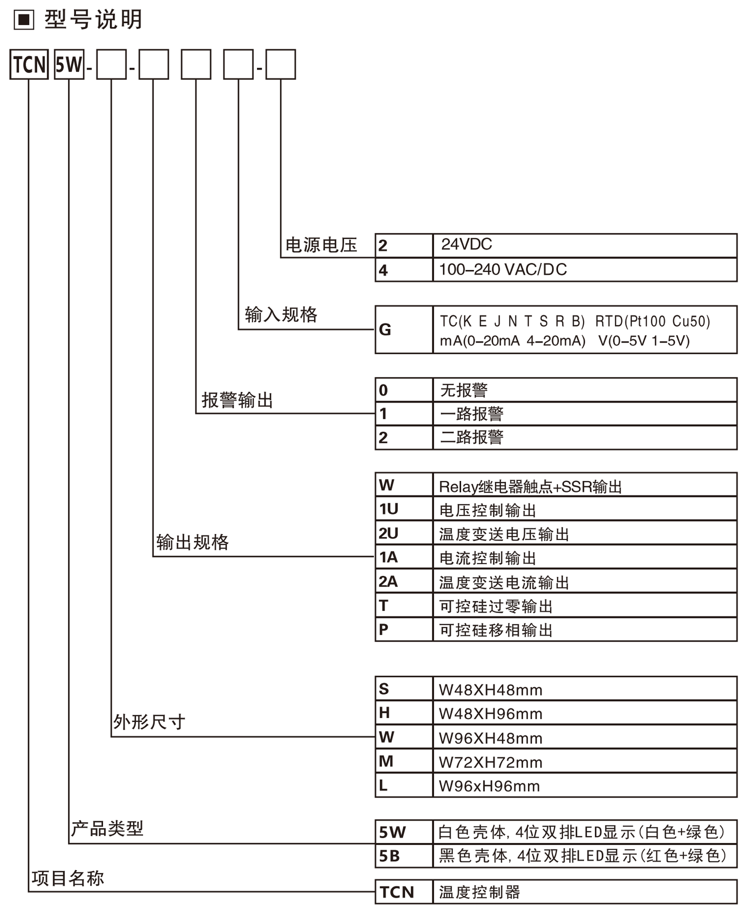
# 数显式PID温度控制器

## TCN5 系列

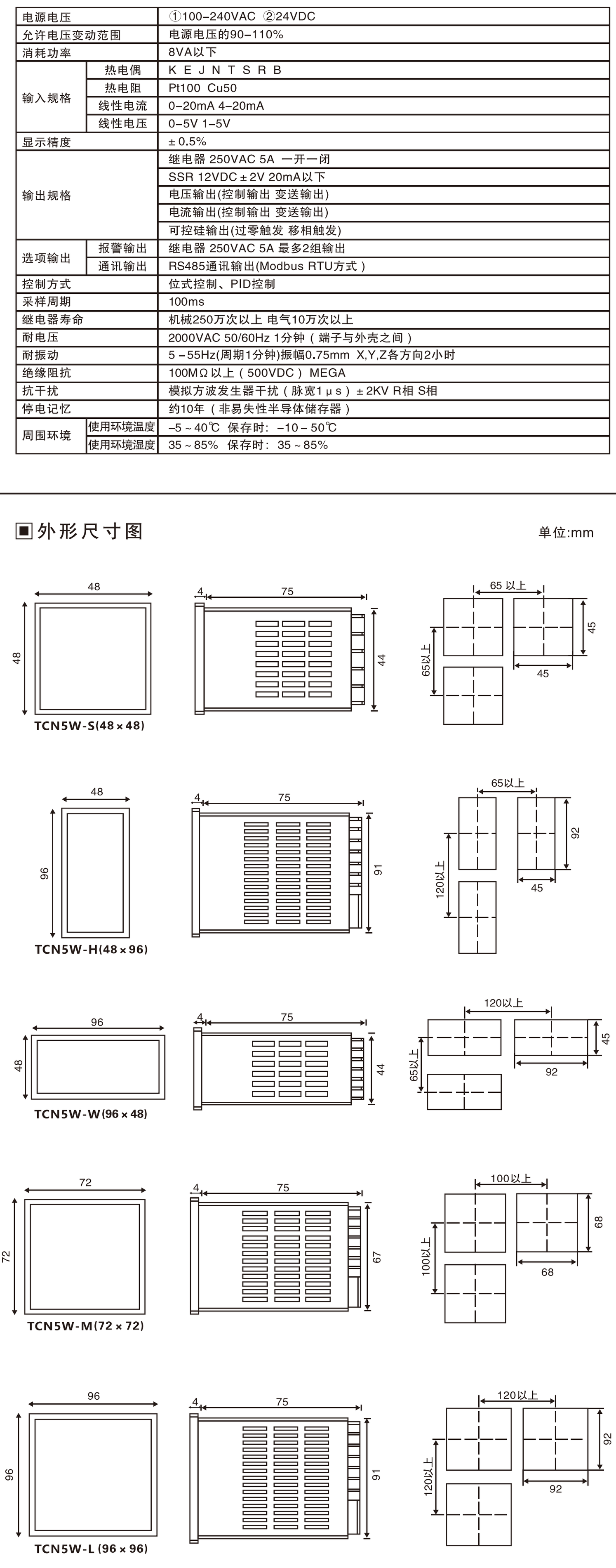
**使 用 说 明 书**

为了您的安全，请在使用前阅读以下内容



| | |
|---|---|
| 5W | 白色壳体，4位双排LED显示(白色+绿色) |
| 5B | 黑色壳体，4位双排LED显示(红色+绿色) |
| TCN | 温度控制器 |

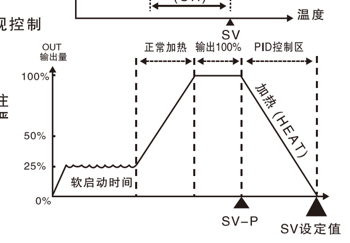
产品类型 / 项目名称





※ 参数间相互关联，请务必按照 "参数组2"→"参数组1"→ "SV设定" 的顺序进行设置。

※ 恢复出厂设置后：1. 所有参数将恢复出厂默认（除 "参数组3" 中的 [bUF]、"参数组2" 中的 [oUt] 参数外）。 2. 输入规格默认为 "订货要求值"。 3. SV设定值恢复为 "100"。





※时间单位为秒。

※仅作用于模拟量输出或移相输出。

3.尽量远离高频设备(高频焊机、高频缝纫机、大容量SCR控制器)

4.本产品在以下环境中使用。

① 室内 ②污染等级2 ③海拔2000m以下 ④安装分类II

※如违反上述注意事项，可能导致产品故障，请务必遵守。

V24.1

# Digital Display PID Temperature Controller

## TCN5 Series

**Manual Instructions**

**Pls read the following safety considerations before use**

## ■ Safety Considerations

※Please observe all safety considerations for safe and proper product operations to avoid hazards.

※Safety considerations are categorized as follows.

⚠Warning Failure to follow these instructions may result in serious injury or death.

⚠Caution Failure to follow these instructions may result in personal injury or product damage.

### ⚠Warning

1. **Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss.(e.g.nuclear power control, medical equipment,ships,vehicles,railways. aircraft,combustion apparatus,safety equipment,crime/disaster prevention devices,etc.)**
   Failure to follow this instruction may result in personal injury,fire,or economic loss.
2. **The unit must be installed on a device panel before use.**
   Failure to follow this instruction may result in electric shock.
3. **Do not connect,repair,or inspect the unit while connected to a power source.**
   Failure to follow this instruction may result in electric shock.
4. **Check the terminal numbers before connecting the power source.**
