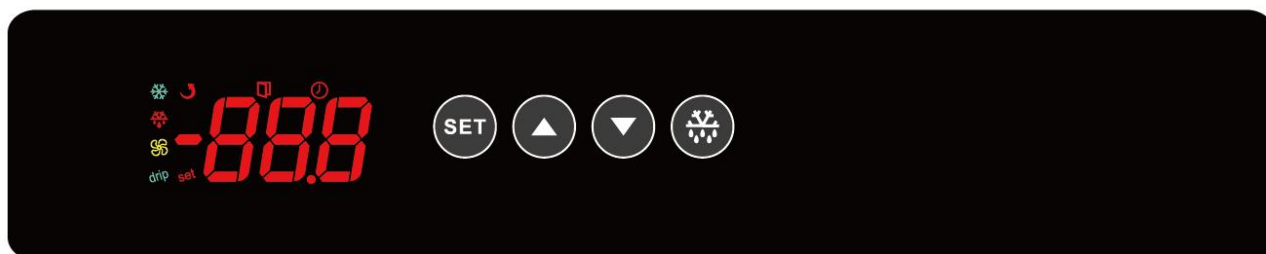
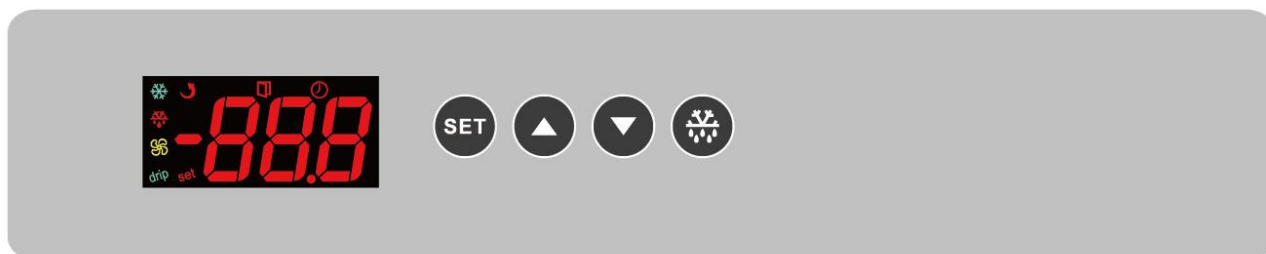


# Temperature Controller HK-02 User Manual

## 1 Product General

- The temperature controller could be used in the middle and low temperature medicine cabinet, kitchen cabinet, supermarket split cabinet, air curtain cabinet, island counter, wine cabinet, etc.
- The controller adopts building block design concept and users could select defrost, fan, light/external alarm according to their demand.
- The function of evaporator sensor, condenser sensor, door switch and buzzer is optional.
- Refrigeration relay output could reach to 16A/240VAC, which could directly drive single-phase 1Hp compressor.
- Large panel of color digital tube, work status symbol display, temperature display resolution is 0.1.
- It has temperature sensor self-test function, and once test the failures, it has multiple protection and alarm methods.
- Copy card function, convenient for the manufacturing and after-sale service of equipment manufacturers.
- Temperature measuring unit could switch between Celsius and Fahrenheit.
- With the function of Synchronous defrost switch signal detection, and it could form the network of real-time clock Synchronous defrost.
- Cabinet temperature over limit alarm has two modes: absolute value and relative value.
- Light/external alarm relay could be selected by the software, and when select the function of external alarm relay, it could connect the remote alarm bell.
- With the complete control logic of hot-gas defrost start without the pressure difference in the refrigerant pipe, to prevent starting with the pressure, for the purpose of a longer compressor life.

## 2 Operation and display panel






PCB dimension: 220mm\*35mm\*1.6mm

## 3 Technical parameters

- 1) Measuring range:  $-50^{\circ}\text{C} \sim 90^{\circ}\text{C}$  or  $-58^{\circ}\text{F} \sim 194^{\circ}\text{F}$  (only when sensor calibration is set as 0)
- 2) Controlling range:  $-50^{\circ}\text{C} \sim 85^{\circ}\text{C}$  or  $-58^{\circ}\text{F} \sim 185^{\circ}\text{F}$
- 3) Resolution:  $0.1^{\circ}\text{C}$  or  $1^{\circ}\text{F}$

