# PID-SSR Temperature Controller Instruction Manual

## 1. Features:

1.1 Input Sensor Types

Can be connect the following sensors and signals to the universal input.

Thermocouple (temperature input): K, J, T, E, S,R,B

Resistance thermometer (temperature input): Pt100, CU50

1.2 Control Outputs

A control output can be a relay output, voltage output (for driving SSR), or linear current output, depending on the model.

1.3 Adjusting PID Constants

Can be easily set the optimum PID constants by performing AT (auto-tuning) with the limit cycle method.

1.4 Standard Alarms

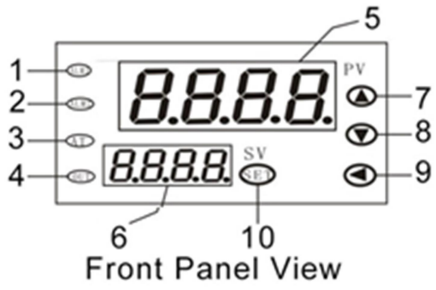
Can be output an alarm when the deviation, process value, set point, or manipulated value reaches a specified value.

1.5 Use this controller within the following allowable range:

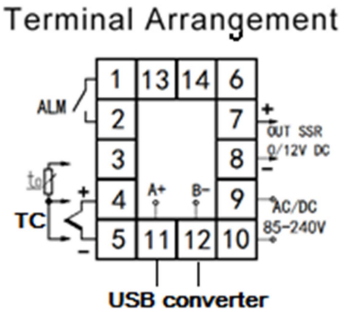
Allowable ambient temperature: −0 to +55 °C

Allowable ambient humidity: 5 to 85 % RH.

## 2. Parts Description:



Front Panel View




**1 ALM1:** lamp Lights when Event occurs

**2 ALM2 lamp:** Lights when Event occurs

**3 AT lamp:** Flashes during Auto-tuning (AT)

**4 Output lamp:** Lights when output is turned on

**5 PV display:** Displays Measured value (PV) or various Parameter symbols

**6 SV display:** Displays segment level, Set value (SV), Manipulated output value (MV) or various Parameter set values.

**7 Up key:**

−Increase numerals.

**8 Down key:**

−Decrease numerals

− To scroll through numbers faster, press and hold the Up key.

**9Shift key:** Shift digits when settings are changed.

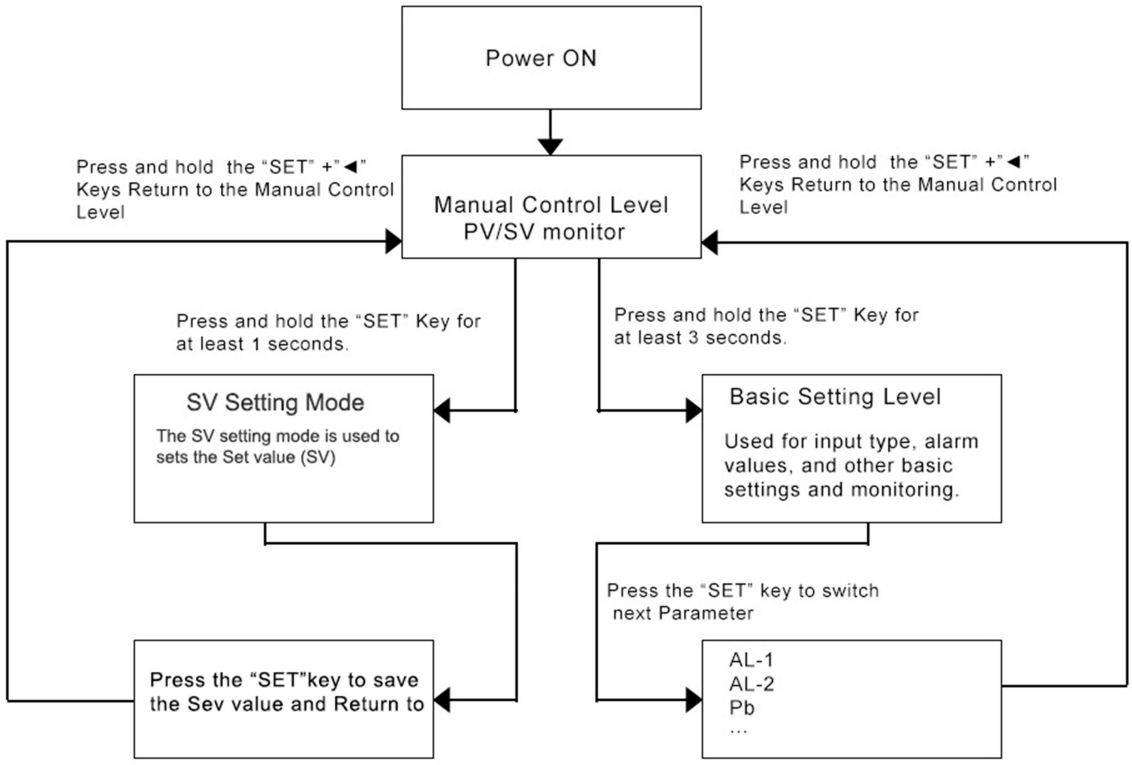
**10 Set (SET) key:** Used for Parameter calling up and set value registration.

