for multi-terminal control;
- ◆ Support debugging software for setting parameters and IO control;
- ◆ Support software and hardware customization. Contact Us for details.

1.2 Parameter

Parameter	
Contact capacity	10A/30VDC 10A/250VAC
Durability	100,000 times (Electrical) 10,000,000 times (Mechanical)
Data interface	RS485
Rated voltage	DC 9-28V
Power indication	1 LED (power, always on) 1 LED (working: flashing)
Output indication	16 LEDs (relay on and off)
Working temperature	-40°C ~ 85°C, Industrial Grade
Size	200*110*60mm
Weight	330g
Default communication format	9600,n,8,1
Baud rate	300~38400bps

Functions	Flash ON Flash OFF All ON All OFF NO Lock Linkage Lock Linkage All Channel Lock Linkage 2Device NO Lock Linkage 2Device Lock Linkage
Software support	Working mode change DO independent control DI status query Overall DO control; Debugging information query; Support various configuration software; support Labview, etc.
Installation	35mm Din Rail Mounting / Screw Holes

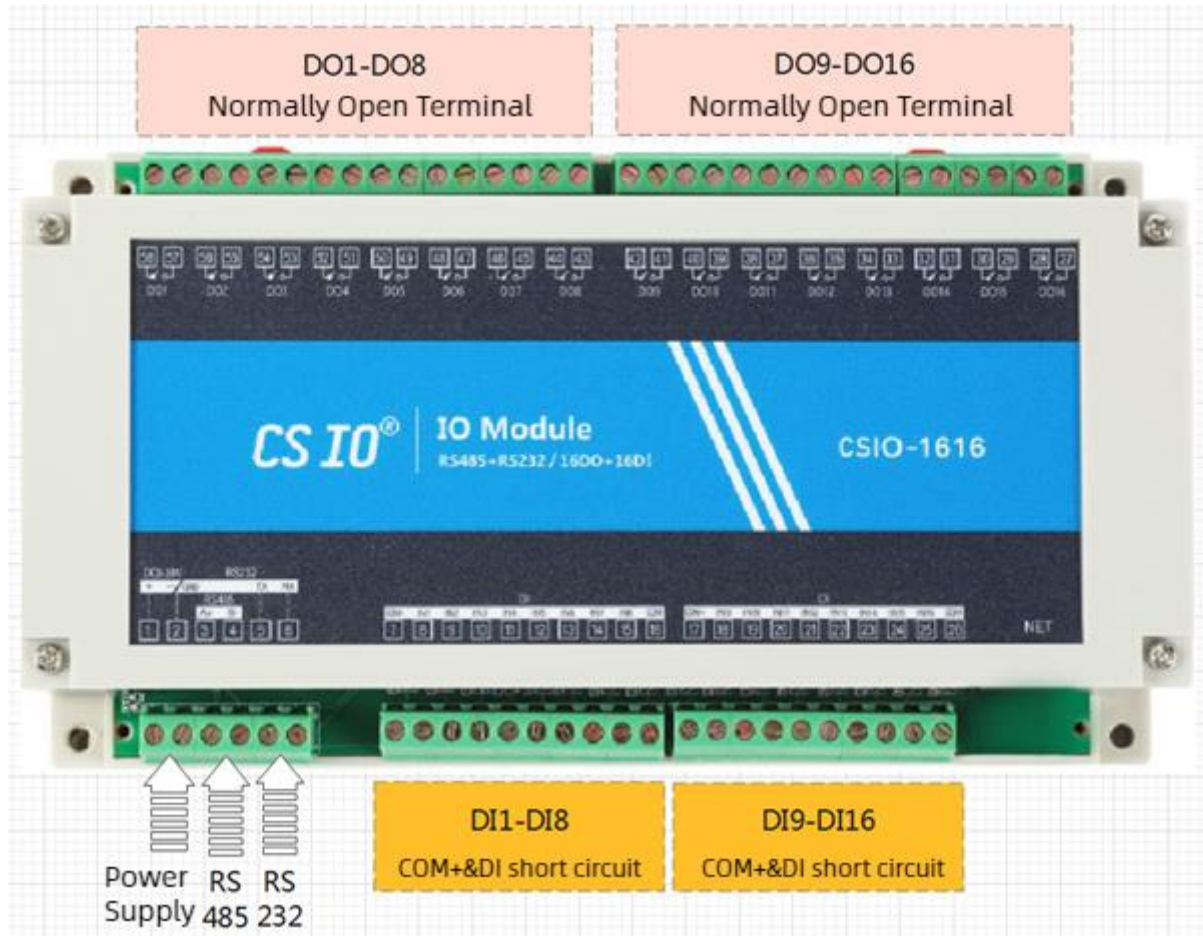
1.3 Item Selection