- 4) Accuracy: -40°C ~ 50°C, ±1°C, 51°C ~ 70°C, ±2°C, others, ±3°C  
or -40°F ~ 122°F, ±2°F, 123°F ~ 158°F, ±4°F, others, ±6°F
- 5) Power supply: 220VAC±10%, 50/60Hz
- 6) Power consumption: <3W
- 7) Input: Cabinet sensor, evaporator sensor, condenser sensor, door switch
- 8) Output: Compressor relay: 16A/240VAC;  
Light relay: 10A/240VAC;
- 9) Work ambient temperature: 0°C ~ 55°C
- 10) Storage temperature: -25°C ~ 75°C
- 11) Relative humidity: 20% ~ 85% (non condensing)

#### 4 Indicator light status description

| Indicator light  | Symbol  | Status | Meaning   |
|------------------|---|--------|---|
| Setting          | Set   | ON     | Parameter setting                               |
|                  |   | OFF    | Status of temperature measuring and controlling |
| Refrigeration    |    | ON     | Refrigeration work                              |
|                  |   | OFF    | Refrigeration stop                              |
|                  |   | FLASH  | Refrigeration time delay                        |
| Defrost          |   | ON     | Defrost work                                    |
|                  |   | OFF    | Defrost stop                                    |
| Defrost dripping | drip  | ON     | Start defrost dripping                          |
|                  |   | OFF    | Stop defrost dripping                           |
| Door switch      |  | ON     | Cabinet door open                               |
|                  |   | OFF    | Cabinet door close                              |

#### 5 Parameter list

| Menu                 | Functions                              | Setting range                        | Default | Unit  |
|----------------------|--|--------------------------------------|---------|-------|
| Common user menu     |  |                                      |         |       |
| St                   | Temperature set value                  | Upper limit ~ Lower limit            | 2°C     | °C/°F |
| Po                   | Administrator menu Password            | 00 ~ 99 (password is 55, unmodified) | 00      | /     |
| Administrator's menu |  |                                      |         |       |
| C1                   | Hysteresis value                       | 0.5°C ~ 9.0°C                        | 4.0°C   | °C/°F |
|                      |  | 1°F ~ 20°F                           |         |       |
| C2                   | Compressor start Min. interval         | 0 ~ 60                               | 3       | min   |
| C3                   | Compressor initial start Min. interval | 0 ~ 90                               | 2       | min   |
| C4                   | Cabinet sensor calibration             | -10.0°C ~ 10.0°C                     | 0.0°C   | °C/°F |
|                      |  | -20°F ~ 20°F                         |         |       |
| C5                   | Temperature set lower limit            | -50°C ~ temperature set value        | 2°C     | °C/°F |
|                      |  | -58°F ~ temperature set value        |         |       |
| C6                   | Temperature set upper limit            | temperature set value ~ 85°C         | 8°C     | °C/°F |
|                      |  | temperature set value ~ 185°F        |         |       |

|     |   |  |       |       |
|-----|---|--|-------|-------|
| C7  | Max.standby time after finishing compressor start Min. interval (note①) | 0 ~ 90, 0:Max.standby time calculation is forbidden  | 9     | min   |
| C8  | Refrigeration Min. running time   | 0 ~ 90, 0: Refrigeration Min.running time calculation is forbidden   | 0     | min   |
| d1  | Evaporator sensor selection   | 0: Disabled, 1: Enabled  | 0     | /     |
| d2  | Evaporator sensor calibration   | -10.0°C ~ 10.0°C<br>-20°F ~ 20°F   | 0.0°C | °C/°F |
| d3  | Defrost cycle calculation   | 0: accumulated refrigeration time<br>1: natural time   | 1     | /     |
| d4  | Defrost cycle   | 0 ~ 90, 0: Defrost forbidden   | 4     | hour  |
| d5  | Defrost status display  | 0:Display cabinet temperature<br>1:Display dEF during defrost and defrost time delay, display cabinet temperature after finishing defrost time delay.<br>2:Always display dEF during defrost and defrost dripping<br>3:Always display start-defrost cabinet temperature during defrost and defrost dripping          | 3     | /     |
| d6  | The maximum time of defrost   | 1 ~ 90   | 30    | min   |
| d7  | Defrost termination temperature   | 0°C ~ 50°C<br>32°F ~ 122°F   | 8°C   | °C/°F |
| d8  | Dripping time after defrost   | 0 ~ 60, 0: Defrost dripping time forbidden   | 0     | min   |
| d9  | Cabinet temperature display time delay after defrost                    | 0 ~ 90   | 10    | min   |
| d10 | Time delay after defrost start  | 0 ~ 60<br>0:Defrost start time delay is canceled   | 10    | min   |
| d11 | Defrost type  | 0:Electric heating defrost<br>1:Hot gas defrost  | 0     | /     |
| F1  | Fan running mode  | 0:Fan and compressor run or stop synchronically<br>1:Fan runs continuously, stops during defrost<br>2: Fan runs continuously, stops during defrost and defrost dripping<br>3: Fan runs continuously, stops during defrost, fan time delay after defrost<br>4:Controlled by defrost sensor, fan stops during defrost. | 1     | /     |
| F2  | Fan initial start time delay after                                      | 0 ~ 60   | 0     | min   |

