K61-DL20
Switch Value Transmission Module

User Manual

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Contents

I. Product Introduction

1. This product is a cross-communication function product. Function: The sender collects 4-channel switch signal and transmits the data to the receiver through wireless (LoRa spread spectrum) or network port, and the receiver restores the 4-channel switch signal.

2. Product model K61-Dxx, including sending (collection) end: K61D-40Rxx; receiving (output) end: K61D-04Rxx. (For more naming details, see the "Product Model Naming" chapter)

Figure 1-1

3. The module also has 485 data transparent transmission function. The 485 data of the sender and receiver can be transparently transmitted through LoRa wireless communication.

4. The product has a high degree of ease of use, avoids long-distance wiring, greatly reduces the cost of manpower/material resources, and reduces the difficulty of construction and maintenance.

5. Aimed at industrial users, all-industrial-grade design, after a lot of testing, the quality is stable and reliable.

6. Construction-free installation: It can replace the link cable, and the transmission distance is long, eliminating the trouble of cable construction.

7. Programming-free design: no programming is required, all parameters can be configured through the host computer software, which is easy to use and reliable in operation.

8. Automatic error correction: The terminal has strong error correction ability and can actively correct the disturbed data packets, greatly improving the transmission reliability.

1.1 Features

- The sending (collection) end supports 4-channel digital signal input;
- The receiving (output) end supports 4-way digital signal output;
- It has the function of transparent data transmission between the first communication interface (RS485 (default)/RS232) and the second communication interface (LoRa/ETH network port...);
- With hardware watchdog, it has high reliability and recoverability;
- It has good protection functions such as overcurrent, overvoltage, anti-reverse connection, and anti-misconnection;
- Rich indicator lights, comprehensive view of the status, easy to troubleshoot;
- The device has a debounce time of 25ms, which makes the input acquisition signal more stable and reliable and less

susceptible to interference;

- The communication channel can be set, and a maximum of 83 channels can be used for data communication in one area without interfering with each other;
- The wireless 433Mhz (LoRa spread spectrum) communication power is 0.1W, the communication distance is 4000 meters (open space), and stable transmission is possible within 500 meters of ordinary scene applications;
- Customized functions are supported, please contact sales.

1.2 Basic parameters

Table 1.1 Basic parameters

Category	Item	Description
DI input DO output	Number of DI/DO channels	4
	Interface Type	Switch (digital) type
	Connection method	5.08mm industrial grade plug-in terminal
	Refresh rate	When a signal change is detected, trigger immediately (debounce time 150ms).
	DI signal input	1. The dry and wet nodes are compatible, and the low-level input of the switching value is valid; 2. DI acquisition channel and GND: the effective voltage input range of low-level action is less than 0.7V; the withstand voltage range is less than 30V; reverse connection may cause product damage.
	DO signal output	1. The switch output type is: relay normally open contact output; 2. Relay contact load current range: ≤3A.
Physical characteristics	Product Size	110*84.32*25.3mm（length*width*height）
	Product weight	164±5g
	Package weight	710±10g
Working environment	Operating temperature	-40℃～85℃
	Storage temperature	-60℃～125℃
	Working humidity	5%～95% RH
	Storage humidity	1%～95%
	Waterproof level	Not waterproof, with certain moisture resistance
	Dust rating	Completely blocks dust
Power supply	Operating Voltage	DC voltage: DC 8V～28V
	Power connector type	5.08mm industrial grade plug-in terminal
	Transmitter power consumption	Pmax (maximum power consumption) = 1W, Pav (average power consumption) ≤ 0.5W
	Receiver power consumption	Pmax (maximum power consumption) = 1W, Pav (average power consumption) ≤ 0.5W
First method of	Type	RS485
	Whether with isolation	No

communication	Connection method	5.08mm industrial grade plug-in terminal
Second means of communication	Type	LoRa Wireless Spread Spectrum (SX1262)
	Transmit power	160mW (22dBm)
	Working frequency	410.125～493.125Mhz (default 410.125Mhz)
	Measured distance	4000 meters (clear and open environment, maximum power, airspeed 2.4K, antenna gain 5dBi, feeder length 1m);It is recommended that the actual engineering application distance should be less than or equal to 1000 meters.
	Air rate	2.4～62.5kbps (default 4.8kbps)
	Receive sensitivity	-138dbm
	Actual frequency calculation formula	Actual frequency=410.125Mhz+channel*1Mhz
	Number of channels	83
	Matching Antenna Interface/Impedance/Frequency	SMA female thread inner needle/equivalent impedance 50Ω/433Mhz

1.3 Description of dimensions, interfaces, indicators, etc.

1.3.1 Product Dimensions

Note: 1. The size of the sender and receiver are the same, see the figure below.

2. Figure 1-2 below is the reference size of the product, the error is ±0.3mm, please refer to the actual product.

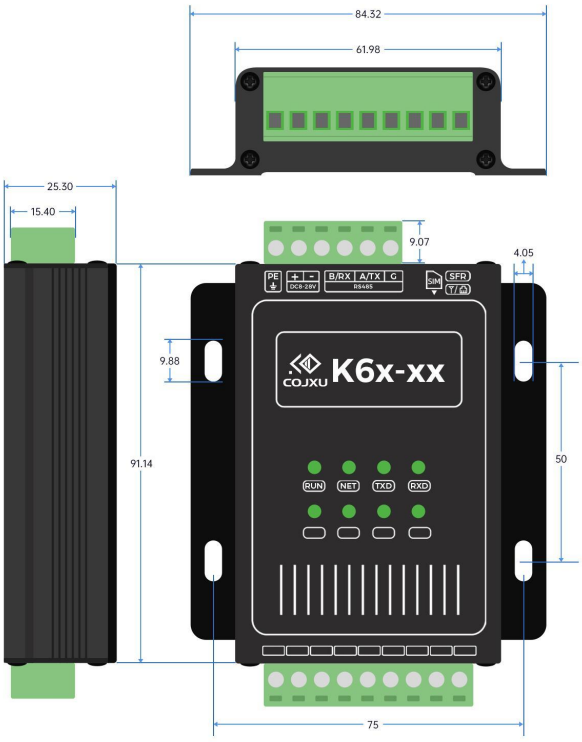


Figure 1-2 Product Dimensions

1.3.2 Product Interface Description

(1) Interface description of the sending (collecting) end product

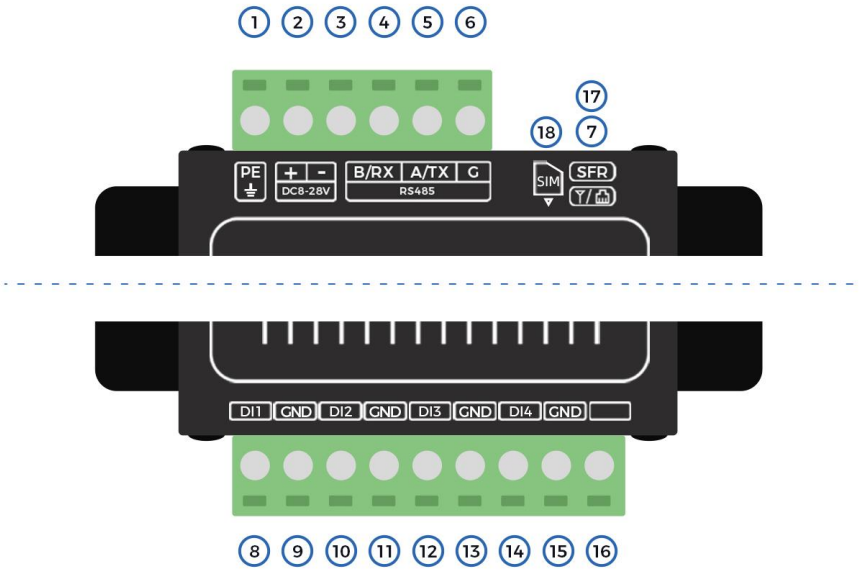


Figure 1-3 Display of the product interface on the sending (collecting) end

Table 1.3.2 Definition of Pin Functions of Sending (Acquisition) End Products

No.	Port and Other	Function	Description

	Definitions		
1	PE	Protective earth terminal	Lightning protection grounding. If the ground lead is good, it is recommended to connect the product case to the ground; vice versa.
2	+	Positive power supply	The power input is positive, and the DC voltage input range is DC 8-28V.
3	-	Power ground	Power input negative (0V).
4	B/RX	Communication interface B/RXD	RS485 interface B/(RS232_RXD).
5	A/TX	Communication interface A/TXD	RS485 interface A/(RS232_TXD).
6	G	Communication port	RS485 ground (can not be connected)/RS232 signal ground (0V).
7	Second communication interface	Antenna port/network port	433Mhz antenna port/network port socket
8	DI1	Switch value acquisition channel 1	Switch signal acquisition channel 1. With GND: dry contact input is closed and valid; wet contact is less than 0.7V valid.
9	GND	Input negative	Input negative (0V).
10	DI2	Switch value acquisition channel 2	Switch signal acquisition channel 2. With GND: dry contact input is closed and valid; wet contact is less than 0.7V valid.
11	GND	Input negative	Input negative (0V).
12	DI3	Switch value acquisition channel 3	Switch signal acquisition channel 3. With GND: dry contact input is closed and valid; wet contact is less than 0.7V valid.
13	GND	Input negative	Input negative (0V).
14	DI4	Switch value acquisition channel 4	Switch signal acquisition channel 4. With GND: dry contact input is closed and valid; wet contact is less than 0.7V valid.
15	GND	Input negative	Input negative (0V).
16		None	Leave it in the air, do not connect.
17	SFR	Reset	Press and hold for 3 seconds to restore the factory settings (Set Factory Reset) (indicated by the status of the RUN light).
18	SIM	SIM card slot	Insert a data IoT card or a phone card with a sufficient data plan. (This product has no SIM card slot)

(2) Description of the product interface at the receiving (output) end.

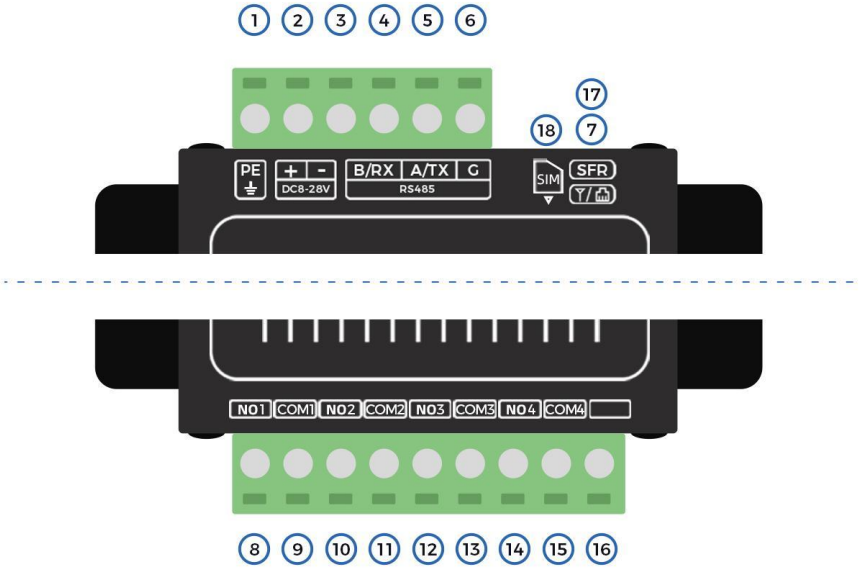


Figure 1-4 Display of the product interface on the receiving (output) end

Table 1-4 Definition of pin function of receiving (output) end product

No.	Port and Other Definitions	Function	Description
1	PE	Protective earth terminal	Lightning protection grounding. If the ground lead is good, it is recommended to connect the product case to the ground; vice versa.
2	+	Positive power supply	The power input is positive, and the DC input voltage range is 8-28V.
3	-	Power ground	Power input negative (0V).
4	B/RX	Communication interface B/RXD	RS485 interface B/(RS232_RXD).
5	A/TX	Communication interface A/TXD	RS485 interface A/(RS232_TXD).
6	G	Communication port	RS485 ground (can not be connected)/RS232 signal ground (0V).
7	Second communication interface	Antenna port/network port	433Mhz antenna port/network port socket
8	NO1	Switch output channel 1	The relay is normally open contact output, and the contact current is less than or equal to 3A.
9	COM1	Public 1	Common terminal of relay output channel 1.
10	NO2	Switch output channel 2	The relay is normally open contact output, and the contact current is less than or equal to 3A.
11	COM2	Public 2	Common terminal of relay output channel 2.
12	NO3	Switch output channel 3	The relay is normally open contact output, and the contact current is less than or equal to 3A.
13	COM3	Public 3	Common terminal of relay output channel 3.

14	NO4	Switch output channel 4	The relay is normally open contact output, and the contact current is less than or equal to 3A.
15	COM4	Public 4	Common terminal of relay output channel 4.
16		None	Leave it in the air, do not connect.
17	SFR	Reset	Press and hold for 3 seconds to restore the factory settings (Set Factory Reset) (indicated by the status of the RUN light).
18	SIM	SIM card slot	Insert a data IoT card and a phone card with a data plan. (This product has no SIM card slot)

1.3.3 Indicator light description

(1) Send (collection) end LED light indication, as shown in below picture.