## 3. Parameters

| ID | Code | Name | Manual | Setting range | Ex-Factory |
|---|---|---|---|---|---|
| 0 | SP | Setting value | Set the temperature set value (SV) which is the target value for control | Determined by P-SL P-SH | 100 |
| 1 | AL-1 | Alarm 1 | Refer to ALP for the alarm mode suitable. | Determined by P-SL, P-SH | 300 |
| 2 | AL-2 | Alarm 2 | | | 100 |
| 3 | Pb | PV Bias | The value set in the PV bias is added to the actual input value to correct the input value. | ±20.0 | 0.0 |
| 4 | kP | Proportional Band | Set when PI or PID control is performance. For heating / cooling PID action.<br>**When P=0,the controller is ON/OFF control** | 1～9999 | 100 |
| 5 | kI | Calculus time | Eliminates offset occurring in proportional control. | 0～3000 | 500 |
| 6 | kd | Differential time | Prevents overshoot and/or undershoot caused by integral action effect.. | 0～2000S | 100S |
| 7 | kt | PID control cycle. | Control response time | 2～120 | 20S |
| 8 | FILT | Digital Filter | This is a 1st-order lay filter by software prepared in order to reduce fluctuations of measured value (PV) by noise. | 0～99 | 20 |
| 9 | Hy | Differential gap | When the control is ON/OFF control（P=0）<br>Relay contact may repeat its turning ON and OFF due to input fluctuation if measured value (PV) is near the alarm set value. the differential gap setting can prevent the relay contact from ON or OFF repetition. | 0.1～50.0 | 0.5 |
| 10 | dp | Decimal point position selection | Set the position of the decimal point for the measured value to be displayed. | 0～3 | 0 |
| 11 | outH | Output limiter high | The min value and max value of output current. | outL～200 | 200 |
| 12 | outL | Output limiter low | | 0～outH | 0 |
| 13 | AT | Auto tuning | 1: Auto tuning (AT) with learning start<br>0: Auto tuning (AT) with learning stop<br>Turns OFF automatically when the AT with learning function is completed. | 0～1 | 0 |
| 14 | LocK | Set data lock | LOCK=0, Set value (SV) and Parameter can be set.<br>LOCK=1,Only set value (SV) can be set.<br>LOCK＞1, Set value (SV) and Parameter cannot be set. | 0～50 | 0 |
| 15 | TS | Input type | Cu50(Cu50)–50.0～150.0°C;<br>Pt100(Pt1) –199.9～200.0°C;<br>Pt100 (Pt2)–199.9～600.0°C;<br>K(K) -30.0～1300°C;<br>E(E) -30.0～700.0°C; J (J)-30.0～900.0°C;<br>T(T) -199.9～400.0°C; S(S) -30～1600°C; | ____ | K |
| 16 | OP-A | Main output Opt. (Depends on your order) | 0:no output<br>1:Relay output<br>2:Voltage output (for driving SSR)<br>3:Zero-cross output(for driving Triac)<br>4:PID linear current output(4-20mA /0-10v)<br>(A single functional) | 0～7 | READ ONLY |
| 17 | C F | Measured value (PV) unit select | C: Celsius<br>F: Fahrenheit<br>If the value is changed, the controller needs to execute Auto-tuning again. Refer to 6.Auto-tuning | C | C |
| | | | 0: Alarm function OFF; | 0～10 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| 18 | ALP | Alarm output Opt. | 1: Process high alarm;<br>2:Process low alarm;<br>3:Process high and low alarm.(H1 and L2)<br>4: Deviation High alarm ;<br>5: Deviation low alarm;<br>6:Deviation High and Low alarm.(H1 and L2)<br>7: Deviation high/low alarm;<br>8: Band alarm. | | |
| 19 | COOL | System function Opt. | '0':reverse control(heating)<br>'1':positive control(cooling) | 0～1 | 0 |
| 20 | P-SH | Range high | The control is displayed after the Input type and Input range. | P-SL～9999 | 1300 |
| 21 | P-SL | Range low | | -1999～P-SH | 0 |
| 22 | Addr | Address | Communication address can be set from 0 to 255 | 0～63 | 1 |
| 23 | bAud | Communication speed | 1200; 2400; 4800; 9600; | ____ | 9600 |
| 24 | HY-1 | Alarm1 Differential gap | Relay contact may repeat its turning ON and OFF due to input fluctuation if measured value (PV) is near the alarm set value. the differential gap setting can prevent the relay contact from ON or OFF repetition. | 0.1～50.0 | 0.5 |
| 25 | HY-2 | Alarm2 Differential gap | | 0.1～50.0 | 0.5 |

