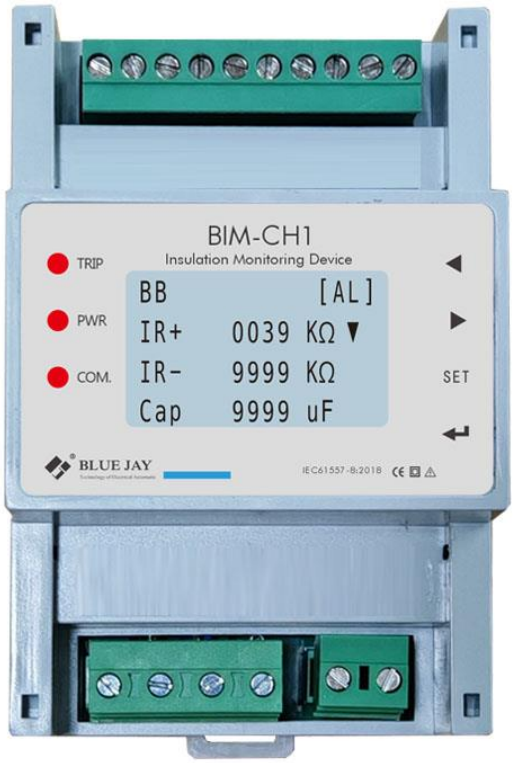
BIM-CH1
Insulation Monitoring Device

User Manual



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Read me

When you use BIM-CH1, be sure to read this user manual carefully, and be able to fully understand the implications, the correct guidance of operations in accordance with user manual, which will help you make better use of BIM-CH1, and help to solve the various problems at the scene.

1. Before turning on the power supply, be sure that the power supply within the provisions of the instrument;

2. When installation, the current input terminal must non-open, voltage input terminals must Non-short circuit;

3. Communication terminal (RS485) is strictly prohibited to impose on high pressure;

4. Be sure the instrument wiring consistent with the internal system settings;

5. When communicating with the PC, instrument communication parameters must be consistent with the PC.

- **Please read this user manual carefully**
- **Please save this document**

Directory

1.- SUMMARIZE

The BIM-CH1 monitors the insulation resistance of DC systems (IT systems) devices up to DC 0-1000V. BIM-CH1 has insulation monitoring start and stop functions. After insulation monitoring is turned on, it can real time monitor the insulation resistance of the positive and negative poles to the ground. The monitoring results are not affected by DC voltage fluctuations and the symmetry of the insulation resistance of the positive and negative poles.

BIM-CH1 is equipped with RS485 /Modbus communication, which can remotely monitor the system status. BIM-CH1 uses two working principles for monitoring: unbalanced bridge method to monitor the insulation resistance value to ground, and balanced bridge method to monitor the voltage value to ground. Optional temperature sensor can be used for system temperature measurement.

FEATURES

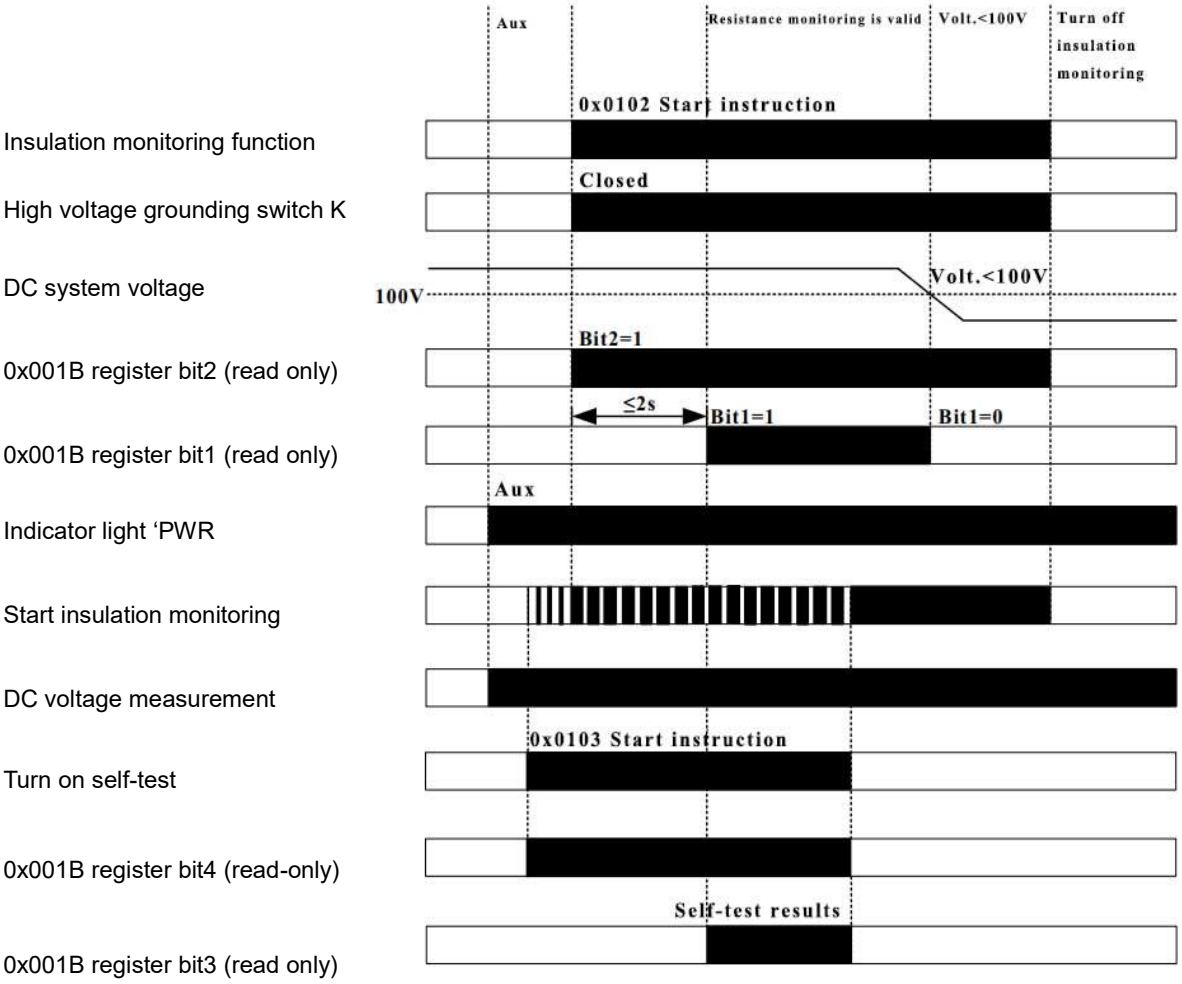
- Adaptive capacitance to ground;
- Widely insulation monitoring range (100V~1000VDC);
- Monitoring the insulation resistance for unearthed DC systems: 0KΩ~10MΩ;
- Two working modes: balanced bridge method, used to monitor the voltage value to the ground / unbalanced bridge method, used to monitor the insulation resistance to the ground;
- Measured value indication via a multi-functional LCD display;
- Automatic device self-test with connection monitoring;
- DC voltage reverse connection alarm function;
- RS485 communication, MODBUS RTU protocol;
- Selectable N/C or N/O relay operation;
- Password protection to prevent unauthorized parameter changes;
- Optional temperature sensor for system temperature measurement.

