# Dial-Switch Intelligent Temperature Controller  Operation Manual



## Features：

⊙ Optional input signal types and models

⊙ With functions of measured display,control output,alarm output etc.

⊙ Used for industrial machinery, machine tools,measuring instruments

⊙ Setting by dial switch , easy to operate.

 

The instruction explain instrument settings, connections,name and etc,please read carefully before you use the temperature controller. Please keep it properly for necessary reference.

1.Safe Caution

| ⚠ Warning |
|---|

1）When the failure or abnormal of products lead to a system accidents,please set  proper protection circuit in the external.

2）Please don`t plug in before completing all the wire.Otherwise it may lead to electric shock, fire, fault.

3）Not allow to use outside the scope of product specification,otherwise it may lead to fire,fault.

4）Not allow to use in the place where is inflammable and explosive gas.

5）Do not touch power terminal and other high voltage part when the power on,otherwise you may get an electric-shock.

6）Do not remove,repair and modify this product,otherwise it may lead to electric shock, fire, fault.

## ⚠ Caution

1) The product should not be used in a nuclear facility and human life associated medical equipment.

2) The product may occur radio interference when it used at home.You should take adequate countermeasures.

3) The product get an electric shock protection through reinforced Insulation. when the product is embedded in the devices and wiring,please subject to the specification of embedded devices.

4) In order to prevent surge occurs,when using this product in the place of over 30m indoor wiring and wiring in outdoor, you need to set the proper surge suppression circuitry.

5) The product is produced based on mounting on the disk.In order to avoid to touch the wire connectors,please take necessary measures on the product

6) Be sure to observe the precautions in this manual, otherwise there is a risk of a major injury or accident.

7) When wiring, please observe the local regulation.

8) To prevent to damage the machine and prevent to machine failure, the product is connected with power lines or large  capacity input and output lines and other methods please install proper capacity fuse or other methods of protection circuit.

9) Please don't put metal and wire clastic mixed with this product,otherwise it may lead to electric shock, fire, fault.

10) Please tighten screw torque according to the rules.If not,it may lead to electric shock and fire.

11) In order not to interfere with this products to dissipate heat, please don't plug casing around the cooling vent hole and equipment.

12) Please don't connect any unused terminal.

13) Please do the cleaning after power off, and use the dry cleaning cloth to wipe away the dirt. Please don't use desiccant, otherwise, it may casue the deformation or discoloration of the product.

14) Please don`t knock or rub the panel with rigid thing.

15) The readers of this manual should have basic knowledge of electrical,control, computer and communications.

16) The illustration, example of data and screen in this manual is convenient to understand,instead of guaranteeing the result  of the operation.

17) In order to use this product with safety for long-term,regular maintenance is necessary. The life of some parts of the equipments are by some restrictions, but the performance of some will change for using many years.

18) Without prior notice, the contents of this manual will be change. We hope these is no any loopholes, if you have questions or objections, please contact us.

## ⚠ Caution of Install & Connection：

### 1. Installation：

1) This product is used in the following environmental standards：（IEC61010-1）[Overvoltage categoryⅡ、 class of pollution 2]

2) This product is used in the following scope:surrounding environment, temperature, humidity and environmental conditions.Temperature: 0 ~ 50℃; Humidity：45 ~ 85%RH;Environment condition：Indoor warranty,The altitude is less than 2000m.

3) Please avoid using in the following places:

  The place will be dew for changing temperature;with corrosive gases and flammable gas;with vibration and impact;with water, oil, chemicals, smoke and steam facilities with Dust, salt, metal powder;and with clutter interference, static electric and magnetic fields, noise;where has air conditioning or heating of air blowing directly to the site; where will be illuminated directly by sunlight; where accumulation of heat will happen caused by radiation.

4) On the occasion of the installation, please consider the following before installation.

In order to protect heat saturated, please ensure adequate ventilation space.

Please consider connections and environment,and ensure that the products below for more than 50mm space.

Please avoid to installed over the machine of the calorific value(Such as heaters, transformer, semiconductor operations, the bulk dresistance).When the surrounding is more than 50℃, please using the force fan or cooling fans.But don't let cold air blowing directly to  the product.