   Failure to follow this instruction may result in fire.
5. **Do not disassemble or modify the unit,Please contact us if necessary.**
   Failure to follow this instruction may result in electric shock or fire.

### ⚠Caution

1. **Do not use the unit outdoore**
   Failure to follow this instruction may result in shorten the life cycle of the unit,or electric shock.
2. **When connecting the power input and relay output cables,use AWG20( 0.50mm²)cables and make sure to tighten the terminal screw bolt above 0.74N.m to 0.90N.m.**
   Failure to follow this instruction may result in fire due to contact failure.
3. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in shorten the life cycle of the unit or fire.
4. **Do not use loads beyond the rated switching capacity of the relay contact.**
   Failure to follow this instruction may result in insulation failure,contact melt,contact failure,relay broken or fire.
5. **Do not use water or oil-based detergent when cleaning the unit.Use dry cloth to clean the unit.**
   Failure to follow this instruction may result in electric shock or fire.
6. **Do not use the unit where flammable or explosive gas,humidity,direct sunlight,radiant heat, vibrationorimpact may be present.**
   Failure to follow this instruction may result in fire or explosion.
7. **Keep dust and wire residue from flowing into the unit.**
   Failure to follow this instruction may result in fire or product damage.
8. **Check the polarity of the measurement input contact before wiring the temperature sensor.**
   Failure to follow this instruction may result in fire or explosion.
9. **For installing the unit with reinforced insulation,use the power supply unit which basic level is ensured.**

