

GL105-mA Intelligent Temperature Controller

User's Guide



1 Caution

Abnormal operating conditions can lead to one or more undesirable events that, in turn, could lead to injury to personnel or damage to the equipment or other property. Do not touch the AC terminals while the power is supplied to the controller to prevent an electric shock. Make sure power is disconnected while checking the unit inside. To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment.

2 Features

- Compact size, only 48x48x75mm.
- RTD input (PT100, CU50) or Thermocouple input (K, E, S, R, J, T, B, WRe3/25).
- Display the temperature in Celsius or Fahrenheit.
- Universal controller to work with either SSR or contactor.
- PID, On/off or Manual control mode.
- When set the main control to SSR output, the internal relay J1 can be set for alarm.
- Optional serial communication port (RS-485/Modbus_RTU).

3 Specifications

- Power supply: AC/DC85-260V (50Hz/60Hz).
- J1 relay contact capacity: AC250V/3A, DC 30V/5A.
- Relay contact life: 1×10^5 .
- Linear current output: 0-20mA, 4-20mA.
- Temperature accuracy: $\pm 0.2\% \pm 1$ unit of full input range
- Display resolution: 1°C , 1°F ; or 0.1°C , 0.1°F with Pt100.
- Dual lines, four digits, $^\circ\text{F}$ or $^\circ\text{C}$ display.
- Operating condition: $0-50^\circ\text{C}$, 85% RH.

- Process high/low alarm.
- Optional RS485 (Modbus RTU) communication.
- < 2 Watt power consumption.
- Dimensions: 48x48x75mm.
- Mounting panel cutout: 45x45mm

4 Back terminals

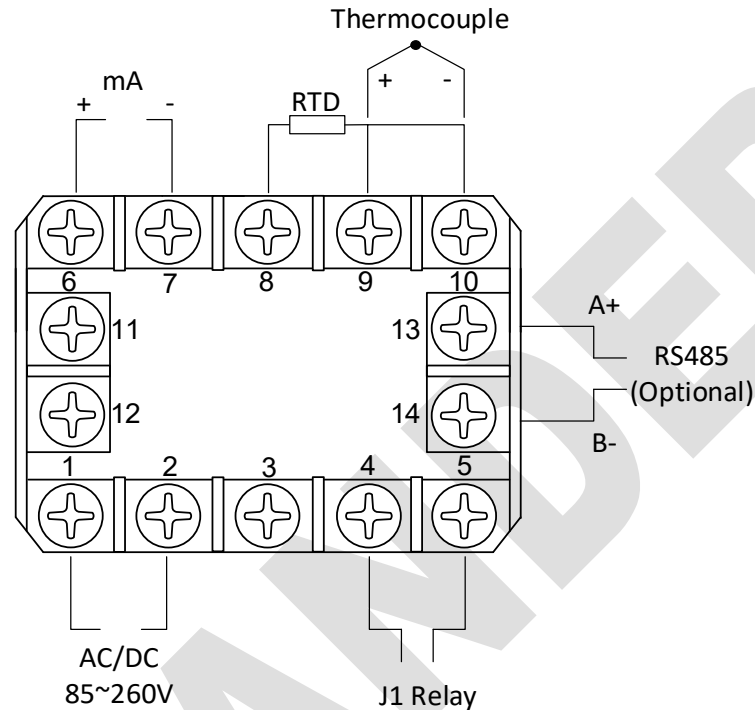


Figure 1 Back Terminals Wiring Diagram

4.1 Sensor connection

The default setting for the input type is for K type thermocouple, for different probe type, please check the parameter **Inty** in [Table 1](#).

For thermocouple, connect the positive wire to terminal 9 and the negative wire to terminal 10. For K type thermocouple, if the wires are red and yellow, the yellow wire is positive. If they are red and other color (blue, white, green....), the red is positive. If the polarity is reversed, when the temperature goes higher, the readout will decrease.

For three-wire PT100 probe, if the wire color code is red, red and white (to IEC60751), connect the two red wires to terminals 9 and 10 respectively, and connect the white wire to terminal 8. For two-wire PT100 probe, connect one wire to terminal 8 and connect the other wire to terminal 9, and short the terminals 9 and 10. The parameter **Inty** need to be changed to P10.0 (for 0.1 degree display resolution) or P100 (for 1 degree display resolution).

