直流绝缘监测仪（双路）

使用说明书

DC insulation monitor device (IMD)
(Dual channels)
Operating instruction

GYDCG-UBCH2-LZ

Catalog

1 The profile

GYDCG-UBCH2-LZ model is based on MODBUS protocol of DC insulation monitoring device, is used in on-line monitoring insulation resistance of the DC floating system (two DC system shared one ground). two DC channels are controlled independently, two DC insulation monitoring non-interference in each other. Users can enable or disable the insulation monitoring function of each DC channel and acquire insulation resistance values by RS485 communication.

The IMD can monitor the positive and negative symmetrical and asymmetric insulation resistance, can accurately measure the insulation resistance value even under the condition of DC voltage change. In the case of existing DC ground capacitance, the IMD can realize adaptive insulation monitoring of grounding capacitance below 3uF (positive and negative ground capacitance below 3uF respectively, and total capacitance below 6uF). In the case of existing ground capacitance, the maximum monitoring time is not more than 2.5s.The IMD can measure the insulation resistance value in the DC system of 100~1000V, the resistance range of 1KΩ~10MΩ, read unit by KΩ. When the insulation resistance value is greater than 10 MΩ, the insulation resistance data read value is 60000 (0xEA60), indicating infinity.

The user can turn the insulation monitoring function on and off by writing register 0x0102, and check whether the current insulation monitoring function is enable or disable by reading register 0x001B Bit2. After the insulation monitoring function is enable, the insulation resistance value can be read at least 1 second later (the real monitoring time depends on the capacitance to the ground, and the monitoring time is not more than 2.5s). If the read insulation resistance data is 65535 (0xFFFF), means the data is invalid. The invalid data (0xFFFF) indicates that the insulation monitoring function is not fully started, or is in the closed state, or the DC voltage is less than 100V. If the insulation resistance data is 60000 (0xEA60), means the data is valid, indicating that the current insulation resistance is infinite. Alternatively, the user can check whether the insulation monitoring value is valid by reading Bit1 in register 0x001B.

The insulation resistance can be monitored continuously and in real time after the insulation monitoring function is turned on. The user can read the current insulation resistance value at any time after the insulation monitoring function is turned on.

The IMD can also monitor the DC voltage value, the current voltage value can be read in real time after the insulation monitoring function is turned on. If turne off insulation monitoring function, the voltage value is 0.

After the insulation monitoring function is disabled, the high voltage switch is disconnected, and the product will be completely separated from the DC and the ground.

2 Mechanism description

This IMD adopts dual-DC channels independent control scheme. Its schematic diagram is shown in the following figure. Users can control dual-channel startup, shutdown and data reading respectively according to the content of communication protocol. Take DC1 channel as an example. When the insulation monitoring function is disable, the positive and negative extreme relays K1 and K2 are disconnected, and the DC voltage and insulation resistance monitoring will not be provided at this time. When the host computer of the user sends the DC1 open instruction to IMD, K1 and K2 relays are closing, and the DC1 voltage is collected and insulation resistance is calculated immediately. The user can read the corresponding DC1 voltage and insulation resistance value. The application and principle of DC2 is same to DC1. Dual independent control. When the two insulation monitoring functions are closed, the K5 relay is disconnected and the IMD disconnects from the ground.
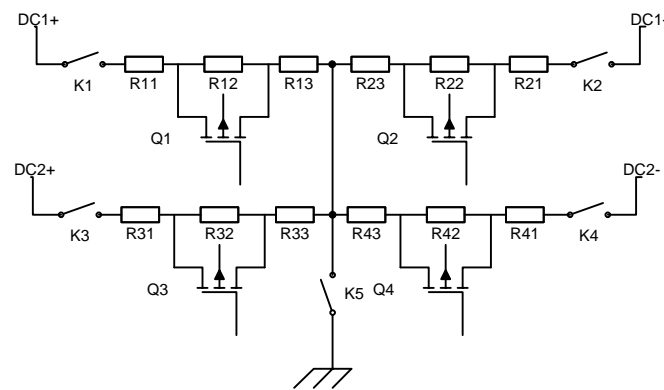

Figure 1 Schematic diagram of double DC- channels insulation monitoring principle

3 Ports and functions

3.1 The enable and disable of each DC channels

After the insulation monitoring function is enabled, the positive and negative high voltage switch is closed, and the insulation resistance is measured. You can turn on and turn off the machine by means of communication. For details, see section of Communication Protocol.