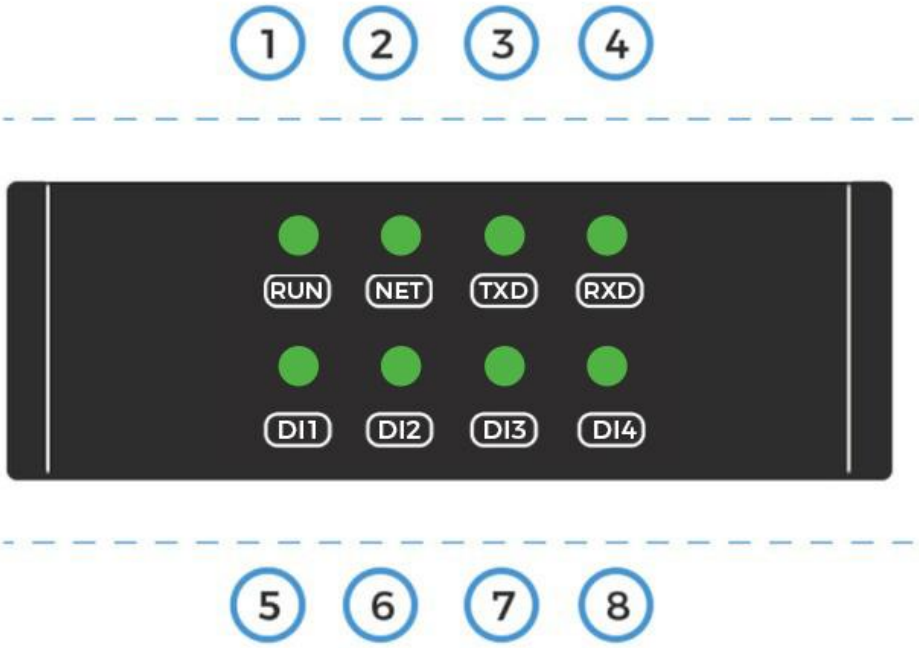


Figure 1-5

Table 1-5 Function table of analog input module

No.	Indicator Name	Description
1	RUN	Flashing for 0.5 seconds: indicates that the product is in normal operation; after 3 seconds of steady light, it will flash for 0.5 seconds: press and hold the button for 3 seconds, indicating that the factory reset is successful.
2	NET	Steady on: The second communication interface is connected successfully; Off: The second communication interface is disconnected.

3	TXD	Blinking: Indicates that the product sends out a data signal.
4	RXD	Blinking: Indicates that the product has received a data signal.
5	DI1	Steady on: The switch value closed/active low level signal input is collected; Off: No valid digital signal input is collected.
6	DI2	Steady on: The switch value closed/active low level signal input is collected; Off: No valid digital signal input is collected.
7	DI3	Steady on: The switch value closed/active low level signal input is collected; Off: No valid digital signal input is collected.
8	DI4	Steady on: The switch value closed/active low level signal input is collected; Off: No valid digital signal input is collected.

(2) LED light indication on the receiving (output) end, as shown below.

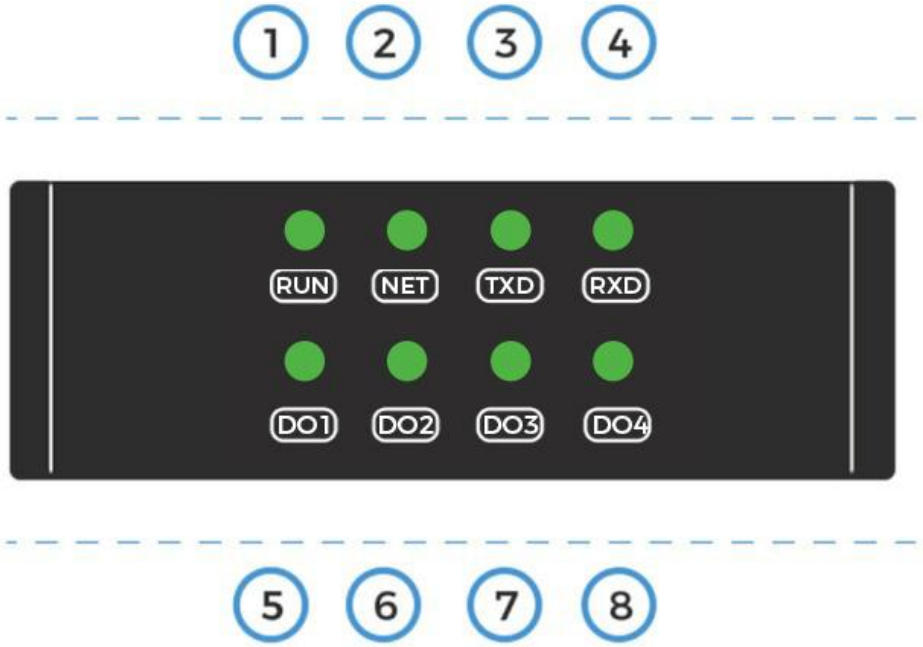


Figure 1-6 Indicator light of analog output module

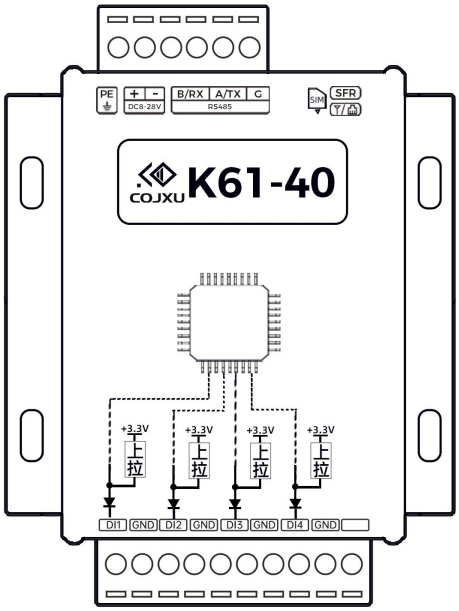
Table 1-6 Function table of analog output module

No.	Indicator Name	Description
1	RUN	Flashing for 0.5 seconds: indicates that the product is in normal operation; after 3 seconds of steady light, it will flash for 0.5 seconds: press and hold the button for 3 seconds, indicating that the factory reset is successful.
2	NET	Steady on: The second communication interface is connected successfully; Off: The second communication interface is disconnected.

3	TXD	Blinking: Indicates that the product sends out a data signal.
4	RXD	Blinking: Indicates that the product has received a data signal.
5	DO1	Always on: the normally open contact of the relay is active (closed); Off: The relay normally open contact is normal (open).
6	DO2	Always on: the normally open contact of the relay is active (closed); Off: The relay normally open contact is normal (open).
7	DO3	Always on: the normally open contact of the relay is active (closed); Off: The relay normally open contact is normal (open).
8	DO4	Always on: the normally open contact of the relay is active (closed); Off: The relay normally open contact is normal (open).

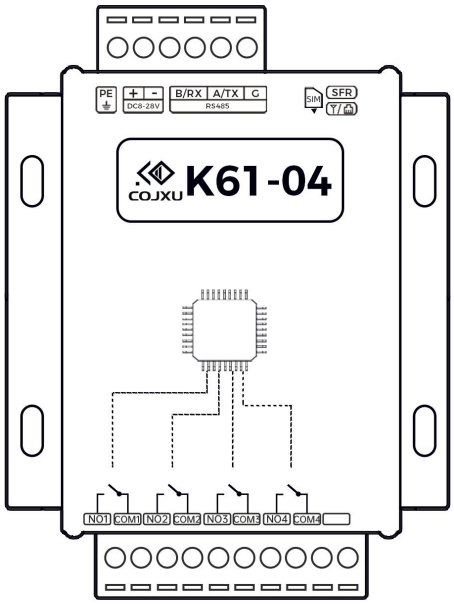
1.4 Internal circuit structure of the product

1.4.1 The internal principle diagram of the sending (collecting) end product



Internal principle diagram of analog input product

1.4.2 The internal principle diagram of the receiving (output) end product



Internal schematic diagram of analog output product

II. Quick Start (Users are advised to read this chapter first)

This chapter is an introduction to the quick start of this product. It is recommended that users read this chapter carefully and operate according to the instructions. There will be a systematic understanding of this product, and users can also choose the chapters you are interested in to read according to their needs. For specific details and instructions, please refer to the remaining relevant chapters.

2.1 List of products and accessories

Figure 2-1 The complete set of products including modules and accessories

Table 2-1 The complete set of products includes modules and accessories

Item	Model	Quantity
Switch signal acquisition module	K61D-40RL20	1
Switch signal output module	K61D-04RL20	1
12V/1A adapter power supply	CQ12-120100-CC	2
Power adapter cable	DYX01-A	2
Suction cup antenna (SMA inner thread inner needle/equivalent impedance 50 Ω /433Mhz/3.5dBi gain/feeder length 1 meter)	TX433-XPL-100	2
USB to 485 tool	K1T-UR0	1
Slotted screwdriver	2*50mm Flat-blade screwdriver	1

2.2 Quick use

2.2.1 Step 1: Connect the product to the antenna and power

(1) Connect the antenna and power supply as shown in the figure below.

a. **Antenna connection**: remove the K61-40 and K61-04 antenna caps, and screw the 433Mhz frequency band "suction cup antenna" on the product clockwise;

b. **Power connection**: connect the "red wire" of the "power adapter cable" to the "+" pole of the product, and the "black wire" to the "-" pole of the product; connect the "12V/1A adapter power supply" to the "power adapter cable" .

Figure 2-2 Connecting the antenna and power

(2) Notes:

a. When wiring, please do not connect the wrong port, so as not to damage the product! !

b. For the RF antennas of the transmission pair, it is necessary to be as open as possible and to be able to see directly; the RF antennas should be as far away as possible: walls, metal shields, big trees, hills, large buildings, etc.

c. The top of the radio frequency antenna should not be attached to objects that have a great attenuation effect on radio frequency, such as metal and walls, so as not to affect the transmission of radio frequency signals.

d. The distance between the RF antennas of the product is preferably 1 meter or more. If the high-power RF product is too close to the RF antenna, the receiver cannot receive data. (For more details, see the Frequently Asked Questions and Solutions (FAQ) section)

2.2.2 Step 2: Sending (collecting) terminal product signal input wiring

(1) Connect a switch (or sensor, etc.) to the DI and GND interfaces of the K61-40 acquisition end of this product as shown in Figure 2-3 below. Then, after tightening the screw on the plug-in terminal of this product, close the switch (or let the sensor output a closed switch signal). When the switch is closed, the corresponding IO light is always on, indicating that the switch closed signal is collected.

(2) Notes:

a. When the input voltage is applied, below 0.7V belongs to the closed state (effective state and the switch signal is closed), and above 0.7V belongs to the open state (invalid state and the switch signal is disconnected).

b. When the communication between the K61-40 device and the K61-04 device is successfully established, the "NET" light is on;

c. When the switch signal is collected, the corresponding IO light is always on. If the IO light is not on, please check whether the sensor outputs a closed switch signal normally;

d. When the terminal is connected to the wire, please tighten the screw on the plug-in terminal of this product, and pay attention that the conductive part of the terminal cannot be pressed against the insulation layer of the wire, so as to avoid

poor contact and cause abnormality.
(For more details, see the "FAQ" section)

2.2.3 Step 3: Receive (output) end product signal output wiring

(1) According to the figure 2-3 below, connect the DO and GND wires of the output end of K61-04 of this product according to the figure below (or connect them to the switch signal acquisition sensor). After receiving the switch signal sent by the sender, the K61-04 device will output a closed switch signal, the light bulb in the picture will be on, and the corresponding IO light will be always on.
(2) Notes:
a. The output of this product is a switch signal, and it will not output voltage;
b. When the devices are powered on (sending and receiving), check the "NET" light of the K61-04 device, if the "NET" light is on, the communication between the two devices is successfully established;
c. When the corresponding IO light is on, it means that the K61-40 sender receives a switch signal, and the K61-04 output terminal outputs a closed switch signal:
d. When the terminal is connected to the wire, please tighten the screw on the plug-in terminal of this product, and pay attention that the conductive part of the terminal cannot be pressed against the insulation layer of the wire, so as to avoid poor contact.
(For more details, see the "FAQ" section)