|     |   |   |      |      |
|-----|---|---|------|------|
|     | electrified   |   |      |      |
| F3  | Fan start time delay after defrost  | 0 ~ 60 , 0: Fan time delay canceled   | 2    | min  |
| F4  | Fan working lowest temp.  | -50℃ ~ Fan working highest temp.<br>-58°F ~ Fan working highest temp.   | -50  | ℃/°F |
| F5  | Fan working highest temp.   | Fan working lowest temp. ~ 85℃<br>Fan working lowest temp. ~ 185°F  | 85   | ℃/°F |
| A1  | Compressor run and stop in a proportional time after cabinet sensor failure | 0: Cancel the mode of “Run/stop in a proportional time”<br>1: Start the mode of “Run/stop in a proportional time” | 1    | /    |
| A2  | Compressor stop time in the mode of “Run/stop in a proportional time”       | 1 ~ 60  | 5    | min  |
| A3  | Compressor running time in the mode of “Run/stop in a proportional time”    | 1 ~ 60  | 30   | min  |
| A4  | Buzzer alarm output switch  | 0: Buzzer output disabled<br>1: Buzzer output enabled   | 1    | /    |
| A5  | Cabinet temperature lower limit alarm value                                 | -50℃ ~ Cabinet temperature upper limit alarm value<br>-58°F ~ Cabinet temperature upper limit alarm value         | -50℃ | ℃/°F |
| A6  | Cabinet temperature upper limit alarm value                                 | Cabinet temperature lower limit alarm value ~ 85℃<br>Cabinet temperature lower limit alarm value ~ 185°F          | 85℃  | ℃/°F |
| A7  | Cabinet over temperature alarm time delay                                   | 0 ~ 60  | 20   | 3min |
| A8  | The initial cabinet over temperature alarm time delay after electrified     | 0 ~ 60  | 40   | 3min |
| A9  | Over temperature alarm upper deviation                                      | 1℃ ~ 30℃<br>1°F ~ 60°F  | 10℃  | ℃/°F |
| A10 | Over temperature alarm lower deviation                                      | 1℃ ~ 30℃<br>1°F ~ 60°F  | 5℃   | ℃/°F |
| A11 | Over temperature alarm mode   | 0: Absolute temperature point<br>1:set value+ over temperature alarm deviation                                    | 0    | /    |
| A12 | Light/Alarm relay selection   | 0:Light output<br>1:Alarm output  | 0    | /    |




|     |  |  |      |       |
|-----|--|--|------|-------|
| do1 | Control output of door switch                        | 0:Door switch is canceled<br>1:Close fan during door open<br>2: Turn on the light when door open, turn off the light when door closed<br>3:Close fan and turn on the light when door open, Turn off the light when door closed<br>4: When door is open, it is the synchronous signal input of defrost, defrost will start. | 0    | /     |
| do2 | Buzzer response when door open                       | 0:NO<br>1:YES  | 0    | /     |
| cd1 | Condenser sensor selection                           | 0:Disabled<br>1:Enabled  | 0    | /     |
| cd2 | Condenser high temperature alarm start value         | 30°C ~ 90°C<br>86°F ~ 194°F  | 55°C | °C/°F |
| cd3 | Lower hysteresis of condenser high temperature alarm | 1°C ~ 15°C<br>2°F ~ 30°F   | 5°C  | °C/°F |
| cd4 | Condenser high temperature protect start value       | 30°C ~ 90°C<br>86°F ~ 194°F  | 70°C | °C/°F |
| u1  | Celsius /Fahrenheit selection (note②)                | 00: Fahrenheit<br>01: Celsius  | 01   | /     |

**Note①:** Only valid when the cabinet sensor is in proper working.

**Note②:** After switch between Celsius /Fahrenheit, users need to adjust all related parameters themselves to make sure the correct parameter setting.