4.2 Output connection

The output can be set to linear current output provides 0-20 mA or 4-20mA current output or J1 relay.

To drive a load by the linear current output, set the main control output to 1, 2 or 5 (**Outy** in [Table 1](#)), then set the Main Output Mode (Coty) to "0-20" or "4-20". Connect terminal 7 to the negative input and terminal 6 to the positive input of the loads which takes linear input like a linear controlled valve.

To drive a load by the J1 relay, set the main control output to 3 or 4 (Outy in [Table 1](#)), and connect the load with its power to the terminals 4 and 5. Please note the relays are just a switch, there is no power on them. The power needs to be provided to the load connected to the relay.

4.3 Power to the controller

The controller can be powered by AC/DC from 85 to 260V. The ground power line is not necessary. For DC power, the polarity does not matter.

5 Front Panel

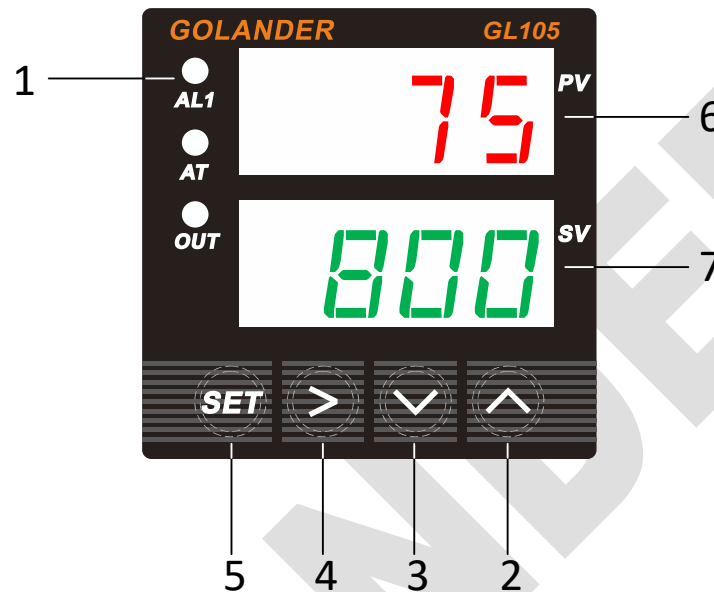


Figure 2 Front Panel

1 – Indicators

AL1: relay J1 output indicator. On when J1 relay closed

AT: Auto tune indicator. Flashing during auto tune. On when in [Manual Control Mode](#)

OUT: Main output indicator.

2 – Up key, select next parameter or increase value

3 – Down key, select previous parameter or decrease value

4 – Shift Key, Shift the digit when changing the setting; press and hold the key to start auto tune;

check output percentage: Press Shift key momentarily to change the SV window from set temperature to real-time output percentage. It will be □ xxx. For example, □ 90 the current output percentage is 90%. Press Shift key again to switch back to set temperature.

5 – SET key, parameter set/confirm; switch between Manual and Auto mode.

6 – PV, measured value display

7 – SV, target value display

6 Initial function parameters (input passcode 0089 after pressing the SET key)

Table 1

Symbol	Name	Description	Range	Factory Value	Mark
Inty	Inty	Input prob type	See Table 2	K	Note 1
Outy	Outy	Control output type	1, 2, 3, 4, 5	1	Note 2

<i>C o t y</i>	coty	Main output mode	0-20mA; 4-20mA; SSR (n/a)	0-20	Note 3
<i>H y</i>	Hy	Hysteresis Band	0~9999	3	Note 4
<i>P s b</i>	Psb	Display temperature offset	-100~100 (degrees)	0	Note 5
<i>r d</i>	rd	Control action type	0: heat; 1: cool	0	
<i>C o r F</i>	CorF	Display Unit selection	C; F	F	
<i>i d</i>	id	Unit ID	1-64	5	Note 6
<i>b A u d</i>	Baud	Baud rate	1200, 2400, 4800, 9600	9600	Note 6
<i>E n d</i>	END	Exit			

To access the 0089 menu, press the **SET** key, the display will show 0000, use the **UP/DOWN** key to change the value to 0089. Press **SET** key, the display will change to be *i n t y*. Press **UP/DOWN** key to change the display to other parameters, or press **SET** key again to modify the value for **Inty**, then press **SET** key to confirm the change. When changing the value, user can use the **>** key to shift the digit. Use the same operation to access the [SV and alarm parameters](#) (input passcode 0001 after pressing the **SET** key) and [PID parameters](#) (input passcode 0036 after pressing the **SET** key) menu.