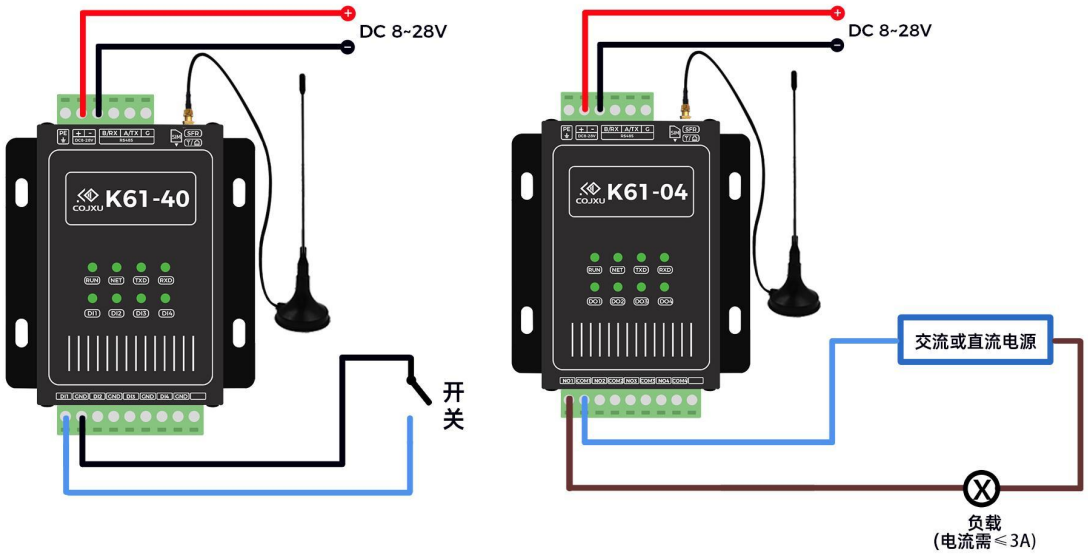


Figure 2-3 Connecting IO ports

2.2.4 Step 4: Power on the product and observe the status of the indicator lights

(1) Plug the two 12V/1A adapters into the power strip (mains AC220V), and the entire system is powered on.
(2) Observe the status of the indicator light, the sending end collects the digital signal and the receiving end outputs the

digital signal, as shown in Figure 2-4.

a. The RUN light flashes once every 0.5 seconds, indicating that the product is powered on successfully;

b. When the NET light of the supporting product is on, it means that the wireless communication between the two modules is successful;

c. The DI light is on, indicating that the acquisition signal is successful; the DO light is on, indicating that the output signal is successful;

(3) Notes:

a. For more details on the functions of the indicator lights, see the chapter "Indicator Description";

b. If the NET indicator does not light up, it means that the wireless communication is unsuccessful. It is necessary to check whether the antennas of the product are installed correctly, ensure that the distance between the antennas is 1 meter or more, and that there is no obstruction between the antennas of the product.

2.2.5 Step 5: On-site installation

(1) Important knowledge points: The necessary conditions for communication between LoRa wireless spread spectrum technology paired products: channel, address, and airspeed. Products with the same three parameters can perform data communication. Conversely, if the parameters are different, data communication cannot be performed. (That is, the LoRa channel of the transmitter module is the same as the LoRa channel of the receiver module, the LoRa address of the transmitter module is the same as the LoRa address of the receiver module, and the LoRa wireless airspeed of the transmitter module is the same as the LoRa wireless airspeed of the receiver module.)

(2) Default parameters: For the default parameter properties of this product, see the nameplate label on the back of the product for details.

(3) Key point: It is recommended that users configure, record and manage the LoRa wireless spread spectrum channel, address, and airspeed of the paired product when using this product in engineering.

Reason: to avoid data conflicts between the same type of products in engineering applications and the field environment; in addition, to avoid forgetting the three parameters of the installed equipment when adding this product next time, which leads to have to read the parameters on site, causing unnecessary Trouble.

(4) Configuration operation details: For details of LoRa wireless parameter configuration method, please refer to "Driver and Configuration Software Tool Installation", and the configuration software interface is shown in Figure 2-5 below.

Figure 2-5 Screenshot of configuration software

2.3 Model selection overview

2.3.1 Product model selection table

Model	Description
K41-DG	1-way switch bidirectional 4G remote transmission. It is used in the case of long distance and 4G signal
K41-DL20	1-way switch value two-way 433M wireless remote transmission, open communication transmission distance 4KM
K41-DL30	1-way switch value two-way 433M wireless remote transmission, open communication transmission distance 8KM
K42-DG	2-way 0/4～20mA analog one-way 4G remote transmission. It is used in the case of long distance and 4G signal
K42-DL20	2-way 0/4 ～ 20mA analog one-way 433M wireless remote transmission, open communication transmission distance 4KM
K42-DL30	2-way 0/4 ～ 20mA analog one-way 433M wireless remote transmission, open communication transmission distance 8KM
K43-DG	1-way 0/4～20mA analog quantity and 1-way switch quantity one-way 4G remote transmission. It is used in the case of long distance and 4G signal
K43-DL20	1 channel 0/4～20mA analog quantity and 1 channel switch value one-way 433M wireless remote transmission, open communication transmission distance 8KM
K43-DL30	4-way switch value unidirectional Ethernet (LAN) remote transmission. It is used for the situation that two network ports in the LAN can ping through
K61-DE	4-way switch value one-way Ethernet (Internet) remote transmission. Used in different places, as long as there is a network port that can access the Internet

K61-DEW	1 channel 0/4～20mA analog quantity and 1 channel switch value one-way 433M wireless remote transmission, open communication transmission distance 8KM
K61-DL20	4-way switch value one-way 433M wireless remote transmission, open communication transmission distance 4KM
K62-DE	4-way 0/4～20mA analog Ethernet (LAN) remote transmission. It is used for the situation that two network ports in the LAN can ping through
K62-DEW	4-way 0/4～20mA analog Ethernet (Internet) remote transmission. Used in different places, as long as there is a network port that can access the Internet
K62-DL20	4 channels 0/4～20mA analog quantity 433M wireless remote transmission, open communication transmission distance 4KM
K71-DG	8-way switch one-way 4G wireless remote transmission. It is used for application scenarios with long distances and 4G signals
K71-DL30	8-way switch value one-way 433M wireless remote transmission, open communication transmission distance 8KM
K72-DG	6 channels of 0/4～20mA analog 4G wireless remote transmission. It is used for application scenarios with long distances and 4G signals
K72-DL30	6 channels 0/4～20mA analog quantity 433M wireless remote transmission, open communication transmission distance 8KM

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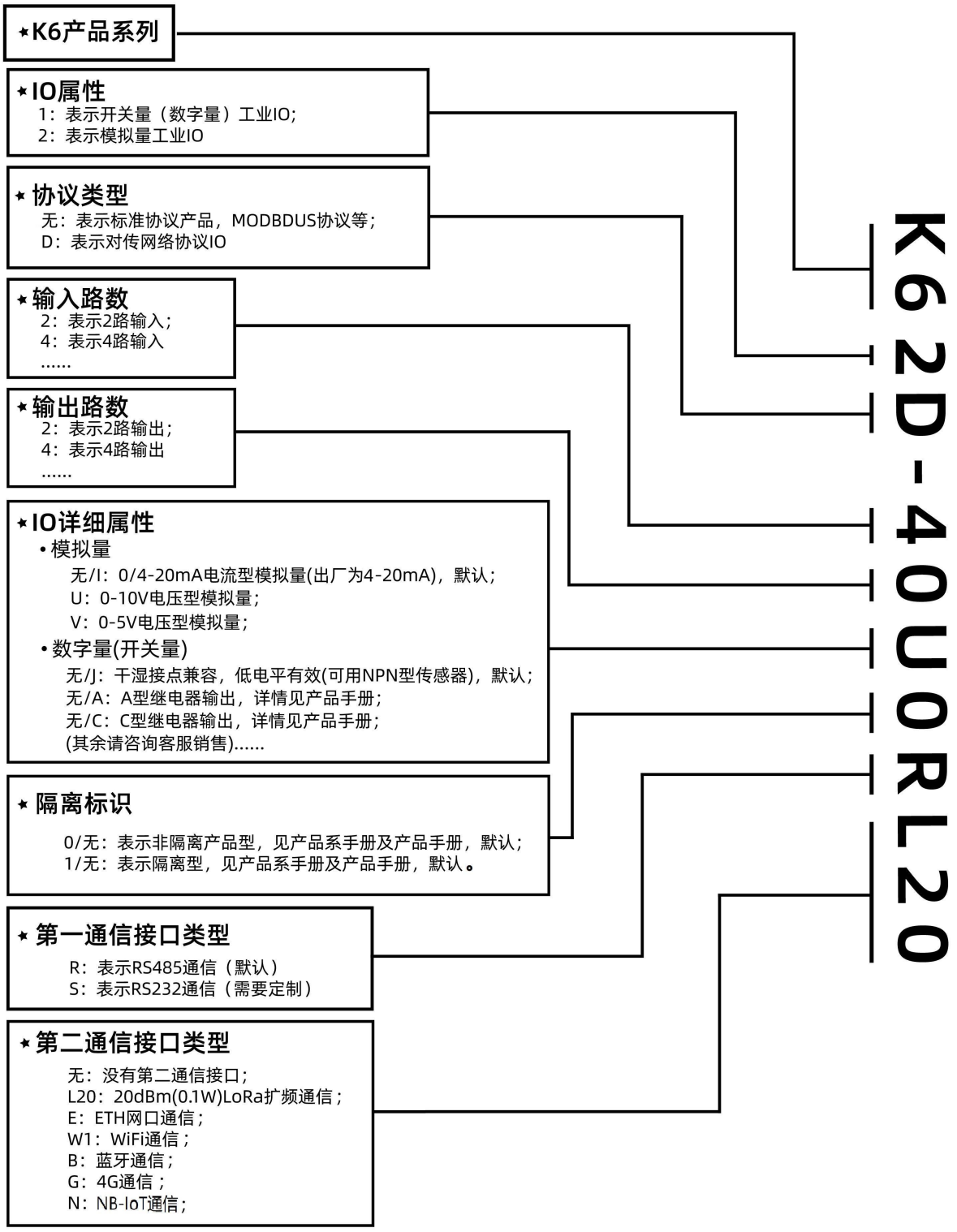
(For more details, please log in to the official website to check the product model and download the relevant user manual)

2.3.2 Product model naming rules

Take K62D-40U0RL20 as an example:



III. Hardware connection and related knowledge

3.1 Power Hardware Connection

3.1.1 Power supply selection

Power supply selection: According to the product nameplate label, select the appropriate DC regulated power supply. Power supply requirements: strong anti-interference ability, small ripple, and sufficient load capacity; it is best to have functions such as overcurrent protection, overvoltage protection and lightning protection to ensure long-term normal operation of the product. It can also be powered by our standard power adapter.

3.1.2 Power Connection

The wiring diagram of the power supply: please refer to the following figure 3-1

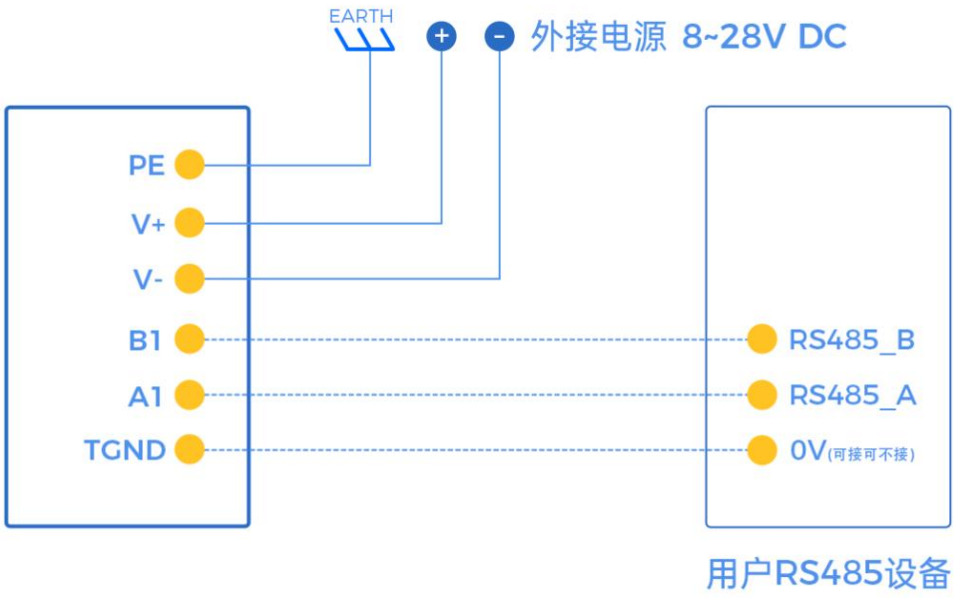


Figure 3-1 RS485 wiring diagram

3.1.3 Precautions and instructions for power connection

(1) The power interface of this product has the capabilities of overcurrent protection, anti-reverse connection protection, power surge protection, etc.;

(2) In a complex environment such as a lot of radio frequency interference, strong electromagnetic interference, easy generation of static electricity when dry, complicated wiring, no separation of strong and weak currents, and good earth grounding, it is recommended to connect the product "PE" to the ground. It can effectively protect the product and

suppress interference;

(3) The earth connection should conform to the national standard. If it is not guaranteed whether the ground connection conforms to the national standard, it is recommended that the PE of this product is not connected to the ground to prevent interference or even damage to the product.

3.2 Hardware connection of the first communication method

3.2.1 The first communication method: RS485

1) RS485 function

a. Configure product parameters;

b. Adopt RS485 remote transmission (pair transmission);

c. After the "RS485 transparent transmission" function is enabled, data transparent transmission is performed;

(For details, see "(2) Transparent Transmission" and "(3) RS485 Transparent Transmission Filtering" in the chapters "Basic Product Parameter Reading and Change Writing" and "Mode Configuration Parameter Description").

