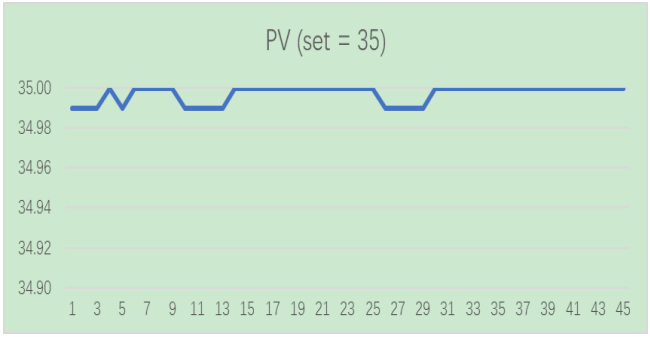
ZL-7817A Temperature Controller
Instruction Manual V1.2b

Introduction

This new version provides optional PID and on/off control.
Internal control resolution now is 0.01C degree to reach better control result.
Integrated SSR output with **5A rate power** driving ability.
An auxiliary output: timer on/off, and/or high temperature protection



Specification

Sensor: NTC, $R_{25℃}$ = 10K, $B_{25/50℃}$ = 3470K
Setting range: -40.0 ~ 130.0℃
Power supply: 100 ~ 240Vac, 50/60Hz
Output R1: **5A**, 250Vac (**rated current**)
Output R2: **7A**, 250Vac (**resistive**)
Working: -10 ~ 45℃, 5 ~ 85%RH without dew
Case materials: PC + ABS fire proof
Protection level: IP65 (Front side only)
Dimension: W78 x H34.5 x D71 (mm)

Installation drilling: W71 x H29 (mm)

Display

Display

Display	Function	On	Blinking
	Heater status	Heater output R1 is energized	
	Timer output status	Timer output R2 is energized	
	PID auto tune status		PID auto tuning
	Failure		Warning
	Set status		Setting
E1	Failure		Sensor failure
Hi	Failure		High temperature warning
Lo	Failure		Low temperature warning
iA	Failure		External warning input effective
UnL	Restore to factory settings	Will restore to ***factory setting***s	
At1	Auto tuning fails		Temperature not stable during Auto tuning
At2	Auto tuning fails		Temperature vibration level not satisfied
At3	Auto tuning fails		Temperature vibration period not satisfied
SUc	Auto tuning finished		Auto tuning finished successfully

Model, version display

After reset, the model (ZL-7817 A) and version (version 1.0) will display consecutively:

Operation

Set set-point (SP). Factory default set is 35.0℃

Keep〖S〗depressed for 3 seconds to enter into temperature setting status:
blinks, the SP value displays.
Press〖▲〗or〖▼〗to set the value.
Press〖S〗to save and exit the status.
The status will exit, and the value will be saved, when there is no key operation for 30 seconds.

Set system parameters

Keep〖P〗depressed for 3 seconds to enter into parameter setting status:

blinks, dispay shows “U10”, the 1st system parameter code.

Press〖▲〗or〖▼〗to select parameter code.

Press〖S〗to show the value of the parameter.

Press〖▲〗or〖▼〗to the value of the parameter.

Press〖S〗to return back to parameter code selection.

In this way, we can check and/or set all parameters.

Keep〖P〗depressed for 3 seconds to save and exit the status.

The status will exit, and the value will be saved, when there is no key operation for 30 seconds.

If parameter U99 value is not “0000”, the password (the value of U99) is required to enter into parameter setting status:

After〖P〗depressed for 3 seconds, display shows “---0”.

Press〖▼〗to select the digit of password, press〖▲〗to set the value of the digit.

After 4 digits are set, press〖S〗to enter the password.

If the password is correct, enter into the parameter setting status. Else exit.

