# SYL-1512A1 PID TEMPEARATURE CONTROLLER INSTRUCTION MANUAL

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**WARNING**

·Wiring precautions

-Install an external protection circuit if failure of this instrument could result in damage to your system.

-In order to prevent instrument damage or failure, protect the power line and the input/output lines from high currents by using fuses with appropriate ratings. A very fast blowing fuse (such as an $I^2t$ fuse) is needed when the output device is a solid-state relay (SSR). Please check with your fuse supplier for the correct fuse for your SSR.

·Power supply

-Supply power of the specified rating.
-Do not turn on the power until all of the wiring is completed.
-Never use this instrument in the presence of inflammable gases or vapor.
-In order to prevent electric shock or burns, never touch the inside of the instrument.
-Do not attempt to modify this instrument.

·Maintenance

-Only authorized service engineers should replace parts.
-In order to use this instrument continuously and safely, conduct periodic maintenance. Some parts used in this instrument have a limited service life and may deteriorate over time.

**Caution**

·Only clean the instrument when power is off.
·Please use a soft cloth or tissue to clean up stains on the display.
·Never use sharp & hard objects such as screwdrivers or ball pens to touch the buttons on the panel.

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## 1. Features

- ◆ Compact size, 1/32 DIN that is only 24 x 48 x 75 mm (1x2 x3")
- ◆ Supports 10 different types of commonly used temperature sensors, including Pt100 and Cu50 RTDs, T、R、J、B、S、K、E、and WRe3-WRe25 thermocouples.
- ◆ The PID control output can be configured by user for either relay contact or SSR.
- ◆ The relay contact output can also be configured as the alarm output, or on/off control
- ◆ Auto-tune function can automatically find the best PID parameters.
- ◆ Temperature can be displayed in Fahrenheit and Celsius.
- ◆ Can be used with either DC or AC power source.


**Figure 1**

## 2. Specification

- ◆ Power supply：85～260VAC or 85～360VDC
- ◆ Power consumption：<2W
- ◆ Sampling rate：4 sample/sec
- ◆ Accuracy：0.2% full scale

- Display range：-1999～9999
- Display resolution：1 ℃，1℉，or 0.1 ℃，0.1℉ with Pt100 RTD sensor input.
- SSR driving output: 8VDC,  40 mA
- LED display：0.28” red color
- Out of range display：“EEEE”
- Working condition：0～50℃，≤85%RH
- Relay contact rating：220VAC @  3A
- Outside dimensions：48×24×75mm
- Mounting cutout dimension：45×22mm

## 3. Front Panel and Operation

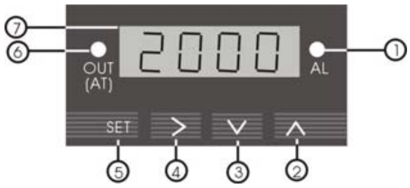



Figure 2

① AL- Relay J1 indicator
② Select next parameter/value increment.
③ Select previous parameter/value decrement
④ Digit shift/Auto tuning
⑤ Set/Confirm
⑥ OUT- Output indicator
（AT）- blinking during auto-tuning process
⑦ Parameter Display

## 4. Parameter Setting

### a) Configuration Parameters

Table 1, Configuration Parameter Setting

| Code | | Description | Setting Range | Initial Setting | Note |
|---|---|---|---|---|---|
| InEY | Inty | Input Type | See table 2 | K | |
| ouEY | outy | Controlled output device | 0, 1, 2, 3, 4 | 2 | 1 |
| HY | Hy | Hysteresis Band | 0-9999 | 3 | 3 |
| AEdu | Atdu | Autotune offset | 0～200(deg) | 10 | 2 |
| PSb | PSb | Input offset | -100～100(deg) | 0 | |
| rd | rd | Control function | 0：heating<br>1：Cooling | 0 | |
| CorF | CorF | Display Unit | 0：℃ 1：℉ | 1 | |
| End | End | Exit | | | |

**Note 1**．0：Relay J1 as alarm output; SSR output disabled。
1：Relay J1 as PID controlled relay contact output. SSR output disabled.
2：Relay J1 as alarm output; SSR PID control output.
3：Relay J1 as alarm output; SSR On/off control output.