Item #	DO	DI	Analog	RS485	Address Dial
CS-IO101	1	1	0	RS485 * 1	Address Dial
CS-IO204	2	4	0	RS485 * 1	Address Dial
CS-IO222A	2	2	2(0-20mA)	RS485 * 1	Address Dial
CS-IO404A	4	0	4(0-20mA)	RS485 * 1	Address Dial
CS-IO404	4	4	0	RS485 * 1	Address Dial
CS-IO606	6	6	0	RS485 * 1	Address Dial
CS-IO808	8	8	0	RS485 + RS232	
CS-IO1600DI	0	16	0	RS485 + RS232	Address Dial
CS-IO1600	16	0	0	RS485 + RS232	Address Dial
CS-IO3200	32	0	0	RS485 + RS232	Address Dial
CS-IO1616	16	16	0	RS485 + RS232	Address Dial

1.4 Dimension

200*110*60mm

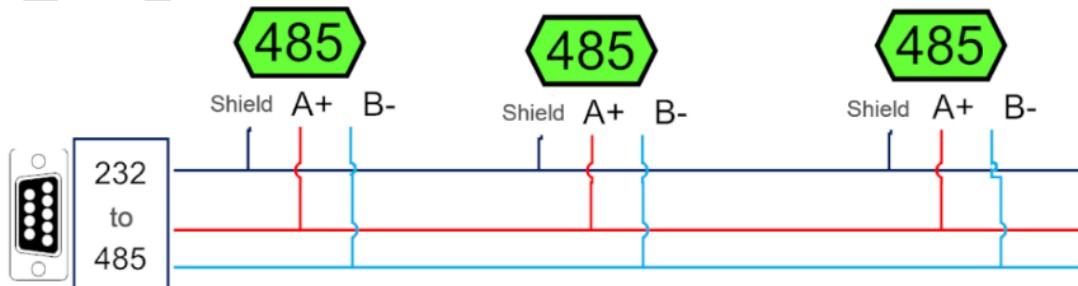
2 Wiring Instructions
2.1 Terminal Definition



2.2 Communication Wiring

By default, its address is 1, The host computer software can use the default address 1 to communicate with the device (or broadcast address 254, which is only applicable when one device is mounted on the network).

RS485 Wiring

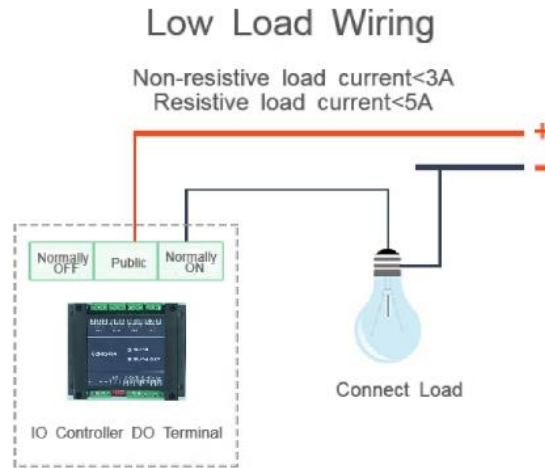


2.3 DO Wiring

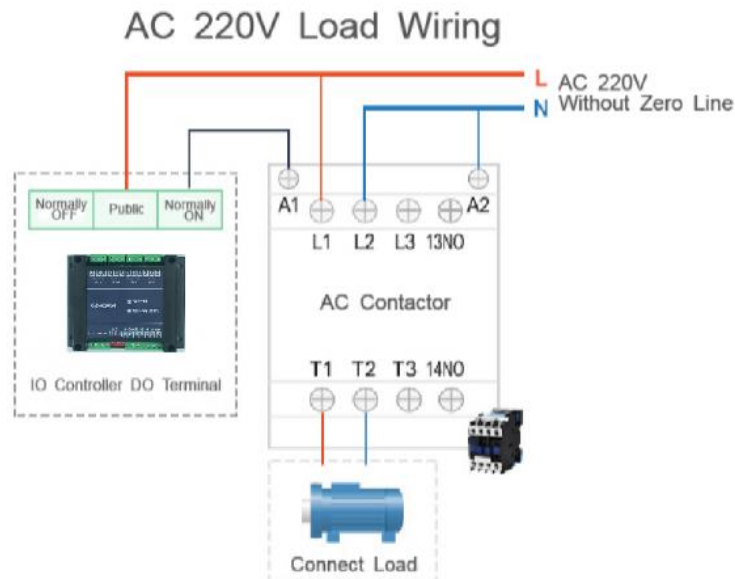
The relay is a normally open terminal, each channel has 2 terminals,

