TEP Series

# Intelligent Programmable Temperature Controller


Features:

- •Up to 16 segments of ramp/soak curve.
- •The number and length of the curve can be set freely.
- •The operations, such as pause, stop, repeat and so on, can be flexiblely written into the program menu.
- •Fast select the curve need to run.
- •Support the PV start function.

## I. Model

TEP 6- □R C18□ - A —

1. A: Version
2. Blank: TC/RTD/mV/Rt input X: mA/V input
3. 10: without RS485 communication
   18: with RS485 communication
4. C: 2 alarms
5. R: Relay output S: SSR output D Note:DC 4-20mA (can be adjusted as analog output by ACT menu)
   K: SCR output (to be ordered)
6. I Note: 4～20mA analog output (can be adjusted as current control output) Blank: No such function
7. 3: 72W*36H*70.5L 4: 48W*48H*100L
   6: 48W*96H*100L 7: 72W*72H*100L
   8: 96W*48H*100L 9: 96W*96H*100L
   80: 160W*80H*96L
8. TEP Series Temperature Controller

Please note the input signal type when you choose the model.
1st type:TC/RTD/mV/Rt; 2nd type: mA/V.

Note: TEP series only have one 4~20mA output function. For size 6/8/9, when relay output/SSR output is together with DC 4~20mA, it is identified by "I", for example: IR, IS, etc, but there is no such model for size 3/4/7.



## II. Model

| No. | Model | Main control output | Alarm No. | Analog output | RS485 | Auxiliary power |
|---|---|---|---|---|---|---|
| 1. | TEP3-DC18 | SSR / 4~20mA | 2 | ○ | ● | |
| 2. | TEP3-DC10 | SSR / 4~20mA | 2 | ○ | | |
| 3. | TEP3-RC18 | RELAY | 2 | | ● | |
| 4. | TEP3-RC10 | RELAY | 2 | | | |
| 5. | TEP4/7-DC18 | 4~20mA | 2 | ○ | ● | ● |
| 6. | TEP4/7-DC10 | 4~20mA | 2 | ○ | | ● |
| 7. | TEP4/7-SC18 | SSR | 2 | | ● | |
| 8. | TEP4/7-SC10 | SSR | 2 | | | |
| 9. | TEP4/7-RC18 | RELAY | 2 | | ● | |
| 10. | TEP4/7-RC10 | RELAY | 2 | | | |
| 11. | TEP6/8/9/80 -ISC18 | SSR / 4~20mA | 2 | ○ | ● | ● |
| 12. | TEP6/8/9/80 -ISC10 | SSR / 4~20mA | 2 | ○ | | ● |
| 13. | TEP6/8/9/80 -IRC18 | RELAY / 4~20mA | 2 | ○ | ● | ● |
| 14. | TEP6/8/9/80 -IRC10 | RELAY / 4~20mA | 2 | ○ | | ● |
| 15. | TEP6/8/9/80 -DC18 | RELAY / 4~20mA | 2 | ○ | ● | ● |
| 16. | TEP6/8/9/80 -DC10 | RELAY / 4~20mA | 2 | ○ | | ● |
| 17. | TEP6/8/9/80 -SC18 | SSR | 2 | | ● | |
| 18. | TEP6/8/9/80 -SC10 | SSR | 2 | | | |
| 19. | TEP6/8/9/80 -RC18 | RELAY | 2 | | ● | |
| 20. | TEP6/8/9/80 -RC10 | RELAY | 2 | | | |

"●" : The meter has this function.
"○" : The meter has this function, but it is combined with another function. This series only have one loop 4~20mA output, but the user can modify menu ACT to use it as main control output or analog output ( refer to menu illustration for details).



## III. 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 | Indoor use only, temperature: 0~50℃ no condensation, humidity < 85%RH, altitude<2000m |
| Storage enenvironment | -10~60℃, no condensation |
| SSR output | DC 24V pulse voltage, load<30mA |
| Current output | DC 4~20mA load<500Ω, temperature drift 250PPM |
| Communication port | RS485 port Modbus-RTU protocol, max input 30 units |
| 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 |
| isolation voltage | Signal input, output, power: 1500VAC 1min, <60V low voltage circuit: DC500V,1min |
| Total weight | About 400g |
| Cover 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 |
| Panel Protection level | IP65(IEC60529) |
| Safety Standard | IEC61010-1 Overvoltage category Ⅱ, pollution level 2, levelⅢ(Enhanced insulation) |