In order to improve the anti - interference performance and security, please try to stay away from high pressure machines, power machines to install.
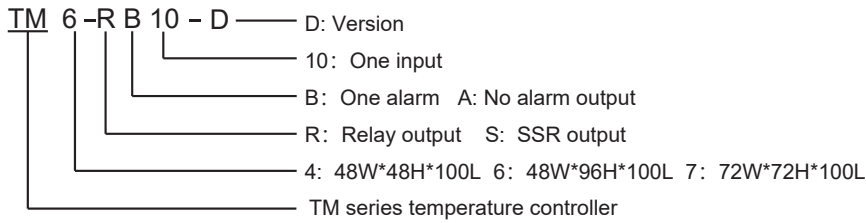
  Don`t install on the same plate with high pressure machine and the product.

  The distance should be more than 200mm between the product and power line.

### 2.Cable caution：

1) Please use specified compensation wire in the place of TC input;Please use insulated TC if the measured device is heated metal.

2) Please use the cable of lesser resistance in the place of RTD input,and the cable(3 wire) must be no resistance difference,but the total length is within 5m.

3) In order to avoid the effect of noise,please put the input dignal away from meter cable,power cable,load cable to wiring.

4) In order to reduce the power cables and the load power cables on the effect of this product,please use noise filter in the place where easy to effect.You must install it on the grounding of the disk if you use the noise filter,and make the wiring to be shortest between  noise filter output side and power connectors.Don`t install fuse and switch on the wiring of noice filter output side,otherwise it will reduce the effect of noise filter.

5) It takes 5s from input power to output.If there is a place with interlocking actions circuit signal,please use timer relay.

6) Please use twisted pair with a shield for analog output line,to ensure the reliabilty of signal, if necessary.

7) Please use twisted pair with a shield for remote RS485 communication cable,and deal with the shield on the host side earth, to ensure the reliabilty of signal.

8) This product don't have the fuse; please set according to rated voltage 250V,rated current 1A if you need; fuse  type:relay fuse.

## ■ Model

```
TM  6 - R B 10 - D ─── D: Version
                    ─── 10：One input
                    ─── B: One alarm   A: No alarm output
                    ─── R：Relay output   S: SSR output
                    ─── 4: 48W*48H*100L  6：48W*96H*100L  7：72W*72H*100L
                    ─── TM series temperature controller
```

## ■ Model Illustration

| NO. | Model | Control Output | Alarm |
|-----|-------|----------------|-------|
| 1 | TM□-SB10 | SSR | 1 |
| 2 | TM□-RB10 | RELAY | 1 |

## ■ Specifications

1. Electrical Parameters

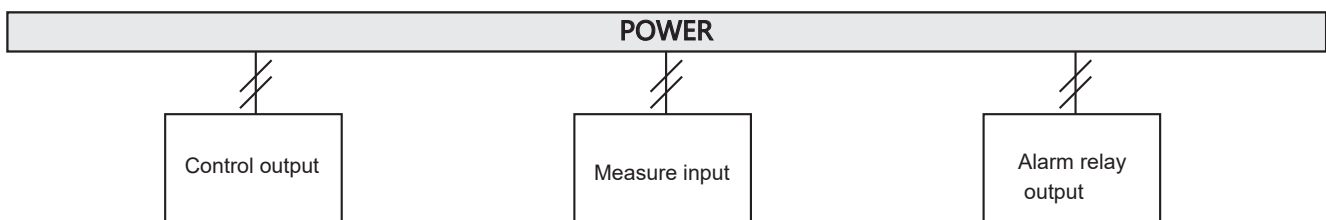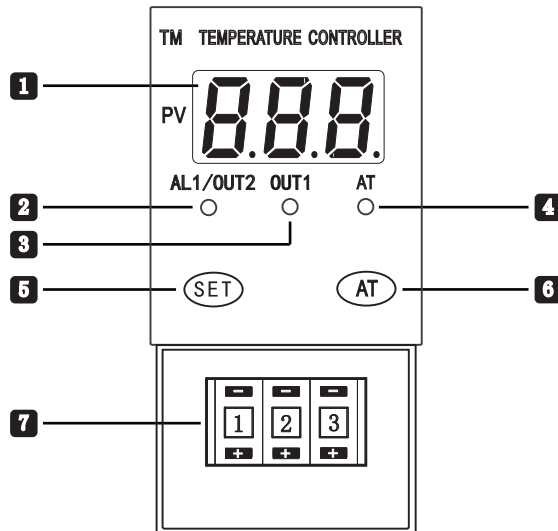| | |
|---|---|
| Sample rate | 2 times/per second |
| Relay capacity | AC 250V /3A  Life of rated load>100,000 times |
| Power supply | AC/DC 100 ~ 240V (85-265V) |
| Power consumption | < 6VA |
| Environment | Temperature of indoor：0 ~ 50℃ no condensation，Humidity：＜85%RH，altitude<2000m |
| Storage enenvironment | -10 ~ 60℃, no condensation |
| SSR output | DC 24V pulse voltage，load<30mA |
| Insulation impedance | Input, output, power VS meter cover ＞20MΩ |
| ESD | IEC/EN61000-4-2  Contact ±4KV /Air ±8KV perf.Criteria B |
| Pulse traip anti-interference | IEC/EN61000-4-4  ±2KV  perf.Criteria B |
| Surge immunity | IEC/EN61000-4-5  ±2KV  perf.Criteria B |
| Voltage drop & short interruption immunity | IEC/EN61000-4-29 0% ~ 70%            perf.Criteria B |
| Dielectric strength | Signal input /output /power 1500VAC 1min，between lower than 60V circuits, DC500V,1min |
| Total weight | About 400g |
| Shell material | The shell and panel frame PC/ABS (Flame Class UL94V-0) |
| Panel  material | PET(F150/F200) |
| Power failure memory | 10 years，times of writing: 1 million times |
| Safety Standard | IEC61010-1 Overvoltage category Ⅱ，pollution level 2，levelⅡ(Enhanced insulation) |

