Instructions for Use of Industrial 4-Channel Relay Module

Introduction

This industrial 4-channel relay module allows you to control your electrical equipment only through one computer serial port. It supports DC7-30V wide voltage power supply, optocoupler isolation, four-way switching input, and four-way relay output. The management and controlling of electrical equipment can be completed by a computer, which makes this module able to be widely used in scenarios like factories, hotels, etc., as well as lighting control in stages, homes, cinemas, etc., and can also be used for motor control, production line control, etc.

The module adopts the standard Modbus RTU protocol, the communication interface supports RS485 or RS232, and supports communication baud rates of 2400, 4800, 9600, 19200, 38400 (default 9600). Each relay output is independent and can be connected to different load devices, such as 220V electric lights, 24V solenoid valves, etc. Both AC and DC devices can be controlled. Each relay output contact is isolated, and can set 0-255 device addresses. It also supports flash on/off function.

Specification

- Contact Capacity: 10A/30V DC, 10A/250V AC
- Durability: 100,000 times
- Data Interface: RS485
- Rated Voltage: DC 7-30V
- Power Indicator: 1 red LED indicator

- Output Indicator: 4 red LED indicators
- Temperature Range: industrial grade, -40℃～85℃
- Default Communication Format: 9600, n, 8, 1
- Baud Rate: 2400, 4800, 9600, 19200, 38400
- Size: 115*95*41mm / 4.53*3.74*1.61 inch

Interface Description

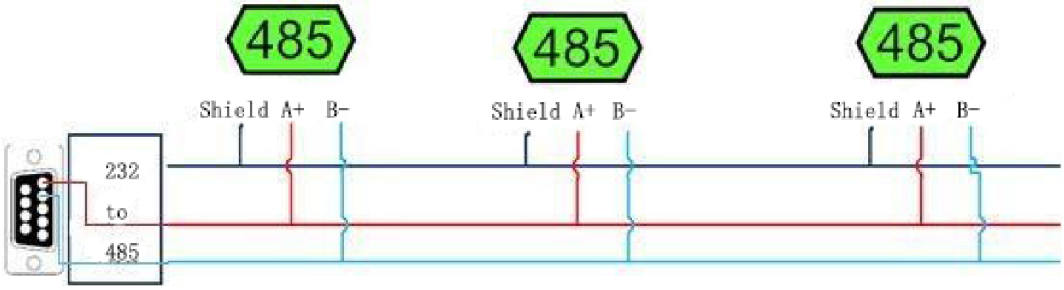
Pin Description:

Number	Pin	Description
1	+	Positive power supply
2	-	Negative power supply
3	VIN	When passive input, VIN and COM are used for short-circuiting, please refer to the input wiring diagram for details
4	COM+	When passive input, VIN and COM are used for short-circuiting, please refer to the input wiring diagram for details

5	IN1	The first way switch input
6	IN2	The second way switch input
7	IN3	The third way switch input
8	IN4	The fourth way switch input
9	COM-	Used for passive input, refer to the input wiring diagram for details
10	Normally opened	The first relay output NO
11	The public side	The first relay output Common
12	Normally closed	The first relay output NC
13	Normally opened	The second relay output NO
14	The public side	The second relay output Common
15	Normally closed	The second relay output NC
16	Normally opened	The third relay output NO
17	The public side	The third relay output Common
18	Normally closed	The third relay output NC
19	Normally opened	The fourth relay output NO
20	The public side	The fourth relay output Common
21	Normally closed	The fourth relay output NC