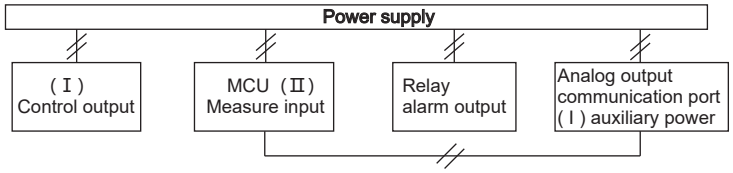


### 2. Measured signal specifications:

| Input type | Symbol | Measure range | Reso-lution | Accuracy | Input impedance /auxiliary current | Communication parameter code |
|---|---|---|---|---|---|---|
| K | E | -50~1200 | 1℃ | 0.5%F.S±3digits | > 500kΩ | 0 |
| J | J | 0~1200 | 1℃ | 0.5%F.S±3digits | > 500kΩ | 1 |
| E | E | 0~850 | 1℃ | 0.5%F.S±3digits | > 500kΩ | 2 |
| T | t | -50~400 | 1℃ | 0.5%F.S±2℃ | > 500kΩ | 3 |
| B | b | 250~1800 | 2℃ | 1%F.S±2℃ | > 500kΩ | 4 |
| R | r | -10~1700 | 1℃ | 1%F.S±2℃ | > 500kΩ | 5 |
| S | S | -10~1600 | 1℃ | 1%F.S±2℃ | > 500kΩ | 6 |
| N | n | -50~1200 | 1℃ | 0.5%F.S±1℃ | > 500kΩ | 7 |
| PT100 | Pt | -200~600 | 0.2℃ | 0.5%F.S±0.3℃ | 0.2mA | 8 |
| JPT100 | JPt | -200~500 | 0.2℃ | 0.5%F.S±0.3℃ | 0.2mA | 9 |
| CU50 | CUS0 | -50~150 | 0.2℃ | 0.5%F.S±3℃ | 0.2mA | 10 |
| CU100 | CU00 | -50~150 | 0.2℃ | 0.5%F.S±1℃ | 0.2mA | 11 |
| 0~50mV | 0-50 | -1999~9999 | 12bit | 0.5%F.S±3digits | > 500kΩ | 12 |
| 0~400Ω | r-t | -1999~9999 | 12bit | 0.5%F.S±3digits | 0.2mA | 13 |
| *4~20mA | 4-20 | -1999~9999 | 12bit | 0.5%F.S±3digits | 100Ω | 14 |
| *0~10V | 0-10 | -1999~9999 | 12bit | 0.5%F.S±3digits | >1MΩ | 15 |

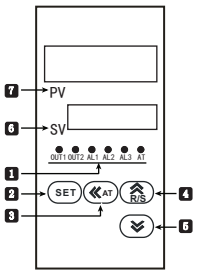
*Pls indicate the requirement when choose the model.

### 3. Isolation diagram




"// ": Isolation
Note: When the auxiliary power supply between (Ⅰ) & (Ⅱ) is used as the power supply for external sensor, if the sensor is non-isolated, it does not isolate.

## VI. Panel Illustration



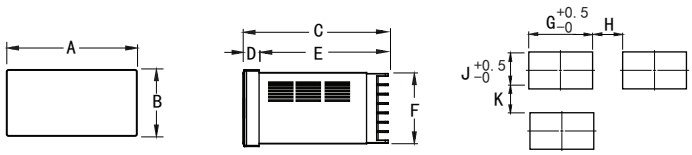

| No. | Symbol | Name | Function |
|---|---|---|---|
| 1 | OUT1 | OUT1 indicator light (red)* | Main control output indicator light, it is on when there is output. |
| | OUT2 | OUT2 indicator light (red)* | Cooling output indicator light, it is on when there is output. |
| | AL1 | Alarm1# indicator light (red) | 1st alarm output indicator light, it is on when there is alarm output, it is off when there is no output. |
| | AL2 | Alarm2# indicator light (red) | 2nd alarm output indicator light, it is on when there is alarm output, it is off when there is no output. |
| | AL3 | Alarm3# indicator light | AL3: this product does not have this function. |
| | AT | AT indicator light (green) | Auto tune indicator light, it is on when the meter is auto tuning. |
| 2 | SET | SET function key | Menu key/confirm key, to enter or exit the modification mode, or confirm and save the modified parameter. |
| 3 | ≪AT | Shift /AT key | Activate key/ shift key/ AT auto tune key (in measure and control mode, long press to enter/exit auto tune) |
| 4 | R/S | Increase key/ R/S | Increase key, in measure and control mode, long press it to shift RUN/STOP mode, or check the menu in reverse order. |
| 5 | ≫ | Decrease key | Decrease key, check the menu in sequence, long press to enter program menu. |
| 6 | SV | Display window (green) | Set value / parameter display window, the control is stopped when it displays “STOP” . |
| 7 | PV | Display window (red) | Measured value/ parameter code display window |

*: Size “3” light is green color.



