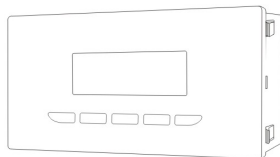Temperature Controller of Dry Transformer

LD-B10-10  Series　❙　Manual　❙

# Company Profile

Fujian LEAD Automatic Equipment Co., Ltd., founded in 1993, with the registered capital of RMB 120 million, is a high-tech enterprise integrated with the research, development, production, marketing and service of sensors, intelligent instrument, intelligent transformer components and industrial automation & intelligent control equipment, and it has developed to be the brand-name enterprise producing power transformers and transmission and distribution switchgear components in China, Standing Director Unit of National Special Transformer Industrial Technology Innovation Strategic Alliance, Top 100 enterprise of "Innovation 100" of Entrepreneurs & Scientists Innovation Forum in China. The market share of LD-series dry-type transformer thermostats has ranked No.1 for years in China. Weici Company took the lead to apply microcomputer excitation technology to mid-small sized hydropower stations in China in 1990, and it has been awarded with the third award of Fujian science and technology progress. The company employs over 300 employees which above 70% are from university and secondary school. It has passed the certification of ISO9001 Quality Management System and ISO14001 Environmental Management System, and has established the long-term cooperative relationship with Fuzhou University, Fujian Agriculture and Forestry University and multiple colleges and universities and scientific research institutes, thus forming the combination of production, education and scientific research, improving the R&D and innovation capacity and being awarded with multiple national patents.

After years of market development and operation, Fujian LEAD has formed complete production line of power transformers and transmission and distribution switchgear components. The main products of Fujian LEAD include integrated controllers of dry-type/ oil-immersed/ underground-type transformers, special controllers for rail transit transformers, intelligent distribution monitoring instrument, multi-function power meters, var compensators, negative control terminal & distribution and substation terminal, oil-water transmission controllers, thermal conductivity flowmeters, shaft current sensors, special intelligent instrument for hydropower stations, intelligent control screens of hydroelectric generating sets and all kinds of power equipment components, sensors, intelligent instrument and industrial automation control equipment. Fujian LEAD products have been widely applied Yangtze Three Gorges, Bird's Nest stadium, National Center for the Performing Arts, Shanghai World Expo, Shenzhen Metro, Shanghai Metro, Guangzhou Asian Games stadium and other national key projects. After years of development, Fujian LEAD has developed to be the best kit factory for transmission and distribution equipment enterprises in China. Till now, ten offices have been set for market exploration, maintenance and pre-sale and post-sale service, which have significantly enhanced the trust of users on LEAD products.

Fujian LEAD has established a sound and comprehensive long-term cooperation relationship with Jiangsu Huapeng Transformer Co., Ltd., XUJI ELECTRIC CO., LTD., Shandong Luneng Group Co., Ltd., Chongqing Water Turbine Works Co., Ltd., Hainan Jinpan Enterprise Co., Ltd., Tebian Electric Apparatus Stock Co., Ltd. (TBEA), CHINA XD GROUP CO., LTD., Sunte Electric Equipment Co., Ltd., Pearl Electric Co., Ltd. and other 300 transmission and distribution equipment manufacturing enterprises.

Tel: +86 137 5812 6394

Mail:fanpeng02@126.com

# <u>Safety Guidance</u>

Please read the instructions carefully before installing and operating the controller, and proper keeping.

## ⚠️ ⚠️ Warning

- ◆ Please read the instructions and wiring diagram carefully before using the controller.
- ◆ The controller monitors dangerous power transformers. If users do not obey a prescribed procedure to operate, that will lead to property damage or serious injury or even death.
- ◆ Only qualified technical personnel are allowed to operate the controller, and all safety instructions, installation, operation and maintenance procedures in the manual should be known before operating.
- ◆ Make sure that all electrical connections are correct and secure. The controller must be grounded reliably.
- ◆ After the controller is powered on, some terminals are energized, please be careful.
- ◆ **The sensor cable plug and the power cord should be separated from the controller before the transformer voltage test, so as not to damage the controller!**

## ⚠️ Attention

- ◆ The controller may only be used for the purpose specified by our company, and unauthorized modifications may cause the controller to malfunction or even fail.
- ◆ Please note the use conditions of the controller, especially the humid environment.
- ◆ The controller is avoided to be used in the atmosphere contains sulfur dioxide, hydrogen sulfide and other corrosive gases using, otherwise it will be damaged.
- ◆ Do not apply a voltage or current that is greater than the rated value on the output terminals.
- ◆ Do not use a lighter to grill the sensor, otherwise the sensor will fail.
- ◆ Undefined terminals are not allowed to use.
- ◆ Please put the instructions in an easy place and give it to all users.