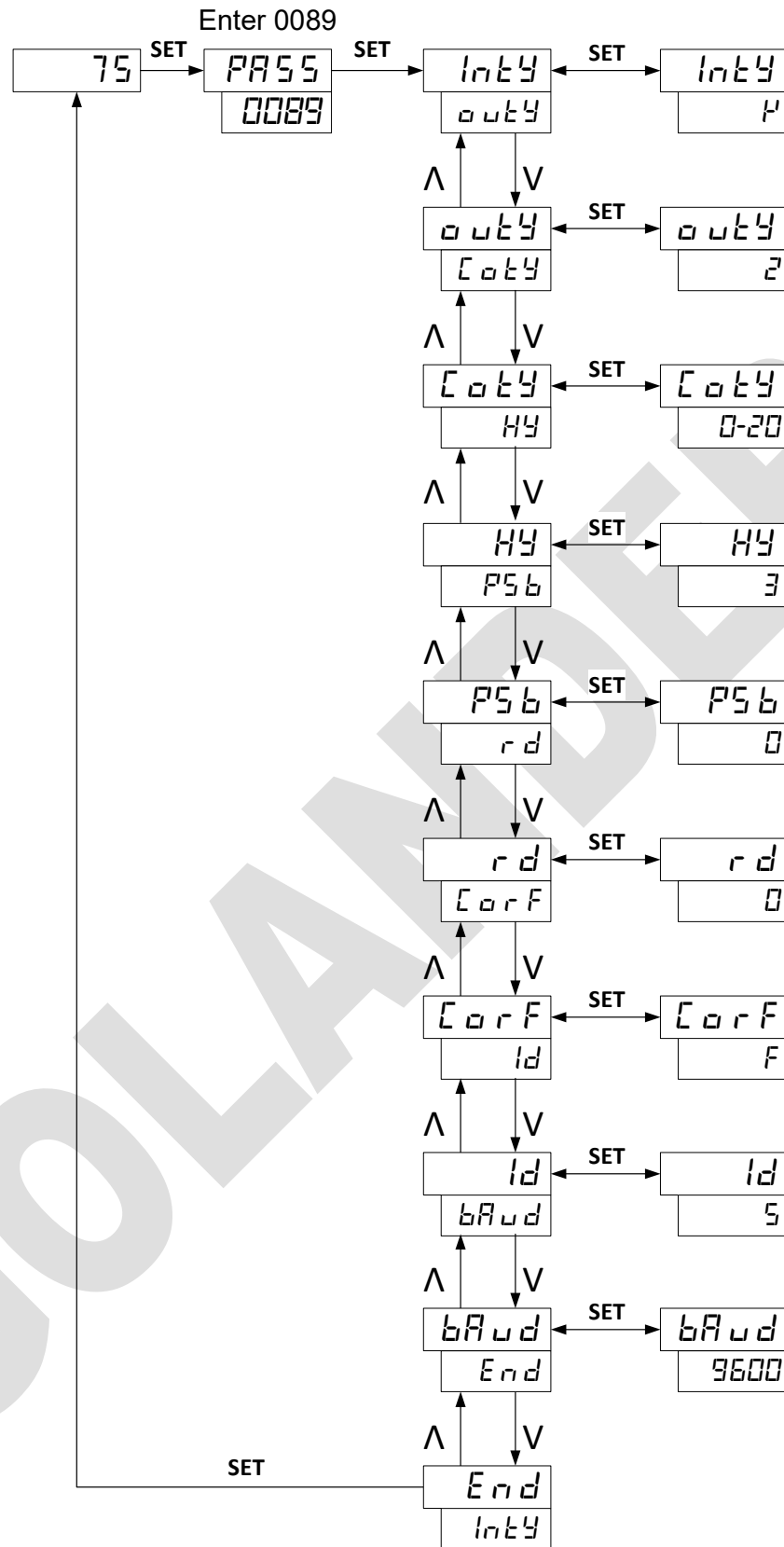


Figure 3. Initial function parameters setup

Note 1. Inty – Input probe type

The default setting for the input probe type is K type thermocouple. If not, please change the **Inty** to the one of the input type shown in the [Table 2](#).