APPLICATIONS

- DC charging systems;
- DC system up to 1000 V;
- Railway vehicle, electric vehicle (EV/HEV);
- Photovoltaic solar system, energy storage systems;
- Substation DC panels, UPS power supply system;
- Medical fields and others;

2.- Function introduction

2.1.- Insulation resistance monitoring function



Insulation monitoring function control sequence

- After the product is powered on, the 'PWR' light turns on and the DC voltage is continuously monitored.
- Insulation monitoring can be turned on and off by writing to the 0x0102 register.
- You can determine whether the present insulation monitoring is on or off by reading bit2 of the 0x 001B register.
- The conditions for the effective DC-to-ground insulation resistance in Table 2 below must be met. The insulation resistance values of 0x0012 and 0x0013 are valid values. The resistance values of 0x0012 and 0x0013 can be read; if the resistance value is > 10MΩ, 0xEA60 is

displayed, which is 60000; if The values of 0x0012 and 0x0013 are invalid values, that is, 0xFFFF is displayed, which is 65535.

- Users can read the insulation resistance value as soon as 0.7s~2s after turning on the insulation monitoring function. For the presence of DC capacitance to ground, the module can adaptively monitor ground capacitance below 3uF (the positive and negative capacitances to ground are below 3uF respectively, and the total capacitance is below 6uF). When there is capacitance to ground, the monitoring time does not exceed 2s.

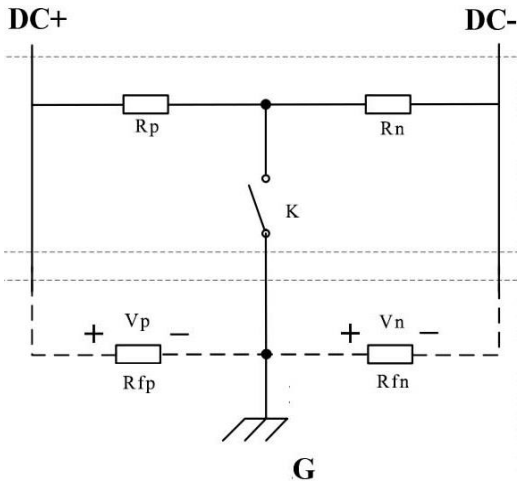
DC to ground resistance/voltage monitoring