4:  J1 as On/off control relay contactor output. SSR output disabled.

**Note 2**. The autotune offset will shift the SV value down by the the Atdu value during the auto tune process. That will preventing the system from damaging from over temperature during the autotune.

**Note 3**. Hysteresis Band (also called dead band, or differential), Hy, is used for on/off control. Its unit is degree (C or F). In heating mode, the output will be off when PV>SV and on again when PV <SV-Hy. In the cooling mode, the output will be off when PV <SV and on again when PV> SV+Hy

Press (SET), The enter code “0089” press (SET) again. Then, following the flow chart in Fig. 3

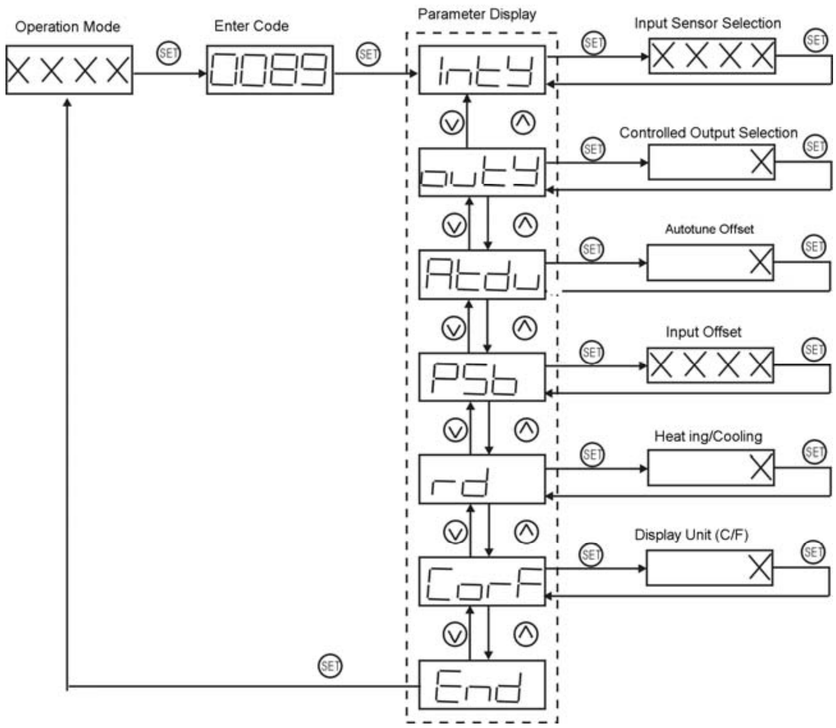



**Figure 3 Setup flow chart**

1） Press (SET) to enter setting mode;
2） Press (>)、(∨) and (∧) to enter parameters;
3） Press (SET) to confirm;
4） Press (∨) or (∧) to select the new parameter

Table 2, Temperature sensor code.

| Symbol | | Description | Working Temperature Range |
|---|---|---|---|
| | t | T Thermocouple | -200～400 ℃; -320~752 ℉ |
| | r | R Thermocouple | -50～1600 ℃; -58~2900 ℉ |
| | j | J Thermocouple | -200～1200℃; -320~2200 ℉ |
| | WRE | WRe3- WRe25 Thermocouple | 0～2300℃; 32~4200 ℉ |
| | b | B Thermocouple | 350～1800℃; 660~3300 ℉ |
| | S | S Thermocouple | -50～1600℃; -58~2900 ℉ |
| | K | K Thermocouple | -200～1300℃; -320~2400 ℉ |
| | E | E Thermocouple | -200～900℃ ; -320~1650 ℉ |
| | P10.0 | Pt100 RTD | -99.9～600.0℃; -99.9~999.9 ℉ |
| | P100 | Pt100 RTD | -200～600℃; -320~1100 ℉ |

| | | | |
|---|---|---|---|
| Cu50 | Cu50 | Cu50 RTD | -50.0～150.0℃; -60~300 ℉ |

**b) PID Parameters**

To enter PID parameter setting mode, press (SET), then enter code "0036", press (SET) again. The parameter flow chart is similar to Fig. 3