## 6. Keys Function




### 6.1 Keys description



| Keys  | Function   |
|---|--|
| Set   | Enter the status of parameter setting;   |
|   | Switch between menu and parameter;   |
|  | Adjust menu and parameters;  |
|   | Open/close light(only valid for the model with light control)                            |
|  | Adjust menu and parameters   |
|  | View evaporator sensor temperature   |
|   | Exit from parameter setting;   |
|   | Press 3s to forced switch between refrigeration, defrost/defrost delay, defrost dripping |



### 6.2 Keys operation


#### 1) Parameter modified


In the status of temperature measuring and controlling, press Set key for three seconds to enter user menu, it displays the code St, then press Set key again, display the value of St. It could be modified by pressing the key  or .

When it displays the code St, press the key , display the code Po, then press Set key, display 00, at this time, press  or  to input the password of administrator menu.


Press Set key again to confirm the password input, and the controller will automatically verify the correctness of password. When it passes, it could select parameter items St、Po、C1、C2.....Cd3 (that is, any parameter items both in the administrator menu and user manuals) by pressing the key  or . Or else, only the parameters items St and Po available, others could not be displayed.

When the parameter item is selected, press Set key to enter to the setting of the current item, press  or  to modify the value, and then press Set key to return to the menu.



Under the status of parameter setting, press  key or no key operation within 30s, it will exit from parameter setting and automatically save the current parameter value.

Note: The password input of administrator menu only is valid for single entering. After exit from the parameter setting by pressing , it needs to input the correct password again for next parameter adjustment.


## 2) Temperature viewing

In the status of temperature measuring and controlling, press  to view the current evaporator sensor measured temperature value (note: evaporator sensor is enables and works properly).

## 3) Manually forced operation


In the status of temperature measuring and controlling, press  for three seconds to force the switch between refrigeration, defrost/defrost delay, defrost dripping. Press  to open or close the light (Only valid when Light/alarm relay is used as light and there is no linkage between light control and door switch.)

## 4) One-key restore operation


In the status of temperature measuring and controlling, press the Set key +  key at the same time for 10 seconds, the controller performs a one-key restore operation, that is, restores all parameters to the factory default values, and the rSt code is displayed after successful execution.

## 6.3 Copy card

### 6.3.1 Upload (Copy the parameters of controllers to copy card)

- 1) Set controller parameters by keys;
- 2) Insert copy card, hold and press  key until it displays“uP” in the front panel.
- 3) Plug off copy card in 3 seconds, then power on controller gain.

### 6.3.2 Download (Copy the parameter of copy card to the controller)

- 1) Insert copy card, hold and press  key until it display "do" in the front panel.
- 2) Plug off the copy card, and power on the controller again in 3 seconds.

Note: If it displays“Er”, it indicates the failure of programming. At this time, you need to check whether the copy card is reliably inserted, if yes, repeat the above steps again.

If it displays“EP”, it indicates inconsistent data between copy card and controller, programming fails. At this time, need to change to the right copy card and repeat the steps above; or upload the data of copy card again, and repeat the steps above.

(★ For copying process, it requires a reliable power supply and effective connection of copy card, and it is forbidden to plug off the copy card before finishing operation)

## 7. Control output

### 7.1 Compressor

#### 1) Normal status:

When the cabinet temperature is higher than the set temperature (St) +hysteresis (C1), and finish the compressor start Min. interval, the compressors will start;

When the cabinet temperature is lower than the set temperature (St), and the continuous refrigeration running time is large than C8, the compressor will close.

When the cabinet temperature is between the set temperature(St) and the temperature of the set temperature(St) +hysteresis(C1), if the refrigeration is closed, then after finishing compressor start Min. interval and Max.standby time after finishing compressor start Min. interval(C7), the refrigeration will start.

Note: Compressor start Min.interval is calculated by Compressor initial start Min. interval (C3) after it is electrified for the first time, and it will be calculated by Compressor start Min. interval (C2) in the future.