Table 2

Symbol	Name	Sensor Type	Temperature Range	Note
ξ	T	T type thermocouple	-200~400 °C; -320~752 °F	Internal resistance 100Kohms
r	R	R type thermocouple	-50~1600 °C; -58~2900 °F	
J	J	J type thermocouple	-200~1200°C; -320~2200 °F	
$\mathcal{H} r E$	WRE	Wre type thermocouple	0~2300 °C; 32~4200 °F	
b	B	B type thermocouple	350~1800 °C; 660~3300 °F	
S	S	S type thermocouple	-50~1600 °C; -58~2900 °F	
P	K	K type thermocouple	-200~1300 °C; -320~2372 °F	
E	E	E type thermocouple	-200~900 °C; -320~1650 °F	Constant current output 0.2mA
$P 100$	P10.0	PT100 RTD, 0.1° resolution	-99.9~600.0 °C; -99.9~999.9 °F	
$P 100$	P100	PT100 RTD, 1° resolution	-200~600 °C; -320~1100 °F	
$C u 50$	Cu50	CU50 RTD	-50.0~150.0 °C; -60~300 °F	

Note 2. Outy - Control output type

- 1: Set J1 relays as absolute alarm output, mA port as PID control output.
- 2: Set J1 relay as derivation alarm output, mA port as PID control output.
- 3: Set J1 relay as PID control output, mA port disabled.
- 4: Set J1 as on/off control output, mA port disabled.
- 5: Set J1 relay as absolute alarm output, mA port disabled.

Note 3. Coty - Main output mode

"0-20" - Main output is set to 0- 0 mA linear current output mode.

"4-20" - Main output is set to 4-20 mA linear current output mode.

"SSR" - Not available on this model.

Note 4. Hy - Hysteresis Band

The parameter **Hy** is only for on/off control (Outy=4). For heating control mode, when the measured temperature PV reaches the target temperature **SV**, the control output will be off; when PV drops down to **SV-Hy**, the control output will be on again. For cooling control mode, when PV drops down to SV, the control output will be off, when PV increases to **SV+Hy**, the control output will be on again.

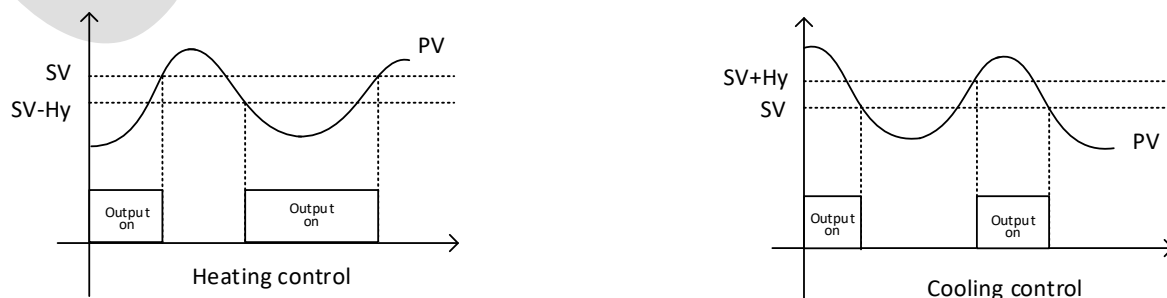


Figure 4. on/off control

Note 5. Psb - Display temperature offset

This feature allows the input value to be changed to agree with an external reference or to compensate for sensor error. For example, if the measured temperature of the controller is 100 degrees, but the reference temperature is 98 degrees. By setting the **Psb**= -2, the PV display of the controller would change to be 98. To set the negative value for **Psb**, use the shift key to move the focus digit to the first digit from the left, and then use the down key to change the digit to show the negative symbol.

Note 6. Unit ID and bAud

They are used for RS485 communication. For details, please check the commutation manual.

7 PID parameters (input passcode 0036 after pressing the SET key)

Table 3

Symbol	Name	Description	Range	Factory value	Mark
P	P	Proportional band	0.1~99.9%	5.0	Note 7
I	I	Integral time	2~1999 Seconds	100	Note 8
d	d	Derivative time	0~399 Seconds	20	Note 9
End	END	Exit			

Note 7. P – Proportional band

The proportional term generates an output that is directly proportional to the current error value. The proportional band defines the range over which the output decreases from 100% to 0%. For example, in a heating system with the integral (I) and derivative (D) terms set to 0, the output will remain at full power until the temperature reaches SV – P (setpoint minus the proportional band). From that point up to the setpoint (SV), the output gradually decreases from 100% to 0%. The narrower the proportional band (P), the more aggressively the system responds to errors. This is because the output changes more steeply within a smaller error range. In practice, proportional-only control typically results in a steady-state offset error. To eliminate this error, integral action is required.