2.3.1 Low Load Wiring

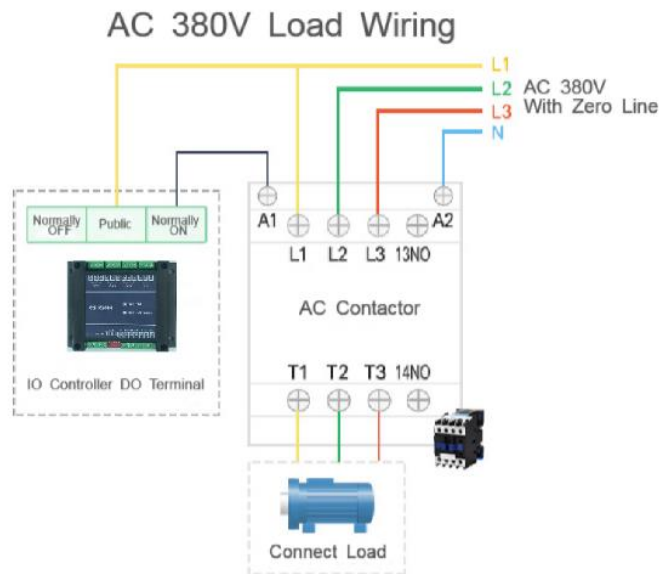
Applicable for non-resistive load current < 3A or resistive load current < 5A



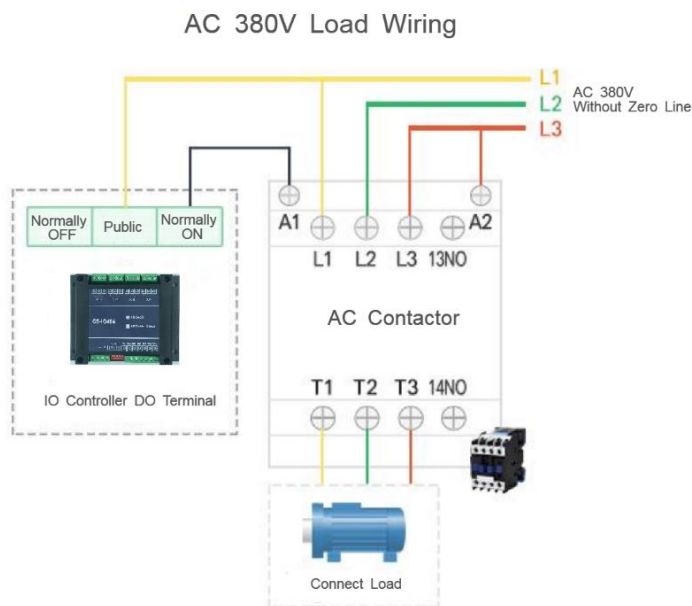
2.3.2 AC 220V Load Device Wiring



2.3.3 AC 380V Load Device Wiring 【With Zero Line】



2.3.4 AC 380V Load Device Wiring 【Without Zero Line】



Please add an AC contactor/intermediate relay between this device and the load in the following four cases:

1. Load rated voltage > 30VDC
2. Load rated voltage > 250VAC
3. Non-Resistive Load Current > 3A
4. Resistive load current > 5A

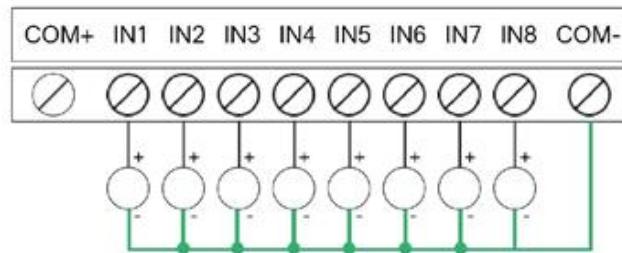
2.4 Digital Input Wiring

There are 16 switching value acquisition ports in total. The DI terminal is connected to V+ to trigger a valid signal. Please ensure that the voltage is $\geq 5V$.

1. Left floating DI terminal or given 0 voltage, and the data point reads 0.
2. Connect DI terminal to V+, or a positive voltage $\geq 5V$, and the data point reads 1.