## **2) Cabinet temperature sensor failure:**

A1=0, cancel the function of "Run/stop in a proportional time" , the compressor closes;

A1=1, open the function of "Run/stop in a proportional time", the compressor will run in cycle according to the proportion (Refrigeration running time A3 and refrigeration stop time A2).

## **7.2 Defrost**

1) d4 = 0, Defrost is forbidden.


2) d4 ≠ 0, when it is not in the state of defrost nor defrost dripping:

① Evaporator sensor is enabled (d1 = 1), and evaporator sensor temperature is higher than Defrost termination temperature (d7), then defrost could not be started.

② Evaporator sensor is enabled (d1 = 1) and evaporator sensor temperature is lower than Defrost termination temperature (d7) or evaporator sensor is disabled (d1 = 0) (Any of the following conditions could start defrost):

a、When defrost cycle (d4) finishes running, defrost is started;

Note: Defrost cycle is calculated according to the selected natural time (d3 = 1) or accumulated refrigeration time (d3 = 0);

b、Hold and press  for three seconds, start defrost;

c、If the door switch is as synchronous signal input of defrost (d01 = 4) ,the door open is the external synchronous defrost signal, the defrost is started.

Note: When finish time delay after defrost start (d10), there will be an output of defrost.

3) In the state of defrost (Any of the following condition could close defrost) :

① Evaporator sensor is enabled (d1 = 1), and evaporator sensor temperature is higher than defrost termination temperature (d7), defrost is closed;

② When finish running the maximum time of defrost (d6), defrost is closed;

③ Hold and press  for three seconds, defrost is closed;

4) After defrost, it enters the state of defrost dripping, and within dripping time after defrost(d8), refrigeration output is forbidden. The dripping will be discharged during this time period.After finishing dripping time after defrost, it enters to the status of refrigeration cycle.

5) Defrost status display

d5=0: Display cabinet temperature

d5=1:Display dEF during defrost and defrost time delay, display cabinet temperature after finishing defrost time delay.

d5=2:Always display dEF during defrost and defrost dripping

d5=3:Always display start-defrost cabinet temperature during defrost and defrost dripping

6) Defrost type:

d11=0:Electric heating defrost

d11=1:Hot gas defrost

| Defrost type<br>System status | Electric heating defrost | Hot gas defrost   |
|-------------------------------|--------------------------|-------------------|
| Refrigeration output          | Compressor start         | Compressor start  |
|                               | Electric heating close   | Four-valves close |
| Defrost time delay            | Compressor stop          | Compressor stop   |
|                               | Electric heating close   | Four-valves open  |
| Defrost output                | Compressor stop          | Compressor start  |
|                               | Electric heating open    | Four-valves open  |
| Defrost dripping              | Compressor stop          | Compressor stop   |
|                               | Electric heating close   | Four-valves open  |

### 7.3 Light

do1=0 or 1or 4: press  to open the light, and press  again to close the light.

do1=2 or 3: When door open, the light will be opened, and when close the door, light will be closed.

Note: A12 = 0, Light/Alarm relay will be used as light relay, and light relay will pick-up when the light opens, disconnect when the light closes.

### 7.4 Internal Alarm

Temperature sensor failure alarm:

When cabinet sensor fails, the digital tube display E1;

When evaporator sensor fails, the digital tube display E2;

When condenser sensor fails, the digital tube display E3;

Condenser high temperature alarm: when the condenser temperature sensor is activated (cd = 1), when the condenser temperature exceeds the condenser high temperature alarm activation value (cd2), and the condenser high temperature alarm is issued after 90 minutes of continuous accumulation, the digital tube displays CH, But it does not affect the control output; the temperature drops back to the starting value of the condenser high temperature alarm (cd2)-after the condenser high temperature alarm returns to the difference (cd3), the alarm is released.

Condenser high temperature protection alarm: when the condenser temperature sensor is activated (cd = 1), when the condenser temperature exceeds the condenser high temperature protection activation value (cd4), the controller displays the CP code and immediately turns off the compressor and other control outputs. When the temperature drops back to the starting value of the high-temperature protection value of the condenser (cd4)-the return difference (cd3) under the high-temperature alarm of the condenser is counted for another hour, the compressor and other control outputs return to normal. After CP protection occurs, the digital tube will keep displaying the CP alarm code until the controller is powered off.