Note 8. I – Integral time

The integral term drives the process toward the set value (SV) by accumulating the error over time, it adds to the output based on both the magnitude and duration of the deviation between the process value (PV) and the setpoint SV. A smaller integral time results in a faster response, but may cause instability or overshoot. Conversely, a larger integral time leads to a slower response, but provides greater stability.

Note 9. d – Derivation time

The derivative responds to the rate of change of the process variable (PV), providing anticipatory action to reduce overshoot and improve stability. A larger d value increases the damping effect. However, if d is set too small or too large, it can reduce system stability, cause oscillation, or prevent convergence. Normally d is set to 25% of the I value.

8 Control parameters (input passcode 0038 after pressing the SET key)

Table 4

Symbol	Name	Description	Range	Factory value	Mark
bb	bb	Proportional band range limit	1-1999	300	Note 10
SouF	SouF	Overshoot suppression factor	0.0-1.0	0.2	Note 11
ot	ot	Proportional cycle	1-500 seconds	2	Note 12

<i>F i l t</i>	FILT	Digital filter factor	0-3	0	Note 13
<i>E n d</i>	END	Exit			

Note 10. bb – Proportional band range limit

Proportional Band Range Limit (bb) defines the temperature range within which the proportional control (P) is active. When the absolute difference between PV and SV exceeds bb, the proportional output remains at 100%. To fine-tune controller performance using bb, it should be set smaller than the proportional band (P). The default value is 300°C.

Note 11. SouF – Overshoot suppression factor

Overshooting and undershooting are restricted by the **SouF** and increase of the parameter can suppress the overshooting

Note 12. ot - Proportional cycle

Control Cycle (ot): Specifies the time interval (in seconds) at which the controller updates its output. A smaller ot improves control precision but may reduce the lifespan of mechanical relays due to frequent switching.

For Outy = 1 or 2 (relay or SSR output), set ot to 1-3 seconds.

For Outy = 3 (external relay/contact), set ot to 20-40 seconds.

For Outy = 4 or 5, ot is ignored.

In general, use a smaller ot for fast-response systems, and a larger ot for slower systems.

Note 13. Filt – digital filter factor

The filter is to increase the measured temperature display stability, but will delay the response. When **Filt** is set to 0, the filter is disabled. 1, 2 and 3 are weak, medium and strong, respectively.

9 SV and alarm parameters (input passcode 0001 after pressing the SET key)

Table 5.

Symbol	Name	Description	Factory value	Mark
<i>S v</i>	SV	Target temperature (Set Value)	80	Note 14
<i>A H 1</i>	AH1	Alarm (J1 relay) on temperature	800	Note 15
<i>A L 1</i>	AL1	Alarm (J1 relay) off temperature	900	Note 15
<i>E n d</i>	END	Exit		

Note 14. The **SV** value can be set by accessing the 0001 menu. Or, when in normal operation mode, use the **UP** or **DOWN** key to change the **SV** directly.

Note 15. When the J1 relay is set as alarm, the relay will be controlled by the two parameters **AH1** and **AL1**. The alarm can be set as high alarm or low alarm.

For high alarm, set **AH1** > **AL1**. When the temperature increases to **AH1**, the J1 relay will be closed (alarm on), when the temperature drops down to **AL1**, the J1 relay will be open (alarm off).

For low alarm, set **AH1** < **AL1**. When the temperature decreases to **AH1**, the J1 relay will be closed (alarm on), when the temperature increases to **AL1**, the J1 relay will be open (alarm off).