3.2 The LED display

After the module is powered on, the PWR indicator is on. The 'DC1' light is on when DC1 is working, and the 'DC2' light is on when DC2 is working.

3.3 RS485 communication

Users can send data frames through the RS485 communication port to achieve: modify baud rate, modify communication address, enable or disable the insulation monitoring functions. By receiving data frames to check: communication address, whether the IMD can read DC voltage values, positive insulation resistance value, negative insulation resistance value. The communication protocol adopts the standard MODBUS RTU protocol. The initial address of the first channel is' 01H ', the initial address of the second channel is' 02H ', and the initial baud rate is 9600bps. For detailed operation, see '7 Communication Protocol'.

3.4 The CONFIG configuration

Two Dip switch configuration bit 'CONFIG', one of which can be used to configure the communication verification mode. E stands for EVEN parity and O stands for ODD parity. To use the corresponding checksum, simply dial the corresponding position to "ON". If E and O are set to no, indicates NONE parity. See Figure 2
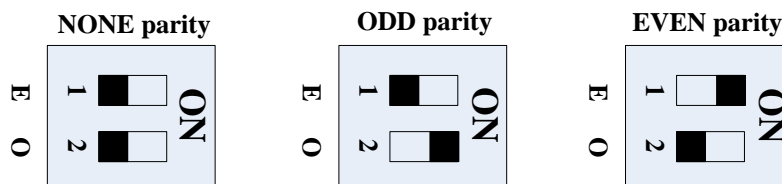
Figure 2 Configuration of communication verification mode

3.5 Initializing Module Communication Parameters

Dip switch configuration bit 'CONFIG', second function can be used to initialize communication parameters. When E and O of CONFIG are dialed to ON at the same time for at least 3 seconds, the baud rate is restored to 9600bps and the communication address is restored to 01H and 02H. The system can be initialized only once after each power on. The total number of times for modifying the baud rate, changing the communication address, and initializing the baud rate must be less than 1 million. See Figure 3.
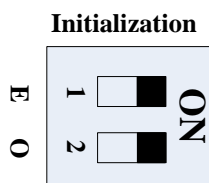
Figure 3 Initial configuration of communication parameters

3.6 Other Precautions

1、   If the received insulation resistance value is 65535, it indicates that the insulation resistance is invalid.

2、   The measurement range of the grounding resistance is between 1kΩ~10MΩ. When the measurement value is greater than 10MΩ, the received value is 60000(0xEA60) ,means infinite.

3、   DC voltage in 100V-1000V, insulation resistance monitoring can work normally. When the DC voltage is less than 100V, the received value is 65535 (invalid). It is recommended that the DC voltage be higher than 300VDC for higher accuracy.

4   Wiring Method
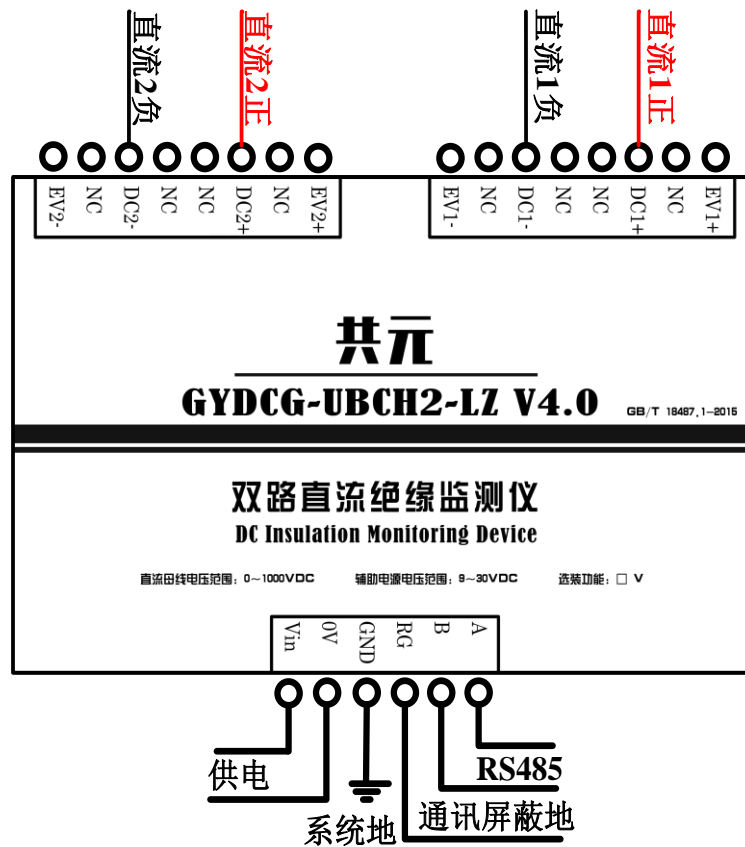
The name of the interface	Connection mode	note
DC1+	DC 1 positive pole	
DC1-	DC 1 negative pole	
DC2+	DC 2 positive pole	
DC2-	DC 2 negative pole	