**Special Product Description:**

If the contents of the instruction do not conform to the product, the wiring diagram of the actual product shall prevail.

# **Contents**

# 01 General function description and type selection

## Product overview

Safe operation and working life of power transformers depends largely on the safety and reliability of transformer winding. If the temperature of transformer winding exceed the temperature which insulation withstand, it will damage the insulation. This is one of the most important reasons that transformers cannot operate normally.
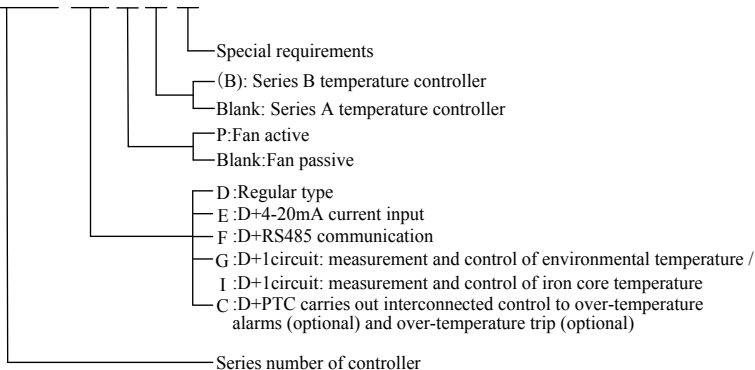
LD-B10-10 series temperature controller of dry transformer (referred to as temperature controller) is an intelligent controller designed especially for safe operation of dry transformer. The temperature controller features adoption of single chip computer technology and utilization of the platinum thermo-resistors embedded in the winding of the dry transformer for detection and display of temperature rise of the transformer windings. It can start or stop the cooling fan automatically for forced air cooling of windings and control over-temperature alarm and over-temperature tripping output so that the transformer will be operated safely.

## Functional features

Temperature monitoring of dry-type transformer: three-phase circuit measurements and display; the maximum display; input open circuit and failure self-inspection display and output; cooling fan manual/automatic start-stop display and output; over-temperature alarms, over-temperature trip display and output; displayed value compensation of all channels; "black box"; control for timing start-stop of the fan; Temperature simulation.

## Type selection (arbitrary combination of E, F, G/I and C)

LD-B10-10 XXX X  X / T

                               Special requirements

                         （B): Series B temperature controller

                         Blank: Series A temperature controller

                    P:Fan active

                    Blank:Fan passive

               D :Regular type

               E :D+4-20mA current input

               F :D+RS485 communication

               G :D+1circuit: measurement and control of environmental temperature /

               I :D+1circuit: measurement and control of iron core temperature

               C :D+PTC carries out interconnected control to over-temperature

                  alarms (optional) and over-temperature trip (optional)

           Series number of controller

**Please notice the difference between the series A and series B controller when type selecting.**

## 02 Technical parameters

### Basic technical parameters

| Ambient temperature (℃) | Relative humidity (%RH) | Measurement range(℃) | Sensor type |
|---|---|---|---|
| -20～55 | ＜95 (25℃) | -30.0～240.0 | Pt100 (Three-wire) |
| Power frequency (Hz) | Power voltage (V) | Power consumption of controller (W) | Resolution (℃) |
| 50/60(±2) | AC220 (-15% ,+10%) | ≤8 | 0.1 |
| Contact capacity | | Accuracy grade | |
| Fan: 6A 250VAC (cosφ=0.4) Other: 5A 250VAC/5A 30VDC (resistive) | | Grade 1 (controller: grade 0.5; sensor: grade B) | |
| Conforming to the relevant standards | | Dimension (mm) | |
| JB/T7631-2016，ISO9001:2008， IEC61000-4:2002，GB/T17626-2008 | | Opening $76^{+1} \times 152^{+1}$ Appearance $82 \times 158 \times 106$ | |