2.Measured signal specifications：

| Input type | Symbol | Measure range | Resolution | Accuracy | Input impedance/auxiliary current |
|------------|--------|---------------|------------|----------|-----------------------------------|
| K | ᯄ | -50 ~ 999 | 1℃ | 0.5%F.S±3digits | ＞500kΩ |
| J | ᒍ | 0 ~ 999 | 1℃ | 0.5%F.S±3digits | ＞500kΩ |
| E | E | 0 ~ 850 | 1℃ | 0.5%F.S±3digits | ＞500kΩ |
| T | ᒜ | -50 ~ 400 | 1℃ | 0.5%F.S±2℃ | ＞500kΩ |
| PT100 | Pᒜ | -200 ~ 600 | 1℃ | 0.5%F.S±3digits | 0.2mA |
| CU50 | CUS | -50 ~ 150 | 1℃ | 0.5%F.S±3℃ | 0.2mA |
| CU100 | CU0 | -50 ~ 150 | 1℃ | 0.5%F.S±1℃ | 0.2mA |

3.Isolation diagram

| POWER |
|---|

| Control output | Measure input | Alarm relay output |
|---|---|---|

// ： isolation

## ◼ Name of universal panel



| No | Symbol | Name | Function |
|----|--------|------|----------|
| 1 | PV | Display window | Setting value/parameters display window |
| 2 | AL1/OUT2 | AL1/OUT2 | Alarm output indication light |
| 3 | OUT1 | OUT1 | Main control output indication light ,it is lighting when the output is ON |
| 4 | AT | AT | Auto-tuning indicate light,it indicates auto-tuning status when lighting on |
| 5 | SET | SET function key | Menu key/confirm key, to enter/exit modified mode or confirm modified parameters |
| 6 | AT | AT Key | AT auto-tuning key,long press to enter/exit auto-tuning under measure control mode |
| 7 | | dial switch | add or reduce the parameter value in parameter setting status |

## ◼ Dimension and installation size

panel size          side size          Hole size
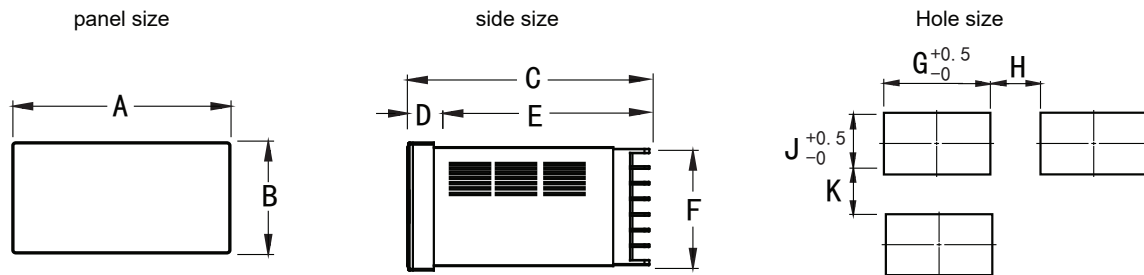