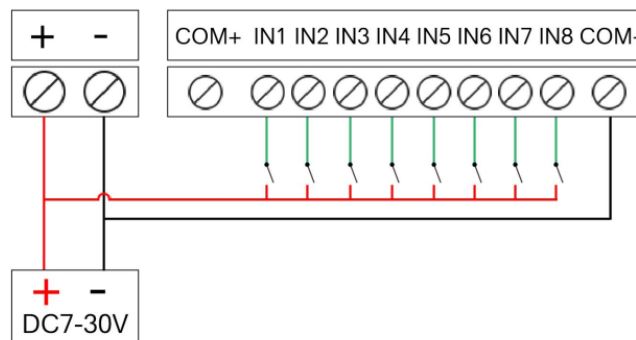
2.4.1 Active Signal Wiring

Suitable for measuring signals with voltage, such as level and pulse output.



2.4.2 Passive Switch Value (Dry Contact) Wiring

It is suitable for passive contact signal, such as various switches, buttons, etc.



3 Parameters and Working Mode Configuration

3.1 Device and PC Connection Settings

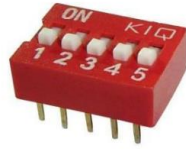
The USB end of the USB to RS485 converter is directly connected to the USB port of computer, and 485 end is wired according to the wiring method in "Chapter 2.2 Communication Wiring".

Serial port number query method: Open "My Computer - Device Manager - Port (COM and LPT)" and the COM number that appears after the USB to 485 device is inserted is the serial port number.

3.2 Device Address

3.2.1 Introduction

The Offset Address of this device is 1 by default, and the broadcast address is 254 to communicate, but 0 cannot be used.



5-bit DIP switch

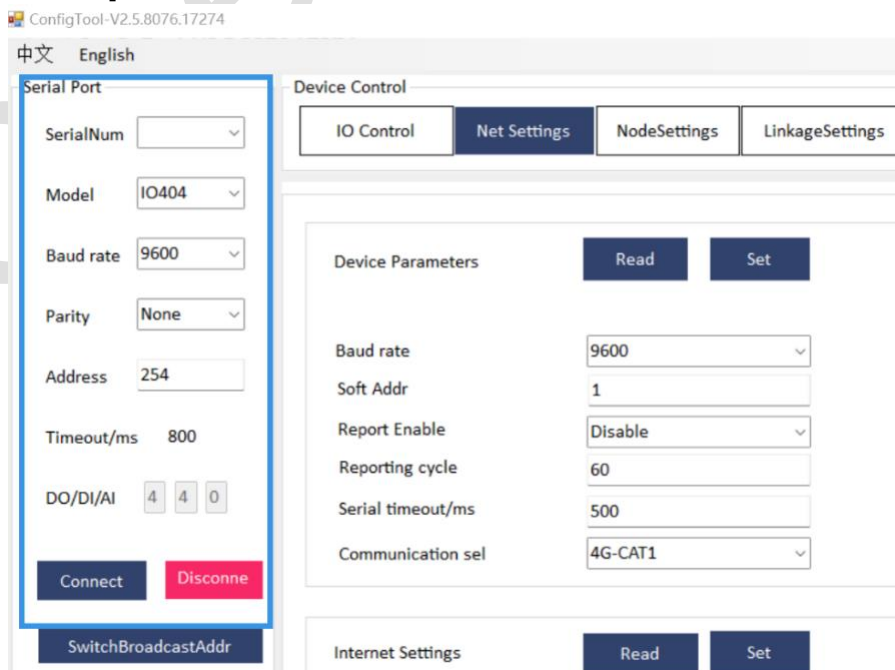
Communication address = Hardware address (dip switch address) + Offset address.

The device's Factory default settings of communication address is 1. With DIP switch, users can quickly modify the device address.

- (1) The address is "31" when all 5 dial codes are dialed above;
- (2) The address is "0" When all 5 dial codes are dialed below;
- (3) The leftmost 1 is the lowest digit in binary;
- (4) DIP address table:

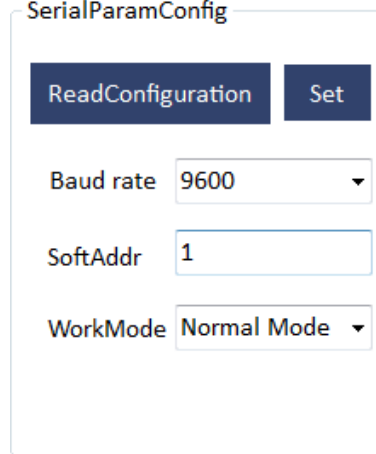
3.2.2 Device Communication Address Reading

After the device connected normally, the I/O module debugging software read the current address 254 [only support broadcast read address when there is one device on the bus].