Vin	Positive pole of power supply	9-30VDC
0V	Negative pole of power supply	
GND	GND	
RG	485 Communication Ground port (can leave it unwired)	Reserved, communication shielded line access point
A	485A	
B	485B	

5 Structural Parameters

The module can be installed by guide rail or screw fixation. Guide rail using standard width 36mm. External dimensions are shown as follows: (Unit: mm)
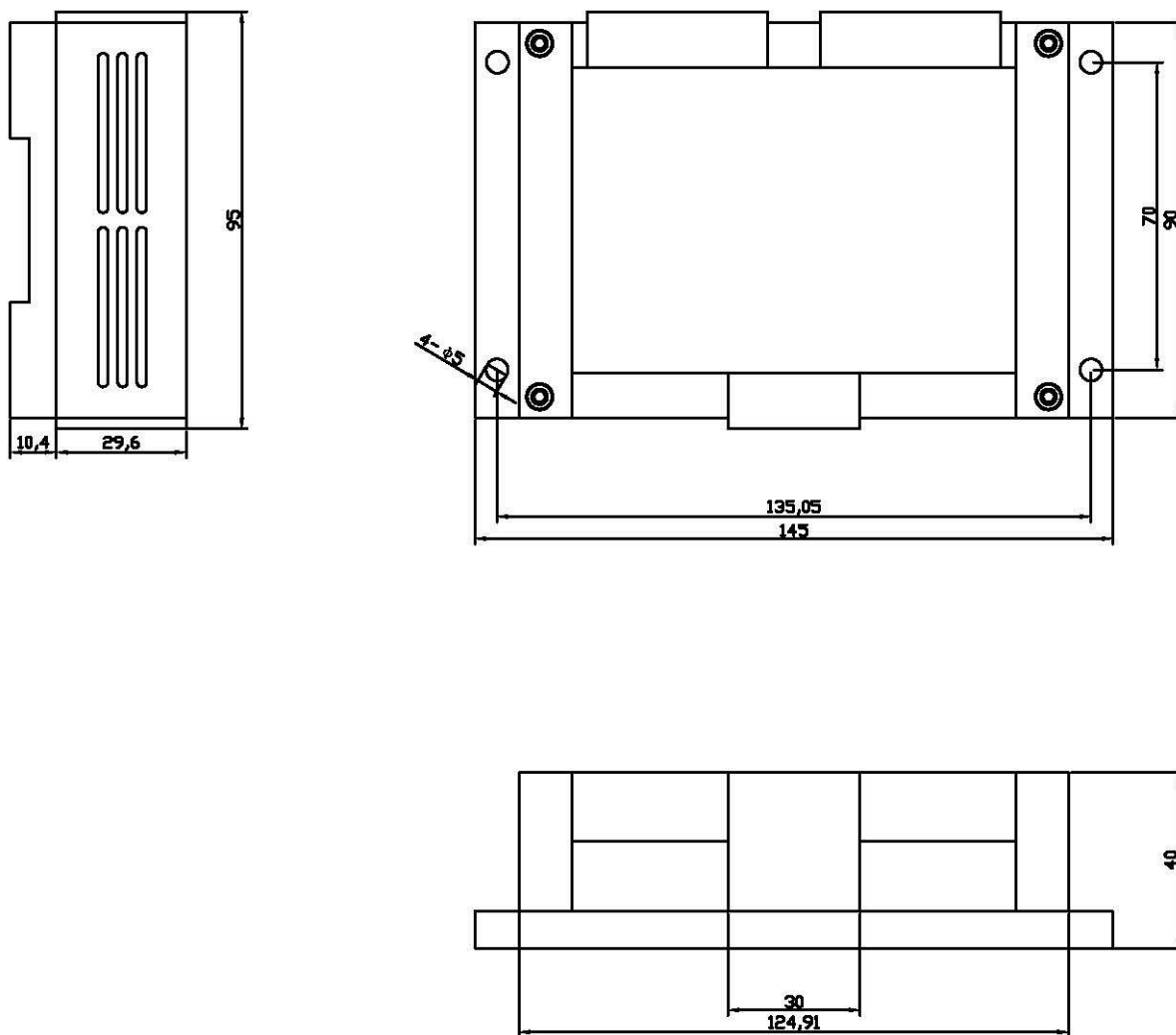
6 Electrical Parameters