Wiring

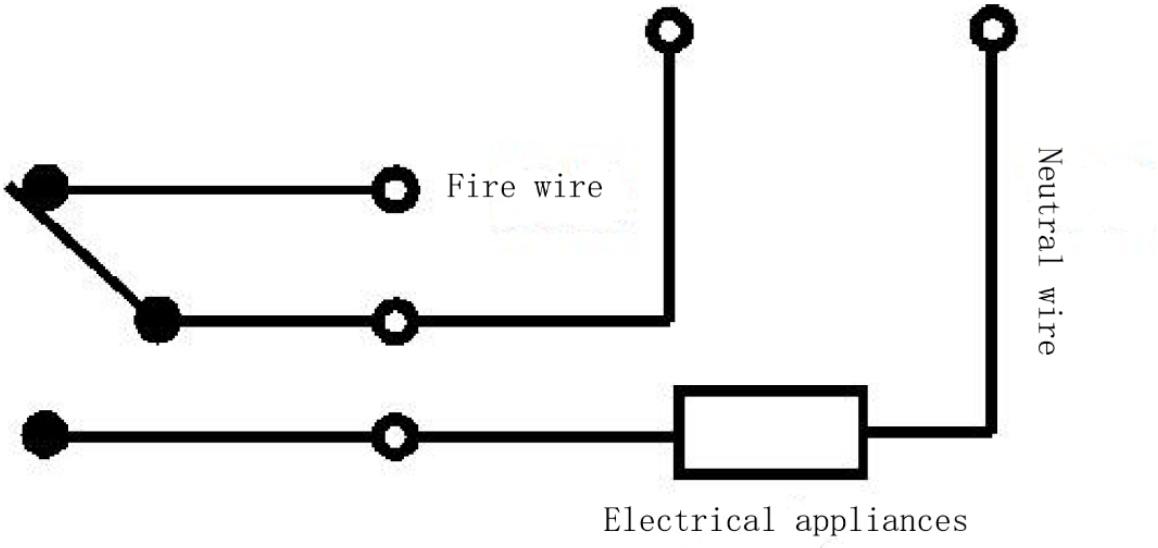
1. RS485 cascade connection



The COM port of a computer is generally RS232, so you need a 232-485 converter for connection(an active and isolated converter is recommended for industrial environments). After conversion, RS485 has A and B two wires, A is connected to the board A terminal, and B is connected to the board B terminal, the 485 shield can be connected to GND. If there are more equipment, it is recommended to use shielded twisted-pair cable and a chain network structure.