| Mode | A | B | C | D | E | F | G | H(Min) | J | K(Min) |
|------|---|---|---|---|---|---|---|--------|---|--------|
| 4:(48*48) | 48 | 48 | 97.5 | 6.5 | 91 | 45 | 45.5 | 25 | 45.5 | 25 |
| 6:(96*48) | 48 | 96 | 97.5 | 9 | 88.5 | 89.5 | 45 | 25 | 92 | 25 |
| 7:(72*72) | 72 | 72 | 97.5 | 9 | 88.5 | 67 | 67.5 | 25 | 67.5 | 25 |

# ■ Operation & menu

## 1. Operation process & method

measure control mode



Press SET > 3s

Press SET > 3s

Press SET > 3s

| Display | Label |
|---|---|
| `200` (PV) | |
| `P` (PV) | * Proportional band — LCK≠33 |
| `I` (PV) | * Integral time |
| `d` (PV) | * Differential time |
| `SPd` (PV) | * control speed |
| `oVS` (PV) | * pvershoot limit |
| `db` (PV) | * On-off control backlash |
| `CP` (PV) | * OUT1 control cycle unit: second |
| `CPI` (PV) | * OUT2 control cycle unit: second |
| `PC` (PV) | * cooling proportionality coefficient |

| Display | Label |
|---|---|
| `LCK` (PV) | * password — LCK=33 |
| `ot` (PV) | * Control mode |
| `InP` (PV) | * input signal |
| `PS` (PV) | * amend |
| `HY2` (PV) | 2nd alarm hysteris |
| `AL2` (PV) | * Alarm 2 value |
| `Ad1` (PV) | * Alarm mode |
| `HY1` (PV) | * 1st alarm hystersis |
| `AL1` (PV) | * Alarm 1 value |

| Display | Label |
|---|---|
| `VEr` (PV) | ● Software version |
| `ACt` (PV) | ● Control output mode |
| `FL` (PV) | ● Range low limit |
| `FH` (PV) | ● Range high limit |
| `Ft` (PV) | ● Digital filter coefficient |

| Display | Label |
|---|---|
| `dtr` (PV) | ● Display fuzzy tracking value |
| `dP` (PV) | ● Decimal point setting |
| `Pt` (PV) | ● compressor starting delay unit: second |
| `AEI` (PV) | ● Alarm extend function |
| `Ut` (PV) | ● Temperature unit setting |

"*" : common menu
"●" : advanced menu

1. SET key : In normal display status, long press SET key to enter setting menu . In modifying temperature setting value or parameter value status , short press SET key to confirm after modifying.

2. AT key : In normal display status , long press AT key to enter auto-tuning status . AT indication light is on . In menu setting , short press AT key , PV display window is turn to display value from display parameter mode. In this status ,can modify the parameter value by dial switch.

3. Dial switch: dial switch value is the setting value. In modifying parameter status, it will show the maximum value if beyond the parameter's range.