## V. Dimension and installation size ( unit: mm)

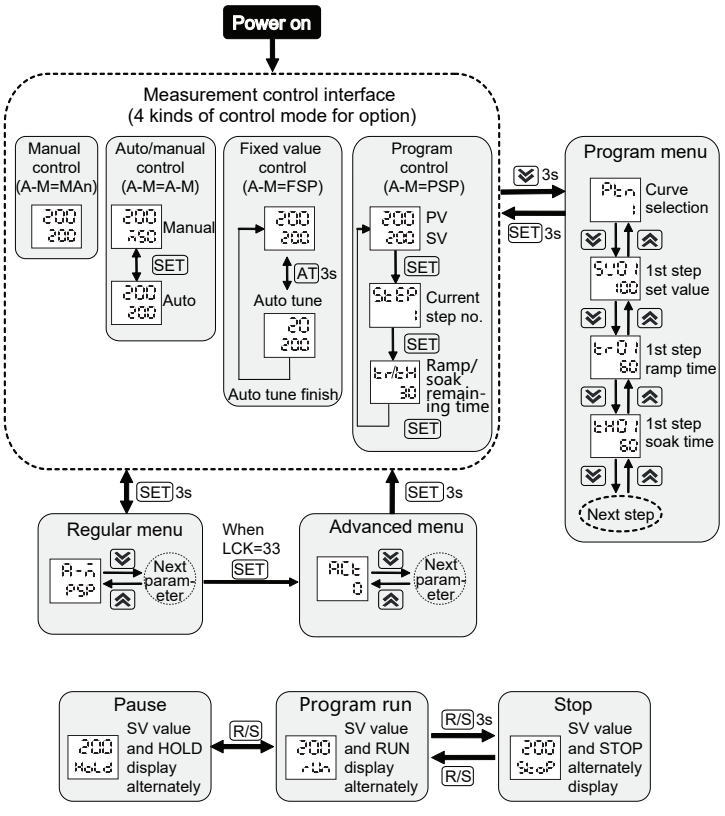
Front size　　Side size　　Hole size




| Model | A | B | C | D | E | F | G | H(Min) | J | K(Min) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3:(72*36) | 72 | 36 | 70.5 | 6.5 | 64 | 32 | 68 | 25 | 33 | 25 |
| 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 |
| 8:(48*96) | 96 | 48 | 97.5 | 9 | 88.5 | 44.5 | 92 | 25 | 45 | 25 |
| 9:(96*96) | 96 | 96 | 97.5 | 9 | 88.5 | 91.5 | 92 | 25 | 92 | 25 |
| 80:(160*80) | 160 | 80 | 96 | 13 | 83 | 75.5 | 155.5 | 30 | 76 | 30 |



## VI. Operation Process & Menu






## Regular Menu

:Parameters will keep displaying all the time for all models and all control modes.
:Parameters will be hided based on models and control modes.

| No. | Sym-bol | Name | Illustration | Setting Range | Factory set |
|---|---|---|---|---|---|
| 1 | A-M | A-M | Auto/manual control mode | PSP: auto program control<br>FSP: auto fixed value control<br>MAn: manual control<br>A-M: auto/manual control | PSP |
| 2 | PoM | POM | Running mode after power on, this parameter become effective only when A-M is set as PSP | PVSt: start from PV<br>rSt: start from 1st step<br>run: start from power failure<br>HoLd: keep the temperature before power off<br>StoP: stop running(ouput close) | rst |
| 3 | AL1 | AL1 | 1st alarm set value | FL~FH | 10 |
| 4 | AL2 | AL2 | 2nd alarm set value | FL~FH | 5 |
| 5 | HY1 | HY1 | 1st alarm hysteresis value | 0~1000 | 1 |
| 6 | HY2 | HY2 | 2nd alarm hysteresis value | 0~1000 | 1 |
| 7 | Ad1 | AD1 | 1st alarm mode, pls refer to alarm logic diagram (page13) | 0~12 | 3 |
| 8 | Ad2 | AD2 | 2nd alarm mode, pls refer to alarm logic diagram (page13) | 0~6 | 4 |
| 9 | PS | PS | Amend value | -1999~9999 | 0 |
| 10 | inP | INP | Input signal type | Refer to signal table(page3) | K |
| 11 | ot | OT | Control mode<br>0: ON/OFF heating control<br>1: PID heating control<br>2: N/M 3: N/M<br>4: ON/OFF cooling control<br>5: PID cooling control | 0~5 | 1 |
| 12 | P | P | Proportional band, note: when the input type is switched between TC and RTD,the P value need to be modified manually. Eg.:when INP is changed from K to PT100, P=30 should be modified to P=300;when INP is changed from PT100 to K, P=300 should be modified to P=30. | 1~9999 | 30 |
| 13 | I | I | Integral time | 0~9999 | 120 |
| 14 | d | D | Differential time | 0~9999 | 30 |
| 15 | CP | CP | Control cycle, unit: second | 1~200 | 20 |
| 16 | db | DB | On-off control hysteresis,note:when the input type is switched between TC and RTD, the processing mode is same as proportional band. | 0~1000 | 5 |
| 17 | LCK | LCK | Lock function. 0001:SV value can’t be modified. 0010: menu setting value only can be checked, can’t be modified. 0033: can enter to advanced menu. 0123: menus reset to factory setting. | 0~9999 | 0 |

Advanced Menu

| No. | Sym-bol | Name | Illustration | Setting Range | Factory set |
|---|---|---|---|---|---|
| 18 | ACt | ACT | Control output mode. 0:relay/SSR output. 1:SSR output(only for TEP3). 2: 4~20mA control output. Note: for TEP3, TEP4, TEP7, ACT set as 3, 4~20mA can be changed to analog output. | 0~2 (0~3) | 0 |
| 19 | AE 1 | AE1 | 1st alarm extension,refer to table page 14. | 0~5 | 0 |
| 20 | AE2 | AE2 | 2nd alarm extension,refer to table page 14. | 0~5 | 0 |
| 21 | dP | DP | Decimal point. TC has no decimal place, RTD has one decimal place, decimal place of linear signal can be set freely. | 0~3 | 0 |
| 22 | Ft | FT | Filter coefficient, the higher of the value , the stronger of filter function. | 0~255 | 10 |
| 23 | dtr | DTR | PV fuzzy tracking value, it can get a stable control display value in some status. Note: when the alarm set value is near to SV value, may happen that the alarm value is not completely equal to display value( as the operation of alarm output is subject to actual measured value).Set it as 0 to close this function. Temperature unit ℃/℉. | 0.0~2.0 (0~20) | 1.0 (10) |
| 24 | Ut | UT | Temperature unit: ℃/℉ | ℃/℉ | ℃ |
| 25 | FL | FL | Measure range low limit, this parameter must be less than FL. | Refer to signal table | -50 |
| 26 | FH | FH | Measure range high limit, this parameter must be greater than FH. | Refer to signal table | 1200 |
| 27 | brL | BRL | Analog range low limit, when it is greater than BRH, the analog output is reserve analog. | FL~FH | -50 |
| 28 | brH | BRH | Analog range high limit, when it is less than BRL, the analog output is reserve analog. | FL~FH | 1200 |
| 29 | oLL | OLL | Control output low limit, this parameter must be less than OLH. | -5.0~100.0 | 0.0 |
| 30 | oLH | OLH | Control output high limit, this parameter must be less than OLL. | 0.0~105.0 | 100.0 |
| 31 | SFo | SFO | Soft-start output limit, when PV is lower than SFT,this parameter will limit the meter control output power to its setting range. | 0.0~100.0 | 100.0 |
| 32 | SFt | SFT | Soft-start temperature threshold,when PV is lower than temperature SV of this parameter, it will limit the control output power. | -1999~9999 | 0 |
| 33 | Sno | SMO | Curve turning point smoothing coefficient, if the tmperature is overshoot because of short heating time and great heating amplitude of the termperature control curve, properly set this parameter to smooth the cureve turning point, so as to decrease the temperature overshoot. Note: if TR(ramp remaining time) =0, but SV value still don't reach soak step temperature, it's normal. | 0~100 | 0 |
| 34 | GSt | GSK | Soak time temperature range, if the curve runs to soak step, only when PV value is withing SV±GSK, the soak time will be counted, otherwise, it won't be counted. | 0~9999 | 50 |