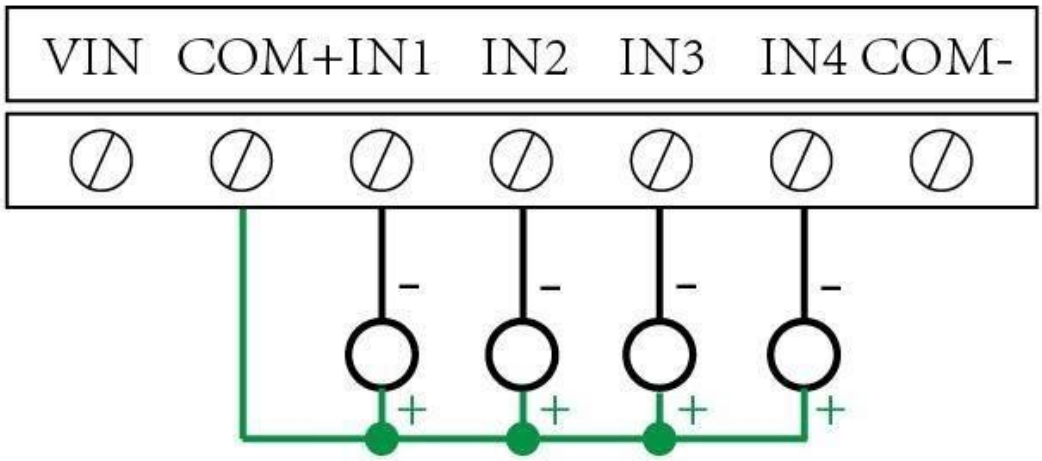
2. Output wiring

2.1. General relay wiring instructions

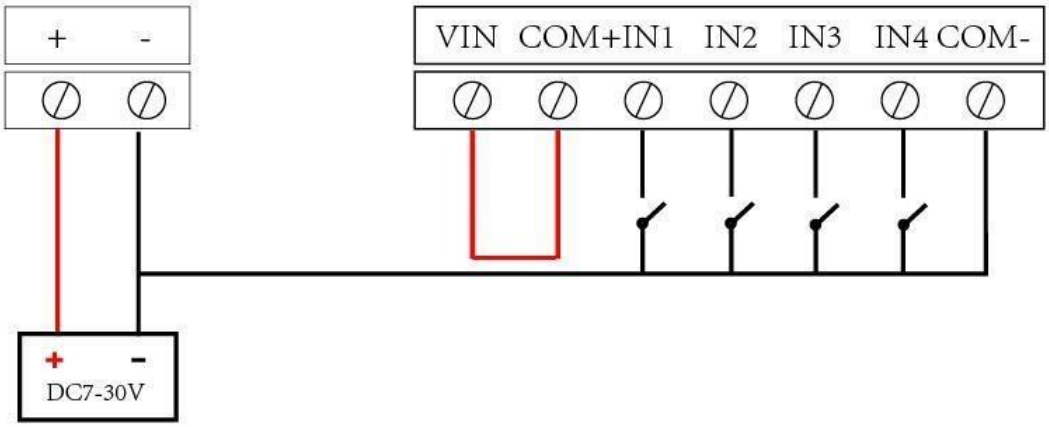


3. Input wiring

3.1. Wiring diagram of active switch (NPN-type low level)



3.2. Wiring diagram of passive switch (dry contact)



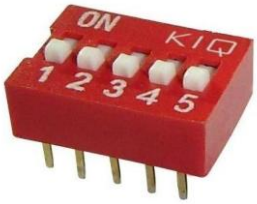
Parameters and Working Mode Settings

1. Device address

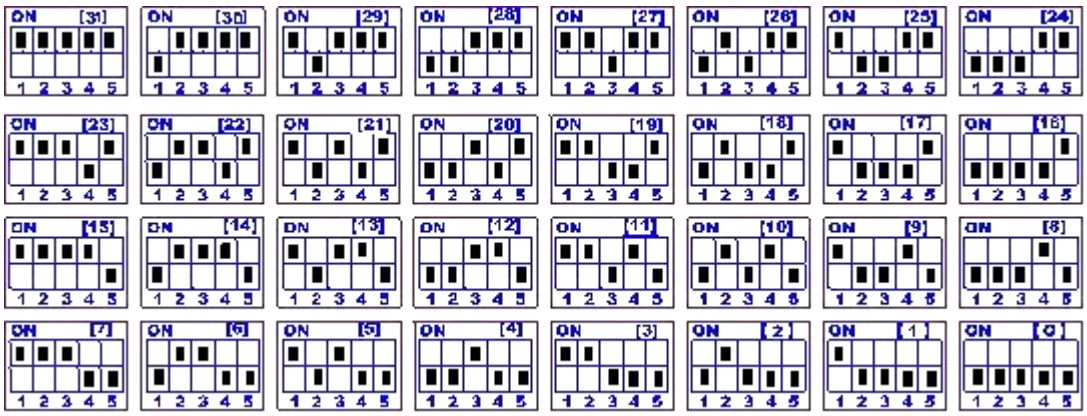
The module device address is 1 by default, and the communication broadcast address is 254. *If the default address is read as 0, change the address first. 0 cannot be used for communication.*

Device address = DIP switch address + offset address.

2. DIP switch address



1. When all five switches are dialed to the "ON" position, it is the address "31";
2. When all the five switches are dialed to the "OFF" position, it is the address "0";
3. The leftmost 1 is the lowest bit of the binary system.
4. Address table:



3. Working mode

Local non-locking mode

The module itself has a card module with optocoupler input and relay output. In this mode, the input optocoupler and relay are directly linked. That is: the optocoupler input signal is valid—>the corresponding relay is connected; The optocoupler input signal is canceled—>the corresponding relay is disconnected.

In this mode, due to the 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.

All relays are directly linked by optocoupler in this mode, so there will be a phenomenon that the serial port can not operate the relay. This is not an abnormal phenomenon, it is because after the serial port operates the relay, it is linked by the state of the optocoupler before the relay is activated.