# 03 Installation instructions (inserted installation)
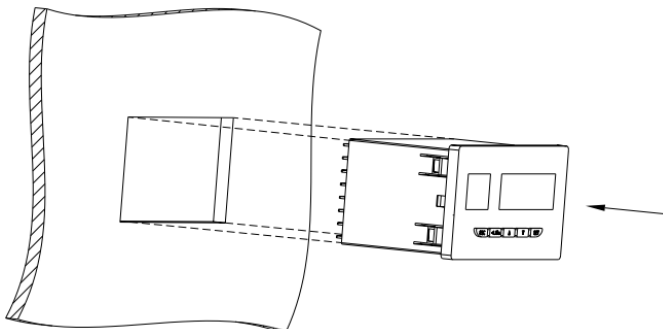


1.  An inserted hole is opened on the transformer cabinet according to the size of the inserted installation hole of the controller.
2.  Insert LD-B10-10 temperature controller into the inserted hole of transformer cabinet.
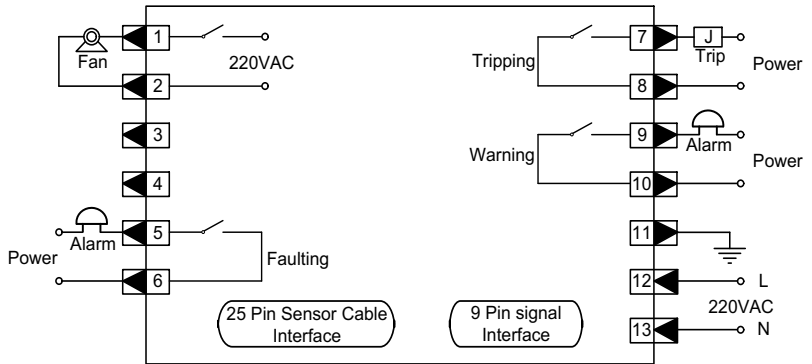
# 04 Wiring diagram example and instructions

**LD-B10-10D/E/F wiring diagram** (Note: 9-pin interface is not available for LD-B10-10D)
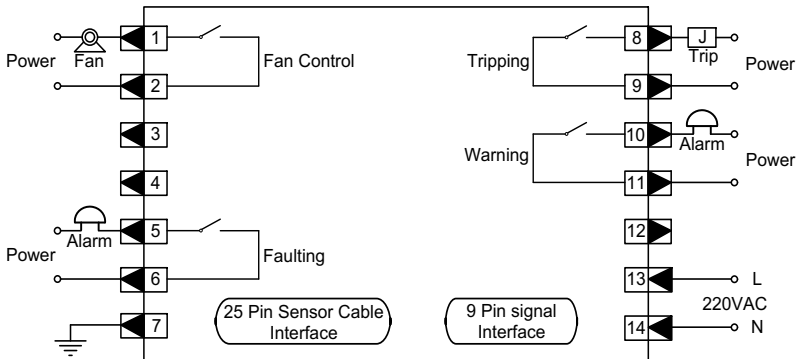


3
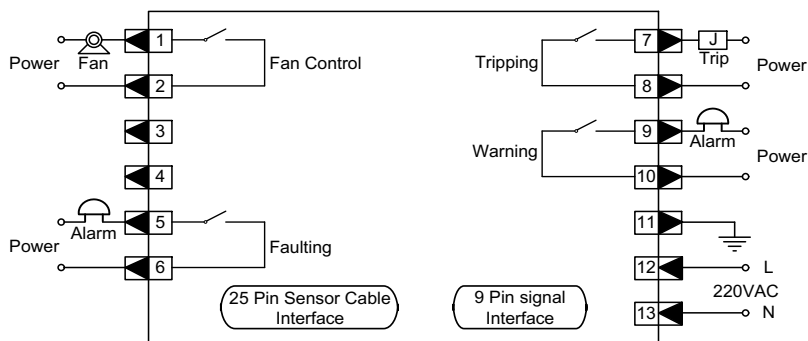
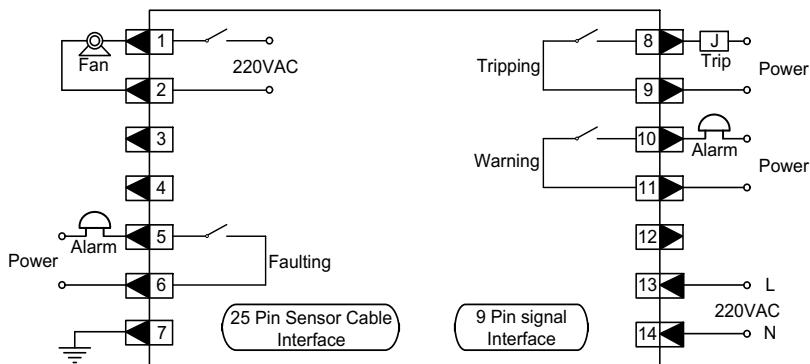**LD-B10-10DP/EP/FP wiring diagram** (Note: 9-pin interface is not available for LD-B10-10DP)