Continue

| | | | | | |
|---|---|---|---|---|---|
| 35 | PdC | PDC | Control algorithm selection, FUZ: fuzzy algorithm STD: standard algorithm | FUZ/STD | FUZ |
| 36 | bAd | BAD | Communication baud rate | 4.8K/9.6K | 9.6K |
| 37 | Add | ADD | Communication address | 1~247 | 1 |
| 38 | dtC | DTC | Communication delay time, for detailed explanation, refer to page 22 | 0~29 | 0 |
| 39 | Prty | PRTY | Check bit: NO: no check, EVEN: even parity check odd: oll parity check | NO/EVEN/odd | NO |
| 40 | CAE | CAE | User self-calibration function, used for the calibration of non-temperature signal. YES: enable. NO: use factory set. | YES/NO | NO |
| 41 | CAL | CAL | User self-calibrate low limit input. Input a low-limit signal to the signal terminal and flash YES to activate the calibration, after the confirmationit it will display OK, then the signal low limit calibration is finished. | YES/OK | YES |
| 42 | CAH | CAH | User self-calibrate high limit input. Input a high-limit signal to the signal terminal and flash YES to activate the calibration, after the confirmationit it will display OK, then the signal high limit calibration is finished. | YES/OK | YES |
| 43 | VEr | VER | Software version | - - | - - |

Program menu

| No. | Sym-bol | Name | Illustration | Setting Range | Factory set |
|---|---|---|---|---|---|
| 44 | Ptn | PTN | Temperature control curve selection, for example,in the whole program menu,there are three THxx set as STOP or RPT,so the curve total no. is 3, and the setting range of PTN is 1~3. | 1~ curve total no. | 1 |
| 45 | SV01 | SV01 | 1st step set value | FL~FH | 0 |
| 46 | tr01 | TR01 | 1st step ramp time (minute) | 0~9999 | 0 |
| 47 | tH01 | TH01 | 1st step soak time (minute). HoLd: the curve pauses. StoP:the curve stops. RPT: the curve repeats. | 0~9999, HoLd/StoP/ RPT | 0 |
| | | | 2nd ~ 15th steps same as above | | |
| 48 | SV16 | SV16 | 16th step set value | FL~FH | 0 |
| 49 | tr16 | TR16 | 16th step ramp time (minute) | 0~9999 | 0 |
| 50 | tH16 | TH16 | 16th step end method | StoP/RPT | StoP |



## VII. Programing

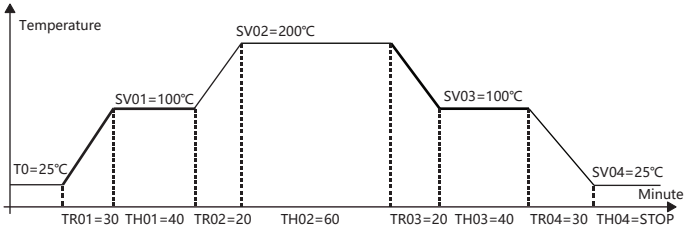
When THxx=STOP or RPT, it means the end point of a curve. The next step of the last curve's end point is the starting point of the next curve. STOP means that at this point the curve will stop runing and output shut-down, RPT means that at this point the curve will repeat again from the starting point of the curve. When THxx=HOLD, it means the curve will automatically enter the pause mode (soak and stop counting time), but it is not taken as the end point of the curve.

| PTN | SV01 | SV02 | SV03 | SV04 | SV05 | SV06 | SV07 | SV08 | SV09 | SV10 | SV11 | SV12 | SV13 | SV14 | SV15 | SV16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 100 | 200 | 100 | 25 | 100 | 200 | 800 | 1000 | 200 | 50 | 100 | 200 | 500 | 1000 | 900 | 100 |
| | TR01 | TR02 | TR03 | TR04 | TR05 | TR06 | TR07 | TR08 | TR09 | TR10 | TR11 | TR12 | TR13 | TR14 | TR15 | TR16 |
| | 30 | 20 | 20 | 30 | 30 | 20 | 40 | 30 | 50 | 40 | 30 | 30 | 100 | 30 | 30 | 30 |
| | TH01 | TH02 | TH03 | TH04 | TH05 | TH06 | TH07 | TH08 | TH09 | TH10 | TH11 | TH12 | TH13 | TH14 | TH15 | TH16 |
| | 40 | 60 | 40 | STOP | 40 | 60 | 100 | 100 | 100 | RPT | 60 | 90 | HOLD | 60 | 60 | RPT |

In this program table, there are 3 THxx set as STOP or RPT, TH04=STOP, TH10=RPT, TH16=RPT. The program automatically generates 3 curves. The starting point and end point of each curve are respectively as follows:
Curve 1: run from 1st step to 4th step, and stop running.
Curve 2: run from 5th step to 10th step, and repeat.
Curve 3: run from 11th step to 16th step, and repeat.
PTN=3 means choosing curve 3 as running curve.
Note: after the setting of the program menu, under the control interface, need to reset once (keep pressing R/S key until it displays STOP, and then click R/S key again to activate).