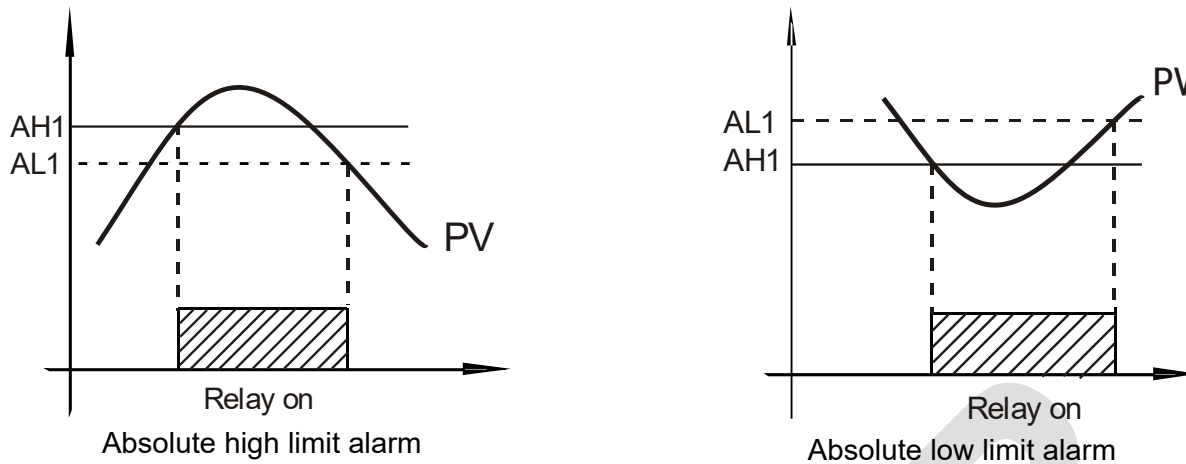
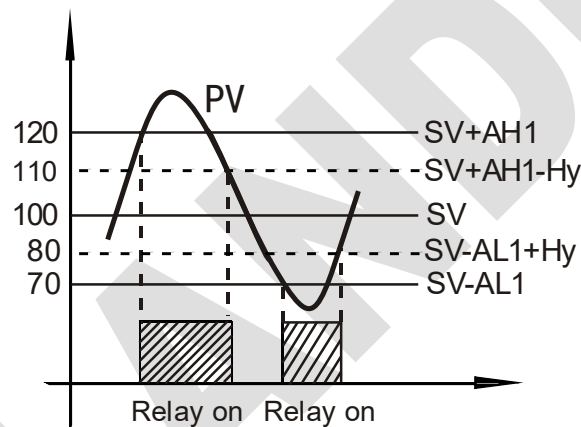


Figure 5. Absolute limit alarm



SV=100, AH1=20, AL1=30, HY=10

Figure 6. Derivation Alarm

10 Auto tune

For PID control mode, if the control with default **P**, **I** and **d** parameters settings are not able to hold the target temperature, the built-in auto tune function can find the right PID parameters for the system. When on heating mode, it will heat up the system to the target temperature then let the system cool down. It will repeat this process for about 3 times, then the controller will calculate the parameters automatically.

To activate the auto tune function, press and hold the **>** key until the “**AT**” indicator starts to blink. When auto tune process finished, the “**AT**” indicator will stop blinking. The new values for parameters **P**, **I** and **d** are calculated by the controller.

To stop the auto-tuning, press and hold **>** key for 3 seconds, until “**AT**” indicator stops blinking. The PID parameters values will not change.

Auto-tune is supported when the main output is configured as a relay (Outy = 3 or 4) or as a linear output (Outy = 1 or 2). When auto-tune is run in linear output heating mode (Outy = 1 or 2, rd = 0), the output behaves in a bang-bang manner: it outputs 100% when PV is below SV, and 0% when PV exceeds SV.

Please note:

- Auto tune from time to time, there will be a significant temperature overshoot, please lower SV value to prevent accident.
- The sensor and the load need to be connected properly, otherwise, the auto tune will not complete.
- The time for the auto tune depends on the system response time, would be from a few minutes to hours.
- Only need to run auto tune one time.

11 Manual Control Mode

User can switch the control mode from PID mode to manual mode. Manual mode allows user to adjust the output percentage manually. The output will remain the set percentage regardless what the measured temperature is. For example, if the cycle time is 2 seconds, output percentage is set to 75, then in every 2 seconds, the output will be on for 1.5 seconds and will be off for 0.5 seconds. To switch from PID mode to manual mode, press and hold the **SET** key until the AT indicator turns on. The PV window of the controller will still show the measured temperature, the first digit of the SV window will show a letter "M", which means the controller is on manual mode. The right 3 digits of the SV window will show the output percentage. User can use the **UP/DOWN** key to change the percentage manually. To switch back to PID mode, press and hold the **SET** key until the **AT** indicator turns off.