## ■ Model composition

TCN 5W - □ - □ □ □ - □

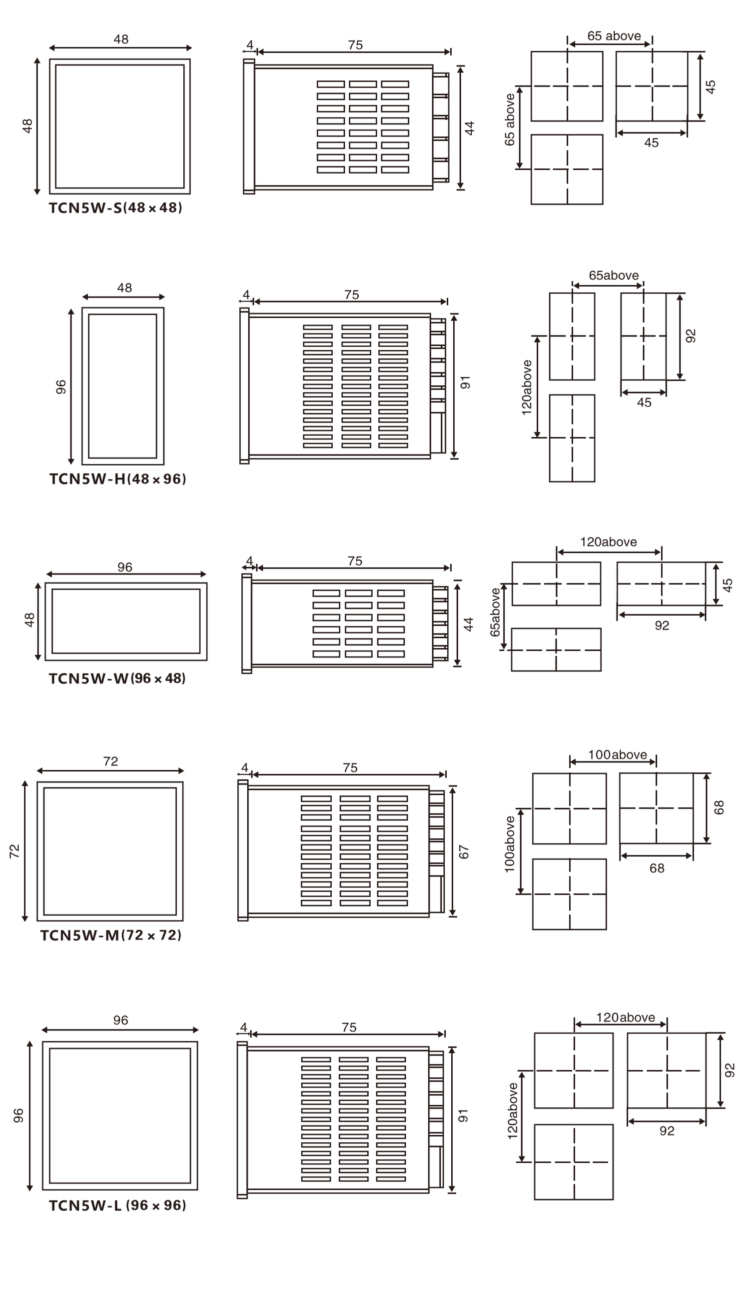
| Item | Code | Description |
|---|---|---|
| Power supply | 2 | 24VDC |
| | 4 | 100–240VAC/DC |
| Input | T/R | Thermocouple (K E J) Thermal resistance (Pt100 Cu50) |
| | A | Linear current (0-20mA 4-20mA) |
| | U | Linear voltage (0-5V 0-10V) |
| | G | TC,RTD,0-20mA,4-20mA,0-5V,0-10V |
| Alarm output | 0 | No alarm |
| | 1 | One alarm |
| | 2 | Two alarms |
| Output | W | Relay contact+SSR output |
| | 1U | Voltage controlled outputut |
| | 2U | Temperature variable voltage output |
| | 1A | Current controlled output |
| | 2A | Temperature variable current output |
| | T | SCR zero–crossing output |
| | P | SCR phase shift output |
| Size | S | W48XH48mm |
| | H | W48XH96mm |
| | W | W96XH48mm |
| | M | W72XH72mm |
| | L | W96xH96mm |
| Product type | 5W | White color housing, LED color white&green |
| | 5B | Black color housing, LED color red&green |
| Item | TCN | Temperature controller |