Table 3, PID and relevant parameters

| Symbol | | Description | Setting range | Initial Setting | note |
|---|---|---|---|---|---|
| P | P | Proportional Constant | 0.1～99.9 (%) | 5.0 | 4 |
| I | I | Integral time | 2～1999(Sec) | 100 | 5 |
| d | d | Derivative time | 0～399(Sec) | 20 | 6 |
| SouF | SouF | Damp constant | 0.1～1.0 | 0.2 | 7 |
| ot | ot | Cycle rate | 2～199(sec) | 2 | 8 |
| FILt | FILT | Digital filter strength | 0～3 | 0 | 9 |
| End | End | Exit | | | |

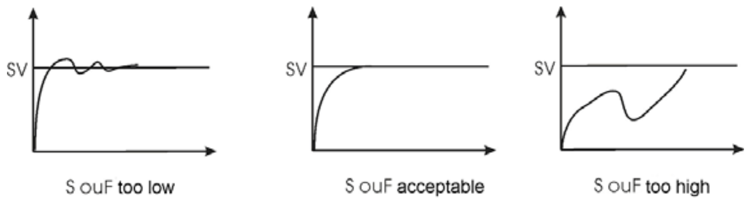
The values of the P, I, and D parameters are critical for good response time, accuracy and stability of the system. Using the Auto-Tune function to automatically determine these parameters is recommended for the first time user. If the auto tuning result is not satisfactory, you can manually fine-tune the PID constants for improved performance.

**Note 4**. Proportional Constant (P): Represents the gain of the signal amplifier. Larger gain means the controller will have more output power change for the same difference between set temperature (SV) and measured temperature (PV). Smaller P value represents higher gain, or faster action.

**Note 5**. Integration time (I): Brings the system up to the set value by adding a constant to the output that is proportional to how far the process value (PV) is from the set value (SV) and how long it has been there. When I decreases, response speed is faster but the system is less stable. When I increases, respond speed is slower, but system is more stable.

**Note 6**. Differentiation time (d): Responds to the rate of change of the process value so that the controller can compensate in advance before |SV-PV| gets too big. A larger number increases its action. Setting d-value too small or too large would decrease system stability, causing oscillation or even non-convergence.

**Note 7**. Damp constant: This constant can help the PID control further improve the control quality. It helps to damp the temperature overshoot. When its value is too low, the system might overshoot. When it is too high, the system will be over damped.




**Note 8**. Control Period (also called cycle rate) (ot): When ot gets smaller, heating/cooling cycle is drive faster, system respond speed is faster. For SSR output, ot is normally set at 2. But when using contact control (Relays), contacts wear out faster so it is normally at 5~30 seconds.

**Note 9**. Digital Filtering (Filt): Filt=0, filter disabled; Filt=1, weak filtering effect; Filt=3, strongest filtering effect. Stronger filtering increases the stability of the readout display, but causes more delay in the response to changes in temperature.

**c) Temperature setting and Alarm setting**

To enter the temperature and alarm parameter setting mode, press (SET), enter the code "0001", and press (SET) again. The parameter flow chart is shown in Fig. 3

Table 4. Temperature and Alarm Parameter

| Symbol | | Description | Initial setting | Note |
|---|---|---|---|---|
| Su | SV | Target temperature (Set Value) | 800 | 11 |
| AH1 | AH1 | Alarm on temperature | 800 | |
| AL1 | AL1 | Alarm off temperature | 900 | |
| t | T | Not functioning for this model | 00:30 | |
| End | End | Exit | | |

**Note 11**. The SV can also be set directly during the normal operation mode. Press (^) or (v) key to switch the display from process value (PV) to set value (SV). Press (^) or (v) key again to increase or decrease SV by 1 degree.

**i. Relay J1 value**

① When AH1=AL1，relay is disabled,

② AH1＞AL1 is for absolute high alarm. See fig. 4.

③ AH1＜AL1 is for absolute low alarm. See fig. 5.