## 4. Operation




### 4.1 Basic Setting Level:

Press the key SET 3 seconds to enter into the main Parameters, the controller will display the Parameter code(1～25)in the window at the upper tube, and display the Parameter data at the lower tube. Press Key ▲、▼ or ◄ to adjust the Parameters, and then press the Key SET to preserve.

It will be preserved of the data and withdrawal of the setting with no any operations automatically within 10 seconds.

Electronics Lock. All the Parameter can be revised when Lock=0; Only the "SP" can be revised when Lock=1.

**4.2Setting value Level**:

Press the key SET 1 seconds to enter into the SV Setting Mode. When the operation mode is the Auto-tuning mode, the Set value (SV) can be set.

**4.3Manual Control Operation:**

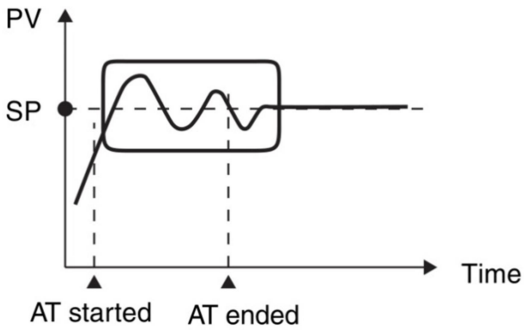
Press the ◀ key about 3S enter into the manual regulation, it will display “H” at the lower row, in this time can set the output power; press the ◀ key about 3S again it will withdraw the manual regulation.

**4.4 Reset function operation:**

Press and hold the ▼ key, then switch on the power of the controller. Wait until the display flashes three times , the controller will come back to default setting.

Tip: Main output Opt(OP-A) can be set only if lock=18

## 5. Determining PID Constants(Auto-tuning)




When AT is executed, the optimum PID constants for the set point at that time are set automatically. A method (called the limit cycle method) for forcibly changing the manipulated variable and finding the characteristics of the control object is employed.

Set the HY is 0.5～1℃, if the output is relay set the t=10S, then set the AT=1, the lamp of AT will be flashed, in this time the controller enter into **Auto-tuning**. now meter’s control way is on-off mode, after 3 times vibrating( 3 control period) automatically save P, I, D parameter, the self-adjusting procession finished.