## 2. Menu Illustration

| No. | menu name | Description | Set range | Factory set |
|---|---|---|---|---|
| 1 | PV | measure value display , if the value beyong the measure range , it will show LLL/HHH | refer to input signal table | No |
| 2 | SV | control temperature target setting , dial switch value setting | | |
| 3 | P | Proportional band, the less of setting value,the faster of systemresponse . conversely , system response slower . P=0 , PID control is not valid | 0 ~ 999 | 30 |
| 4 | I | Integral time , the less of the value,the stronger of integral action.Conversely ,integral action is lower. I=0, no integral action | 0 ~ 999 | 120 |
| 5 | D | Differential time . The higher value,the stronger function of differential.Conversely, lower differential function. D=0, no differential function. | 0 ~ 999 | 30 |
| 6 | SPD | PID control speed adjustment, optional 0(N)no function,1 (S) slow, 2(ss)medium slow, 3（SSS）very slow，4（F）fast, 5（FF）medium fast，6（FFF）express | 0 ~ 6 | N |
| 7 | OVS | Overshoot limit,in the process of PID control,when PV>SV+OVS,it force off output; The lower value,the lower PID adjusted range,the worse control stability; please set a proper value according actual state. | 0 ~ 999 | 5 |
| 8 | DB | On-off control backlash(nagetive backlash on-off control)or cooling control and compressor cooling control dead zone. please change value according to decimal position,when you change input sigal type type. | 0 ~ 100 | 10 |
| 9 | CP | OUT1 control cycle,1:SSR control output, 4-200:relay control output. Unit:second | 1 ~ 200 | 20 |
| 10 | CP1 | OUT2 control cycle,cooling relay output cycle.Unit:second | 4 ~ 200 | 20 |
| 11 | PC | OUT2 cooling proportionality coefficient,the higher value,the stronger cooling | 1 ~ 100 | 10 |
| 12 | AL1 | 1st alarm value,note:the minus is dealed as absolute value when it is as a deviation value . | FL ~ FH | 200 |
| 13 | HY1 | 1st alarm backlash value | 0 ~ 100 | 1 |
| 14 | AD1 (1) | 1st alarm type,note: set the AD1=0 , when 1st alarm is used as out2 (cooling output ) | 0 ~ 12 | 1 |
| 15 | AL2 | 2nd alarm value,note:the minus is dealed as absolute value when it is as a deviation value . | FL ~ FH | 600 |
| 16 | HY2 | 2nd alarm backlash value | 0 ~ 100 | 1 |
| 17 | PS | Amend value,display value=actual measured value+ amend value | -199 ~ 999 | 0 |
| 18 | INP | Optional input measured signal type:refer to input signal parameters table. Note: it need to change the relevant parameters after changing. | 0 ~ 10 | 0 |
| 19 | OT | Control type : 0:ON/OFF control; 1: PID heating control , 2: ON-OFF cooling control 3:PID heating & cooling control. This mode should set AD1 as 0 , then Out2 can be activated | 0 ~ 6 | 1 |
| 20 | LCK | Lock function;  010:menu setting value only can be checked ,cannot modified.   033: can enter to advanced menu. | 0 ~ 999 | 0 |
| 21 | ACT | Control output mode, 0: relay or ssr output; 1: SSR output control | 0 ~ 1 | 0 |
| 22 | FL | Measure range low limit, set value must be less than measure range high limit | Refer to input signal table | -50 |
| 23 | FH | Measure range high limit,the set value must be more than measure range low limit. | Refer to input signal table | 999 |
| 24 | FT | filter coefficient , the higher of value,the stronger of filter function | 0 ~ 255 | 10 |
| 25 | UT | Temperature unit: ℃: degrees Celsius  F：Fahrenheit | 25（℃）26（℉） | 25（℃） |
| 26 | AE1(2) | alarm extension function | 0 ~ 5 | 0 |
| 27 | PT | Starting delay time of compressor, unit:second | 0 ~ 999 | 180 |
| 28 | DP | decimal point setting , can set 1 decimal point for temperature less than 100 | 0 ~ 3 | 0 |
| 29 | DTR | PV fuzzy tracking value,it can get a stable control display value in some status. Note:when the alarm setting value is equal with SV setting value after setting the DTR value,operation of alarm output is subject to actual measured value. Setting 0 to close the function.     Temperature unit:F/℃ | 0.0 ~ 2.0 | 1.5 |
| 30 | VER | software version | —— | —— |

(1) Alarm parameters and output logic diagram:

Symbol description："☆" means alarm hystersis，"▲" means alarm value，"△" means SV value

| No. | Type | Alarm output image：the hatched section means the alarm action |
|---|---|---|
| 1 | High limit absolute value alarm | AL |
| 2 | Low limit absolute value alarm | AL |
| 3 | ※High limit deviation value alarm | SV+AL / SV |
| 4 | ※Low limit deviation value alarm | SV-AL  SV |
| 5 | ※High/low limit deviation value alarm | SV-AL  SV  SV+AL |
| 6 | ※High/low limit interval value alarm | SV-AL  SV+AL |

| No. | Type | The following two group of alarm parameters(AL1、AL2) used in combination,AL1 alarm output , AD2 must set to 0 |
|---|---|---|
| 7 | ※Alarm between high limit deviation value and low limit absolute value. | AL1  SV  AL2 |
| 8 | ※High/low limit deviation value alarm | SV-AL1  SV+AL2  SV |
| 9 | ※Alarm between high limit absolute value and low limit deviation value . | SV-AL1  SV  AL2 |
| 10 | ※Alarm between high limit deviation value and low limit absolute value. | AL1  SV  SV+AL2 |
| 11 | High/low absolute value alarm | AL1  SV  AL2 |
| 12 | ※High/low limit deviation alarm | SV-AL1  SV  SV+AL2 |

※When the alarm value with deviation alarm set to a negative number,it will deal with it as an absolute value.