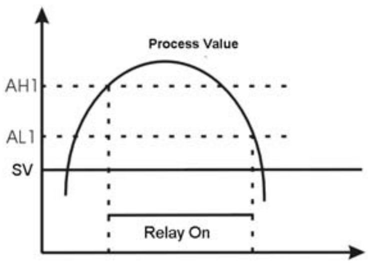



Figure 4

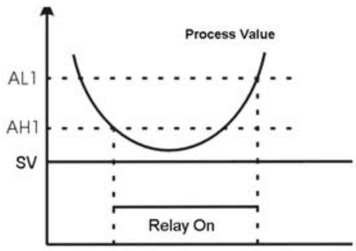



Figure 5

**5. Auto-Tuning**

Auto-Tuning function (also called self tuning) can automatically optimize the PID parameters for the system. The auto-tuning function will heat up the system then let it cool down. It will repeat several times. Based on the response time of the system, the built-in artificial intelligence program will calculate and set the PID parameters for the controller.

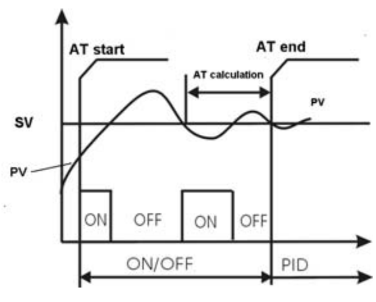



Figure 6

**A**）To activate auto-tuning, press and hold (>) key until the "AT" indicator starts to blink, which indicates auto-tuning is in progress. When "AT" stops blinking, the auto-tuning is finished. Now, newly calculated PID parameters are set and are used for the system. Please note that Auto-tuning is only for PID control mode (when “outy”is set at 1 or 2)

**B**） To stop the auto-tuning, press and hold key until “AT” indicator stops blinking. Then, the previous PID parameters value are resumed，

**6. Terminal Wiring (back view)**

The polarity of power at terminal 1 and 2 do not matter.

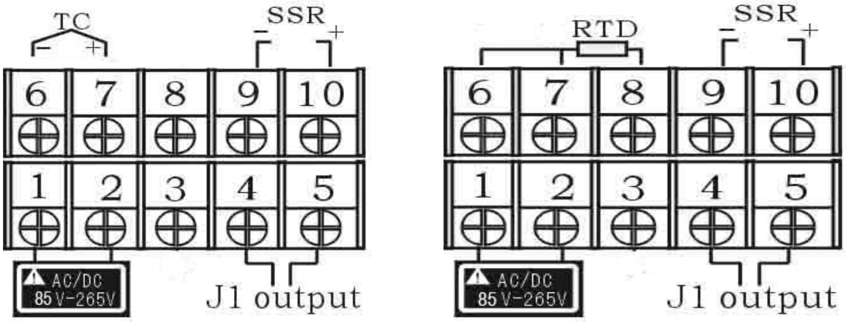



**Figure 7**. Wiring diagram with thermocouple (TC) input on the left and RTD input on the right. Please note that if the RTD is connected by two wires instead of three wires (for short distance application), the terminal 6 and 7 need to be shorted.

**7. Application Example**

A furnace that can operate in the 0℃～1000℃ range needs to be controlled at 800℃. Alarm (powered by the same line voltage) will go off if T > 850℃， Power source is 220VAC，Heating element is switched by a SSR。K type thermocouple is used as the temperature sensor.

a) Wiring diagram

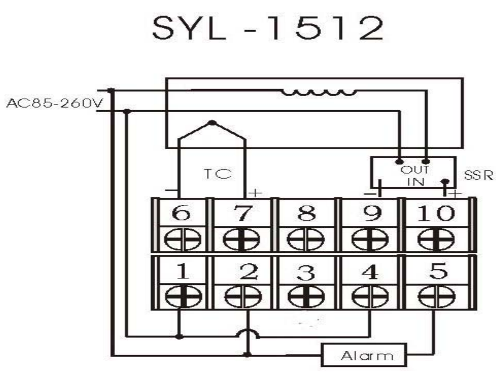



Figure 8,

b) Parameter setting,

（Inty）=K, （outy）=2, （PSb）=0, （rd）=0, （CorF）=0, （FILt）=0

Auto-tunig is used to set the PID parameters.

（SV）=800℃, （AH1）=850℃, （AL1）=848℃

Power up the controller. Press and hold the key until “AT” starts to blink. The controller starts the Auto-tuning. When the “AT” stops blinking, the new PID parameters are generated for the system. The controller is in normal operation mode. The furnace will be maintained at 800℃。

**For accessories, please check our web site at www.auberins.com**