Operation will be as shown in the following diagram:

**Attentions：**

-When **Auto-tuning**, the controller should not change the set value.

-When the power off during **Auto-tuning**, it will restart **Auto-tuning** next time.

-When it need artificially exit during **Auto-tuning**, set the Parameter(AT) to 0 so that can exit，but the setting result will not be valid.

## 6. Alarm (ALM) function：

| Alarm (ALM) function | Alarm status[ON] | Alarm status[OFF] |
|---|---|---|
| Process high alarm | Measured value>Alarm set value | Measured value<Alarm set value |
| Process low alarm | Measured value<Alarm set value | Measured value>Alarm set value |
| Deviation high alarm | Measured value>Alarm set value + Set value | Measured value>Alarm set value + Set value |
| Deviation low alarm | Measured value<Alarm set value - Set value | Measured value>Alarm set value - Set value |
| Band alarm | Measured value<Alarm set value + Set value<br>And<br>Measured value>Alarm set value - Set value | Measured value>Alarm set value + Set value<br>Or<br>Measured value<Alarm set value - Set value |
| Out of band alarm | Measured value>Alarm set value + Set value<br>Or<br>Measured value<Alarm set value - Set value | Measured value<Alarm set value + Set value<br>And<br>Measured value>Alarm set value - Set value |

**Character Symbols：This manual indicates 9-segment display characters as shown below.**

| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | b | C | d | E | F | G | H | I | J | K | L | M |
| **N** | **O** | **P** | **Q** | **R** | **S** | **t** | **U** | **Y** | **T** | | | |
| n | o | P | q | r | S | t | u | y | T | | | |

## 7. Host communication based on MODBUS-RTU protocol [OPTIONAL]

The master controls communication between master and slave. A typical message consists of a request (query message) sent from the master followed by an answer (response message) from the slave. When master begins data transmission, a set of data is sent to the slave in a fixed sequence. When it is received, the slave decodes it, takes the necessary action, and returns data to the master.

7.1 Communication Mode:

| Data bit length | Stop bits | Parity bit | Communication time interval |
|---|---|---|---|
| 8-bit (Binary) | 1,2 | NONE | 300ms |

7.2 Message length of each function (Unit: byte):

| Function code (Hexadecimal) | Function | Query message | | Response message | |
|---|---|---|---|---|---|
| | | Min | Max | Min | Max |
| 03H | Read holding registers | 8 | 8 | 7 | 7 |
| 06H | Preset single register | 8 | 8 | 8 | 8 |

7.3 Message format

| | |
|---|---|
| Slave address | The slave address is a number from 1 to 255 manually set at the front key panel of the controller. |
| Function code | Refer to **7.2. Message length of each function** |
| Data | The data to execute the function specified by the function code is sent to the slave and corresponding data returned to the master from the slave. |
| CRC-16 | CRC-16: Cyclic Redundancy Check |

7.4 Read holding registers [03H]

The query message specifies the starting register address and quantity of registers to be read.

| Slave address | Function code 03H | Register address | Quantity The setting must be 1 | CRC16 |
|---|---|---|---|---|
| Example: The contents of the holding register 1001H are the read out from slave address 1.<br>Query message: 01 03 10 01 00 01 D1 0A<br>Response message: 01 03 02 **00 FD** 79 C5<br>Explain：00FD=253,is processed as 25.3 | | | | |

7.5 Preset single register [06H]

The query message specifies data to be written into the designated holding register. Only R/W holding registers can be specified. The controller EEPROM had a life span of data written to the EEPROM less than 1000,000 times

| Slave address | Function code | Register address | Write data | CRC16 |
|---|---|---|---|---|
| Example: Data is written into the holding register 0001H(AL-1) of slave address 1.<br>Query message: 01 06 00 02 FF 38 68 28<br>Response message: 01 06 00 02 FF 38 68 28<br>When input ALM1 set value is -20.0,-20.0 is processed as -200,-200=0000H-00C8H=FF38H | | | | |

7.6 No response

The slave ignores the query message and does not respond when:

• The slave address in the query message does not coincide with any slave address settings.