(2) RS485 hardware connection

Wiring connection: RS485 wiring is very simple; you only need to connect product A of RS485 communication to A, and B to B to complete the wiring. For the wiring diagram, see Figure 3-1 above.

3) RS485 parameter value options

a. Baud rate: 1200, 2400, 4800, 9600 (default), 14400, 19200, 38400, 43000, 56000, 57600, 115200

b. Check digit: None (default), Odd, Even, Mark, Space

c. Data bits: 6, 7, 8 (default), 9

d. Stop bit: 1 (default), 2

(4) Product RS485 hardware protection

This product RS485 has the capabilities of overcurrent protection, power surge protection, inductive lightning protection, and EMC electromagnetic compatibility.

(5) RS485 bus wiring rules

a. If the transmission distance of the RS485 bus exceeds 100 meters, it is recommended to connect a 120Ω resistor in parallel at the beginning and end of the RS485 network. Because with the extension of the transmission distance, the echo reflection signal will be generated on the 485 bus network.

b. In industrial field applications, if the field interference source is very complex, there may be a high common mode voltage between nodes. Although the RS485 interface uses a differential transmission method, it has the ability to resist common mode interference. But when the common mode voltage is greater than +12V or less than -9V, it exceeds the limit receiving voltage of the RS485 receiver, the receiver will not work, and may even burn the chip and equipment. At this time, the RS485 optical isolation repeater should be used in the RS485 bus network to eliminate the influence of the common mode voltage.

c. Since the RS485 bus transmits a pair of differential signals, the data transmission line between each device on the RS485 network is best to use a twisted pair with an additional shielding layer, and the shielding layer should be reliably grounded at one point.

d. In the simple application of the 485 bus, the bus-type topology wiring method is generally used. But in a more complex system, the wiring construction of the bus topology is not only very cumbersome, but also wastes a lot of

connections. By using 485 hubs or 485 repeaters flexibly, the bus topology can be connected into a star or tree topology. It greatly facilitates the pre-construction and post-maintenance work.

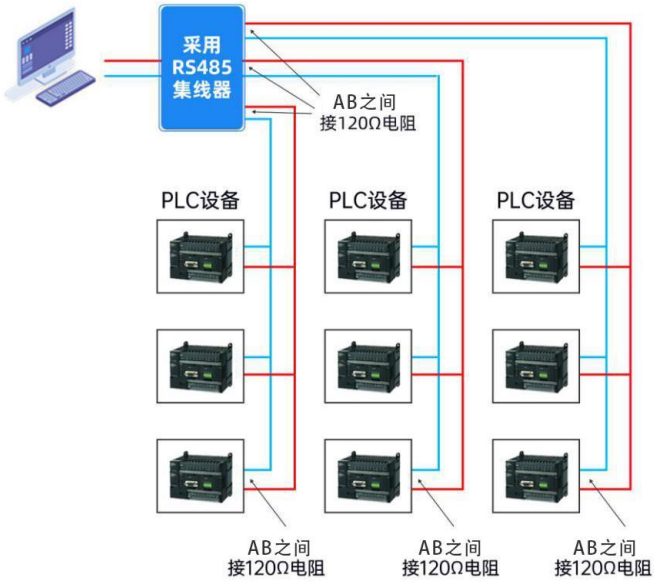


Figure 3-2 RS485 star topology

e. Pay attention to the load capacity of the RS485 bus. The factors that affect the load capacity are: the power supply capacity of the RS485 converter connected to the serial port of the host computer, the communication distance, the quality of the RS485 data wire, and the baud rate.

h. The passive RS485 converter steals electricity from the serial port of the computer, the power supply is poor, and the load capacity is insufficient. If there are many devices on the RS485 network, an RS485 converter with power supply should be used. Choose a good 485 dedicated communication cable and use the lowest baud rate as possible. The use of RS485 repeaters or RS485 hubs can improve the load capacity of the RS485 bus.

3.3 Hardware connection of the second communication method

3.3.1 The Hardware connection and installation of the second communication method(LoRa spread spectrum）

(1) RF antenna connection, installation and instructions

The connection method of the product antenna: see the "Product connection antenna and power supply" section above.

(2) What antenna should be used for wireless communication

a. When the user chooses the antenna, the antenna frequency band should match the wireless operating frequency and impedance requirements of the product. (For parameter details, see the "Basic Parameters" chapter)

b. Reason: The special frequency band antenna used for this product has good standing wave performance and more stable data transmission.

(3) RF antenna installation

a. For transmission pair RF antennas, it should be as open as possible and as far as possible to see directly; RF antennas should be as far away as possible: walls, metal shields, big trees, hills, large buildings, etc.

b. The radio frequency antenna should not be close to objects that have a great attenuation effect on radio frequency, such as metal, walls, ground, trees, sea water, etc., so as not to affect the transmission of radio frequency signals.

c. When the suction cup antenna is installed, the wires should be as straight as possible, and the suction cup base should be attached to the metal object.

d. It is best to keep the distance between the RF antennas of the product at 1.5 meters or more. If the high-power RF product is too close to the RF antenna, the receiver cannot receive data.

e. If the measured distance is not ideal, it is recommended to analyze and improve the communication distance from the antenna installation method, antenna quality and LoRa wireless configuration parameters.

h. The product comes standard with antenna parameters, see "Product and Accessories List". If the feeder is not long enough, users need to purchase a feeder extension cable, or purchase an antenna with a longer feeder. Do not peel off the antenna and extend it by itself, which will cause the impedance mismatch of the RF antenna, resulting in serious signal attenuation.

3.4 Switch input and output hardware connection

3.4.1 Wet node: NPN normally open/PNP normally closed sensor (DI) wiring method

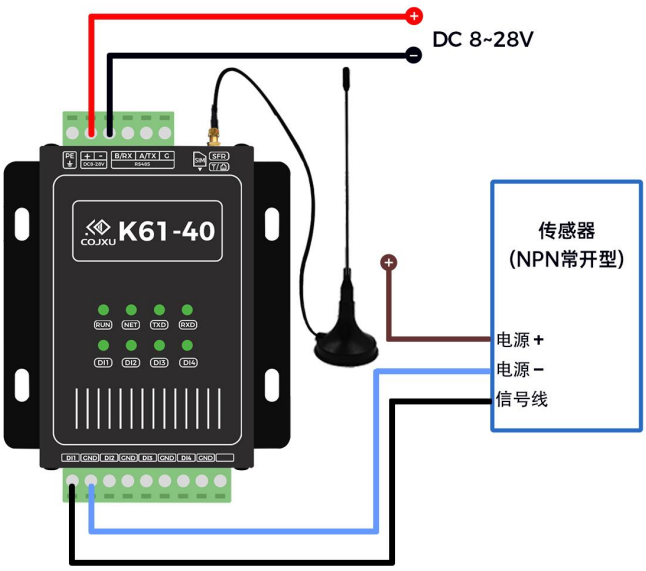


Figure 3-2 Sensor wiring diagram

3.4.2 Dry Contact: Key Switch (DI) Wiring Method

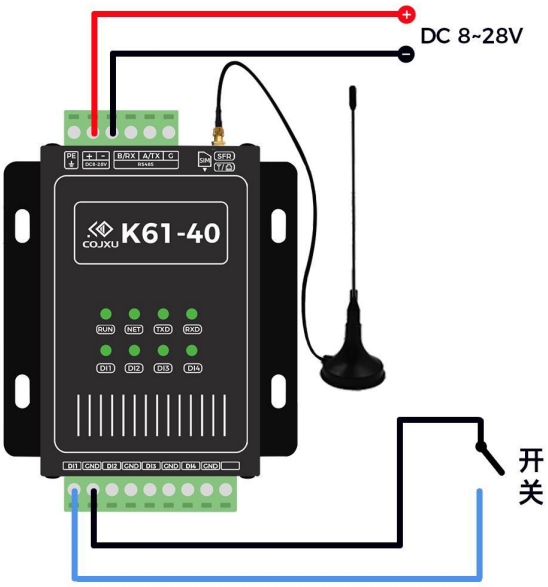


Figure 3-3 Key switch wiring diagram

3.4.3 Wiring method of switch output (DO)

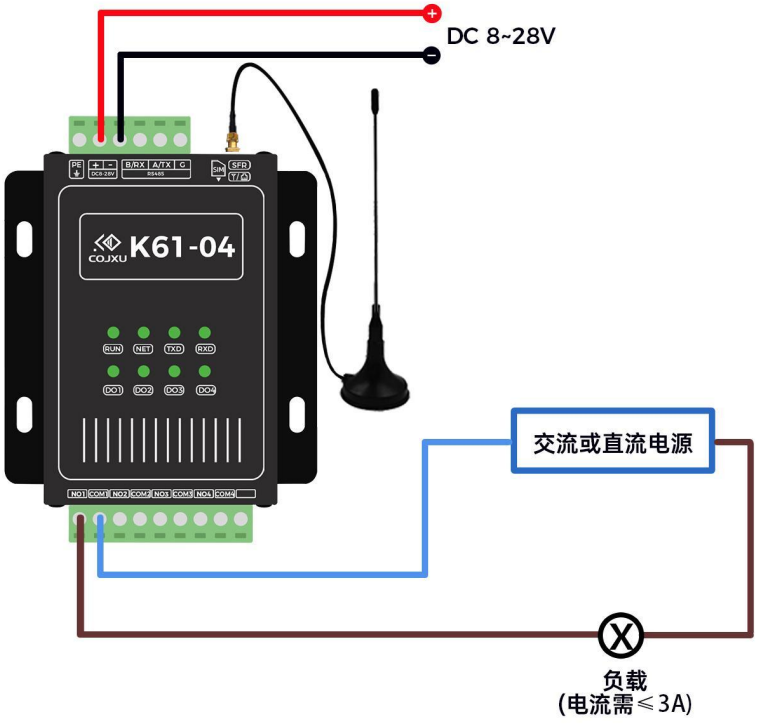


Figure 3-4 Schematic diagram of receiving terminal wiring (output: passive switch signal)

IV.Configuration software driver installation, each function parameter reading, description and writing

Serial tool installation, configuration software installation, basic parameters, device properties, I/O configuration, mode configuration, etc.

4.1 Configuration software tools and driver installation

Bill of materials used in this chapter	
Items	Quantity/Remarks
Windows system computer	1 set
USB to 485 tool	1
ProductsSwitching Power Supply/Power Adapter	1
Product	Some
Wire	Some
CH340 driver (serial port driver)	Computer driver installation package
Mircosoft.Net_Framework_4.0 and above computer environment driver	Computer driver installation package
Interchange Industrial Network IO Setting Tool.exe	Configure the software installation package

4.1.1 Configuration software tools and driver installation package download

(1) Method 1: Go to the official website: www.cojxu.com → click "Download" → "Point-to-point remote follow-up" → click "LoRa 433M" → find "Pair Transmission Industrial Network IO Setting Tool", download the compressed package and unzip it .

(2) Method 2: Enter the official website:
http://www.cojxu.com/data-download.html?id=47&pid=33#load

4.1.2 Configuration software tools and driver installation

(1) First confirm whether the "CH340 driver" has been installed. If already installed, skip this step.
Confirmation method: Plug the "USB to 485" into the USB port of the computer (as shown in Figure 4-1 and Figure 4-2) → right-click on "My Computer/This Computer" → "Management" → "Device Manager" → "Ports" "In the drop-down option, you will see the driver of CH340/CH341 → it means it has been installed, otherwise, it is not installed. (For different computers and configurations, the viewing steps are similar.)

图 4-1

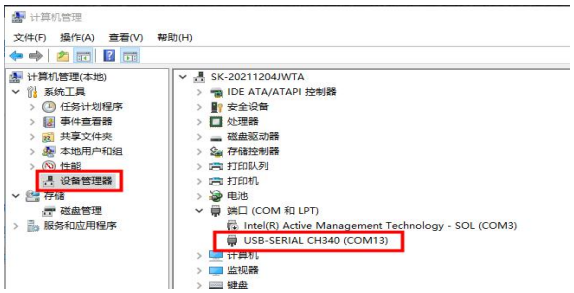


图 4-2

(2) If the "CH340 driver" is not installed, enter the following steps. If already installed, skip this step.