Measured value	Valid/invalid	Condition	Readable
DC to ground insulation resistance value	Valid	**Need to meet both:** 1. Send the command to turn on insulation monitoring to 0x0102; 2. 0.7s~2s after turning on the module; 3. DC voltage ≥100V; 4. Set to automatic switch bridge mode;	0x0012 is the positive to ground resistance RfP 0x0013 is the positive to ground resistance RfN Bit1 of 0x001B is "1"
	Invalid	**Meet any of the following:** 1. Send the turn off insulation monitoring command to 0x0102; 2. Turn on the module within 0.7s~2s; 3. DC voltage <100V; 4. Set to balanced bridge mode;	0x0012 is 0xFFFF 0x0013 is 0xFFFF Bit1 of 0x001B is "0"
DC to ground voltage value	Valid	**Need to meet both:** 1. Turn on balanced bridge mode to 0x0100; 2. Send the command to turn on insulation monitoring to 0x0102;	0x0015 is the positive to ground voltage VP 0x0016 is the negative ground voltage VN Bit8~bit10 of 0x001B is "000"
	Invalid	**Meet any of the following:** 1. Turn on automatic switching bridge mode to 0x0100; 2. Send the shutdown insulation monitoring command to 0x0102	0x0015 is 0xFFFF 0x0016 is 0xFFFF Bit8~bit10 of 0x001B is "100"

2.2.- Insulation monitoring working principle

BIM-CH1 adopts the bridge method circuit, as shown in the figure below. After insulation monitoring turned on, the grounding switch K is disconnected by default. After the insulation monitoring turned on, the grounding switch K is closed, and the insulation resistance values RfP and RfN of the positive and negative poles to the ground or the voltage values VP and VN of the positive and negative poles to the ground can be read.

When insulation monitoring powered on the RfP, RfN or VP, VN data are updated in real time, and the RfP, RfN data update cycle is 0.7s~2s, and the VP and VN update cycle is 100ms. After the insulation monitoring is turned off, the grounding switch K is disconnected, and thereafter RfP, RfN, VP, and VN are all invalid values.



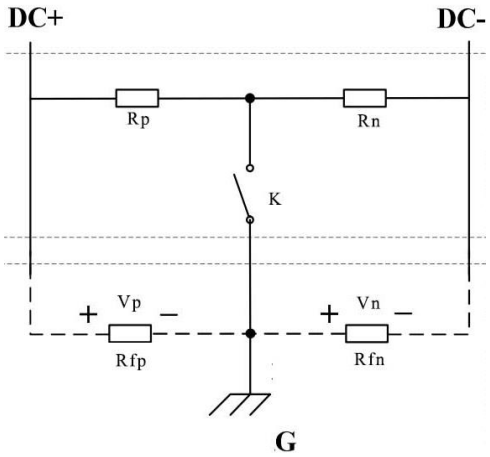
2.3.- Insulation monitoring working mode

The insulation resistance monitoring can be realized only when the DC voltage is between 100V and 1000V.

By writing the 0x0100 register, you can select two working modes: Balanced bridge mode or Automatic switch bridge mode: Balanced /unbalanced bridge.

Automatic switch bridge mode means that the insulation monitor automatically switches the internal positive and negative poles to ground resistance.

As shown in Figure, [RP=3MΩ, RN=600KΩ] and [RP=600KΩ, RN=3MΩ] switch between each other. This mode monitors the insulation resistance to ground, and can read the 0x0012 and 0x0013 registers, that is, the insulation resistance values of the positive and negative poles to ground.



The positive and negative voltages to ground and negative to ground voltage are not monitored, and the 0x0015 and 0x0016 registers are invalid values (0xFFFF).

Balanced bridge mode means that the internal positive and negative pole-to-ground resistances (RP and RN) of the insulation monitor are fixed values. This mode monitors the positive and negative pole-to-ground voltages and can read the 0x0015 and 0x0016 registers, which are the positive and negative pole-to-ground voltage values., the insulation resistance of the positive and negative poles to ground is not monitored, and the 0x0012 and 0x0013 registers are invalid values (0xFFFF). The balanced bridge mode can be realized by writing the 0x0100 register. The balanced bridge resistance is [RP=3MΩ, RN=3MΩ].

After the module is powered on, the default is automatic switch bridge mode. After the working mode changed, the insulation monitoring on and off does not change the mode status, Users can check the present working mode by querying bit8~bit10 of register 0x001B.

Working mode table

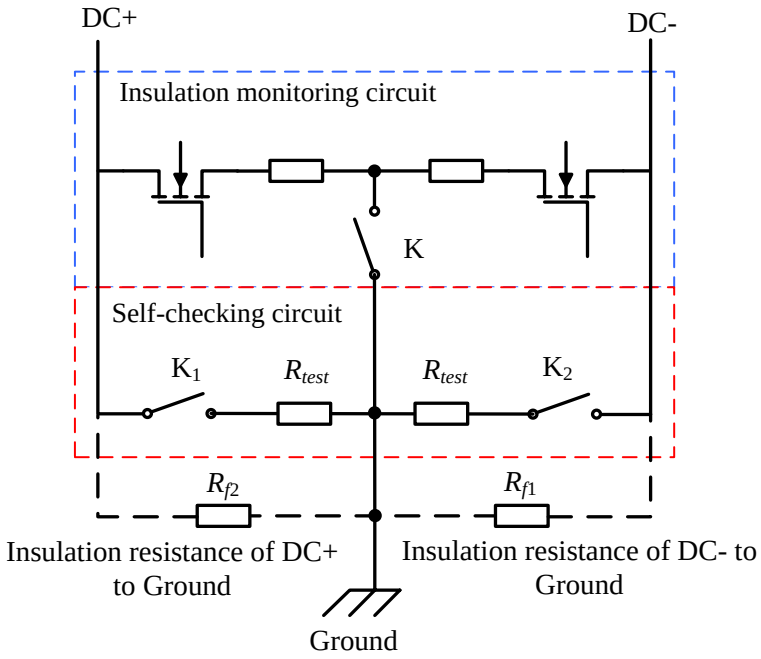
Write 0x0100	Working mode	Bridge resistor	Reading status
0x0004	Automatic switch bridge mode	{R_P=3MΩ,R_N=600KΩ} and {R_P=600KΩ,R_N=3MΩ} switch between	Positive and negative pole-to-ground voltages VP and VN are both invalid values and display 0xFFFF. Insulation resistance to ground RfP and RfN are both valid values
0x0000	Balanced bridge mode	R_P=3MΩ,R_N=3MΩ	Insulation resistance to ground RfP and RfN are both invalid values and display 0xFFFF. Positive and negative pole-to-ground voltages VP and VN are both valid values.