2. Alarm extension function table

| AE1 code | | Alarm handling mode when show HHH/LLL | Remark |
|---|---|---|---|
| Power on alarm, alarm does not inhibit. | 0 | The state when alarm keep HHH/LLL in previous time | As long as meet the requirement of alarm , make alarm output . |
| | 1 | Forced alarm output | |
| | 2 | Forced alarm close | |
| Power on alarm , alarm inhibits. | 3 | The state when alarm keep HHH/LLL in previous time | Before PV value reach the set value at the first time ,the alarm does not output) |
| | 4 | Forced alarm output | |
| | 5 | Forced alarm close | |

## ■ Key function operation

1. PID parameter auto-tuning operation
   1) Our default PID parameter may not suitable for usage status, please use PID auto-tuning function to get suitable PID.
   2) SV value must be larger than current PV value , and the larger the better.
   3) Before auto-tuning , set proper alarm value , or remove the alarm effect to avoid the effect of alarm output.
   4) Set SV value well.
   5) Set is as PID control mode.
   6) PV value is at normal room temperature status, connect load power supply , long press AT key to enter auto-tuningmode, AT indicator will flash.
   7) Auto-tuning need a period, to ensure auto-tuning result,  do not modify parameters or power-off during auto-tuning.
   8) When AT light is off , it will exit auto-tuning. PID will update automatically, and can ge good control result.
   9) During auto-tuning, long press AT key, measure beyong range , display abnormally, power off ect will stop auto-tuing.
  10) In the place with current output amplitude limit, it may not get the best PID parameters even after auto-tuning.
  11) Experienced users can set a proper PID parameter according to their experience.

2. PID and cooling control operation
   1) PID heating control act on OUT1 , cooling control act on OUT2.
   2) Cooling control OUT2 will make output by AL1 alarm relay, set AD1=0 when used for cooling control
   3) Set the control mode OT to 3.
   4) Please set the cooling start offset to a value larger than 5 , to ensure the cooling would not affect PID heating control impact.
   5) Please set the cooling control cycle CP1 to a proper value,and change the cooling scaling factor to a a proper value.
   6) When PV value > SV+DB value,the cooling control start to effect;the bigger value of PV,the longer output time of OUT2

## ■ Wire Connections

TM4

TM6

TM7
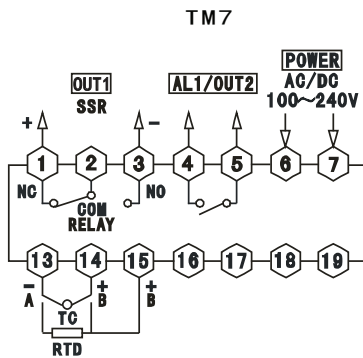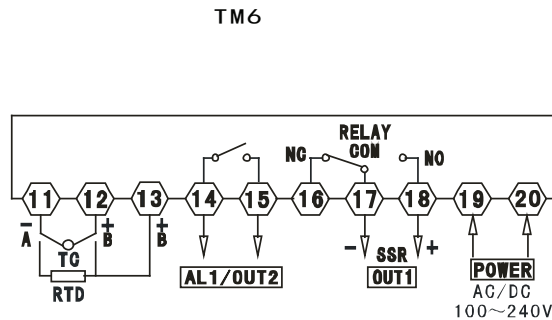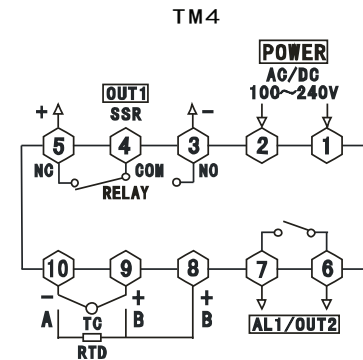
Note: If there is any change, please subject to the drawing on the meter

## ■ Methods of simple fault

| Display | Check Methods |
| --- | --- |
| LLL/HHH | Checks whether the input disconnection and whether normal of FH value,FL value,working environment temperature and whether input signal is selected correctly. |
| PV value flashing | When PV value out of FL or FH limit , PV value is flashing ,output stop.Please check FL and FH value limit , to make sure the PV value is in the range. |
| Display Err | SV value is out of the range of FL and FH limit range |