3.2.3 Offset Address Setting and Reading

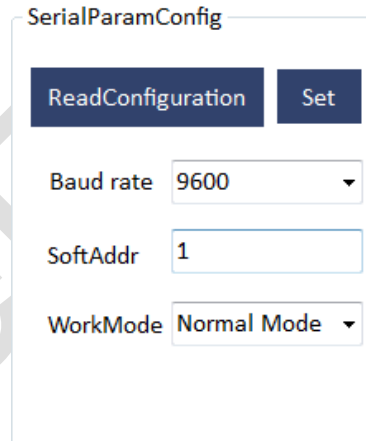
Click "Read" or "Set" to read or set the Offset Address of the device (address parameters stored in the device).



The screenshot shows a web interface titled "SerialParamConfig". At the top, there are two buttons: "ReadConfiguration" and "Set". Below these are three configuration fields: "Baud rate" is a dropdown menu set to "9600"; "SoftAddr" is a text input field containing the number "1"; and "WorkMode" is a dropdown menu set to "Normal Mode".

3.2.4 Baud Rate Reading and Setting

Click "Read" and "Set" to read and set the baud rate and address respectively, which will take effect immediately after the operation.



This screenshot is identical to the one in section 3.2.3, showing the "SerialParamConfig" interface with "ReadConfiguration" and "Set" buttons, and fields for "Baud rate" (9600), "SoftAddr" (1), and "WorkMode" (Normal Mode).

3.3 Working Mode

3.3.1 Normal Mode

The relay takes corresponding actions after ON or OFF command.

3.3.2 NOLock Linkage Mode

It is a board module with optocoupler input and DO. In this mode, the input optocoupler and the relay are directly linked.

The optocoupler input signal takes effect -> the corresponding relay is pulled in,
 The optocoupler input signal is canceled -> the corresponding relay is disconnected.

In this mode, due to mechanical and program delay, there will be a certain delay

between the optocoupler input signal and the relay action, but the maximum will not exceed 0.05 seconds.

In this mode, all relays are directly linked by the optocoupler, so the serial port cannot operate the relay. This is not an abnormal phenomenon, but after the serial port operates the relay, it is linked by the optocoupler state before the relay is still in action.

3.3.3 Lock Linkage Mode

In this mode, each time the optocoupler inputs a signal, the corresponding relay is flipped once.

The optocoupler input signal takes effect -> the relay flips (the pull-in changes to disconnect, the disconnect changes to pull-in);

The optocoupler input signal is canceled -> the relay does not act;

This mode also has the delay problem of unlocked mode, but the delay time is also not greater than 0.05 seconds. This mode can be mainly used for external signal triggering to control the start and stop of the device. For example, an optocoupler is connected to a button, and the corresponding relay is connected to an electrical device. Each time the button is pressed, the device will switch to a start-stop state.

3.3.4 All Channel Lock Linkage Mode

The module itself has a board module with optocoupler input and DO. In this mode, each time the optocoupler inputs a signal, the corresponding relay will be pulled in, and relays of the other optocouplers will be disconnected if no signal is input.

The optocoupler input signal takes effect -> the corresponding relay is pulled in and other relays are disconnected;

The optocoupler input signal is canceled -> the relay does not act;

This mode also has a delay problem, but the delay time is also not greater than 0.05 seconds. This mode can be mainly used for external signal triggering to control the start and stop of different devices, such as

The multi-channel optocoupler is not connected to a button, and the corresponding relay is connected to an electrical device. If you press a button, the corresponding device will switch to the start state, and other devices will stop running.

3.3.5 2Device NOLock Linkage Mode

This mode requires two devices with the same address and mode to complete. After the two devices are connected through direct connection 485 or cross 232, the optocoupler state of module 1 will directly control the state of the corresponding relay of module 2.

No. 1 optocoupler input signal of module 1 is valid—> No. 1 relay of module 2 is OFF

No. 1 optocoupler input signal of module 1 disappears -> No. 1 relay of module

2 is disconnected

The relay response delay time in this mode is longer than the previous modes, but not more than 0.1 second (9600 baud rate).

In this mode, if the 485 bus is used, multiple devices can be connected in parallel, and the addresses of the devices match each other, so that the remote switch value can be transmitted. For example, if there are multiple low-speed switches on site that need to be transmitted to the control room 500 meters away to control the alarm lights or bells, it is only necessary to arrange a few modules in the workshop and connect them to the corresponding modules in the machine room through two twisted-pair shielded cables. can complete this task. In the same way, the button signal of the computer room operation can also be directly transmitted to the relay located in the computer room module.