2.4.- Insulation monitoring internal self-test function

When the DC voltage is ≥100V and the insulation monitoring module is turned off, the module will automatically self-test on its internal circuit (no control required) with a self-test period of 5 seconds.

When the sampled value of the monitored bridge voltage matches the bridge resistance value, it means that the self-test is passed.

By reading Bit4 of the 0x001B register can judge the self-test whether is passed or not. passed self-test is "1"; not passed is "0". If the self-test results are not updated, the last result will remain unchanged.



3.- TECHNICAL PARAMETERS

Basic parameters

Parameter	Value		
Power supply	10-30VDC, Power 3w		
DC voltage range	100V~1000V		
DC voltage measurement accuracy	≤2V+0.3%		
Insulation resistance measurement range	1KΩ~10MΩ (DC System voltage:100V~1000V)		
Insulation monitoring accuracy ((When :DC voltage:100V-1000V)	**C_Y range**	**Resistance range**	**Accuracy**
	0~0.8μF	≤60kΩ	≤3kΩ
		60kΩ<R≤1MΩ	≤5%
	0.8μF ~3μF	≤60kΩ	≤6kΩ
		60kΩ<R≤1MΩ	≤20%
Insulation resistance value update time after turning on	After insulation monitoring is turned on, the time until the effective resistance value can be read for the first time	0.7s~2s	
Insulation resistance value update time	Switch the insulation resistance until the module can read the switched insulation resistance value.	0.5s~3s	
Insulation monitoring function switching times	$50*10^5$ times		
Off-line pressure test	<2mA		
Standard	IEC 61557-8:2018		
Humidity	85%		
Storage temperature	- 40°C ~125°C		
Operating temperature	- 40°C ~75°C		

Notes:

1.When facing the ground insulation resistance R_{ISO}+ and negative insulation resistance to ground R_{ISO}-, The difference is too large, Multiplier of difference>5 times, R_{ISO}+ and R_{ISO}- Large resistors may not be typical values.

2.C_Y Refers to the positive and negative Y capacitance values of the system bus to ground.

Withstand voltage test

Pressure point	Maximum voltage rating	Time
DC+/DC- to GND	4200VDC/3000VAC	≤1min
Power supply +/- to GND	3500VDC/2500VAC	≤1min
RS485 A/B to GND	3500VDC/2500VAC	≤1min
DC+/DC- to Power supply +/-	3500VDC/2000VAC	≤1min
DC+/DC- to A/B	3500VDC/2000VAC	≤1min

Note:

The power supply side (+/-), RS485(A/B), and Ground(G) should be isolated from each other

4.- INSTALLATION AND START-UP

The manual you hold contains information and warnings that -users should follow in order to guarantee a proper operation of all the instrument functions and keep it in safety conditions. The instrument must not be powered on and used until its definitive assembly is on the cabinet's door.

If the instrument is not used as manufacturer's specifications, the protection of the instrument will be damaged.

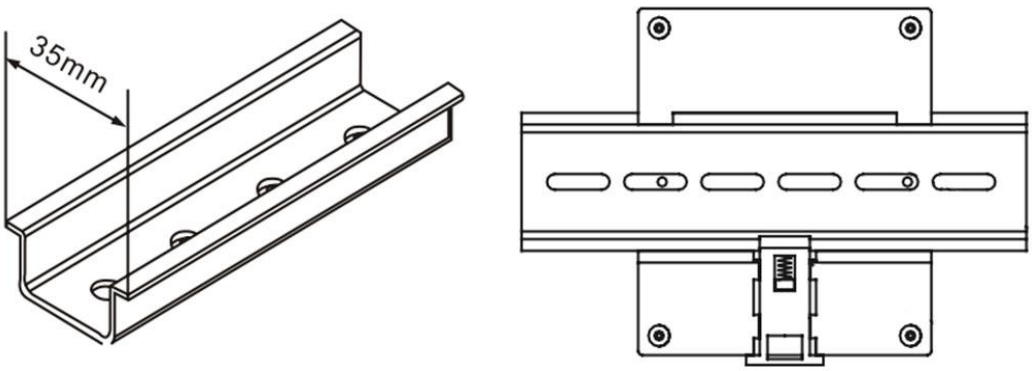
When any protection failure is suspected to exist (for example, it presents external visible damages), the instrument must be immediately powered off. In this case contact a qualified service representative.