Open the downloaded compressed package and decompress the folder (as shown in Figure 4-3 and Figure 4-4 below) → find the compressed package with the words "CH340" and decompress it → double-click and click "SETUP.EXE" → install → After the installation is complete, it will prompt " Driver installed successfully" → Finish

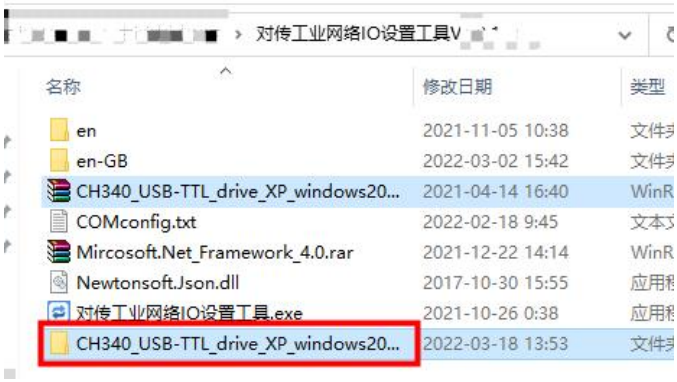


Figure 4-3

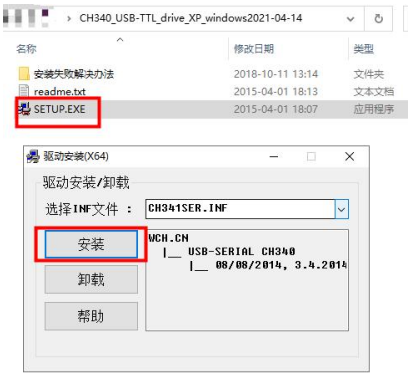


Figure 4-4

(3) Run the configuration software of "Interconnect Industrial Network IO Setting Tool.exe". (This setting tool supports: Chinese and English)

Open the downloaded compressed package and decompress the file → find and double-click the "Inter-Transfer Industrial Network IO Setting Tool.exe" to run the configuration software → If the operation is successful, the installation is successful. (If opening fails, you will need to go to the next step.)

Figure 4-5 Setting tool software interface

(4) If the configuration software of "Pair Transmission Industrial Network IO Setting Tool.exe" fails to run, enter the following steps.

Cause analysis: The reason for the failure to open may be that the version of Net_Framework in the computer compilation environment is too low, and you need to install version 4.0 or above.

Install Mircosoft.Net_Framework_4.0 and above: Open the downloaded zip file and unzip the file → find and unzip "Mircosoft.Net_Framework_4.0.rar" → double-click to run "dotNetFx40_Full_x86_x64.exe" → After completion, run the "Intercommunication Industrial Network IO" Set up tool.exe".

4.1.3 Introduction to configuration software tool interface

As shown in Figure 4-6 below

(1) Communication serial interface. Support CH340/CH341 to drive serial port, can read 485, 232, TTL data.

(2) Display interface of product basic attributes. Read the company's product type, local S/N code (equipment unique identification code), firmware version, etc.

(3) RTU product read configuration interface. Read and configure the company's product information parameters, so that the product is suitable for various industrial system environments.

(4) The second communication interface reads the configuration interface. Read and configure the second communication interface of the company's product, so as to connect the product to various communication types.

(5) "" is the relevant parameter comment. Users can view and help understand when configuring parameters.

(6) Chinese and English switching function. This configuration software supports Chinese and English interfaces, which is convenient for foreign and domestic users to use.

(7) Log column. Users can view the configuration instructions of the company's modules according to the information in the log column, and users can change the configuration module parameters according to the configuration instructions; at

the same time, it is also convenient to analyze abnormal problems and solve problems when configuring and writing parameters.

(8) Basic operation interface of the module. Functions such as saving, restarting, and restoring factory settings can better solve abnormal situations such as errors and misoperations when users configure information.

Figure 4-6 Configuration software tool Interface introduction

4.2 Reading and changing the basic parameters of the product

This chapter mainly introduces how to read product device attributes: device type, firmware version, product unique identification code, changing serial port parameters, etc. The detailed steps are as follows：

4.2.1 Product hardware connection and COM port selection

(1) Wiring connection: Connect the product hardware to the power supply and the "USB to RS485" tool, and connect the "USB to RS485" tool to the computer USB, as shown in Figure 4-7 below.

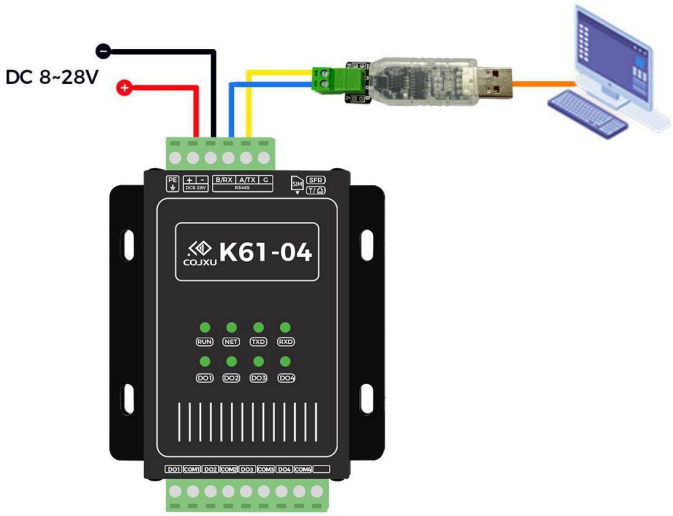


Figure 4-7 Schematic diagram of power supply and RS485 hardware wiring

(2) Check the COM port number (as shown in Figure 4-8): If there is only one COM port on the computer, then you do not need to check it, you can skip this step. (If there are multiple COM ports on the computer, you need to determine the number of COM ports corresponding to this product. The check method is as follows.)

Viewing method: Right-click "My Computer/This Computer" → "Management" → "Device Manager" → "Port" drop-down option, you will see the driver of CH340/CH341, and you can view the corresponding COM port number → Plug and unplug Corresponding "USB to RS485" to determine the corresponding COM port number.

Figure 4-8 Computer port of USB to RS485 module

4.2.2 Reading the basic parameters of the product

(1) Basic parameter reading content: device type, local S/N code, firmware version.

(2) Basic parameter default value parameter table, as shown in Table 4-1 below.

Table 4-1

Baud rate：	9600 bps	Data bits：	8
Check digit：	None（无校验位）	Stop bit：	1

(3) Basic parameter reading steps (as shown in Figure 4-9 below)

Steps: Select the correct COM port number → switch to the default serial port parameters according to Table 4-1 → click "Open Serial Port" → click "Search/Read Device" → read successfully.

The basic parameters of the product can be read. (If there is any abnormality, please refer to the exception handling chapter of "The device cannot be searched by the configuration software")

Figure 4-9 Basic parameter reading

4.2.3 Serial port parameter change, write and restore default

(1) Write content of serial port parameters: baud rate, check bit, data bit, stop bit.

(2) This function can only be changed and written when 485 data transparent transmission is turned on, in order to match the serial port parameters of other products of the user. In other cases, users are advised not to change the serial port parameters of this product.

(3) Steps (as shown in Figure 4-10 below): Select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, they can be restored to factory settings) → "Search/Read Device" → Read successfully → Change as required: baud rate, parity bit, data bit, stop bit parameters → click "Write" → "Log" column to see a successful prompt → click "Save" → click "Restart" → complete changes

Next, you can verify → under the newly written serial port parameters → click "close serial port" → click "open serial port" again → "search/read device" → read successfully, then the settings are changed.

Figure 4-10 Change write serial port parameters

(4) Restore default serial port parameters

a. Press and hold the "SFR" reset button of the product for 3 seconds: the product restores the factory default parameters, that is, the serial port parameters also return to default.

b. The user can also use the current correct COM port number and the current serial port parameters to change the product according to the default parameters and write it through the configuration software of "Inter-communication Industrial Network IO Setting Tool.exe".

4.3 I/O configuration Parameter reading, description and writing

This chapter mainly introduces: the reading and configuration of each parameter of the I/O channel.

4.3.1 I/O configuration parameter reading

(1) I/O configuration Parameter read content: DI digital signal acquisition/DO digital signal output, network disconnection recovery time, DO digital output, channel value.

(2) Steps (as shown in Figure 4-11): Select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, they can be restored to factory settings) → "Search/Read Device" → "3.I/O Configuration" → Click "Read" in "I/O Configuration" → You can view the above parameters:

(Note: The reading methods of the sender and receiver are the same.)

Figure 4-11 I/O configuration parameter reading

4.3.2 I/O configuration Parameter description

(1) Network disconnection recovery time: When the network disconnection recovery time is set to ≥20 seconds. After the connection between the sending end and the receiving end is disconnected, if the network is still disconnected after a long delay, the receiving end will output a disconnected switch signal.

Note: When the user uses, the default parameters cannot meet the requirements of the environment and the site, the user needs to debug and write the appropriate time, and determine the appropriate network disconnection recovery time value by observing the "NET" connection indicator of the product. In case of engineering application, the disconnection of the network will cause the receiving end to output a disconnected digital signal or maintain the output value before the disconnection, thus affecting the instability or malfunction of the system!

Parameter name	Scope and Options	Illustrate
Sender: network disconnection recovery time (K61-40)	0 seconds	Turn off disconnection recovery. The receiving end keeps the output value before the disconnection, until the network connection returns to normal, or the initial value is restored by artificial power failure.
	20 seconds to 57600 seconds (default 20 seconds)	Enable disconnection recovery. That is, after the disconnection time is exceeded, the receiving end outputs the disconnected switch signal.
Receiver: disconnection recovery time: (K61-04)	0 seconds	Turn off disconnection recovery. The receiving end keeps the output value before the disconnection, until the network connection returns to normal, or the initial value is restored by artificial power failure.
	60 seconds to 57600 seconds (default 60 seconds)	Enable disconnection recovery. That is, after the disconnection time is exceeded, the receiving end outputs the disconnected switch signal.

Example: The network disconnection recovery time is set to: 20 seconds. After the sender and receiver are disconnected, the product will continue to search for connections. If the connection between the sending end and the receiving end is still disconnected after 20 seconds, the product network indicator "NET" light is off, and the receiving end returns to the default output and outputs a disconnected digital signal.

(2) DO digital output: the output state of the output terminal.

Parameter name	Scope and Options	Illustrate
DO digital output	Mutual transmission	When the sending end is closed, the receiving end is closed, and when the sending end is disconnected, the receiving end is disconnected.
	Mutual self-lock	The sending end is closed and disconnected once, and the state of the receiving end changes once (closed to open, open to closed)
	Time off	The sending end is closed and disconnected, and the receiving end waits for a certain time to close, the default is 1S, the range (1~5000S)

(3) Channel value: The channel value of the acquisition (or sender).

Parameter name	Scope and Options	Illustrate
DI	Action	The closed switch signal is collected
	Normal	The disconnected switch signal is collected

4.3.3 I/O configuration parameter writing

(1) Refer to "I/O Configuration Parameter Description" for each parameter and parameter comparison table 4-12, and enter the following parameter writing steps.

(2) I/O configuration parameter writing:

1. Example: Write DO output to self-lock, 60s network disconnection recovery time, wireless parameters: air rate 4800, wireless channel 0, module address 0.

2. Steps (as shown in Figure 4-12): Select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, they can be restored to factory settings) → "Search/Read Device" → "I/O Configuration" → drop-down to select "self-locking" → enter the network disconnection recovery time of 60s → click "Write" in "3. I/O Configuration" → the log column prompts success → According to Table 4-2, configure LoRa wireless airspeed is 4.8Kbps, wireless channel 0, module address 0 → click "Write" in "2.LoRa Configuration" → the log bar prompts success → click "Save" → next to verify whether the read is successful → click " Restart" → Repeat the steps in the chapter "I/O configuration parameter reading and parameter description" to check.

(Note: For paired products, it is recommended that this parameter should be configured the same for both the sender and receiver. When using, the user can check the status of the indicator lights. For indicator lights, see the chapter "Indicator Description")

Figure 4-12 Configure to self-lock

4.4 Mode configuration Parameter reading, description and writing

4.4.1 Mode configuration Parameter read

(1) Read content of mode configuration parameters: pairing mode, 485 transparent transmission, 485 transparent transmission filtering, the corresponding relationship between the start/end channel and the target device channel

(2) Steps (see Figure 4-13 below): Select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if you have changed the parameters and forget them, you can restore the factory settings) → "Search/Read Device" → "4. Mode configuration" → Click "Read" in the mode configuration → you can view the above parameters: (Note: The reading method of the sender and the receiver is the same.)

Figure 4-13 Mode configuration Parameter read

4.4.2 Mode configuration and parameter description

(1) Pairing method: For the networking method of paired transmission (remote transmission) products, see the following table 4-3

Table 4-3 Pairing method description

Pairing method	Description	Other
One-to-one (default)	1 sender corresponds to 1 receiver. Data is transmitted between devices.	Factory default
One-to-many (with reply)	1. One sender corresponds to multiple receivers. Data is transmitted between devices, and the values of each channel on the receiver are the same. 2. After receiving the data, all receivers will reply to the sender.	Compared to one-to-many (no reply): 1. Advantages: The sending end and the receiving end are connected to the NET indicator light, which will give an indication, which is convenient for network connection judgment. 2. Disadvantages: There are too many receivers, and each receiver sends information to the sender, which is prone to data conflict at the sender, resulting in abnormal output from the receiver.
One-to-many (no reply)	1. One sender corresponds to multiple receivers. Data is transmitted between devices, and the values of each channel on the receiver are the same. 2. After receiving the data, all receivers will not reply to the sender.	Compared to one-to-many (with reply): 1. Advantages: There are too many receivers, each receiver will not send information to the sender, so it will not cause data conflict on the sender, and the output of the receiver is not prone to abnormality. 2. Disadvantage: The NET indicator light on the sending end will not give an indication, and you can only check the status of the NET

		indicator light on the receiving end. 3. When one-to-many use is recommended, the two types with reply and non-reply can be mixed (that is, multiple receivers do not reply, and 1 receiver has reply).
Channel self-organization	Channel correspondence between products can be combined arbitrarily	1. Advantages: high flexibility. 2. Disadvantages: The configuration writing steps are more complicated and difficult to understand. Users need to read the manual carefully and try to understand.