parameter	conditions	Typical values
DC system voltage measurement range		0~1000VDC
DC system voltage measurement accuracy		≤2V+0.3%
Range of input voltage value of power supply		9~30VDC
The power value of input voltage of power supply		6W
Measuring range of insulation resistance	DC system voltage 100V to 1000V	1KΩ~10MΩ
Insulation monitoring accuracy ①	DC voltage 100V to 300V	≤3KΩ+10%
	DC voltage 300V to 1000V	≤3KΩ+5%
	CY② > 0.3μF, insulation resistance > 1MΩ	> 10%
Storage temperature		-40℃~125℃
Working temperature		-40℃~70℃

① When the positive to ground insulation resistance RISO+ and negative to ground insulation resistance RISO- difference is too large, the multiple of difference > 10 times, RISO+ and RISO- where the large resistance value may not conform to the typical value

② CY refers to the Y capacitance of the system to earth

●Offline pressure test <2mA:

Withstand voltage point		Maximum withstand voltage class	The test of time
DC+/DC- TO GND	DC voltage positive and negative to the earth	4200VDC/3000VAC	≤1min
Vin/0V TO GND	The power supply is positive and negative to the earth	3500VDC/2500VAC	≤1min
A/B TO GND	The RS485 port connects to the ground	4000VDC/2800VAC	≤1min

7 Communication Protocol

The device provides the Modbus RTU protocol interface and uses the Modbus RTU

0x03/0x06 command. The default device addresses are 0x01 and 0x02. Baud rate The default baud rate is 9600 bps. The data bit is 8 and the stop bit is 1. The IMD works in slave mode and supports 9600bps and 19200bps baud rates.

7.1 Read Operation Function 0x03: Read hold register

7.1.1 Request command

BYTE[0] Device address

BYTE[1] Function code 0x03

BYTE[2] The high BYTE of the register's starting address

BYTE[3] Register start address low BYTE

BYTE[4] High BYTE of register length

BYTE[5] Low bytes of register length

BYTE[6] Indicates the low value of CRC check

BYTE[7] Indicates the high value of CRC check

7.1.2 Response command

BYTE[0] Device address

BYTE[1] Function code 0x03

BYTE[2] The high BYTE of the register's starting address

BYTE[3] Register start address low BYTE

BYTE[4] High BYTE of register length

BYTE[5] Low bytes of register length

BYTE[6] Indicates the low value of CRC check

BYTE[7] Indicates the high value of CRC check

7.2 Write operation function code 0x06: Writes a single register

7.2.1 Request command

BYTE[0] Device address

BYTE[1] Function code 0x06

BYTE[2] The high BYTE of the register's starting address

BYTE[3] Register start address low BYTE

BYTE[4] The register parameter is high in bytes

BYTE[5] Register parameter low bytes

BYTE[6] Indicates the low value of CRC check

BYTE[7] Indicates the high value of CRC check

7.2.2 Response command

BYTE[0] Device address

7

BYTE[1] Function code 0x06

BYTE[2] Register BYTE length

BYTE[3] Register high BYTE

BYTE[4] Low BYTE in register

BYTE[5] Register high BYTE

... ...