## ■ Specifications

| | | |
|---|---|---|
| Power supply | | ①100–240VAC ②24VDC |
| Allowable voltage range | | 90–110% of rated voltage |
| Power consumption | | Max.8VA |
| Input specification | TC | K E J N T S R B |
| | RTD | Pt100 Cu50 |
| | Linear current | 0–20mA 4–20mA |
| | Linear voltage | 0–5V 1–5V |
| Display accuracy | | ± 0.5% |
| Output specification | | Relay contact output 250VAC 5A 1NO1NC |
| | | SSR 12VDC ± 2V below 20mA |
| | | Voltage output(control output / variable output ) |
| | | Current output(control output / variable output ) |
| | | Output (zero–crossing output / phase shift output ) |
| Option output | Alarm output | Relay 250VAC 5A Max.two sets of alarm outputs |
| | Com. output | RS485 Communication output(Modbus RTU method) |
| Control method | | ON/OFF position control、PID control |
| Sampling period | | 100ms |
| Relay life cycle | | Mechanical above 2.5 million times, Electrical above 100000 times |
| Dielectric strength | | 2000VAC 50/60Hz for 1min.( between all terminals and case ) |
| Vibration | | 0.75mm amplitude at frequency 5 to 55HZ(for1min.) in eachX,Y,Z direction for 2 hours |
| Insulation resistance | | 100MΩ 以上 ( 500VDC ) MEGA |
| Noise resistance | | Square shaped noise by noise simulator(pulse width 1 u s) 2kV R–phase,S–phase |
| Memory retention | | Approx.10years(non–volatile semiconductor memory type) |
| Environment | Ambient temp. | –5~40C storage:–10–50C |
| | Ambient humi. | 35%~85%RH storage:35~85%RH |

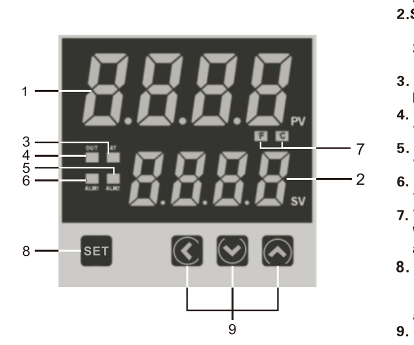
## ■ Dimensions

Unit:mm





## ■ Parts description





**1.Present value (PV) display**
1）RUN mode: Present value(PV) display
2）Parameter setting mode:Parameter display

**2.Set value(SV) display**
1）RUN mode: Set value (SV) display
2）Parameter setting mode:Parameter setting value displav

**3. Auto tuning(AT) indicator**
Flash when the auto–tuning function working

**4. Controloutput(OUT)indicator**
When control output is ON,the light turns ON

**5. Alarm output2 indicator ( ALM2)**
When alarm 2 output is ON,the light turns ON

**6. Alarm output1 indicator ( ALM1)**
When alarm 1 output is ONthe light turns ON

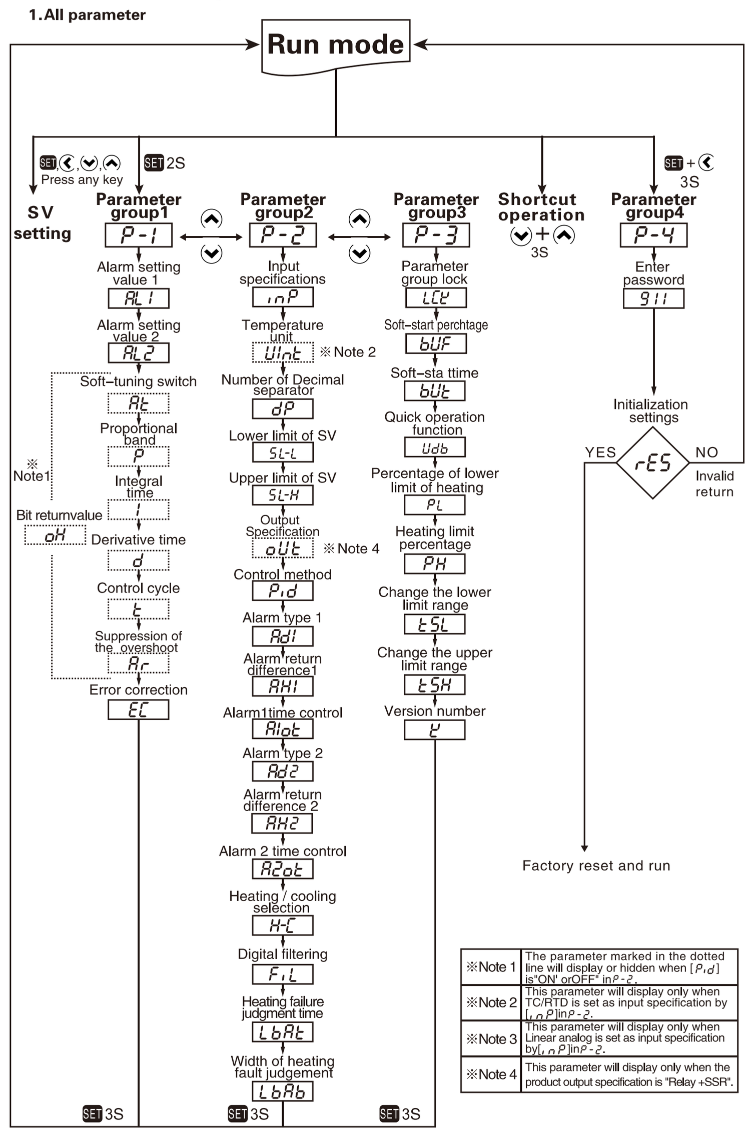
**7. Temperature unit (℃/°F) indicator**
When ℃ indicator lights up , the unit is Celsius and °F indicator lights up ,it is in Fahrenheit