1. One-to-one: the corresponding relationship between the channel values of the sender and the receiver, as shown in Figure 4-14

Description:

A. The arrow is bidirectional, indicating that the data information flow is bidirectional with reply.

B. The value collected by each channel of the sender corresponds to the value output by each channel of the receiver (that is, the signal collected by channel CH1 of the sender corresponds to the output channel CH1 of the receiver, and so on.)

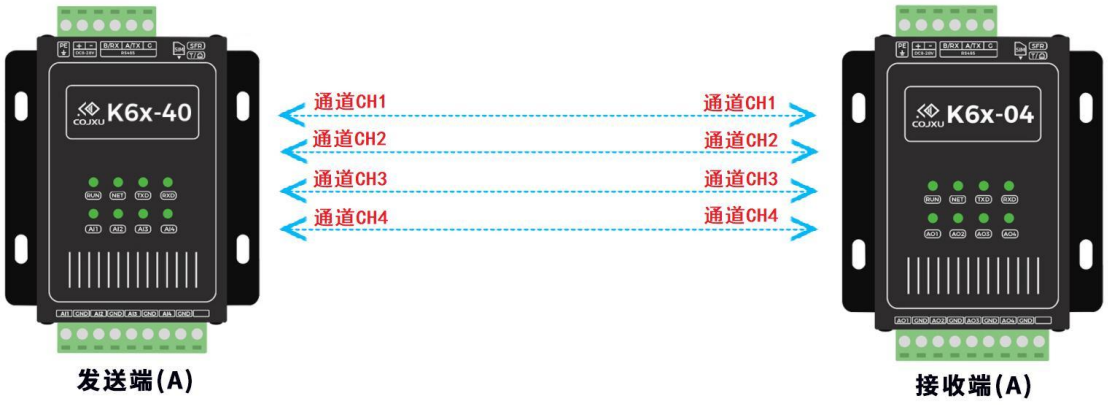


Figure 4-14 One-to-one

2. One-to-many (with reply): the corresponding relationship between the channel values of the sender and the receiver, as shown in Figure 4-15

(Note: In a group, all receivers have replies. If the number is too large, data conflicts will occur, which will also affect the communication quality. It is recommended that the number of receivers with replies does not exceed 4.)

Description: A. The arrow is bidirectional, indicating that the data information flow is bidirectional with reply.

B. "4-channel value" means that the value collected by each channel of the sending end corresponds to the value output by each channel of the receiving end (that is, the signal collected by channel CH1 of the sending end corresponds to the output channel CH1 of the receiving end, so as to analogy.)

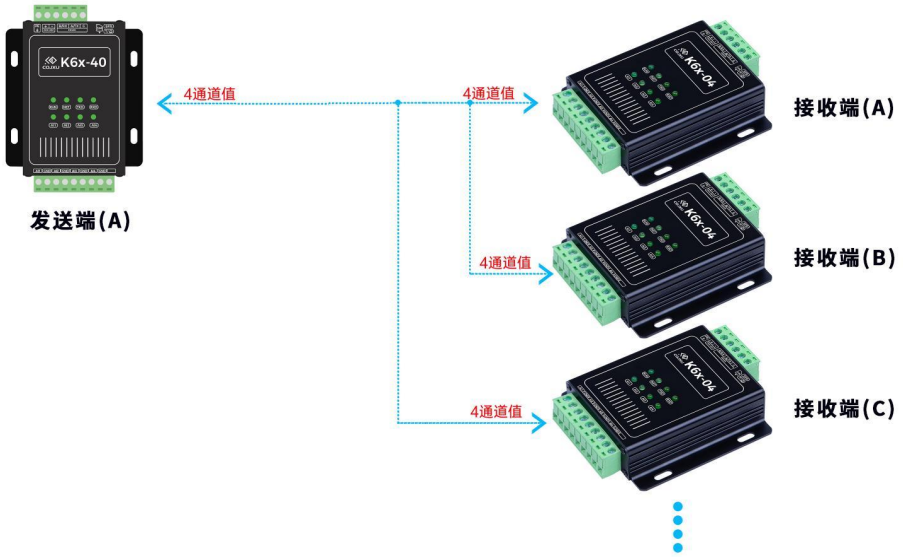


Figure 4-15 One-to-many (with reply)

3. One-to-many (no reply): the corresponding relationship between the channel values of the sender and receiver, as shown in Figure 4-16

(Note: In a group, there must be at least one receiving end with a reply, otherwise the communication module of the sending end will be restarted and the communication quality will be affected.)

Description: A. The arrow is one-way, indicating that the data information flow is one-way without reply.

B. "4-channel value" means that the value collected by each channel of the sending end corresponds to the value output by each channel of the receiving end (that is, the signal collected by channel CH1 of the sending end corresponds to the output channel CH1 of the receiving end, so as to analogy.)

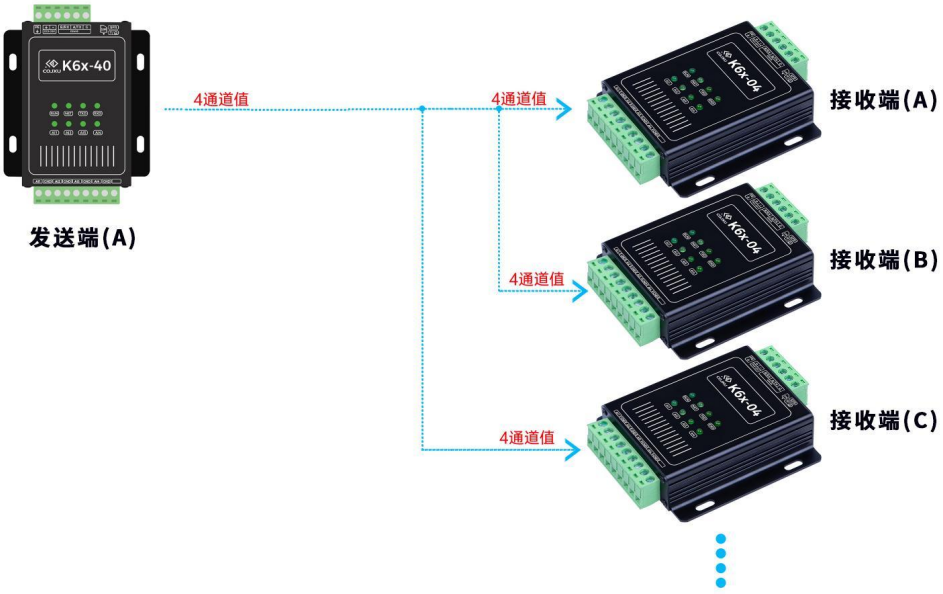


Figure 4-16 One-to-many (no reply)

4. Channel self-organization: The value collected by each channel of the sender and the value output by each channel of the receiver can be combined at will, and both have reply information.

Description: A. The arrow is one-way, indicating that the data information flow is one-way without reply.

B. The combination method is shown in the sample diagram: Figure 4-17, Figure 4-18, etc.

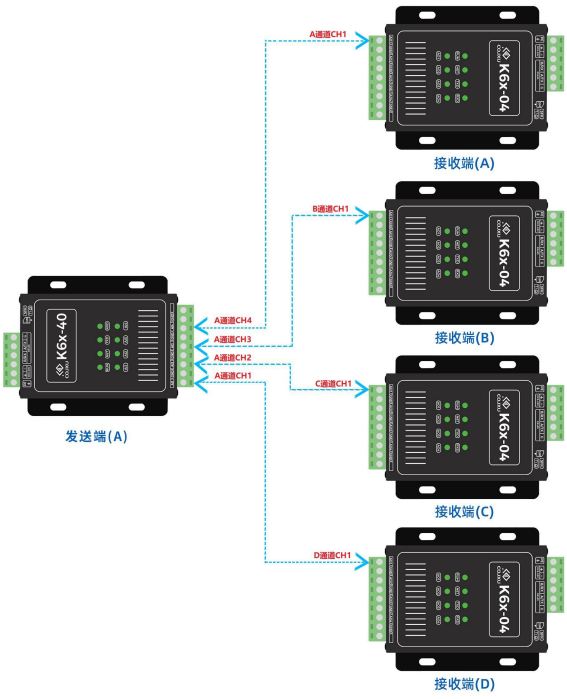


Figure 4-17 An example of self-organization of 1 sender and 4 receivers

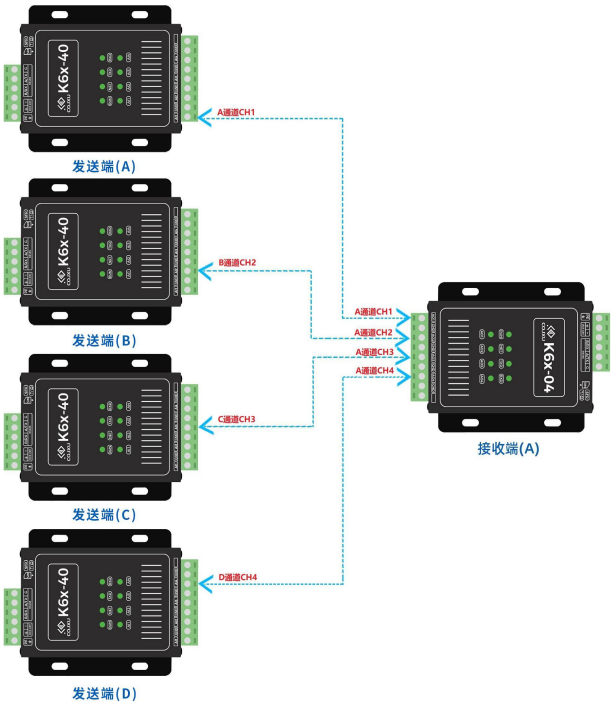


Figure 4-18 4 senders and 1 receiver ad hoc example

(2) 485 transparent transmission: The 485 data of the sender transmits the data to the receiver through wireless (the second communication method), and the receiver outputs the data through 485. The schematic diagram is shown in Figures 4 to 20 below. (To enable this function, see "Table 4-4")

Figure 4-20 Schematic diagram of 485 transparent transmission

Table 4-4 Confirmation of conditions for enabling the 485 transparent transmission function

485 transparent transmission status	Suggest	Illustrate
Off (default)	It is recommended not to enable this feature.	To enable this function, users need to confirm many prerequisites, and it can only be used in systems with less stringent requirements. See below for details
485 transparent transmission status	**Preconditions**	**Illustrate**
Open	Used in risk-permissive systems	1. For each packet of data: user 485 data and internal RTU data of the product are connected to the packet, and the risk of data confusion; 2. The acquisition channel may have abnormal acquisition; 3. The output channel may have abnormal output; 4. With different data lengths, the data packet loss rate will show different degrees; 5. Users need to test themselves whether the stability and tolerance in the system meet the requirements.
	Packet type	Any type
	Packet size	≤240 byte (byte)
	"Refresh Interval"	≥2 seconds
	Time interval for sending packets	1. Recommendation > 2 seconds; 2. The sending time should not conflict with the refresh interval as much as possible; 3. The refresh interval cannot be an integer multiple to prevent data conflict. (See "Refresh Interval" value)

(3) 485 transparent transmission filtering: After this function is enabled, if the length of the user's 485 data packet is less than the set value, it will be filtered out and will not be transmitted transparently.

1. After the "485 transparent transmission" function is enabled, the setting of "485 transparent transmission filtering" will take effect;

2. The purpose of setting the "485 transparent transmission filter" parameter is to filter out interfering data and reduce the error rate of the system.

(4) Correspondence between channel and target: the corresponding relationship between the channel value of the sender and the channel value of the receiver. Details are described in the "Pairing method" section of this chapter.

4.4.3 One-to-one configuration write

(1) Method 1: Restore factory settings

A. Press and hold the "SFR" reset button for 3 seconds (as shown in Figure 4-21 below), and the "pairing method" can be reset to the factory setting: one-to-one.

Figure 4-21 Factory reset button (press and hold a toothpick for 3 seconds)

B. The second communication parameters are configured in pairs: check the communication mode of the product model → check the writing steps of the second communication configuration according to the communication mode → refer to the chapter "parameter reading, description and writing of the second communication mode".

Example: The second communication method is: LoRa wireless spread spectrum. In the second communication configuration writing step, it is necessary to configure the LoRa channel, LoRa address, and LoRa airspeed of the sender and the receiver to be the same. For details, see the "Second Communication Method: LoRa" chapter.

(2) Method 2: The command configuration is written as "one-to-one"

A. Steps (as shown in Figure 4-20): Open the "Interconnection Network IO Setting Tool" → select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, the factory settings can be restored , according to Method 1) → "Search/Read Device" → "4. Mode Configuration" → Select the pairing method as "One-to-One" → Do not fill in the channel correspondence → Click "Write" in "4. Mode Configuration" Enter" → observe the log column, prompting success → click "Save" → click "Restart" → Finish.