3.3.6 2Device Lock Linkage Mode

This mode requires two devices with the same address and mode to complete. After the two devices are connected through direct connection 485 or cross 232, the optocoupler state of module 1 will take effect and the state of the corresponding relay of control module 2 will be reversed.

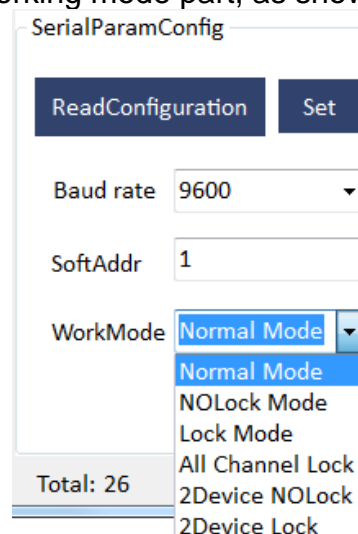
No. 1 optocoupler input signal of module 1 is valid—> No. 1 relay of module 2 is flipped

No. 1 optocoupler input signal of module 1 disappears -> No. 1 relay of module 2 does not act

The application of this mode is similar to the "2Device NOLock Linkage" mode, but it is more suitable for the start and stop of remote-control equipment. Just install a button on the operation end to realize the action of pressing once to start and pressing once to stop.

3.3.7 Working Mode Configuration

After the device communicates normally, select the corresponding working mode setting in the software working mode part, as shown in the following figure:



4 Development Data Instruction

4.1 Communication Protocol Instruction

This product supports standard Modbus commands. For detailed command generation and parsing methods, you can refer to "MODBUS Protocol English Version" based on the register table in this article.

This product supports Modbus RTU format.

4.2 Modbus Register Instruction

Register address table:

Script code	Meaning
01	Read coil register [DO]
02	Read discrete input [DI]
03	Read parameter register (use 06 to write parameters)
05	Write a single coil
15(0x0F)	Write multiple coils

Parameters Configuration			
Communication baud rate	Read register function code 03 Write register function code 06	03E8H	See the baud rate value correspondence table below. The default is 0 and supports 0-5. This register determines the communication baud rate of RS232 and RS485 at the same time.
Spare		03E9H	Spare,the user cannot write any value.
Offset address		03EAH	Communication address=software address+DIP switch address
Working Code		03EBH	Working mode storage
Spare		03ECH	Spare

(1) The Modbus device command supports the following Modbus addresses:
 00001 to 09999 are discrete outputs (coils)
 10001 to 19999 are discrete inputs (contacts)
 30001 to 39999 are input registers (usually analog inputs)
 40001 to 49999 are holding registers (usually store device configuration information)
 In 5-bit code format, the first character determines register type, and the remaining 4 characters represent address.
 Address 1 starts from 0, such as 00001 corresponds to 0000.

(2) Baud rate value corresponding table

Value	Baud rate
0	9600
1	2400
2	4800
3	9600
4	19200
5	38400

(3)

00001 address to query DO status and control;

10002 address to query DI status;

The register address is in accordance with the PLC naming rules, the real address is to remove the highest bit, and then subtract 1

4.3 Command List

Scene	RTU format (send in hexadecimal)
Query 16 DOs 'status	FE 01 00 00 00 10 29 C9
Return query command information	FE 01 02 FF FF AC 58
Query 16DIs'status	FE 02 00 00 00 10 6D C9
Return control information	FE 02 02 00 00 AD AC
Control the 1 st DO on	FE 05 00 00 FF 00 98 35
Return control information	FE 05 00 00 FF 00 98 35
Control the 1 st DO off	FE 05 00 00 00 00 D9 C5
Return control information	FE 05 00 00 00 00 D9 C5
Control the 2 nd DO on	FE 05 00 01 FF 00 C9 F5
Control the 2 nd DO off	FE 05 00 01 00 00 88 05

4.4 Command Details

4.4.1 Control DO

Control 1 DO (take the 1st DO ON as an example, other channels refer to this)

Tx:014-FE 0F 00 00 00 01 01 01 A0 53

Rx:015-FE 0F 00 00 00 01 80 04

Tx:029-FE 05 00 00 FF 00 98 35

Rx:030-FE 05 00 00 FF 00 98 35

Field	Meaning	Note
FE	Device address	It is the broadcast address
05	05 command	Single control command
00 00	Address	Register address of the DO to control
FF 00	Command	Relay ON action
98 35	CRC16	CRC16 checksum of the first 6 bytes of data