4.1.- Installation

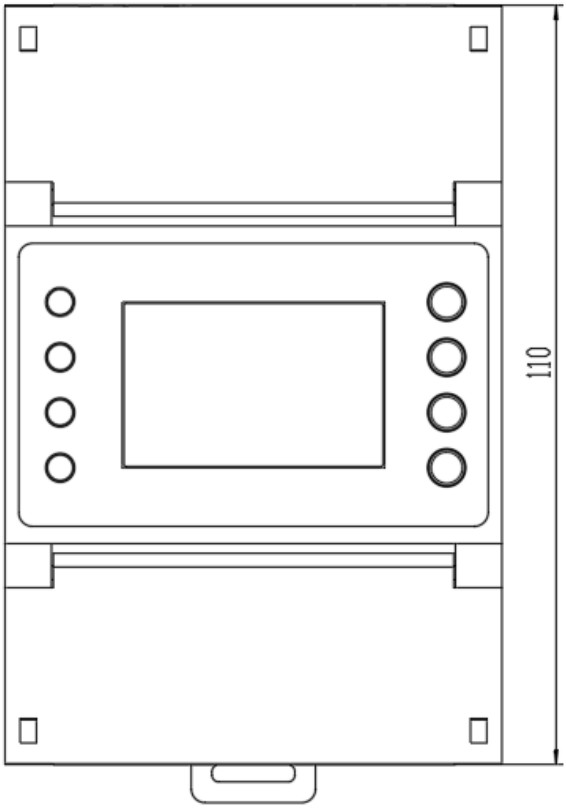
Mounting

The instrument is to be mounted on the 35mm Din-rail. Keep all connections inside the cabinet.

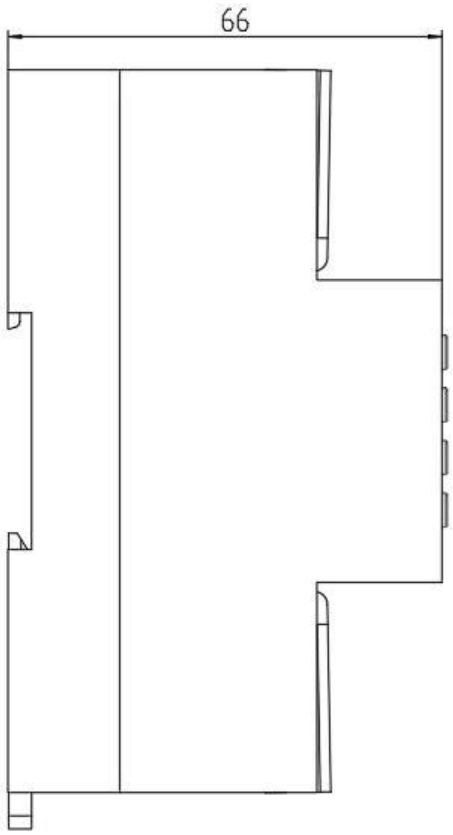
Note that with the instrument powered on, the terminals could be dangerous to touch.
and cover opening actions or elements removal may allow accessing dangerous parts.
Therefore, the instrument must not be used until this is completely installed.



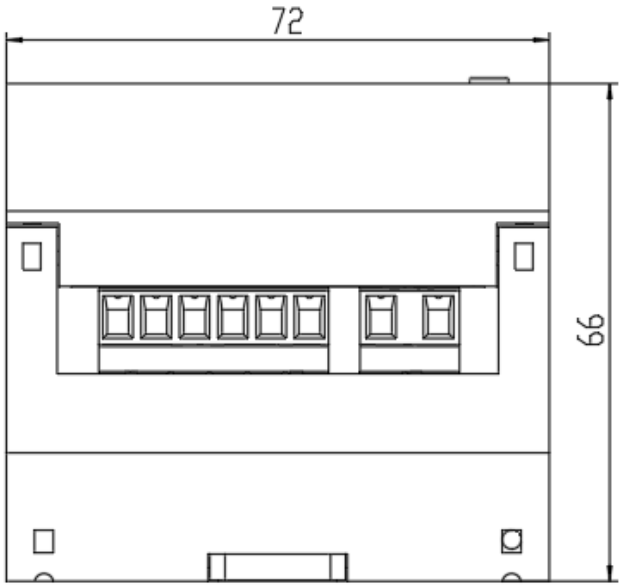
Dimension: W*H*D: 72*110*66 mm



Front view



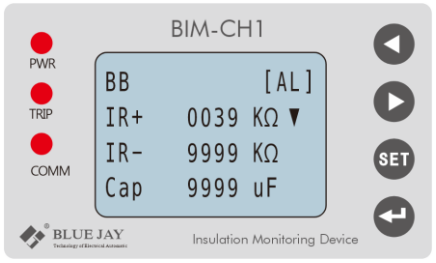
Side view



Upper view

4.2.- Indicator lights and keys description

After the module is powered on, the PWR indicator is on.



PWR	When device is powered on, the light is on
TRIP	When DO is activated, the light is on.
COMM	When communication is connected, the light is on.