Process curve (starting temperature 25℃)
1. Choose curve 1 (the program starts from 1st step to 4th and stop). PTN=1;
2. STEP1: use 30 minutes to raise the temperature to 100℃ and hold it for 40 minutes. SV01=100, TR01=30, TH01=40;
3. STEP2: use 20 minutes to raise the temperature to 200℃ and hold it for 60 minutes. SV02=200, TR02=20, TH02=60;
4. STEP3: use 20 minutes to lower the temperature to 100℃ and hold it for 40 minutes. SV03=100, TR03=20, TH03=40;
5. STEP4: use 30 minutes to lower the temperature to 25℃ and stop running. SV04=25,TR04=30,TH04=STOP;

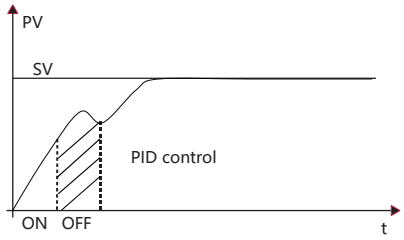





Note: cooling rate of the curve can' t be faster than the natural cooling rate of the controlled object.

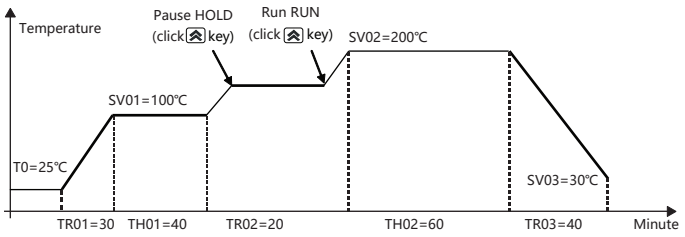
## VIII. Important function operation

①Auto tune

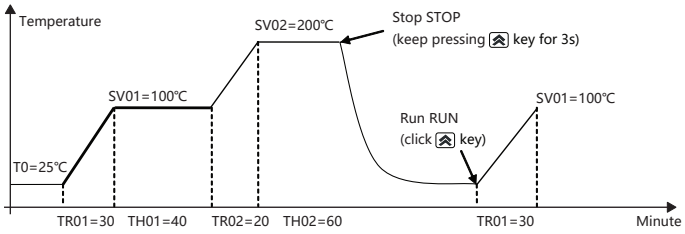



Operation steps:
①Set Paramtere A-M as FSP to enter fixed value control.
②Make sure PV value<1/2 SV value.
③Keep pressing AT key to make AT light turn on.
④The system will automatically enter into auto tune, curve as shown on the left.
⑤AT light turns off, auto tune finishes, the meter will automatically enter PID control.
⑥Set parameter A-M as PSP to resume program control.

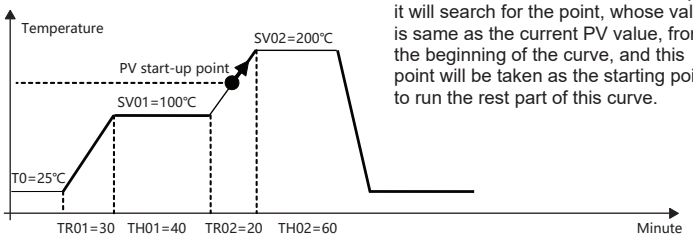
②Pause • run




③Stop • run




④Measured value start-up



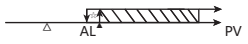
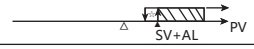
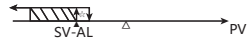
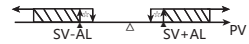
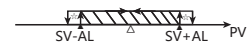

When PoM = PVSt, after the start-up, it will search for the point, whose value is same as the current PV value, from the beginning of the curve, and this point will be taken as the starting point to run the rest part of this curve.

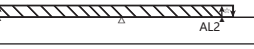
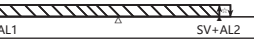
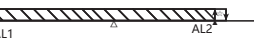
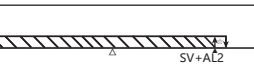
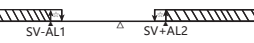


## IX. Alarm Function

(1) Alarm parameter and output logic diagram:

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

| No. | Type | Alarm output(AL1,AL2 is independent of each other) Image: the hatched section means the alarm action. |
|---|---|---|
| 1 | High limit absolute value alarm |  |
| 2 | Low limit absolute value alarm |  |
| 3 | ※High limit deviation value alarm |  |
| 4 | ※Low limit deviation value alarm |  |
| 5 | ※High/low limit deviation value alarm |  |
| 6 | ※High/low limit interval value alarm |  |

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

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

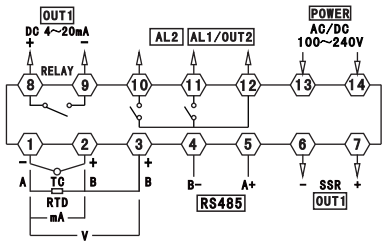


(2) Alarm extension function table

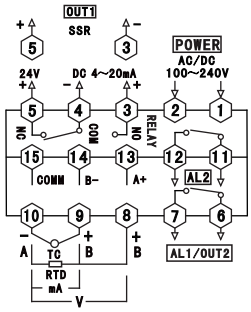
| AE1/AE2 value | Alarm handling mode when it displays HHHH/LLLL | Alarm handling mode when power on |
|---|---|---|
| 0 | Alarm status remain unchanged | Power on alarm non-restraining (As long as it meets the alarm condition, alarm output immediately) |
| 1 | Force alarm output | |
| 2 | Force alarm close | |
| 3 | Alarm status remain unchanged | Power on alarm restraining (After power on, before the PV value reach the SV value for the first time, force alarm close, after that alarm work normally) |
| 4 | Force alarm output | |
| 5 | Force alarm close | |