Cabinet over temperature alarm : When the cabinet temperature is higher than the cabinet temperature upper limit alarm value(A11=0) or higher than (set value + over temperature alarm upper deviation: A11=1), and cabinet over temperature alarm time delay or the initial cabinet over temperature alarm time delay after electrified has been finished, the digital tube will display rH, and the alarm will not be released until the temperature is lower than the cabinet temperature upper limit alarm value(A11=0) or lower than (set value+ over temperature alarm upper deviation: A11=1); When the cabinet temperature is lower than the cabinet temperature lower limit alarm value(A11=0) or lower than (set value- over temperature alarm lower deviation: A11=1), and cabinet over temperature alarm time delay or the initial cabinet over temperature alarm time delay after electrified has been finished, the digital tube will display rL, and the alarm will not be released until the temperature is higher than the cabinet temperature lower limit alarm value or (set value- over temperature alarm lower deviation: A11=1).



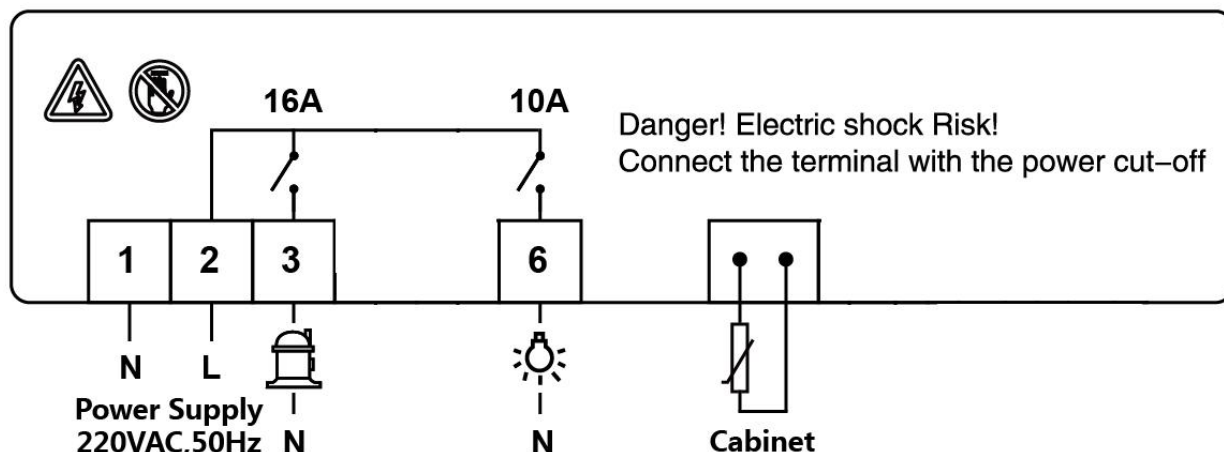
If the buzzer is selected as 1, when there is alarm, door open(do2 is set as 1), the buzzer beeps; When all alarm is released and door is closed(do2 is set as 1) and there is normal power supply, the buzzer mutes, or press any key to mute the alarm.

| Alarm code | Alarm reason  |
|------------|---|
| E1         | Cabinet temperature sensor failure                                      |
| E2         | Evaporator sensor failure   |
| E3         | Condenser sensor failure  |
| cH         | Condenser high temperature alarm  |
| cP         | Condenser high temperature protect                                      |
| rH         | Cabinet high temperature alarm  |
| rL         | Cabinet low temperature alarm   |
| Er         | Copy card programming failure   |
| EP         | Inconsistent data between copy card and controller, programming failure |

### 7.5 External alarm output (A12=1)

The external alarm relay will pick up when there is alarm or door is open (do2 is set as 1), and it will disconnect when all alarm is released and the door is closed (do2 is set as 1).

### 8 Wiring diagram



### 9. Safety rules:

#### ★Danger:

1. Strictly distinguish the power wire, relay output, sensor down-lead and data line, and the relay could not be overloaded.
2. Prohibit connecting the wire terminals without electricity cut-off.

#### ★Warning:

Prohibit using this unit under the environment of over damp, high temp., strong electromagnetism interference or strong corrosion.

#### ★Notice:

1. The power supply should conform to the voltage value indicated in the instruction, and make sure a steady power supply.
2. To avoid the possible interference, the sensor down-lead/data line and power wire should be kept in a proper distance.
3. When evaporator sensor is installed, the sensor should be well connected with the copper tube which is 5cm away from evaporator inlet.