**8. SET key**
Used when entering into parameter setting group returning to RUN mode,turn the parameters down and savina the set values

**9. ◀ ▼ ▲ key**
Used when entering into set value change mode and digit up/down, press and hold the ▼ + ▲ keys for 3s to use the shortcut function

## ■ Parameter Setting

**1.All parameter**





| | |
|---|---|
| ※Note 1 | The parameter marked in the dotted line will display or hidden when [P,d] is"ON' orOFF" inP-2. |
| ※Note 2 | This parameter will display only when TC/RTD is set as input specification by [,nP]inP-2. |
| ※Note 3 | This parameter will display only when Linear analog is set as input specification by[,nP]inP-2. |
| ※Note 4 | This parameter will display only when the product output specification is "Relay +SSR". |

※ In the parameter setting mode, if no key is pressed within 30s, it wil automatically return to the RUN mode and the changed parameters will not be saved.

※ In each parameter group, press SET once to save the set value and go to the next parameter.

※ In each parameter group, press SET for 3s to save the set value and retur to the RUN mode. (In SV setting. press SET only once)

※ The parameters marked by ⬚ may not be displayed depending on the model or other parameter settings

※ When the[,nP],[Unt], and [ dP ]parameters are changed,[ SLL ],[ SLH ],[ AH1 ],[AH2]in "Parameter group 2" ,[ AL1 ],[ AL2 ],[ EC ]in "Parameter group 1" and the "SVsetting value" parameter all will be initialized.

※ Set parameter as "parameter group 2" – "parameter group 1" – "SV setting" order considering parameter relation of each setting group.

※ After Factory reset: 1.All parameters will be restored to factory defaults (except for [bUF] in"Parameter Group 3" and [oUt] in "Parameter Group 2"). 2. The default input specification is "Ordering"Requirement Value". 3. Restore the SV setting to "100".

**2.Parameter group2[P-2]**

| Setting iteml | Parameter | Range | Factory default | Description |
|---|---|---|---|---|
| Input specification | ,nP | See table ofinput specifications and using range | | |
| Temperature unit | Unt | ℃ or °F | ℃ | Set temperature units (℃ or °F) |
| Decimal places | dP | 0～1 | 0 | Decimalplaces |
| Lower limit of SV | SL-L | The minimun lower limit of the corresponding sensor type | | Limit the lower limit of SV |
| SUpper limit of SV | SL-H | The maximum upper limit of the corresponding sensor type | | Limit the upper limit of SV |
| Output Specification | oUt | RLY or SSR | RLY | Output specification selection,RLY for relay output, SSR for SSR output |
| Control Method | P,d | ON or OFF | ON | Control method selection,ON is PID control,OFF is ON/ OFF position control. |
| Alarm Type1 | Ad1 | 00～17 | 1 | 12 kinds of alarm types selection,see the alarm type for details. |
| Alarm Return Difference 1 | AH1 | 0~100 | 1 | The difference required to return to the non–alarm state in the first set of alarm states |
| Alarm 1 time control | A1ot | 0~100 | 1 | = 0 no time function, positive time for delay alarm, negative time for alarm action time, for example = 0005 alarm conditions meet after delay of 5 seconds relay action indicator light operation such as = –005 alarm conditions meet relay action indicator light light, 5 seconds after the relay switch off indicator light off |
| Alarm Type2 | Ad2 | 00~17 | 1 | 12 kinds of alarm types selection,see the alarm type for details. |
| Alarm Return Difference 2 | AH2 | 0~100 | 1 | The difference required to return to the non–alarm state in the second set of alarm states |
| Alarm 2 time control | A2ot | 0~100 | 1 | = 0 no time function, positive time for delay alarm, negative time for alarm action time, for example = 0005 alarm conditions meet delay after 5 seconds relay actio n indicator lights such as = –005 alarm conditions meet relay action indicator ligh ts, after 5 seconds relay off indicator lights |
| Heating/cooling Selection | H-C | HEAT or COOL | HEAT | HEAT is heating mode,COOL is cooling mode. |
| Digital Filter | F,L | 0~200 | 200 | Unit is second, input sampling value filtering period |
| Heating failure judgment time | LbAt | =0 | | No such feature |
| Width of heating fault judgement | LbAb | =2 | | |