## X. Connections

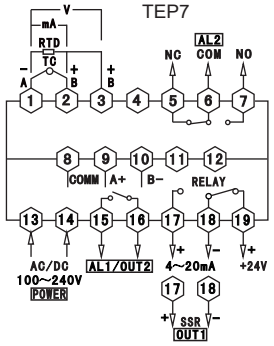
TEP3



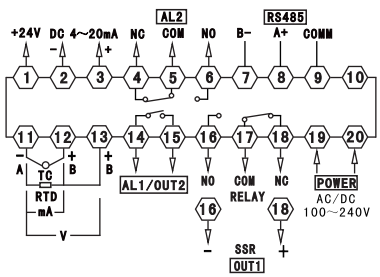

TEP4




TEP7

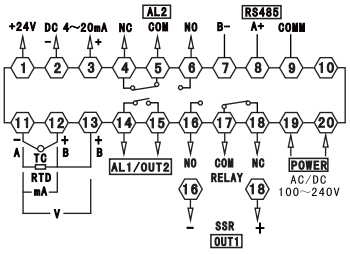



TEP6

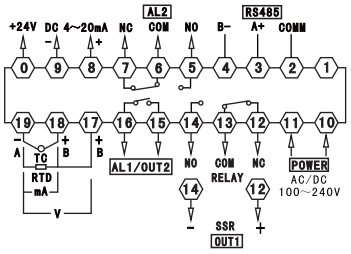




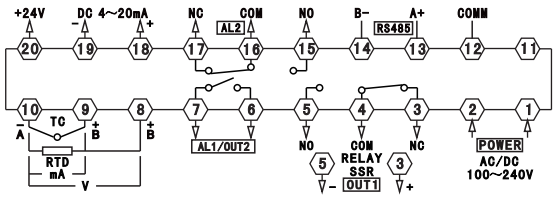

TEP8




TEP9




TEP80




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

## XI. Checking methods of simple fault

| Display | Checking methods |
|---|---|
| LLLL/HHHH | Checks whether the input disconnection and whether normal of FH value,FL value,working environment temperature and whether input signal is selected correctly. |

## XII. Communication procotol

Meter adoptS RS485 Modbus RTU communication protocol, RS485 half duplex communication. Read function code 0x03, write function code 0x10/0x06. Adopt 16 digit CRC check, the meter does not return for error check. Data type adopts short, data transmission order is that high bit in front, low bit behind, pls check the example for details.

Data frame format:

| Start bit | Data bit | Stop bit | Check bit |
|---|---|---|---|
| 1 | 8 | 1 | No |

Abnormal communication processing :
When abnormal response，put 1 on the highest bit of function code. For example: Host request function code 0x03,and slave response function code should be 0x83.

Error code:
0x01---Illegal function: the function code sent from host is not supported by meter.
0x02---Illegal address: the register address designated by host beyond the address range of meter.
0x03---Illegal data: Date value sent from host exceeds the corresponding data range of meter.

Communication cycle：
Communication cycle is the time from host request to slave response data.
ie: communication cycle= time of request data sending +slave preparation time + response delay time + response return time. Eg:9600 Baud rate:communication cycle of single measured data ≥250ms.



1、Read register
For example:Host reads integer SV(set value 200)
The address code of SV is 0x2003, because SV is integer(2 dyte), seizes 1data register. The memory code of decimal integer 200 is 0x00C8.
Note:It should read DP value or confirm DP menu value first to ensure the decimal point postion when reading data,and converse the reading data to get the actual value. On the contrary ,it should converse the data to corresponding ratio first before writing the data into meter.

| Host request（Read multi-register） | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Meter ADD | Function code | Start ADD High bit | Start ADD Low bit | Data byte length high bit | Data byte length low bit | ※CRC code low bit | ※CRC code high bit |
| 0x01 | 0x03 | 0x20 | 0x03 | 0x00 | 0x01 | 0x7F | 0xCA |

| Slave normal answer(Read multi-register) | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Meter ADD | Function code | Data byte number | Data high bit | Data low bit | ※CRC code low bit | ※CRC code high bit |
| 0x01 | 0x03 | 0x02 | 0x00 | 0xC8 | 0xB9 | 0xD2 |

| slave abnormal answer(Read multi-register) | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| Meter ADD | Function code | Error code | ※CRC code low bit | ※CRC code high bit |
| 0x01 | 0x83 | 0x02 | 0xC0 | 0xF1 |

2、Write multi-register

For example:Host use 0x10 function code write SV （setting value 150）ADD code of SV is 0x2000, because SV is integer(2 dyte), seizes 1 data register. The hexadecimal code of 150 is 0x0096.

| Host request（write multi-register） | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Meter ADD | Func-tion code | Start ADD High bit | Start ADD Low bit | Data byte length high bit | Data byte length low bit | Data byte length | Data high bit | Data low bit | ※CRC code low bit | ※CRC code high bit |
| 0x01 | 0x10 | 0x20 | 0x03 | 0x00 | 0x01 | 0x02 | 0x00 | 0x96 | 0x07 | 0xCF |



| Slave normal answer (write multi-register) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Meter ADD | Function code | Start ADD High bit | Start ADD Low bit | Data byte length high bit | Data byte length low bit | ※CRC code low bit | ※CRC code high bit |
| 0x01 | 0x10 | 0x20 | 0x03 | 0x00 | 0x01 | 0xFA | 0x09 |