B. Next, you can check and check → repeat the chapter "Mode Configuration Parameter Read" to confirm whether the configuration is successful.

Figure 4-20 Method 2: One-to-one pairing method configuration write

4.4.4 One-to-many (with reply) configuration write

(1) Configure the content of the written parameters: pairing mode "one-to-many (with reply)", parameter configuration of the second communication mode, precautions.

(2) One-to-many (with reply) configuration write (same steps as "one-to-one" configuration write)

a. Steps (as shown in Figure 4-20): Open the "Interconnection Network IO Setting Tool" → select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, the factory settings can be restored , operate according to method 1) → "Search/Read Device" → "4. Mode Configuration" → select the pairing method as "one-to-many (with reply)" → do not fill in the channel correspondence → click "4. Mode configuration" "Write" in the → observe the log column, prompting success → click "Save" → click "Restart" → Finish.

b. Next, check → Repeat the chapter "Mode Configuration Parameter Read" to confirm whether the configuration is successful.

Figure 4-20 One-to-many (with reply) combined pairing configuration write

(3) The second communication parameter is configured in pairs: check the communication mode of the product model → check the writing procedure of the second communication configuration according to the communication mode → refer to the chapter "parameter reading, description and writing of the second communication mode".

Example: The second communication method is: LoRa wireless spread spectrum. In the second communication configuration writing step, it is necessary to configure the LoRa channel, LoRa address, and LoRa airspeed of the sender and the receiver to be the same. For details, see the "Second Communication Method: LoRa" chapter.

(4) Notes:

a. In a group, there must be at least one receiving end with a reply, otherwise the communication module of the sending end will be restarted and the communication quality will be affected.

b. In a group, all the receivers have replies. If the number is too large, data conflicts will occur, which will also affect the communication quality. It is recommended that the number of receivers with replies should not exceed 4.

To sum up: in a group, the number of receivers (with replies) is less than or equal to 4.

Correct combination example: 1 sender + n receivers combined pairing: then write the configuration of 1 sender and 1 receiver as "one-to-many (with reply)" mode, and configure the other receivers Write as "one-to-many (no reply)" mode. See Figure 4-22 below.

4.4.5 One-to-many (no reply) configuration write

(1) Configure the content of the written parameters: pairing mode "one-to-many (no reply)", parameter configuration of the second communication mode; matters needing attention.

(2) One-to-many (with reply) configuration write (same steps as "one-to-one" configuration write)

a. Steps (as shown in Figures 4-20 below): Open the "Interconnection Network IO Setting Tool" → select the correct

COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, the factory settings can be restored , operate according to method 1) → "Search/Read Device" → "4. Mode Configuration" → select the pairing method as "one-to-many (no reply)" → do not fill in the channel correspondence → click "4. Mode configuration" "Write" in the → observe the log column, prompting success → click "Save" → click "Restart" → Finish.

b. Next, check → Repeat the chapter "Mode Configuration Parameter Read" to confirm whether the configuration is successful.

Figure 4-21 One-to-many (non-reply) combination pairing configuration write

(3) The second communication parameter is configured in pairs: check the communication mode of the product model → check the writing procedure of the second communication configuration according to the communication mode → refer to the chapter "parameter reading, description and writing of the second communication mode".

Example: The second communication method is: LoRa wireless spread spectrum. In the second communication configuration writing step, it is necessary to configure the LoRa channel, LoRa address, and LoRa airspeed of the sender and the receiver to be the same. For details, see the "Second Communication Method: LoRa" chapter.

(4) Notes:

a. In a group, there must be at least one receiving end with a reply, otherwise the communication module of the sending end will be restarted and the communication quality will be affected.

b. In a group, all the receivers have replies. If the number is too large, data conflicts will occur, which will also affect the communication quality. It is recommended that the number of receivers with replies should not exceed 4.

To sum up: if less than or equal to one group, the number of receivers (with replies) is less than or equal to 4.

Correct combination example: 1 sender + n receivers combined pairing: then write the configuration of 1 sender and 1 receiver as "one-to-many (with reply)" mode, and configure the other receivers Write as "one-to-many (no reply)" mode. See Figure 4-22 below.

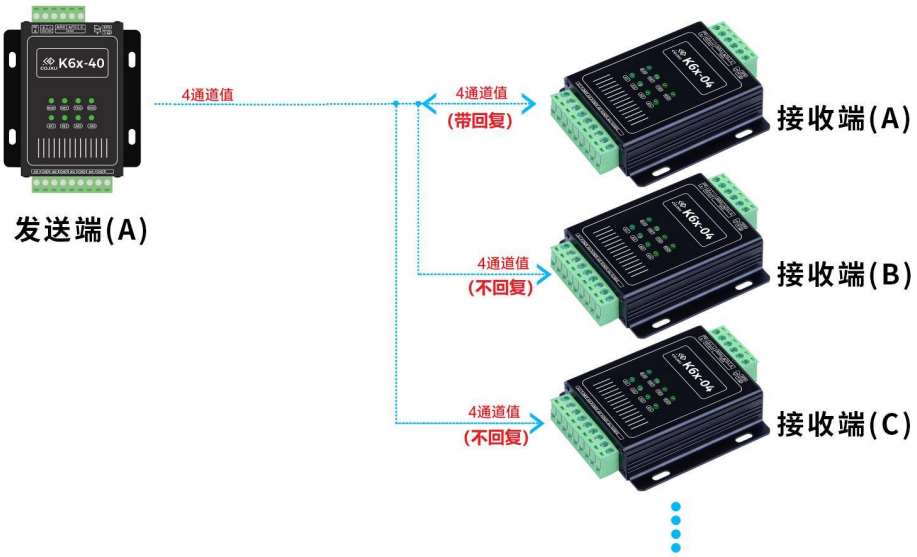


Figure 4-22 "one-to-many (with reply)" and "one-to-many (without reply)" combination pairing

4.4.6 Channel self-organization and configuration write

Users need to write the corresponding configuration of the sender channel and the receiver channel. When users use it, it is necessary to record the correspondence between the channel on the sending end and the channel on the receiving end. Example: sender S/N: D1257C00000271, receiver S/N: D1258C00000294 and D1258C00000310. The corresponding relationship between the sender channel and the receiver channel is as follows:

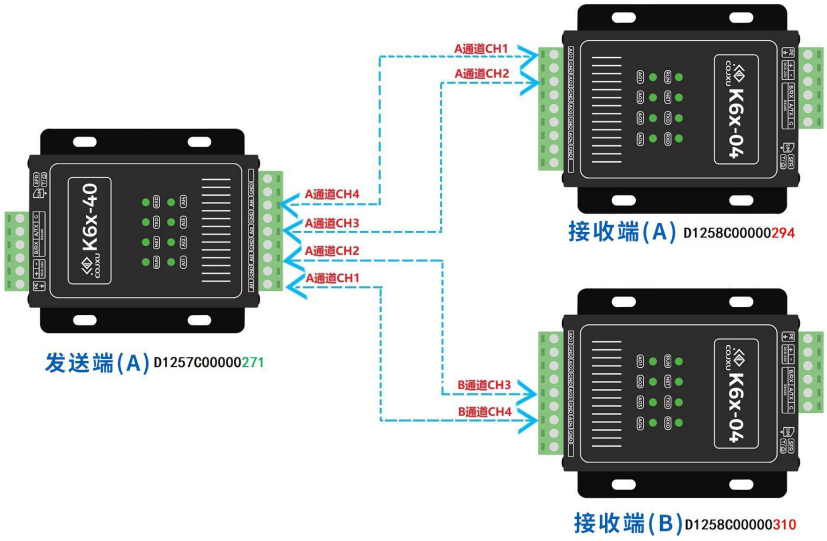


Figure 4-23 Channel self-organization (Example: 1 to 2 channel combination relationship)

1) Send configuration write

A. Configuration and write parameter content: pairing mode "channel self-organization", channel self-organization information, parameter configuration of the second communication method.

B. Steps (as shown in the figure below): Open the "Interconnection Network IO Setting Tool" → select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, you can restore the factory settings, follow the method One operation) → "Search/Read Device" → "4. Mode Configuration" → Select the pairing method as "Channel Self-Group" → Channel correspondence is shown in Figure 4-23 above; target S/N unique identification code and channel configuration Write as shown in Figure 4-24 below → click "Write" in "4. Mode Configuration" → observe the log column, prompting success → click "Save" → click "Restart" → Finish.

C. Next, check → Repeat the chapter "Mode Configuration Parameter Read" to confirm whether the configuration is successful.

Figure 4-24 D1257C00000271 Sender configuration writing steps

4. The second communication parameters are configured in pairs: check the communication mode of the product model → check the writing steps of the second communication configuration according to the communication mode → refer to the chapter "parameter reading, description and writing of the second communication mode".

Example: The second communication method is: LoRa wireless spread spectrum. In the second communication configuration writing step, it is necessary to configure the LoRa channel, LoRa address, and LoRa airspeed of the sender and the receiver to be the same. For details, see the "Second Communication Method: LoRa" chapter.

(2) Receiver configuration write

1. D1258C00000294 configuration steps (as shown in Figure 4-25 below): (configuration method: the same as the sender)

A. Configuration and write parameter content: pairing mode "channel self-organization", channel self-organization information, parameter configuration of the second communication method.

B. Open the "Interconnection Network IO Setting Tool" → select the correct COM port number and the correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, you can restore the factory settings, follow method 1) → "Search "/read device" → "4. Mode configuration" → select the pairing method as "channel self-organization" → the channel correspondence is shown in Figure 4-23 above; the target S/N unique identification code and channel configuration are written as shown in Figure 4- 25 → Click "Write" in "4. Mode Configuration" → observe the log column, prompting success → Click "Save" → Click "Restart" → Finish.

C. Next, check → Repeat the chapter "Mode Configuration Parameter Read" to confirm whether the configuration is successful.

Figure 4-25 D1258C00000294 Receiver configuration writing steps

D. The second communication parameter is configured in pairs: check the communication mode of the product model → check the writing procedure of the second communication configuration according to the communication mode → refer to the chapter "parameter reading, description and writing of the second communication mode".

Example: The second communication method is: LoRa wireless spread spectrum. In the second communication configuration writing step, it is necessary to configure the LoRa channel, LoRa address, and LoRa airspeed of the sender and the receiver to be the same. For details, see the "Second Communication Method: LoRa" chapter.

2. D1258C00000294 configuration steps (as shown in Figure 4-26 below): (configuration method: the same as the sender)

A. Configuration and write parameter content: pairing mode "channel self-organization", channel self-organization information, parameter configuration of the second communication method.

B. Open the "Interconnection Network IO Setting Tool" → select the correct COM port number and the correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, you can restore the factory settings, follow method 1) → "Search /Read Device" → "4. Mode Configuration" → select the pairing method as "channel self-organization" → the channel correspondence is shown in Figure 4-23 above; the target S/N unique identification code and channel configuration are written as shown in Figure 4- 26 → Click "Write" in "4. Mode Configuration" → observe the log column, prompting success → Click "Save" → Click "Restart" → Finish.

C. Next, check → Repeat the chapter "Mode Configuration Parameter Read" to confirm whether the configuration is successful.

Figure 4-26 D1258C00000310 Receiver configuration writing steps

D. The second communication parameter is configured in pairs: check the communication mode of the product model → check the writing procedure of the second communication configuration according to the communication mode → refer to the chapter "parameter reading, description and writing of the second communication mode".

Example: The second communication method is: LoRa wireless spread spectrum. In the second communication configuration writing step, it is necessary to configure the LoRa channel, LoRa address, and LoRa airspeed of the sender and the receiver to be the same. For details, see the "Second Communication Method: LoRa" chapter.

4.4.7 Transparent transmission of the first communication method: open and write the data remote transmission function

(1) Turn on the 485 transparent transmission function

a. Steps (as shown in Figure 4-21 below): Open the "Interconnection Network IO Setting Tool" → select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, the factory settings can be restored , operate according to method 1) → "Search/Read Device" → "4. Mode Configuration" → RS485 Transparent Transmission drop-down to select "On", pairing mode select "One-to-One", RS485 transparent transmission filter input value according to the usage (Default 0) → Click "Write" in "4. Mode Configuration" → observe the log column, prompting success → Click "Save" → Click "Restart" → Finish.

b. Next, check → Repeat the chapter "Mode Configuration Parameter Read" to confirm whether the configuration is successful.

图 4-21 485 透传开启

V.Parameter reading, description and writing of the second communication method

5.1 The second communication method: LoRa

5.1.1 LoRa parameter reading

Read: LoRa channel, LoRa address, LoRa air rate.

Steps (as shown in Figure 4-9): Select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if the parameters have been changed and forgotten, you can restore the factory settings) → "Search/Read Device" → Read "Device Properties" is successful → click "Read" in the LoRa configuration → "5" displays the current LoRa configuration parameter information → read successfully.

Figure 4-9 LoRa parameter reading

5.1.2 LoRa parameter description

(1) LoRa wireless address: It can be understood as the address number of the module, which can be used to identify identities between devices. Therefore, two devices with the same wireless address can identify and communicate with wireless data. Unlike ModBus addresses, the two exist independently.