• The CRC code of the master does not coincide with that of the slave.

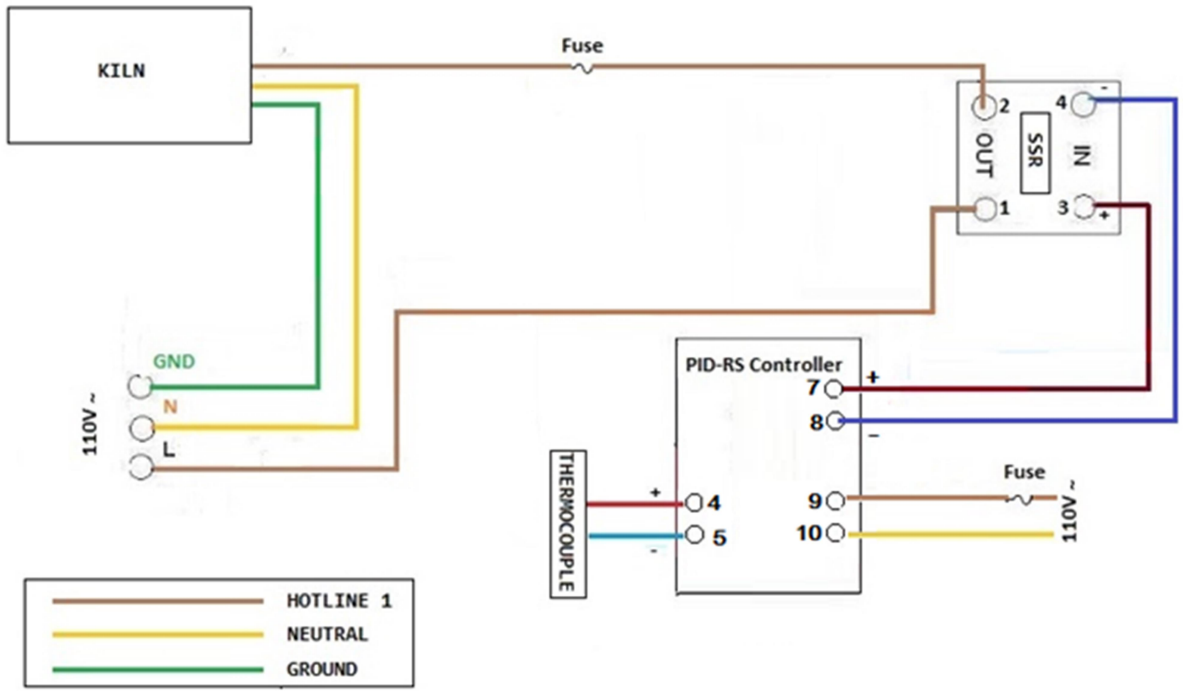
• Transmission error such as overrun, framing, parity and etc., is found in the query message.

• The Communication time interval less than 300ms.

7.7 Register address list:

| Symbol | Decimal point | Real Register | Holding Register |
|---|---|---|---|
| Messured value(PV) | YES | 1001H | 44098 |
| Manipulated output (MV): | NO | 1101H | 44354 |
| Alarm output | NO | 1200H | 44609 |
| Controller parameters *(Refer to 3. Parameters)* | | | |
| SP | YES | 0000H | 40001 |
| AL-1 | YES | 0001H | 40002 |
| AL-2 | YES | 0002H | 40003 |
| Pb | NO | 0003H | 40004 |
| ... And so on | | | |
| HY-2 | YES | 0019H | 40026 |

## Wiring Diagram



# PID-SSR USB Temperature Controller Instruction Manual (Reference Revision 2)

For current product information, availability, and compatible options, use the verified ThermoMart links below. The preceding pages remain the original manual content.

**PRODUCTS USING THIS DOCUMENT**

Models: HMI-PID-SSR-P&P, PID-SSR-USB, SSR-P&P-USB

**View all 3 products**

**All ThermoMart manuals and guides**