3、Write single-register
For example: Host use 0x06 function code write SV (setting value 150)

| Host request（write single-register） | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Meter ADD | Function code | ADD High bit | ADD Low bit | Data high bit | Data low bit | ※CRC code low bit | ※CRC code high bit |
| 0x01 | 0x06 | 0x20 | 0x03 | 0x00 | 0x96 | 0xF2 | 0x64 |
| Slave normal answer(write single-register) | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Meter ADD | Function code | ADD High bit | ADD Low bit | Data high bit | Data low bit | ※CRC code low bit | ※CRC code high bit |
| 0x01 | 0x06 | 0x20 | 0x03 | 0x00 | 0x96 | 0xF2 | 0x64 |

| Slave abnormal answer(write single-register) | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| Meter ADD | Function code | Error code | ※CRC code low bit | ※CRC code high bit |
| 0x01 | 0x86 | 0x02 | 0xC3 | 0xA1 |



Parameters reflection address

| No. | Add reflection | Name | Illustration | Read /write | Remark |
|---|---|---|---|---|---|
| 1 | 0x2000 | PV | Measured value | R | In concert with DP value to read data |
| 2 | 0x2001 | STA | Output state | R | Refer to note① |
| 3 | 0x2002 | MV | Output | R/W | |
| 4 | 0x2003 | SV | Set value | R/W | When it is program control, the read SV is the set value of the current program; the written SV is the set value of fixed value control. |
| 5 | 0x2004 | RSA | Running state setting | R/W | Run(0); stop(2); pause(1); auto tune(3); |
| 6 | 0x2005 | A-M | Auto/manual mode | R/W | Program control(-1); Fixed value control(0); Manual control(1); Manual/ auto key switch(2); |
| 7 | 0x2006 | STEP | Current step no. of the curve | R | |
| 8 | 0x2007 | TR | Ramp remainning time | R | |
| 9 | 0x2008 | TH | Soak remainning time | R | |
| Reserve | | | | | |
| 10 | 0x2010 | INP | Signal type | R/W | |
| 11 | 0x2011 | FL | Range low limit | R/W | In concert with DP value to read data |
| 12 | 0x2012 | FH | Range high limit | R/W | In concert with DP value to read data |
| 13 | 0x2013 | DP | Decimal point | R/W | |
| 14 | 0x2014 | UT | Unit of temperature | R/W | ℃(25)/℉(26) |
| 15 | 0x2015 | PS | Amend value | R/W | |
| 16 | 0x2016 | FT | Filter coefficient | R/W | |
| 17 | 0x2017 | DTR | PV fuzzy tracking value | R/W | 0.0~2.0(0~20) |
| Reserve | | | | | |
| 18 | 0x2020 | AL1 | 1st alarm set value | R/W | |
| 19 | 0x2021 | AL2 | 2nd alarm set value | R/W | Pay attention to add jump |
| 20 | 0x2024 | HY1 | 1st alarm hysteresis, value | R/W | |
| 21 | 0x2025 | HY2 | 2nd alarm hysteresis, value | R/W | Pay attention to add jump |

| | | | | | |
|---|---|---|---|---|---|
| Reserve | | | | | |
| 22 | 0x2028 | AD1 | 1st alarm mode | R/W | |
| 23 | 0x2029 | AD2 | 2nd alarm mode | R/W | Pay attention to add jump |
| 24 | 0x202C | AE1 | 1st alarm extended function | R/W | |
| 25 | 0x202D | AE2 | 2nd alarm extended function | R/W | |
| Reserve | | | | | |
| 26 | 0x2040 | POM | Running mode after power on | R/W | PVST(-2); RST(-1); RUN(0); HOLD(1); STOP(2); |
| 27 | 0x2041 | OT | Control mode | R/W | |
| 28 | 0x2042 | ACT | Control output mode | R/W | |
| 29 | 0x2043 | PDC | PID algorithm | R/W | 0：Fuz;　1：Std |
| 30 | 0x2045 | P | Proportional coefficient | R/W | |
| 31 | 0x2046 | I | Integral time | R/W | |
| 32 | 0x2047 | D | Differential time | R/W | |
| 33 | 0x2048 | CP | Control cycle | R/W | |
| 34 | 0x2049 | DB | On-off control hysteresis | R/W | |
| 35 | 0x204A | OLL | Control output low limit | R/W | Default with 1 decimal place |
| 36 | 0x204B | OLH | Control output high limit | R/W | Default with 1 decimal place |
| 37 | 0x204D | BRL | Analog range low limit | R/W | In concert with DP value to read data |
| 38 | 0x204E | BRH | Analog range high limit | R/W | In concert with DP value to read data |
| 39 | 0x2052 | SFO | Soft-start output limit | R/W | |
| 40 | 0x2053 | SFT | Soft-start temperature threshold | R/W | |
| 41 | 0x2054 | SMO | Curve turning point smoothing coefficient | R/W | |
| 42 | 0x2055 | GSK | Soak time temperature range | R/W | |
| Reserve | | | | | |
| 43 | 0x2060 | PTN | Temperature control curve selection | R/W | Pay attention to add jump |
| 44 | 0x2062 | SV01 | 1st step set value | R/W | |
| 45 | 0x2063 | TR01 | 1st step ramp time | R/W | |
| 46 | 0x2064 | TH01 | 1st step soak time | R/W | -1:HOLD;-2:STOP; -3:RPT |
| 47 | 0x2065 | SV02 | 2nd step set value | R/W | |
| 48 | 0x2066 | TR02 | 2nd step ramp time | R/W | |
| 49 | 0x2067 | TH02 | 2nd step soak time | R/W | Function similar to TH01 |