4.4.2 Query DO Status

Query 16Dos' status

Tx:000-FE 01 00 00 00 10 29 C9

Rx:001-FE 01 02 00 00 AD E8

Field	Meaning	Note
FE	Device address	It is the broadcast address
01	01 command	Query DO status command
00 00	Starting address	Register address of the first DO to be queried
00 10	Number of queries	The number of the DOs to be queried
29 C9	CRC16	CRC16 checksum of the first 6 bytes of data

Field	Meaning	Note
FE	Device address	
01	01 command	Return command: If the query is wrong, return 0x81
02	Number of bytes	All bytes of return status information. $1+(n-1)/8$
00 00	Status of the query	Returned relay status. Bit0: first relay status Bit1: second relay status Bit7: The eighth relay status
AD E8	CRC16	CRC16 checksum of the first 6 bytes of data

4.4.3 Optocoupler Input

Query 16DIs' status

Tx:053-FE 02 00 00 00 10 6D C9

Rx:054-FE 02 02 00 00 AD AC

Field	Meaning	Note
FE	Device address	It is the broadcast address
02	02 command	Query DI (optocoupler input) status command
00 00	Starting address	Register address of the first optocoupler to be queried

00 10	Number of queries	Number of optocoupler status to be queried
6D C9	CRC16	CRC16 checksum of the first 6 bytes of data

Field	Meaning	Note
FE	Device address	
02	02 command	Return command: If the query is wrong, return 0x81
02	Number of bytes	All bytes of return status information. $1+(n-1)/8$
00 00	Status of the query	Return the state of the optocoupler. Bit0: Status of the first optocoupler Bit1: Status of the second optocoupler Bit7: Status of the 8th optocoupler
AD AC	CRC16	CRC16 checksum of the first 6 bytes of data

4.4.4 Flash ON Flash OFF Command

Field	Meaning	Note
FE	Device address	
10	10 Command	Query input register command
00 03	DO address	The address to be controlled
00 02	Number of control commands	The number of commands to the relay
04	Bytes	The total number of bytes of the control message command. $1+(n-1)/8$
00 04 / 00 02	Command	00 04: flash OFF command 00 02: flash ON command
00 0A	Interval time	00 0A is 10 (hexadecimal converted to decimal) The interval time is (0.1 seconds*10)
00 D8	CRC16	Check method

Return code: FE 10 00 03 00 02 A5 C7

Field	Meaning	Note
FE	Device address	
10	10 command	Return instruction: If the query is wrong, return 0x82
00 03	Device address	Query the address of the device
00 02	Number of commands accepted	The number of commands accepted by the device
A5 C7	CRC16	check digit

4.4.5 All ON and All OFF Command

Tx:047-FE 0F 00 00 00 10 02 FF FF A6 64

Rx:048-FE 0F 00 00 00 10 40 08

Field	Meaning	Note
FE	Device address	
0F	0F command	Return command: If the query is wrong, return 0x82
00 00	Starting address	
00 10	Number of Controls	Number of DOs Controlled
02	Bytes	Bytes of Send command
FF FF	ALL ON/ALL OFF command	FF: All ON command 00: All OFF command
A6 64	CRC16	Check digit

Field	Meaning	Note
FE	Device address	
0F	Off command	Return command: If the query is wrong, return 0x8F
00 00	Starting address	
00 10	Quantity	Number of relays returning information
40 08	CRC16	Check digit

4.4.6 Active Reporting Protocol

This function is a non-standard Modbus protocol, which can only be used in dual-computer mode, and is suitable for the serial relay to actively report changed switch value

Filed	Meaning	Note
0x40 0x57	Header	
0x01	Device Address	
0x02	IO status lower 8 bits	
0x00	IO status high 8 bits	
0x42+0x01+0x02+0x00	Check Digit	0x42+deviceaddress+IO status low 8 bits + IO status high 8 bits

5 Product Maintenance

5.1 Device Usage Environment

1. The working voltage is 9~28V. If the input voltage is too high or too low, the device may not work normally or even be damaged.
2. The DI input terminal adopts optocoupler isolation protection, and its bearing voltage is 5~24V.
3. Do not overload for the DO output terminals. Please connect them correctly within the allowable range (refer to the wiring diagram for details).
4. The allowable air humidity of the device is 5~85%RH, and it does not have waterproof capability. Do not use it in condensation or liquid immersion environments.
5. The relay is a component with a certain service life. When the theoretical service life is reached, please replace it in time to avoid danger.