Keys description:

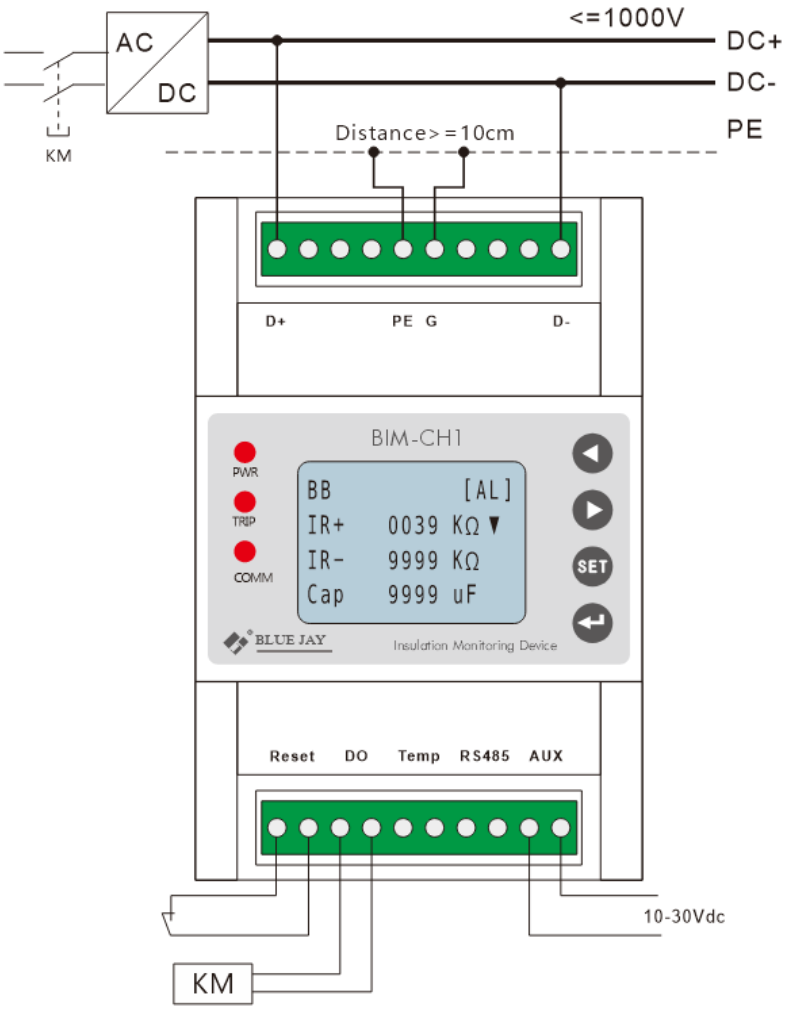
Keys	In Monitor Screen	In Config Sub-menu	In Parameter Setup
◀	Screen will move to previous or next page	Move cursor up and down to select function	Move setting cursor to left
▶			Scroll selection number 0 ~ 9
SET	Call out password screen	Exit & roll back to up level menu.	
↵	Call out Sub-screen	Confirm the values & Entry or jump to down level menu	

Note: In Setup menu, if change the setting value, press SET for exit menu, device will call out confirm screen ask “SAVE”.

Then press SET *exit without saving.*

press ↵ *save and exit.*

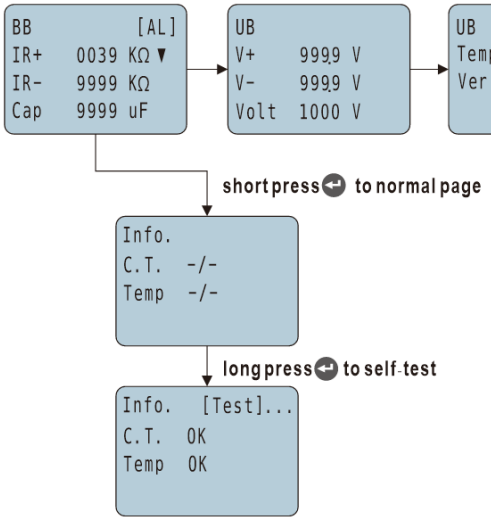
4.3.- Wiring diagram and terminal definition



Terminal	Description
D+	Positive pole of DC
D-	Negative pole of DC
PE	Earth or chassis
G	System ground wire
Reset	Device reset button
DO	Digital output
Temp	Temperature sensor
RS485	Communication interface
AUX	Power supply 10-30VDC

5.- SCREEN DISPLAY

5.1.- Measurement screen



Present working mode

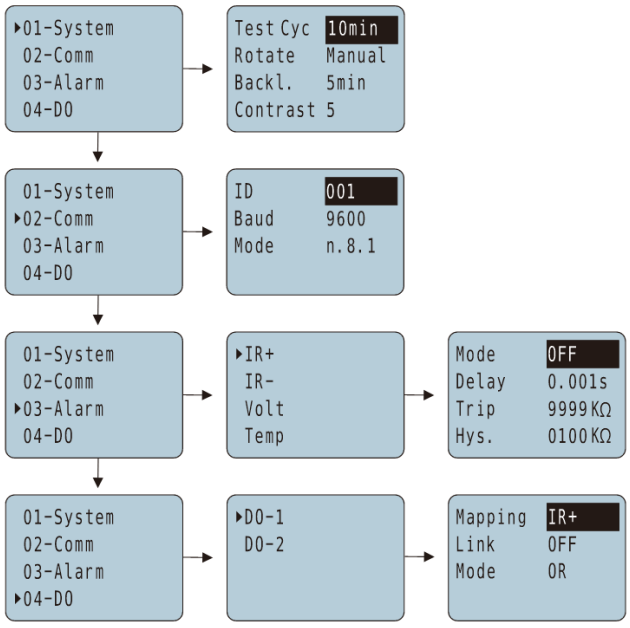
BB: Balanced bridge
UB: Unbalanced bridge
SB: Standby state