Local self-locking mode

The module itself has a card module with optocoupler input and relay output. In this mode, the corresponding relay flips once for each input signal of the optocoupler. That is to say:

The optocoupler input signal takes effect—>relay status is reversed (connected to disconnect, disconnected to connect);

The optocoupler input signal is canceled—>the relay does not operate;

This mode also has the delay problem of the non-lock mode, but the delay time will also not be greater than 0.05 seconds.

This mode can be mainly used in situations where external signals trigger to control the start and stop of equipment, such as optocoupler connected with a button, and relay connected with electrical equipment, then every time the button is pressed, the equipment will switch the start and stop state.

4. Flash On/Off functions and settings

Introduction to Flash On/Off

Manual mode: every time the relay is operated, the relay will flip once (open when closed, close when open);

Flash On mode: Each time the relay is operated, the relay will be connected for 1 second (actual time [unit: second] = set number *0.1) and then disconnected automatically;

Flash Off mode: every time the relay is operated, the relay will be disconnected for 1 second (the time is adjustable) and then closed by itself;

Note: The Flash On/Off modes cannot be written into the device chip. After the flash mode is selected in the software, all channels are in this mode. A single channel can be controlled independently by sending the flash on/off commands to it, which do not affect the normal control of other channels.

Communication Protocol

1. Modbus register description

Coil register address table:

Register name		**Register address**	**Description**
Coil control			
Coil 1	Write coil	0x0001	The first relay output
Coil 2	Instruction Code No. 1	0x0002	The second relay output
Coil 3		0x0003	The third relay output
Coil 4		0x0004	The fourth relay output
Discrete input			
Input 1	Switch	1x0001	The first input
Input 2	Instruction Code No. 2	1x0002	The second input
Input 3		1x0003	The third input

Input 4		1x0004	The fourth input
Configuration parameter			
Communication baud rate	Holding register	4x1001	See the corresponding table of baud rate values in the following table, the default is 0,
			Support 0-5, this register determines the communication baud rate of RS232 and RS485 at the same time
Spare		4x1002	Spare, the user cannot write any value.
Offset address		4x1003	Device address = offset address + DIP switch address
Operating mode		4x1004	Available for users, store user data
Delay		4x1005	Available for users, store user data

Remarks:

①: Modbus device instructions support 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 input)

40001 to 49999 are holding registers (usually storing device configuration information)

Using a 5-bit code format, the first character determines the type of register, and the remaining 4 characters represent the address.

②: Correspondence table of baud rate value

Numerical value	**Baud rate**
0	9600
1	2400

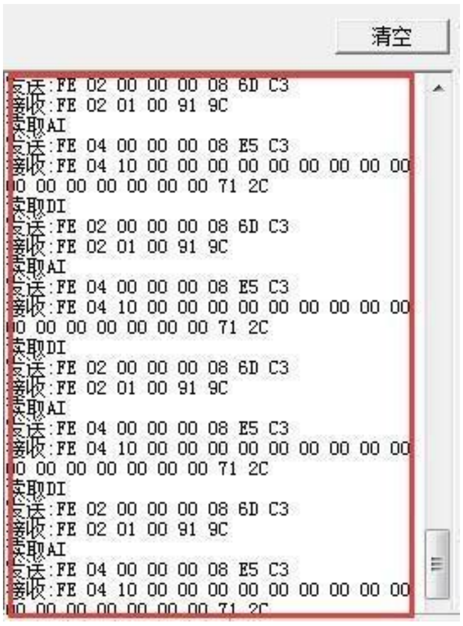
2	4800
3	9600
4	19200
5	38400

2. Instructions for command generation

Application example and description: In addition to the offset address, the local address also has the default 254 as the broadcast address. When there is only one device on the bus, you don't need to care about the DIP switch address, just use the 254 address directly. When there are multiple devices on the bus, select different addresses through the DIP switch, and the control commands are distinguished by the address.