5.2 FAQ

5.2.1 RS485 /RS232 communication, no response when device control

Confirm whether the communication speed, communication address, and wiring are correct.

You can use the broadcast address 254 to try to communicate with unknown addresses;

Confirm whether the serial port number on the software is correct;

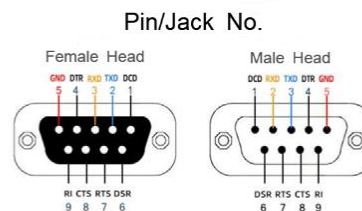
Check whether the power supply and work indicator are normal;

For the RS232 version, please correctly identify the RS232 serial port module used as male or female.

The module TXD is connected to RX pin of the relay

The module RXD is connected to TX pin of the relay

The module GND is connected to GND pin of the relay



5.2.2 The relay can only be turned on but not turned off

Check Whether the read address reads the actual device address;

Check whether there is a return command in the debug information column, and whether the return command is correct.

If reading address fails, there is no return command or abnormal return command, check the communication line and communication converter

When the io module and the controlled equipment share a DC power supply, if the controlled equipment is heavily loaded, it may cause insufficient power supply of the io module and the relay cannot switch normally.

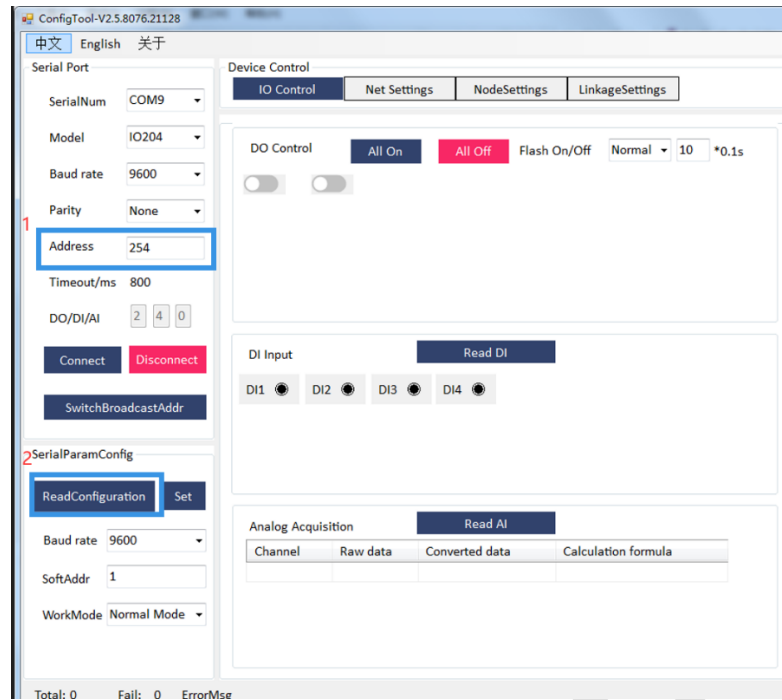
5.2.3 485 interface cannot be used to establish communication and control After the relay powered on.

1. Check whether the 485 line is reversed and whether the voltage is within the specified range;
2. Fill in 254 for the device address on software to test whether it can be can be controlled with different baud rates.

5.2.4 Multiple devices on the 485 bus and ON/OFF operation failed to send the broadcast address 254.

If there are multiple devices on the 485 bus, the address of each device cannot be the same, and the broadcast address 254 cannot be used for communication.

Use DIP switch/software to distinguish the module' address, otherwise the command cannot be executed correctly. (Please refer to below photo: how to set the address if multiple modules)



The broadcast address 254 can be used when there is only one device on the bus. When there is more than one device.

5.2.5 PLC and the device cannot communicate normally

1. Check whether the PLC communication parameters match the relay;
2. Check whether the PLC communication protocol is standard Modbus RTU;
3. Check whether the definition of Siemens 485 bus AB is opposite to this device.

5.2.6 How to restore the factory settings

You can use the DIP switch to restore the factory settings.

Operation steps:

Power on, dial all the dial codes to ON, and toggle bit5 back and forth 6 times.

Dial all the dial codes, then you can use the host computer software (baud rate 9600, address 254) to communicate.

6 After-sale Service

6.1 Commitment

OneFex provides after-sales service of the device within one year from the date of sale. But for damage caused by improper use, you need to send it back and take the freight for repair or adjust. Make sure that the package is in good condition to avoid damage during transportation. Repair the damage of device instrument is free.

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