Short press the ↵ to enter the normal display interface, which shows the present device information.

Long press the ↵ to enter the self-test status.

BK: short line
OK: line normal
ST : device short circuit

5.2.- Configuration screen



System settings

Test cycle interval: 1-30 minutes, manual
Screen rotate mode: 3-30 seconds, manual
Backlight duration: 0-10min
LCD contrast: 1-9

Communication settings

Modbus ID: **1-247**
Comm. port baud ratio
Comm. port data format

Alarm settings

Alarm mode
Delay timer of the trig
Trip value
Hysteresis value

DO settings

Mapping parameters
Link parameters
Association logic mode

6.- COMMUNICATION INTERFACE

6.1.- Connection for RS485

Users can send and receive data frames through the RS485 communication port. The circuit is equipped with 510Ω terminal resistance. For details, see 6 Communication Protocol. Terminals A and B correspond to RS485 outputs A and B respectively.

6.2.- Communication Protocol

This device provides Modbus RTU protocol interface, using Modbus RTU 0x03/0x06 command; baud rate, communication address, parity check mode, can be set by DIP switch, stop bit 1, data bit 8. The time interval between each byte in the sent frame shall not exceed 20ms, otherwise the frame will be cleared.

Modbus RTU Frame Format:

Address code	**1 BYTE**	Slave device address **1-247**
Function code	**1 BYTE**	Indicates the function codes like read coils / inputs
Data code	**4 BYTE**	Starting address, high byte Starting address, low byte Length of registers, high byte Length of registers, low byte
Error Check code	**2 BYTE**	Cyclical redundancy check (**CRC)**

MODBUS FUNCTIONS:

Code	Meaning	Description
FUNCTION 03	Read hold register	This function permits to read all the electrical parameters
FUNCTION 06	Write single register	This function permits to write a value into a single holding register.

6.3.- Register map

6.3.1.- Parameter query-basic parameters, read-only, function x03H

Register	Data	Description
0x0010	DC bus voltage	Unit 0.1V,16-bits
0x0011	Reserve	
0x0012	Insulation resistance of DC+ to ground	Unit KΩ, take an integer (0xFFFF: invalid value; 0xEA60: resistance value greater than 10MΩ)
0x0013	Insulation resistance of DC- to ground	Unit KΩ, take an integer (0xFFFF: invalid value; 0xEA60: resistance value greater than 10MΩ)
0x0014	Reserve	
0x0015	Positive pole to ground voltage value	Unit 0.1V, take an integer
0x0016	Negative pole to ground voltage value	Unit 0.1V, take an integer
0x0017-0x0019	Reserve	
0x001A	Read version number	Ver. 1.21
0x001B	Status bit	Details see chapter 6.3.4
0x0030	Present measurement mode	Balanced bridge/ Unbalanced bridge
0x0031	System leakage capacitance	Unit: 0.1 μF, take an integer
0x0033	Measurement temperature	Unit: 0.1℃
0x0034-0x0040	Reserve	

6.3.2.- Basic parameters, (readable/writable) function x03H/06H

Register	Data	Description
0x0100	Present measurement mode	0: Balanced bridge mode 4: Automatic switch bridge mode: Balanced /unbalanced bridge
0x0101	Reserve	
0x0102	Insulation monitoring control	17: Turn on insulation monitoring function 0: Turn off insulation monitoring function
0x0103	Self-test control	19: Turn on self-test function 0: Turn off self-test function
0x0104-0x010F	Reserve	
0x0200	Test cycle interval	1-30 minutes, manual, default: 10min
0x0201	Screen rotate mode	3-30 seconds, manual, default:15s
0x0202	Backlight duration	0-10min, default: 5min
0x0203	LCD contrast	1-9, default: 5
0x0204-0x0230	Reserve	
0x0300	Modbus ID	Range: 1-247
0x0301	Comm. port baud ratio	0:1200 1:2400 2:4800 3:9600 4:19200
0x0302	Comm. port data format	0:n.8.1 1:o.8.1 2:e.8.1 3:n.8.2
0x0303-0x0330	Reserve	