BYTE[n] Indicates the low value of CRC check

BYTE[n+1] Indicates the high value of CRC verification

	Function code	address	content	Example (address 01,02)	note
1		0x0010	Bus voltage	01 03 00 10 00 01 85 CF 02 03 00 10 00 01 85 FC	Unit: 0.1V, voltage between positive and negative DC bus
2					
3		0x0012	DC1 Positive insulation resistance DC2 Positive insulation resistance	01 03 00 12 00 01 24 0F 02 03 00 12 00 01 24 3C	The unit is KΩ, an integer
4	03 Read the register	0x0013	DC1 Negative insulation resistance DC2 Negative insulation resistance	01 03 00 13 00 01 75 CF 02 03 00 13 00 01 75 FC	The unit is KΩ, an integer
5		0x001A	Read version number	01 03 00 1A 00 01 A5 CD	
7		0x001B	IO state	01 03 00 1B 00 01 F4 0D	Bit1: whether the current insulation resistance monitoring results are valid. Bit2: Whether the insulation monitoring is on and the high voltage switch is closed. Bit7: Bus voltage backconnection alarm (when the backconnection voltage is above 170V, this position 1)
8	06 Write the register	0x0102	Insulation monitoring and control	01 06 01 02 00 11 E9 FA 02 06 01 02 00 12 A9 C8	Enable DC1 insulation monitoring; Enable DC2 insulation monitoring

9			Insulation monitoring and control	01 06 01 02 00 00 29 F6 02 06 01 02 00 00 29 C5	Disable DC1 insulation monitoring; Disable DC2 insulation monitoring
10		0x0103	Modify the address	01 06 01 03 00 02 F9 F7 02 06 01 03 00 03 38 04	Change the address from 01H to 02H; Change the address from 02H to 03H
11		0x0104	Modify the baud rate	01 06 01 04 00 01 08 37 01 06 01 04 00 11 09 FB	Change the baud rate to 9600; Change baud rate to 19200
12	0xFF	0x 66	The host broadcast reads the slave address	The host sends: 0xFF 0x66 0xA5 0xAA 0x2B The slave answers: 0xFF 0x66 add1 add2 CRClo CRCHi ADD1 and ADD2 are the communications addresses of DC1 channel and DC2 channel respectively	Example of reply from machine FF 66 01 02 50 7E The slave addresses are 0x01 and 0x02

In the example, the address 01 is the default address used for the first measurement or modification of device parameters, and the default address for sending and returning data of the second measurement is 02.

■ CRC-16 algorithm (RS485) :

The check data is generated according to the generation polynomial of CRC rules, and the result is added after the instruction as the check code.

Generating polynomial： $X^{16}+X^{15}+X^2+1$

1.Set the CRC register and set it to 0Xffff.

2.Xor the first 8-bit character of the data with the lower 8 bits of the 16-bit CRC register and store the result in the CRC register.

3.The CRC register is moved right by one bit. MSB fill 0, move out and check LSB.

4.If LSB is 0, repeat step 3. If LSB is 1, the CRC register is xor with the polynomial code.

5.Repeat steps 3 and 4 to 8 to complete the shift. At this point an 8-bit data processing is complete.

Example:

1. Start insulation monitoring: 01 06 01 02 00 11 E9 FA

Answer frame: 01 06 02 00 11 78 84

2, close insulation monitoring: 01 06 01 02 00 00 29 F6

Answer frame 01 06 02 00 00 B8 88

3, read the bus voltage and positive and negative electrode resistance to the ground (read 4 registers) : 01 03 00 10 00 04 45 CC

Answer frame 01 03 08 03 E8 02 58 EA 60 02 58 A9 7F

Meaning: Read the DC voltage 0X03E8(100V), the total insulation resistance 0X0258 (600KΩ), the positive insulation resistance 0xEA60 (infinite), and the negative insulation resistance 0X0258 (600KΩ).

4, read IO status: 01 03 00 1B 00 01 F4 0D

Answer frame 01 03 02 00 84 B8 27

Meaning: Bus voltage reverse connection, insulation monitoring is enabled (ground relay is closed), insulation resistance monitoring is invalid.

Answer frame 01 03 02 00 06 38 46

Meaning: there is no reverse connection of bus voltage, insulation monitoring is enabled (ground relay is closed), and insulation resistance monitoring is effective.

5, Read version number: 01 03 00 1A 00 01 A5 CD

Answer frame: 01 03 02 22 01 61 24

The version number is V2201.

8   Common Problems

The problem	The solution
The power indicator LED is off	Check whether the power supply terminal of the module is improperly connected, or the hot swap over current causes the fuse to burn, try to avoid hot plug
Communication failure	Do not use USB-232-485 bipolar interface for communication If the communication fails again, use the CONFIG mode to restore the factory Settings parameters
The insulation monitoring resistance is infinite after the simulation of insulation resistance	Check whether the ground cable is connected reliably at GND port

The insulation monitoring resistance is much smaller than the actual value	The DC ground capacitance may be too large. Check the DC ground capacitance
Communication initialization is invalid	The system can be initialized only once by CONFIG during each power-on.