(2) LoRa wireless channel: The actual frequency of radio frequency transmission is related to the channel, and only devices with the same two channels can perform wireless data communication.

Formula: LoRa wireless transmission actual frequency=410.125(850.125)Mhz+channel*1Mhz

(3) LoRa wireless air rate (airspeed):

1. The faster the airspeed → the shorter the time from sending the data to the receiving end receiving the response data → the shorter the wireless transmission distance.

2. The slower the airspeed → the longer the time from sending the data to the receiving end receiving the response data → the longer the wireless transmission distance.

3. For the relationship between the airspeed and the refresh interval, see the chapter "Acquisition Frequency and Range Configuration".

(4) To sum up, only devices with the same LoRa wireless address, channel, and airspeed can perform data communication.

5.1.3 LoRa parameter configuration writing

(1) Steps (see Figure 4-10 below): Select the correct COM port number and correct (default) parameters → click "Open Serial Port" (if you have changed the parameters and forget them, you can restore the factory settings) → "Search/Read Device" → Read "Device Properties" successfully → Click "Read" in "LoRa Configuration" → "5" shows the current LoRa configuration parameter information → Change the parameters to the information required by the user (be careful not to exceed the "LoRa configuration parameters" range) → click "Write" in "LoRa Configuration" → see the "Log" column pops up a prompt indicating that the writing is successful → click "Save" → see the "Log" column pops up to save successfully, then complete the configuration → click "Reboot the device.

(2) Next, you can verify whether the parameters are correct: repeat the "LoRa parameter reading steps" operation steps.

Figure 4-10 LoRa configuration writing

5.1.4 LoRa configuration parameter range

(1) LoRa channel: 0～83
(2) LoRa address: 0～65535
(3) LoRa Airspeed: 2400～625000bps

IV. ModBus

6.1 ModBus Address Table

6.1.1 Function code and register address table

Register address table (function code: 0x03H, 0x06H)					
Register address	Number of registers	Register properties	Register type	Register parameter range	Support function code
40078(0x004D)	1	ModBus address	read/write	0x01～0xFF（default：1）	0x03、0x06
10017（0x0010）	1	DI1 digital input	read only	0x00~0x01	0x02
10018（0x0011）	1	DI1 digital input	read only		
10019（0x0012）	1	DI1 digital input	read only		
10020（0x0013）	1	DI1 digital input	read only		
00017(0x0010)	1	DO1 switch output	read/write	0~1	0x01、0xF
00018(0x0011)	1	DO1 switch output	read/write		
00019(0x0012)	1	DO1 switch output	read/write		
00020(0x0013)	1	DO1 switch output	read/write		

6.1.2 Change ModBus address

(1) Function code: 03, read holding register; 06, write holding register
(2) Address range: 40078 (0x004D)
(3) Description: Function code 06, set the ModBus address of the device to 0x10, that is, 0001 0000
(4) Note: CRC is calculated by ModBus CRC16 calculation method, not fixed.

Send	01	06	00 4D	00 10	18 11
	Device ModBus address	Function code	Address	Write value	CRC check code

Receive	01	06	00 4D	00 10	18 11
	Device ModBus address	Function code	Address	Write value	CRC check code

Description: Function code 03, the ModBus address of the query device is 0x10, that is, 0001 0000.

Send	10	03	00 4D	00 01	D4 11
	Device ModBus address	Function code	Address	Write value	CRC check code

Receive	10	03	02	00 10	45 8B
	Device ModBus address	Function code	Returns the number of bytes	Write value	CRC check code

6.1.3 Read digital DI input

Function code: 02, read (switch value) input status

Address range: 10017 (0x0010) ~ 10020 (0x0013)

Note: The device defaults to dry contact input. When DI and GND are short-circuited, the read value should be 1; when DI and GND are not short-circuited, the read value should be 0.

Example:

Read 1 channel switch input value, short-circuit DI1 and GND at the DI input terminal. The read digital input value is 0x01. The corresponding binary value is 0000 0001. Each bit represents the state of one digital input, and the lowest is DI1.

ModBus RTU protocol reads digital input:

Send	01	02	00 10	00 01	B8 0F
	Device ModBus address	Function code	Analog starting address	Number of reads	CRC check code

Receive	01	02	01	01	60 48
	Device ModBus address	Function code	Returns the number of bytes	Switch input value	CRC check code

6.1.4 Read switch DO output status

Function code: 01, read coil status

Address range: 00017(0x0010)~00020(0x0013)

Note: When the equipment relay is passively output, and the coil is not energized, the NO port and COM port of the relay are normally open, and the value is 0; Query the relay status by command.

Example:

Read the 2-way switching output status, assuming that DO1 and DO2 are closed, the return value is 03, which corresponds to binary 0000 0011, and the lower four bits represent the switching output status, which are DO4, DO3, DO2, DO1 in sequence.

Modbus RTU protocol to read switch output:

Send	01	01	00 10	00 04	3C 0C
	Device ModBus address	Function code	Analog starting address	Number of read switches	CRC check code

Receive	01	01	01	03	11 89
	Device ModBus address	Function code	Returns the number of bytes	Switch output value	CRC check code

6.1.5 Control switch DO output

Function code: 0F, write multiple coil states
Address range: 00017(0x0010)~00020(0x0013)
Description: The equipment relay is passively output, the coil is not energized, the NO port of the relay is disconnected from the COM port; the coil is energized, the NO port and the COM port are closed. Control relay state by command.
Example:
Function code 0x0F write DO1, DO2 switch output to make NO1, COM1 closed and NO2, COM2 closed. The written value should be 0x03, which corresponds to binary bits 0000 0011
Modbus RTU protocol write switch output:

Send	01	0F	00 10	00 04	01	03	BF 54
	Device ModBus address	Function code	Switch address	Number of write switches	Number of bytes	Write value	CRC check code

Receive	01	0F	00 10	00 04	55 CD
	Device ModBus address	Function code	Switch value address	Write value	CRC check code

VII. Precautions for use

(1) Do not operate this radio in the vicinity of some flammable places (such as coal mines, etc.) or explosive dangerous objects (such as detonators for detonation, etc.).
(2) Do not use it in a working environment that exceeds the environmental characteristics of this product, such as high temperature, humidity, low temperature, strong electromagnetic fields or environments with large dust.

VIII. FAQ

8.1 General question

8.1.1 How to test after getting the product?

- Please see "Quick Start (Users are advised to read this chapter first)" in this manual. If the test process does not go well, please follow the methods below to troubleshoot the issue.

- Pay attention to the polarity of the power supply: "+" is positive, "-" is negative.
- Pay attention to the voltage range of the power supply: If you do not use our matching power supply, please note that the power supply range of the module is 8-28V (DC).
- The SMA connector of the antenna is connected reliably: it should be tightened clockwise.
- Incorrect data:
- a. Check whether the hardware wiring is correct according to "Switch input and output hardware connection";
- b. Check whether other modules are powered on around the device.

8.1.2 Module power supply requirements

- For the power requirements of the transmitter and receiver, see the "Basic Parameters" chapter of the product, or see the nameplate label on the back of the product.
- A suitable DC regulated power supply should be selected, which requires strong anti-high-frequency interference, small ripple, and sufficient load capacity; it is best to have functions such as overcurrent, overvoltage protection and lightning protection to ensure the normal operation of the digital radio. In order to ensure stable communication, it is recommended to reserve more than 50% of the communication distance margin.

8.1.3 The RUN light of the module does not light up.

- The green 5.08 plug-in terminal screw is not tightened or the conductive part is pressed against the wire/cable insulation layer, resulting in poor power contact.
- The power supply voltage is too low, our power supply voltage is 8-28V (recommended power supply voltage is 12VDC, 24VDC).
- Power supply type: DC voltage.

8.1.4 The device cannot be searched by the configuration software

- Check whether there is a USB to 485 driver in the computer management (if there is no driver, you can download the driver from the Internet, or the driver we provide "CH340 driver").
- The wiring method of USB to 485: A to A, B to B.
- Check whether the COM port opened in the host computer is the COM port number of the corresponding device and whether the baud rate is correct (factory default: 9600, 8N1).
- When it prompts that the serial port fails to be opened, please check whether there is other software occupying the serial port, or re-plug and unplug the serial port for testing.
- Poor contact: Check whether there is an insulating layer or other obstructions in the wiring terminals at A and B of the communication port, or whether the wiring terminals are tightened.
- The baud rate is changed and forgotten: long press the "SFR" button to restore the factory settings, and then apply the configuration software again to read. You can also apply the search baud rate function to search.
- If the above conditions are correct: use the host computer to search for the device or use the serial port assistant to try to send data to the device, and see if the RXD light of the device is flashing. If the RXD light of the device does not flash, you need to check whether the USB to 485 is damaged.
- The configuration software and the computer are indeed incompatible and cannot be used: you can use other serial software tools to read the device parameters by viewing the ModBus command of the product.

8.1.5 The communication between the two modules is unsuccessful, and the NET light does not light up

- Whether to connect the antenna (the distance between the two antennas should be greater than 1.5M). Antennas cannot be placed in a closed tin cabinet (preferably in an open area).
- Check whether the configuration information of the communication module is consistent (channel, airspeed, address).
- The communication distance of 485 is too far. It is necessary to add a resistor below 1K ohm on the AB end of 485, preferably on both the sending and receiving ends.
- The LoRa communication distance is too far or there are too many metal shields in the surrounding environment, consider replacing high-power products.

8.1.6 The communication between the two devices is unsuccessful, but the NET light is always on

- The DI acquisition end sensor is damaged or the sensor wiring is wrong.
  a. Check if the DI light of the acquisition module is always on, the input signal is acquired, otherwise, no.
  b. Check whether there is any problem with the sensor wiring connected to the acquisition device. Please verify the sensor type and wire it according to the correct wiring method.
  c. Sensor damage: Use a multimeter to measure the voltage of the sensor signal line.
- The DO output is wired incorrectly.
  a. Users need to check and connect the acquisition module wiring method of the company's DO products. The company's DO products are passive output. For details, please refer to the chapters such as "Hardware Connection of Switch Input and Output".
  b. The user can verify that the DO product of our company is not connected to any load, and then connect the buzzer of the multimeter to the DO signal terminal to observe whether the port output will ring.

8.2 LoRa related questions

8.2.1 LoRa communication, what should be paid attention to?

- When testing the K61-DL20 module, a matching antenna or a 50Ω dummy load must be connected, otherwise the transmitter module will be easily damaged.
- K61-DL20 often has different communication distances in different environments. The communication distance is often affected by temperature, humidity, obstacle density, obstacle volume, and electromagnetic environment. It is recommended that customers actually measure on site.

8.2.2 LoRa communication, what is the actual communication distance of the 4KM or 8KM module?

For LoRa communication, the communication power of the 4KM version is usually 0.16W (22dBm); the communication

power of the 8KM version is usually 1W (30dBm). The transmit power of 8KM is 10 times that of 4KM.

If you need more stable communication, it is recommended that you directly choose the 8KM version.

We have measured the communication distance, and the visible distance is our standard distance. However, practical applications often have certain occlusions, such as several walls, or several high-rise buildings in the middle.

We recommend that customers actually test the communication distance. We also have the following suggestions to improve the stability of LoRa wireless communication.

- The antenna is placed by the window, or even outside the window;
- Adjust the orientation of the antenna, the antenna generally sends signals to both sides of the antenna;
- Appropriately reduce the air rate of transmission;
- For more details, please refer to the chapter "Second Communication Method: LoRa Spread Spectrum".

8.2.3 How should the antenna be placed

The placement of the antenna greatly affects the transmission stability of the module.

- The antenna transmits data to both sides of the antenna and to the upper and middle positions of the antenna. Therefore, pay attention to the placement direction of the antenna pole, which should be parallel to the data receiving and transmitting ends.
- The antenna should be placed in a slightly open location, as close to a window as possible. Do not place directly against a wall or metal.
- In the application scenario of the industrial control box, the antenna must be outside the industrial control box, and the signal of the antenna in the industrial control box will basically be blocked.
- Put the antenna as high as possible.

8.3 Questions related to digital input and output

8.3.1 AI/AO input/no input/output, DI/DO input/no input/output

- Check the wiring, the user needs to distinguish clearly which of the two-wire, three-wire, and four-wire system the sensor is.
- The two modules did not communicate successfully. Check whether the networking is successful.
- The green 5.08 terminal screw is not tightened, resulting in poor contact of the analog input.
- The green 5.08 terminal is not plugged tightly, resulting in poor contact.

8.2.4 The communication between the two modules is unstable

- Check the LoRa communication parameters (channel, airspeed, address) of the two modules, which need to be configured and managed to avoid the same frequency band and the same type of products in the environment, resulting in signal confusion and instability.
- If the antenna distance between the paired products is too far, or there are too many factors for the attenuation of the wireless radio frequency in the middle, the user can judge by indenting the distance between the products. If the reason is the distance, you can change the antenna position of the product to a better place, or replace the antenna with better performance.

Revision history

Version	Revision Description	Maintainer	Revision Date
v1.0	Initial version	Guo Hong	2022-04-01

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