**LD-B10-10D(B)/E(B)/F(B) wiring diagram** (Note: 9-pin interface is not available for LD-B10-10D(B))

LD-B10-10DP(B)/EP(B)/FP(B) wiring diagram (Note: 9-pin interface is not available for LD-B10-10DP(B))



**Note 1:** D25 sensor cable is connected to Pt100 and PTC (type C) signal input; D9 signal cable is

connected to RS485 signal (type F) and 4~20mA current signal (type E) output.

**Note 2:** the actual definition of the terminal block is subject to the wiring diagram of the product!

# 05 Human machine interface

## Key instructions

| Buttons | Functions | Instructions |
|---------|-----------|--------------|
| SET | Setup key | Make sure and enter into the next step. |
| ▲ | Increasing key/Manual key | Function 1: add 1 to the parameter. If the key is held on, the number will be increased quickly. Function 2: manual start and stop fan (in the temperature display state and the fan are not started automatically). |
| ▼ | Decreasing key/Maximum key | Function 1: decrease 1 to the parameter, if the key is held on, the number will be decreased quickly. Function 2: fixed display maximum value of each phase. |

5

| Fn + ESC | Reset | Press the 2 keys over 1S to reset the controller. |
|----------|-------|---------------------------------------------------|
| ESC | Exit/Silence | Function 1: in the setting state, press the key to exit setting state (parameters cannot be saved) Function 2: in the normal displaying state, press the key to silencing. |

## Common function codes diagram
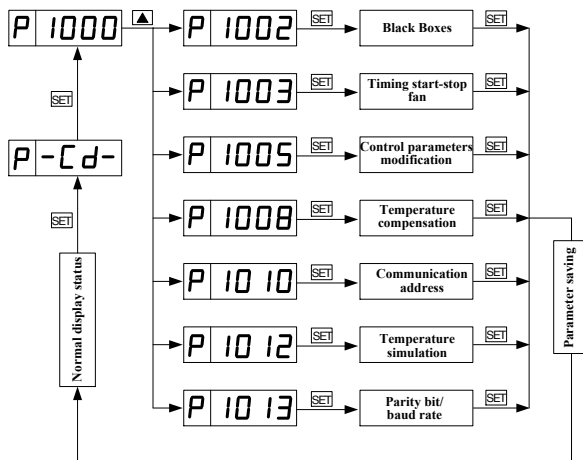


**Note 1:** When the meter is displaying the function prompts, press key SET to enter into the corresponding data display window. If there are multiple function parameters, each parameter is set by pressing the key SET in turn.

**Note 2:** The following parameters are conventional default values. Details are subject to the controller certification or the wiring figure.

**Black box (P1002):** View the temperature of each phase when the controller is powered down

| Key | Display | Instructions | Remarks |
|-----|---------|--------------|---------|
| SET | P-EE- | Power failure records of temperature | Press the key▲ to check the |

| SET | A ###.# | Phase A temperature | power-off temperature of each phase, press the key SET to normal display. |
|-----|---------|---------------------|----------------------------------------------------------------------------|

**Timing start-stop fan (P1003):** Set up the time interval for the start-up of the cooling fan

| Key | Display | Instructions | Range (h) | Remarks |
|-----|---------|--------------|-----------|---------|
| SET | P-00- | Timing start-stop fan setting | 0-150 | Press the key▲ to modify parameter, press the key SET to normal display. |
| SET | P   0 | Default 0 | | |

**Note:** The start-up time of the fan is fixed to 2 minutes. Turn off fan timing start-stop function when parameter is 0.