6.3.3.- Device status, (readable/writable) function x03H/06H

Register	Data	Description
0x0400	DC+ to ground insulation resistance alarm mode	0: Off, 1: Rising , 2: Falling
0x0401	DC+ to ground insulation resistance alarm delay value	Range: 0.001 s-9999 s
0x0402	DC+ to ground insulation resistance alarm trigger value	Range: 0000-9999 KΩ
0x0403	DC+ to ground insulation resistance alarm hysteresis value	Range: 0000-9999 KΩ
0x0404-0x041F	Reserve	
0x0420	DC- to ground insulation resistance alarm mode	0: Off, 1: Rising , 2: Falling
0x0421	DC- to ground insulation resistance alarm delay value	Range: 0.001 s-9999 s
0x0422	DC- to ground insulation resistance alarm trigger value	Range: 0000-9999 KΩ
0x0423	DC- to ground insulation resistance alarm hysteresis value	Range: 0000-9999 KΩ
0x0424-0x042F	Reserve	
0x0430	DC bus voltage alarm mode	0: Off, 1: Rising , 2: Falling
0x0431	DC bus voltage alarm delay value	Range: 0.001 s-9999 s
0x0432	DC bus voltage alarm trigger value	Range: 0000-9999 V
0x0433	DC bus voltage alarm hysteresis value	Range: 0000-9999 V
0x0434-0x043F	Reserve	
0x0440	Temperature alarm mode	0: Off, 1: Rising , 2: Falling
0x0441	Temperature alarm delay value	Range: 0.001 s-9999 s
0x0442	Temperature alarm trigger value	Range: 0000-9999 °C
0x0443	Temperature alarm hysteresis value	Range: 0000-9999 °C
0x0444-0x0450	Reserve	
0x0500	DO-1 mapping parameters	0: DC+ to ground insulation resistance 1: DC- to ground insulation resistance 2: DC bus voltage 3: Temperature 4: DI 1 5: DI 2 6: Reserve
0x0501	DO-1 link parameters	0: Off 1: DC+ to ground insulation resistance 2: DC- to ground insulation resistance 3: DC bus voltage 4: Temperature 5: DI 1 6: DI 2 7: Reserve

0x0502	DO-1 Association logic mode	0: AND, 1: OR, 2: NOT
0x0503-0x050F	Reserve	
0x0510	DO-2 mapping parameters	0: DC+ to ground insulation resistance 1: DC- to ground insulation resistance 2: DC bus voltage 3: Temperature 4: DI 1 5: DI 2 6: Reserve
0x0511	DO-2 link parameters	0: Off 1: DC+ to ground insulation resistance 2: DC- to ground insulation resistance 3: DC bus voltage 4: Temperature 5: DI 1 6: DI 2 7: Reserve
0x0512	DO-2 Association logic mode	0: AND, 1: OR, 2: NOT
0x0513-0x051F	Reserve	

Query the host to read the slave address, special function 0XFF

Register	Data	Description
0X66	Host reads the slave address	Example: Host inquiry: FF 66 A5 AA 2B Slave response: FF 66 01 AB 90 The slave address is 0x01

6.3.4.- Register: 0x001B bit definition

Bit	Data	Description
Bit15~bit11	Null	
Bit10-8	Present working mode	000: Balanced bridge 100: Unbalanced bridge
Bit 7	Bus voltage reverse connection alarm	0: There is no reverse connection of DC voltage or the reverse connection voltage is less than 100V 1: DC reverse voltage is greater than 100V
Bit 6	Negative insulation fault	0: Negative pole insulation no fault 1: Negative pole insulation have fault that the negative pole insulation resistance is less than the setting threshold
Bit 5	Positive insulation fault	0: Positive pole insulation no fault 1: Positive pole insulation have fault that the positive pole insulation resistance is less than the setting threshold
Bit 4	Self-test result bit	1: Self-test passed 0: Self-test not passed or self-test is invalid
Bit 3	Self-test function query	1: Self-test circuit is turned on, and the self-test switch KT is closed. 0: Self-test circuit is closed and the self-test switch KT is disconnected.
Bit 2	Insulation monitoring function turned on or off	0: Insulation monitoring function turned off and the grounding switch K is disconnected. 1: Insulation monitoring function turned on and the grounding switch K is closed.
Bit 1	Insulation resistance monitoring valid or invalid	0: Insulation resistance monitoring has not been completed, and the resistance value is an invalid value. 1: Insulation resistance monitoring is valid and the resistance value can be read
Bit 0	Null	

7.- SAFETY CONSIDERATIONS

All installation specification described at the previous chapters named: **INSTALLATION AND STARTUP, INSTALLATION MODES and SPECIFICATIONS.**

Please note that with the instrument powered on, the terminals could be dangerous to touching and cover opening actions or elements removal may allow accessing dangerous parts. This instrument is factory-shipped at proper operation condition.

- The device must have a professional installation and maintenance;
- Any operation of the device, you must cut off the input signal and power;

8.- MAINTENANCE

The BIM-CH1 does not require any special maintenance. No adjustment, maintenance or repairing action should be done when the instrument is open and powered on, should those actions are essential, high-qualified operators must perform them.

Before any adjustment, replacement, maintenance or repairing operation is carried out, the instrument must be disconnected from any power supply source.

When any protection failure is suspected to exist, the instrument must be immediately put out of service. The instrument's design allows a quick replacement in case of any failure.

For any inquiry about the instrument performance or any failure,
contact to Blue Jay's technical service.

Blue Jay - After-sales service

E-mail: tech@cqbluejay.com