Notice: The RS232 bus is a one-to-one bus, that is, there can only be two devices on the bus, such as a computer and a relay card, and only the 485 bus can mount multiple devices.

The command can be obtained through the serial port debugging tool.



Descriptions for instruction generation: For instructions not in the following table, users can generate them according to the modbus protocol. Reading and writing of the relay coil is actually the reading and writing of the coil register in the modbus register. The address of the relay register has been explained above. Users only need to generate read and write instructions for register operations. For example, reading or writing the status of relay 1 is actually a read and write operation to the coil register 00001 which is corresponding to relay 1.

3. Instruction List

Scene	RTU Format（Sending in hexadecimal）
Query four-way status	FE 01 00 00 00 04 29 C6
Query command returns information	FE 01 01 00 61 9C
Control the first way to open	FE 05 00 00 FF 00 98 35
Control return information	FE 05 00 00 FF 00 98 35
Control the first way to close	FE 05 00 00 00 00 D9 C5
Control return information	FE 05 00 00 00 00 D9 C5
Control the second way to open	FE 05 00 01 FF 00 C9 F5
Control the second way to close	FE 05 00 01 00 00 88 05
Control the third way to open	FE 05 00 02 FF 00 39 F5
Control the third way to close	FE 05 00 02 00 00 78 05
Control the fourth way to open	FE 05 00 03 FF 00 68 35
Control the fourth way to close	FE 05 00 03 00 00 29 C5
Read the first optical coupler	FE 02 00 00 00 01 AD C5
Returned information	FE 02 01 00 91 9C
Read the second optical coupler	FE 02 00 01 00 01 FC 05
Read the third optical coupler	FE 02 00 02 00 01 0C 05
Read the fourth optical coupler	FE 02 00 03 00 01 5D C5

4. Instruction details

4.1. Relay output

Control the first relay (take the first channel closure as an example, refer to this example for other channels)

Sending code: FE 05 00 00 FF 00 98 35

Field	**Meaning**	**Remarks**
FE	Device address	Here is the broadcast address
05	05 instructions	Single control instruction
00 00	Address	To control the address of the relay register
FF 00	Instruction	Relay closing action
98 35	CRC16	CRC16 checksum of the first 6 bytes of data

Relay module returns information:

Return code: FE 05 00 00 FF 00 98 35

Field	Meaning	Remarks
FE	Device address	Here is the broadcast address
05	05 instructions	Single control instruction
00 00	Address	To control the address of the relay register
FF 00	Instruction	Relay closing action
98 35	CRC16	CRC16 checksum of the first 6 bytes of data

4.2. Relay status

Relay query（4-way relay）

Field	Meaning	Remarks
FE	Device address	Here is the broadcast address
01	05 instructions	Query relay status command
00 00	Address	The address of the first relay register to be queried
00 04	Instruction	Number of relays to be queried
29 C6	CRC16	CRC16 checksum of the first 6 bytes of data

Send instruction code: FE 01 00 00 00 04 29 C6

Relay module returns information:

Return code: FE 01 01 00 61 9C

Field	Meaning	Remarks
FE	Device address	
01	01 instructions	Return command: if the query is wrong, return 0x81
01	Number of bytes	Returns the total number

		of bytes of status information. 1+(n-1)/8
00	The status of the query	The returned relay state. Bit0: the first relay state Bit1: The second relay status . . . . . . Bit7: The eighth relay state
61 9C	CRC16	CRC16 checksum of the first 6 bytes of data

4.3. Optocoupler input

Query optocoupler (4 optocouplers)

Send instruction code: FE 02 00 00 00 04 6D C6

Field	**Meaning**	**Remarks**
FE	Device address	
02	02 instructions	Query discrete input (optocoupler input) status command
00 00	Initial address	The register address of the first optocoupler to be queried
00 04	Number of queries	Number of optocoupler status to be queried
6D C6	CRC16	CRC16 checksum of the first 6 bytes of data

Optocoupler return information:

Return code: FE 02 01 00 91 9C

Field	**Meaning**	**Remarks**
FE	Device address	
02	02 instructions	Return command: if the query is wrong, return 0x82
01	Number of bytes	Returns the total number of bytes of status

		information.
00	The status of the query	The status of the returned optocoupler. Bit0: The state of the first optocoupler Bit1: The status of the second optocoupler . . . . . . Bit7: The status of the eighth optocoupler
91 9C	CRC16	CRC16 checksum of the first 6 bytes of data

4.4. Flash On/OFF instructions

Flash On/Off command analysis:

Flash On sending code: FE 10 00 03 00 02 04 00 04 00 0A 41 6B

Flash Off sending code: FE 10 00 03 00 02 04 00 02 00 0A A1 6A

Field	**Meaning**	**Remarks**
FE	Device address	
10	10 instructions	Query input register command
00 03	Relay address	Device address to be controlled
00 02	Number of control commands	Number of commands to control relay
04	Number of bytes	The total number of bytes of the control information command. 1+(n-1)/8
00 04 or 00 02	Instruction	00 04 is the flash on command 00 02 is the flash off command
00 0A	Intermittent time	00 0A is hexadecimal, if it is changed to decimal, it is 10 The interval time is (0.1 second*10)

41 6B or A1 6A	CRC16	Check method

Return code: FE 10 00 03 00 02 A5 C7

Field	**Meaning**	**Remarks**
FE	Device address	
10	10 instructions	Return command: if the query is wrong, return 0x82
00 03	Device address	Query the address of the device
00 02	Number of received commands	Number of commands received by the device
A5 C7	CRC16	Check bit

Example: 1s time on/off

Channel 1 flash on command: FE 10 00 03 00 02 04 00 04 00 0A 41 6B

Channel 2 flash on command: FE 10 00 08 00 02 04 00 04 00 0A 00 D8

Channel 3 flash on command: FE 10 00 0D 00 02 04 00 04 00 0A C0 E7

Channel 4 flash on command: FE 10 00 12 00 02 04 00 04 00 0A 81 AB

Channel 1 flash off command: FE 10 00 03 00 02 04 00 02 00 0A A1 6A

Channel 2 flash off command: FE 10 00 08 00 02 04 00 02 00 0A E0 D9

Channel 3 flash off command: FE 10 00 0D 00 02 04 00 02 00 0A 20 E6

Channel 4 flash off command: FE 10 00 12 00 02 04 00 02 00 0A 61 AA

4.5 Full On/Off command

Full On/Off command analysis

Full on sending code: FE 0F 00 00 00 04 01 FF 31 D2

Full off sending code: FE 0F 00 00 00 04 01 00 71 92

Field	**Meaning**	**Remarks**
FE	Device address	
0F	0F command	Return command: if the query is wrong, return 0x82
00 00	Initial address	
00 04	Quantity Control	Number of relays to be controlled

01	Number of bytes	Send command bytes
FF （or 00）	Full On/Off command	FF: Full on command 00: Full off command
31 D2（or 71 92）	CRC16	Check bit

Return code for full off and full on: FE 0F 00 00 00 04 40 07

Field	**Meaning**	**Remarks**
FE	Device address	
0F	0F command	Return command: if the query is wrong, return 0x82
00 00	Initial address	
00 04	Quantity	Number of relays returning information
40 07	CRC16	Check bit

Common problems and solutions

1. 232 communication, equipment control does not respond, no action

The 232 direct connection is used when the device communicates with the host computer. That is, RX to RX, TX to TX, GND to GND

2. The relay can only be turned on but not off

Check whether the read address is the actual device address, whether there is a return instruction in the debugging information column, and whether the return instruction is correct. If the read address fails, there is no return instruction or the return instruction is abnormal, check the communication wiring connection and communication converter.

3. When 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.

The broadcast address can be used when there is only one device on the bus. If there is more than one device, please use the DIP switch to distinguish the address to control, otherwise, the command cannot be executed correctly because the module is not synchronized in the judgment of the communication data.