## Control parameters modification (P1005)

● Setting of conventional control parameters

| Key | Display | Instructions | Range (°C) | Remarks |
|-----|---------|--------------|------------|---------|
| SET | P-Ob- | Start-stop target values of the fan | -30.0-240.0 | |
| SET | P 90.0 | Default 90 | | |
| SET | P-dF- | Start-stop return differences of the fan | 0.0-15.0 | Press the key▲ to modify parameter, press the key SET to normal display. |
| SET | P 10.0 | Default 10 | | |
| SET | P-AH- | Over-temperature trip target values | -30.0-240.0 | |
| SET | P 150.0 | Default 150 | | |
| SET | P-AL- | Over-temperature alarm target values | -30.0-240.0 | |
| SET | P 130.0 | Default 130 | | |

**Note：** Start-up temperature of fan > Ob+dF          Stop temperature of fan < Ob-dF

Operating temperature of over-temp trip > AH+0.3

Return temperature of over-temp trip < AH-0.3

7

Operating temperature of over-temp alarm > AL+0.3

Return temperature of over-temp alarm < AL-0.3

- Type-G control parameter setting (following the conventional control parameter setting serial )

| Key | Display | Instructions | Range (℃) | Remarks |
|-----|---------|--------------|-----------|---------|
| SET | P-ObJ | Start-stop target values of room fans | -30.0-240.0 | Press the key▲ to modify parameter, press the key SET to normal display. |
| SET | P 35.0 | Default 35.0 | | |
| SET | P-dFJ | Start-stop return differences of room fans | 0.0-15.0 | |
| SET | P 2.5 | Default 2.5 | | |
| SET | P-AHJ | Target values of machine room trip | -30.0-240.0 | |
| SET | P 70.0 | Default 70 | | |

**Note**：Start-up temperature of room fan > ObJ+dFJ

Stop temperature of room fan < ObJ-dF

Operating temperature of room trip > AHJ+0.3

Return temperature of room trip < AHJ-0.3

- Type-I control parameter setting (following the conventional control parameter setting serial )

| Key | Display | Instructions | Range (℃) | Remarks |
|-----|---------|--------------|-----------|---------|
| SET | P-ALJ | Target values of iron core alarm | -30.0-240.0 | Press the key▲ to modify parameter, press the key SET to normal display. |
| SET | P 130.0 | Default 130 | | |

**Note:** Operating temperature of core alarm **>** ALJ+0.3

Return temperature of core alarm **<** ALJ-0.3

**Temperature compensation (P1008): when there are errors in the display value of the measured temperature, the digital compensation of the measured value corrects the measured value**

| Key | Display | Instructions | Range (℃) | Remarks |
|---|---|---|---|---|
| SET | A-Ad- | Temperature compensation of phase A | -19.9-19.9 | Press the key▲ to modify parameter, press the key SET to normal display. |
| SET | A  0.0 | Default 0.0 | | |
| SET | b-Ad- | Temperature compensation of phase b | | |
| SET | B  0.0 | Default 0.0 | | |
| SET | C-Ad- | Temperature compensation of phase C | | |
| SET | C  0.0 | Default 0.0 | | |
| SET | d-Ad- | Temperature compensation of phase d | | |
| SET | d  0.0 | Default 0.0 | | |

## Communication address (P1010)

| Key | Display | Instructions | Range | Remarks |
|---|---|---|---|---|
| SET | P-dd- | Communication address setting | 1-247 | Press the key▲ to modify parameter, press the key SET to normal display. |
| SET | P  1 | Default 1 | | |

## Temperature simulation (P1012)

| Key | Display | Instructions | Simulation range (°C) | Remarks |
|---|---|---|---|---|

| SET | A-AA- | Temperature simulation | -30.5-240.5 | Press the key▲ to modify parameter, press the key SET to normal display. |
|-----|-------|------------------------|-------------|-------------------------------------------------------------------------|
| SET | A-30.0 | Default -30 | | |

**Note: The over-temp trip is not involved in the temperature simulation.**

## Parity bit and baud rate (P1013)

| Key | Display | Instructions | Range | Remarks |
|-----|---------|--------------|-------|---------|
| SET | P-PC- | Parity bit setting | 0-2 | Press the key▲ to modify parameter, press the key SET to normal display. |
| SET | P  0 | Default 0(no parity) | | |
| SET | P-bL- | Baud rate setting | 0-3 | |
| SET | P  3 | Default 3(9600) | | |

**Note 1**: Parity bit: 0: No parity (N)    1: Even parity (E)    2: Odd parity (O)

**Note 2**: Baud rate: 0:1200     1:2400     2:4800     3:9600

# 06 4-20mA current output (Type E)

## Technical requirements for current output

● Load resistance: R≤500Ω; Output accuracy: ±1%

● The corresponding curve and relation expression between measured temperature and output current of the controller:
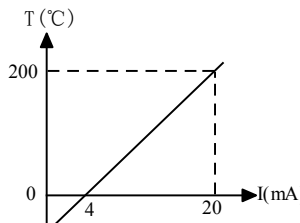


Relation expression of temperature and current: $I = (16.00T/200.0) + 4.00$

Where: T is one phase temperature value (°C)

I refers to the current value corresponding to the temperature of this phase (mA)

## Function features

There is linear relation between 4-20mA current signals and the detected temperature values (0.0-200.0℃), one temperature corresponds to one current. If users have special requirements for current signals, please explain when ordering.