※Input specifications and usage range table

| Input Specification | | Display | Decimalplaces | Range of use (℃) | Range of use (°F) |
|---|---|---|---|---|---|
| Therm–ocouple | K | K | 0 | –30～1300 | –22～2372 |
| | | | 1 | –30.0～999.9 | –22.0～999.9 |
| | E | E | 0 | –30～700 | –22～1292 |
| | | | 1 | –30.0～700.0 | –22.0～999.9 |
| | J | J | 0 | –30～900 | –22～1652 |
| | | | 1 | –30.0～900.0 | –22.0～999.9 |
| | N | n | 0 | –30～1000 | –22～1832 |
| | | | 1 | –30.0～999.0 | –22.0～999.9 |
| | T | t | 0 | –30～400 | –22～752 |
| | | | 1 | –30.0～400.0 | –22.0～752.0 |
| | S | S | 0 | 0～1760 | 32～3200 |
| | | | 1 | 0～999.0 | 32.0～999.9 |
| | R | r | 0 | 0～1750 | 32～3182 |
| | | | 1 | 0～999.0 | 32.0～999.9 |
| | B | b | 0 | 200～1800 | 392～3272 |
| | | | 1 | 200.0～999.0 | 392.0～999.9 |
| Thermal resistance | Pt100 | Pt | 0 | –200～650 | –328～1202 |
| | | | 1 | –99.0～650.0 | –99.9～999.9 |
| | Cu50 | CU | 0 | –50~150 | –58~302 |
| | | | 1 | –50.0~150.0 | –58.0~302.0 |

**3.Parameter group 1[P-1]**

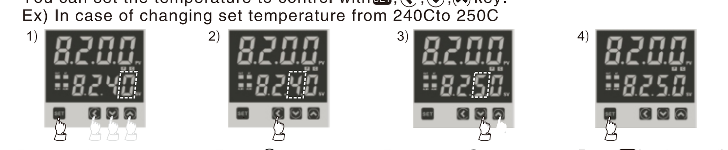
| Setting item | Parameter | Range | Factory default | Description |
|---|---|---|---|---|
| Alarm setting value1 | AL1 | The whole range | 10 | Set alarm1 data. |
| Alarm setting value2 | AL2 | The whole range | 10 | Set alarm2 data. |
| Auto –tuning switch | At | ON or OFF | OFF | ON open auto– tuning OFF close auto– tuning. |
| Proportional band | P | 0.1～999.9 | 30.0 | Proportional band of PID control, the unit is℃recommended by auto– tuning. |
| Integral time | I | 0～9999 | 240 | Integral time ofPID control,the unit is second. recommended by auto– tuning. |
| Derivative time | d | 0～9999 | 60 | Derivative time of PID control the unit is second, recommended by auto– tuning. |
| Control cycle | t | 1～100 | 3 or 20 | PID output control cycle , the recommend edrelay outputis 20 seconds and the SSR outpu tis 2 seconds |
| Suppression of the overshoot | Ar | 1～100 | 100 | Used to suppress PID control overshoot,auxiliary control,recommened by auto– tuning |
| Position backtracking control | oH | 1～999 | 2 | Set the interval between on and off for control(this parameter is displayed only in bit control) |
| Position backtracking control | oHF | 1～999 | 0 | Overtime:PV<SV–OH opens output PV > SV+OHF Turn off output |
| Error correction | EC | –99~999 | 0 | Error correction of display temperature |

**4.Parameter group 3[P-3]**

| Setting item | Parameter | Range | Factory default | Description |
|---|---|---|---|---|
| Parameter group lock | LCK | 0 1 2 3 4 | 0 | 0 Unlok<br>1 Lock parameter group3<br>2 Lock parameter group3,parameter group2<br>3 Lock parameter group3,parameter group2, parameter group1<br>4 Lock parameter group3,parameter group2, parameter group1,SV setting |
| Soft–start perchtage | bUF | 0~100% | 100 | |
| Soft–sta ttime | bUt | | 0 | According to the needs of power–on after the first BUF perc entage heating BUT time, unit seconds = 0 no soft start |
| Quick operation function | Udb | | OFF | At the same time press the add and subtract key more than 3 seconds to achieve the shortcut key work<br>OFF Has no features<br>OUT Turns heating on and off, and the next row displays STOP when heating is turned off<br>AT Key to start or stop self–tuning<br>AL1 Button opens or closes alarm 1<br>AL2 Button turns alarm 2 on or off |
| Percentage of lower limit of heating | PL | | 0 | |
| Heating limit percentage | PH | | 100 | |
| Change the lower limit range | tSL | 0.0---30.0% | 0 | |
| Change the upper limit range | tSH | 3.0---100.0% | 1372 | |
| Version number | V | | | |

**5.SV setting**

You can set the temperature to control with SET, ◀, ▼, ▲ key.
Ex) In case of changing set temperature from 240Cto 250C





1) Press any key among SET, ◀, ▼, ▲,keyin RUN mode. the right digit as SV display flashes and it enters to SV setting group.
2) Press ◀ key to move the desired digit.
3) Press ▼or ▲ key to move the desired number.
4) Press SET key to save the value and it controls with this set value.