| | | | | | |
|---|---|---|---|---|---|
| 50 | 0x2068 | SV03 | 3rd step set value | R/W | |
| 51 | 0x2069 | TR03 | 3rd step ramp time | R/W | |
| 52 | 0x206A | TH03 | 3rd step soak time | R/W | Function similar to TH01 |
| 53 | 0x206B | SV04 | 4th step set value | R/W | |
| 54 | 0x206C | TR04 | 4th step ramp time | R/W | |
| 55 | 0x206D | TH04 | 4th step soak time | R/W | Function similar to TH01 |
| 56 | 0x206E | SV05 | 5th step set value | R/W | |
| 57 | 0x206F | TR05 | 5th step ramp time | R/W | |
| 58 | 0x2070 | TH05 | 5th step soak time | R/W | Function similar to TH01 |
| 59 | 0x2071 | SV06 | 6th step set value | R/W | |
| 60 | 0x2072 | TR06 | 6th step ramp time | R/W | |
| 61 | 0x2073 | TH06 | 6th step soak time | R/W | Function similar to TH01 |
| 62 | 0x2074 | SV07 | 7th step set value | R/W | |
| 63 | 0x2075 | TR07 | 7th step ramp time | R/W | |
| 64 | 0x2076 | TH07 | 7th step soak time | R/W | Function similar to TH01 |
| 65 | 0x2077 | SV08 | 8th step set value | R/W | |
| 66 | 0x2078 | TR08 | 8th step ramp time | R/W | |
| 67 | 0x2079 | TH08 | 8th step soak time | R/W | Function similar to TH01 |
| 68 | 0x207A | SV09 | 9th step set value | R/W | |
| 69 | 0x207B | TR09 | 9th step ramp time | R/W | |
| 70 | 0x207C | TH09 | 9th step soak time | R/W | Function similar to TH01 |
| 71 | 0x207D | SV10 | 10th step set value | R/W | |
| 72 | 0x207E | TR10 | 10th step ramp time | R/W | |
| 73 | 0x207F | TH10 | 10th step soak time | R/W | Function similar to TH01 |
| 74 | 0x2080 | SV11 | 11th step set value | R/W | |
| 75 | 0x2081 | TR11 | 11th step ramp time | R/W | |
| 76 | 0x2082 | TH11 | 11th step soak time | R/W | Function similar to TH01 |
| 77 | 0x2083 | SV12 | 12th step set value | R/W | |
| 78 | 0x2084 | TR12 | 12th step ramp time | R/W | |
| 79 | 0x2085 | TH12 | 12th step soak time | R/W | Function similar to TH01 |
| 80 | 0x2086 | SV13 | 13th step set value | R/W | |



| | | | | | |
|---|---|---|---|---|---|
| 81 | 0x2087 | TR13 | 13th step ramp time | R/W | |
| 82 | 0x2088 | TH13 | 13th step soak time | R/W | Function similar to TH01 |
| 83 | 0x2089 | SV14 | 14th step set value | R/W | |
| 84 | 0x208A | TR14 | 14th step ramp time | R/W | |
| 85 | 0x208B | TH14 | 14th step soak time | R/W | Function similar to TH01 |
| 86 | 0x208C | SV15 | 15th step set value | R/W | |
| 87 | 0x208D | TR15 | 15th step ramp time | R/W | |
| 88 | 0x208E | TH15 | 15th step soak time | R/W | Function similar to TH01 |
| 89 | 0x208F | SV16 | 16th step set value | R/W | |
| 90 | 0x2090 | TR16 | 16th step ramp time | R/W | |
| 91 | 0x2091 | TH16 | 16th step soak time | R/W | -2:STOP;　-3:RPT |
| Reserve | | | | | |
| 92 | 0x2FF0 | ADD | Communication add | R/W | |
| 93 | 0x2FF1 | BAD | Baud rate | R/W | 0：4.8K；　1：9.6K |
| 94 | 0x2FF2 | DTC | Communication delay time | R/W | Refer to note② |
| 95 | 0x2FF3 | PRTY | Parity Check | R/W | 0: no;　1: even parity;<br>2: odd Parity |
| 96 | 0x2FF4 | LCK | Lock | R | |
| 97 | 0x2FF5 | VER | Version | R | |

R：read only;　　R/W: read/write.

Note①：measuring state indication, when data bit=1, it means output; when data bit=0, it meanse no output.

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|
| STOP | HHHH | LLLL | AT | AL2 | AL1 | OUT2 | OUT1 |

Note②: Sequenced transport and response delay of DTC communication data

DTC：□ □ □ — Response delay: 0 ~ 9 means 10 ~ 100ms
　　└── Sequenced transport of byte: 0: high byte in front, low byte behind;
　　　　1: low byte in front, high byte behind
　　└── Reserve

※16 digits CRC check code get C program

```
unsigned int Get_CRC(uchar *pBuf, uchar num)
{
    unsigned i,j;
        unsigned int wCrc = 0xFFFF;
        for(i=0; i<num; i++)
        {
            wCrc ^= (unsigned int)(pBuf[i]);
            for(j=0; j<8; j++)
            {
                if(wCrc & 1){wCrc >>= 1; wCrc ^= 0xA001; }
                else
                    wCrc >>= 1;
            }
        }
    return wCrc;
}
```