# 07 RS485 communication protocol specification (type F)

## Data frame format

| Start bit | Data length | Parity bit | Stop bits |
|-----------|-------------|------------|-----------|
| 1 bit | 8 bits | 0 or 1 bit (settable) | 1 bit |

## The upper computer message format (example)

| Message format | Meter address | Function code | Reading register start Address | Number of reading data | CRC check |
|----------------|---------------|---------------|-------------------------------|------------------------|-----------|
| Telemetry (three-way) | 0x01 | 0x03 | 0x0000 | 0x0003 | 0x05CB |
| Telemetry (four -way) | 0x01 | 0x03 | 0x0000 | 0x0004 | 0x4409 |
| Remote signal | 0x01 | 0x04 | 0x0000 | 0x0001 | 0x31CA |

**Note:** The number of start address and data can be changed according to actual conditions.

## Controller return message format (example)

| Message format | Meter address | Function code | Number of bytes | Data reading | CRC check |
|----------------|---------------|---------------|-----------------|--------------|-----------|
| Telemetry (three-way ) | 0x01 | 0x03 | 0x06 | Phase temperature data | #### |

| | | | | | |
|---|---|---|---|---|---|
| Telemetry (four -way) | 0x01 | 0x03 | 0x08 | Phase temperature data | #### |
| Remote signal | 0x01 | 0x04 | 0x02 | Relay status data | #### |

## Register address definition and data analysis

● Register address of data and description

| Attribute description | Register address | Data type | Proportion factor | Data range |
|---|---|---|---|---|
| Temperature data of phase A | 0x0000 | int16 | 0.1 | -300~2400 |
| Temperature data of phase b | 0x0001 | int16 | 0.1 | -300~2400 |
| Temperature data of phase C | 0x0002 | int16 | 0.1 | -300~2400 |
| Temperature data of d-way | 0x0003 | int16 | 0.1 | -300~2400 |

● Data description

| Temperature data | Failure status | Instructions |
|---|---|---|
| 0x7000 | -OP- | Open circuit |
| 0x8000 | -OL- | Exceeds the lower limit |
| 0x6000 | -OH- | Exceeds the upper limit |

● Register address of signal and data description

| Attribute description | Register address | Data type | Remarks |
|---|---|---|---|
| Relay status data | 0x0000 | uint16 | 1 bit stands for the status of 1 relay. |

● Definition of low 8-bit of relay status data (0 stands for no actions, 1 stands for actions)

| No. | bit7 | bit6 | bit5 | bit4 |
|---|---|---|---|---|
| Functions | Door contact status | Heating and dehumidification | Fan faults | |
| No. | bit3 | bit2 | bit1 | bit0 |

| Functions | Fault alarm | Over-temperature alarm | Over-temperature trip | Fan running |
|-----------|-------------|------------------------|-----------------------|-------------|

Three-circuit temperature measurement (D/E/F)

| No. | bit7 | bit6 | bit5 | bit4 |
|-----|------|------|------|------|
| Functions | Door contact status | Heating and dehumidification | Fan faults | Fault alarm |
| No. | bit3 | bit2 | bit1 | bit0 |
| Functions | Core alarm or room fan running | Over-temperature alarm | Over-temperature trip | Fan running |

Four-way temperature measurements (G/I)

**Note 1:** Door contact status, heating and dehumidification and fan faults are used in case of the special function requirement.

**Note 2:** The time interval of communication sending message shall not be less than 500ms.

# 08 Service

- Any entity and individual that purchases or uses our products may enjoy our after-sale services.

- We guarantee quality and free repair or replacement if product found unsatisfactory in its performance within two years as of the date of delivery or eighteen months from the date of operation.

- If any damage to the product is caused by improper use, test or installation, unauthorized dismantling, sudden change in external power source or unexpected lightning, we shall provide no such guarantee.

- The product beyond the warranty period or the damaged one referred to in paragraph 3 may be returned to our company for maintenance, but the user shall bear a given repairs cost.