**6.Shortcut operation**

Press and hold the ▼+▲ work for 3s to work the shortcut function.

※The specific function depends on the shortcut function type [Udb]in"Parameter group 3".

※Factory default : RELAY/SSR switching.

※This function is not affected by the parameter group lock [LCK].

| Shortcut Key Parameters | Display | | Description |
|---|---|---|---|
| OFF | / | | No shortcut function. |
| AT | At on | At oFF | For auto–tuning work/stop, same function as Auto–tuning[ At ]in"Parameter group 1"ON for work,OFF for stop. |
| AL | AL on | AL oFF | The user can force the alarm to be released when it is alarm.ON is not released.OFF is released. When the alarm range is exceeded, this function is reset. |
| OUT | oUt rLY | oUt SSr | For changing output specifications, same function as output specification [oUt]in"Parameter group 2".RLY for relay output,SSR for SSR output |

**7.Restore factory settings**

Press and hold SET+ ◀ at the same time for 3s and then enter into "Parameter group 4" and enter the password 911, which will enter into the parameter reset [rES].
Select"no"and previous settings are maintained. Select"YES"and all parameters resume to default setting.

※[bUF] in "parameter group 3" and [oUt] in "parameter group 2" will not be restored.

## ■ Functions

**1.Auto tuning[ At ]**

PID auto– tuning measures the control subject's thermal characteristics and thermal response rate, and then determines the necessary PID time constant,And through this function,automic setting of parameters can be realized to achieve high–speed and stable control.

※During auto tuning, the heating system should be in working condition, the measured value PV is lower than the set value SV.

※When the control mode [P,d] parameter is in the"on"state, the Self–tuning switch [At] will be displayed.

※Set the auto– tuning switch[ At ]in state of"on", AT indicator light starts flashing to indicate that it has entered the auto– tuning state.

※During auto tuning process,all parameter groups and SV settings will be locked. if manual interruption of auto– tuning , the auto– tuning switch[ At ]should be set to"oFF"

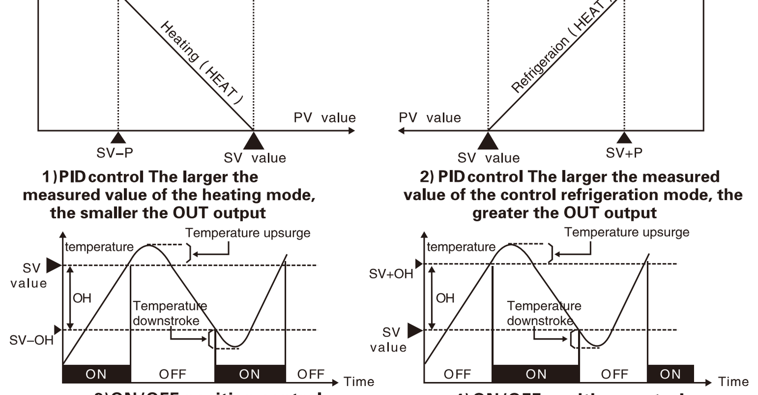
※During auto– tuning process, it will be automatically interrupted if there are failures code "HHHH" or "LLLL".

※When finish auto tuning , AT indicator light stop flashing, the resulting parameters P、I、d、Ar are automatically saved, then return to new control state as new parameters P、I、d、Arand other parameters continue to run.

※Any interruption of auto tuning, the parameters P、I、d、Ar and other parameters will not be modified.

**2.Control method [P,d]**

Control method [P,d]when parameters are in state of "on", currently belongs to PID control mode. if it is in the "oFF" state, it is in the ON/OFF position control state.





1)PID control The larger the measured value of the heating mode, the smaller the OUT output

2) PID control The larger the measured value of the control refrigeration mode, the greater the OUT output

3)ON/OFF position control, heating mode

4)ON/OFF position control, cooling mode

**3.Suppress overshoot[ Ar]**

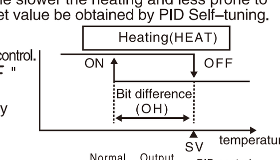
When used for PID control, overshoot suppression is adjusted. The larger the set value, the faster the heating, and it is easy to overshoot; The smaller the set value, the slower the heating and less prone to overshoot. The factory default is 60. It is recommended that the set value be obtained by PID Self–tuning.

**4.Position controlreturn difference[ bH ]**

Set the interval between ON and OFF for controlling output in ON/OFF position control.

※Control method [ P,d ]when parameters are in state of" oFF " bit difference [ oH ] will be displayed.

※If the hysteresis is too small, control output instability may occur due to externalinterference,etc.