12 Examples

12.1 Control a linear 0-20mA Solenoid Valve

Use mA output to control the valve directly.

To use PID mode to control the valve, set outy=1. Set the input type inty to PT100, and set SV to the desired temperature you want to hold, for example, SV=350°F.

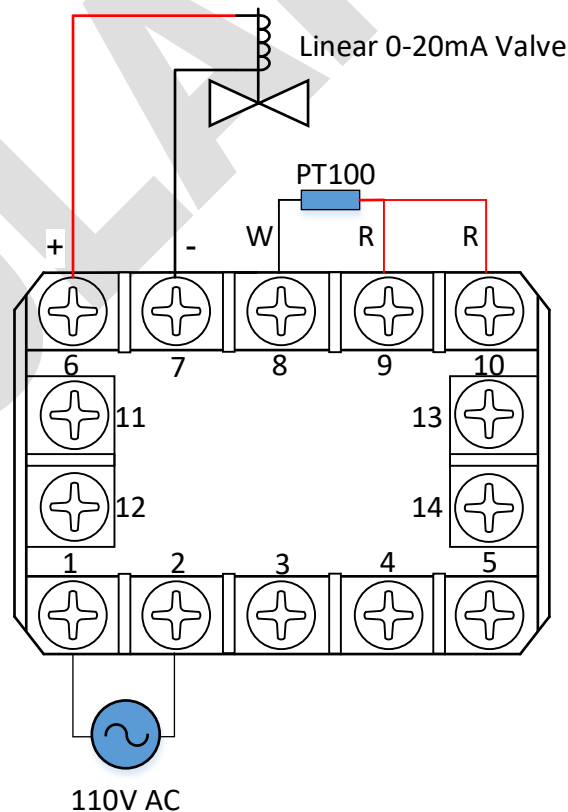


Figure 7. Solenoid Valve Wiring

12.2 Use J1 Relay to Trigger an 110V Alarm Buzzer

J1 relay is controlled by parameters AH1 and AL1.

- 1) J1 relay is set to alarm (Outy=1 or 5).
- 2) High alarm: If you want the buzzer to be on when temperature is higher than 210°F, and to be off when temperature drops down to 205°F, set AH1=210, AL1=205 (AH>AL).
- 3) Low alarm: If you want the buzzer to be on when temperature is lower than 5°F, and to be off when temperature goes back to 10°F, set AH1=5, AL1=10 (AH<AL).

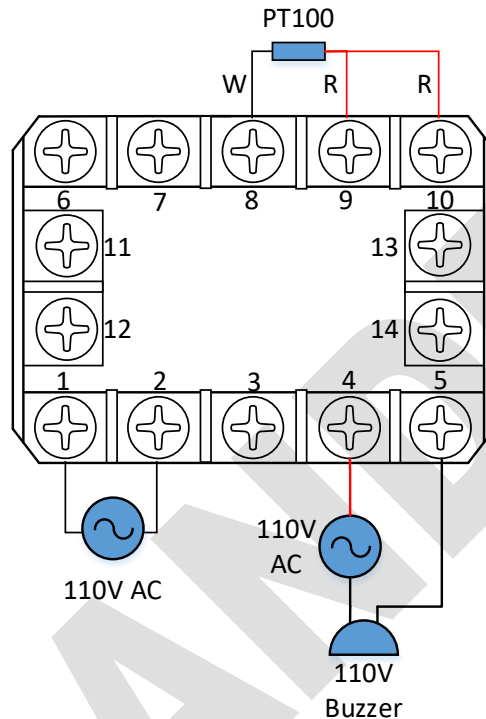


Figure 8. Use J1 Relay for Alarm

13 Quick Guide

First, set the parameter **Inty** to the sensor type connected to the controller if it is not a K type thermocouple, set the parameter **Outy** for the output control mode. For PID mode, if the system is not able to hold the temperature, run [Auto tune](#). Set the alarm parameters **AH1**, **AL1** if needed.

If the controller displays EEEE, that means something wrong with the input or with the setting of the input. Please check the sensor connection and the **Inty** parameter setting. Questions? Please contact us.

Golander LLC
<http://golanderusa.com>
 email: info@golanderusa.com