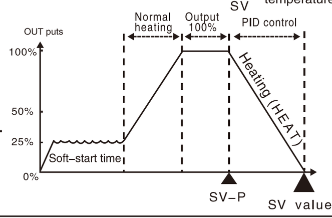
**5.Soft–start time[ bUF ]**

When a heating system is first put into operation, the present value (PV) is well below the set value (SV) while the OUT output reaches 100%.In some industries this can seriously threaten the life of the heating system when the system often goes from a low temperature state to full power instantaneously.

The Soft–start time range limits the output to 25%, which acts as a buffer and extends the life of the heating system.

※The time unit is s.

※Acts only on analog outputs or phase shifted outputs





**6.Error correction [EC]**

Controller itself does not have errors but there may be error by external input temperature sensor. This function is for correcting this error, if actual temperature is 80'C but controller displavs 78C.set input correction value [EC] as "002"and controller displays 80'C.

※Setting range–99~999C

※As the result of error correction, if current temperature value(PV) is over the limit range ,it displays "HHHH" or "LLLL"

**7.Digital filtering [F,L]**

The present value (PV) mav change repeatedly due to unstable input sianal or external interference. which may prevent accurate control. n this case, the dicital filtering function can be used to stabilize the present value (PV) and achieve accurate control.

※When using this function, it is normal that the present value (PV) may deviate from the actual input value

**8.Alarm type1 [Ad1]**

| Set value | Alarm | Positive alarm value(AL1) | Negative alarm value(–AL1) | Deviation alarm/ absolute value alarm |
|---|---|---|---|---|
| 0 | No alarm function | No output | | |
| 1 | Upper limit Deviation | | | Deviation alarm |
| 2 | Lower limit Deviation | | | Deviation alarm |
| 3 | nterval alarm | | Always OFF | Deviation alarm |
| 4 | Off–range alarm | | Always ON | Deviation alarm |
| 5 | Absolute upper limit | | | Absolute value alarm |
| 6 | Absolute lower limit | | | Absolute value alarm |
| 10 | No alarm function | No output | | |
| 11 | Upper limit deviation of standby | | | Deviation alarm |
| 12 | Lower limit deviation of standby | | | Deviation alarm |
| 13 | Alarm within standby | | Always OFF | Deviation alarm |
| 14 | Alarm outside standby | | Always ON | Deviation alarm |
| 15 | Absolute upper limit of standby | | | Absolute value alarm |
| 16 | Absolute lower limit of standby | | | Absolute value alarm |

**9.Alarm type2 [ Ad2 ]**

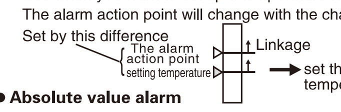
Idem, the default is " 0 ".

● **Deviation alarm**

Use when you want to set up a temperature to produce a linkage.

The alarm action point will change with the change of setting temperature

Set by this difference





● **Absolute value alarm**

No need to use linkage with setting temperature

Operating temperature(absolute value)

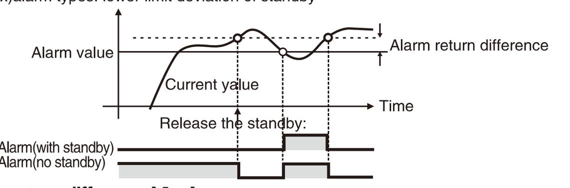
Set alarm action point

alarm action point → Set with the temperature (absolute value)at which the alarmisissued.

● **Standby function**

The standby function means that start from the present value is out of the alarm range, and to the next alarm range before, even if the alarm ON condition is reached, the alarm will not be ON.

Ex)alarm types: lower limit deviation of standby



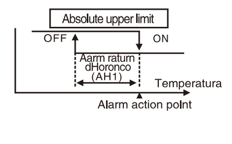


**10.Alarm return difference [AH1]**

It is used to return to the difference of non–alarm state under the alarm state. For example, the alarr action is 120'C in total. and set the alarm. return difference is 20'C.It is the alarm state when the temperature reaches above 120 C. and it is the non–alarm state when the temperature falls below 100 C.

※ Set range:0–100C.

※ The factory default:1℃





**11.Alarm return difference [AH2]**

Idem，the default is"1"

## ■ Error

| Display | Description | Troubleshooting |
|---|---|---|
| HHHH | Input broken or out of input range | Pls check if the input signal is wrong |
| LLLL | Input broken or out of input range | Pls check if the input signal is wrong |

## ■ Precautions

1.To eliminate inductive interference, please separate the wiring of this product from the high–voltage and power lines.

2.When powering on or off the product, please use a power switch or circuit breaker.

3.Try to stay away from high–frequency equipment (high–frequencywelding machines,high –frequency sewing machines, large capacity SCR controllers) as much as possible.

4.This product is used in the following environments.
①Indoor ②Pollution level 2 ③Altitude below 2000m ④Installation Classification Ⅱ

※If the above precautions are violated, it may cause product malfunction, please be sure to comply.

V24.1