System parameter table:

Code	Function	Range	Remark	Factory Setting
U10	Set-point (SP)’s low limit	-40.0 ~ 130.0℃		-40.0℃
U11	Set-point (SP)’s high limit	-40.0 ~ 130.0℃		130.0℃
U12	Low temperature warning point (relative)	0.0 ~ 130.0℃	Absolute low temperature warning point: SP - U12	35.0℃
U13	High temperature warning point (relative)	0.0 ~ 130.0℃	Absolute high temperature warning point: SP + U13	130.0℃
U14	**Hysteresis**	0.0 ~ 20.0℃	Only effective when U74 = 1	0.2℃
U30	Sensor calibration value	-20.0 ~ +20.0℃		0.0℃
U40	Output R2 timer on period’s time unit	0 ~ 2	0: Second; 1: Minute; 2: Hour	1
U41	Output R2 timer on period’s time	1 ~ 9999		120
U42	Output R2 timer off period’s time unit	0 ~ 2	0: Second; 1: Minute; 2: Hour	1
U43	Output R2 timer off period’s time	1 ~ 9999		120
U46	Output R2 working mode	0 ~ 2	0: Timer on/off; 1: Over temperature protection; 2: Timer on/off + Over temperature protection	0
U60	External input warning working mode	0 ~ 2	0: Disable; 1: Normal open; 2: Normal close	0
U70	PID proportional coefficient Kp	0.1 ~ 999.9		2.6
U71	PID integration coefficient Ti	0 ~ 999.9		500
U72	PID differential coefficient Td	0 ~ 999.9		50
U73	PID output amplitude	10 ~ 100%	Percent of full heater power rate.	50%
U74	**Control method**	0 ~ 1	0: PID control; 1: hysteresis control	0
U99	Password	0000 ~ 9999	If 0000, password disabled	0000

Control

Timer output R2

During timer on period (U41, U40), the R2 will be energized.

During timer off period (U43, U42), the R2 will be de-energized.

Temperature control

PID control (U74 = 0)

PID control. The output for heater is R1.

Hysteresis control (U74 = 1)

When measured ≥ Set-point (SP), R1 de-energized. When ≤ Set-point (SP) – U14, R1 100% energized.

Over temperature protection

When the protection function is enabled (U46 = 1 or 2), and if measured temperature ≥ high temperature warning point (SP + U13), R2 will be energized.

Over temperature warning

If measured temperature ≥ high temperature warning point (SP + U13), display blinks, buzzer beeps.
If measured temperature ≤ low temperature warning point (SP - U12), display blinks, buzzer beeps.

External input warning working mode

U60 = 0: Disable. The external input warning function is disabled;
U60 = 1: Normal open. When closed, warning, the R1 will be de-energized, the R2 still works;
U60 = 2: Normal close. When open, warning, the R1 will be de-energized, the R2 still works;

Buzzer warning

When there is failure or warning, the buzzer beeps.
Press〖P〗can stop beeping.
When the failure or warning disappears, the buzzer stops beeping.

Sensor

The sensing resolution is 0.1 Celsius degree. The sensor has tolerance. After calibration (U30), the absolute sensing accuracy could be 0.1 degree.
When the sensor fails (open or short), the display blinks, and there will be warning, the R1 will be de-energized, the R2 still works.

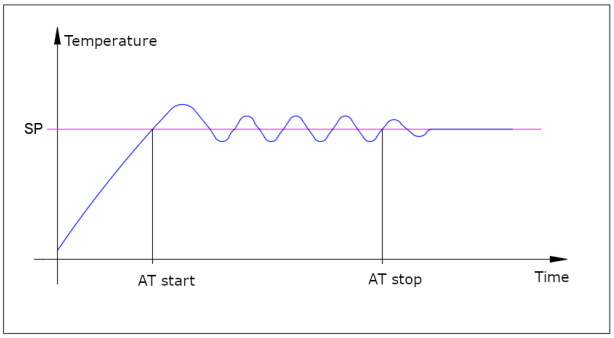
Restore system parameters to factory settings.

Keep〖P〗and〖▲〗depressed simultaneously for 5 seconds, display shows “UnL”. Press〖▼〗twice, all system parameter settings will be restored to factory setting.

PID parameters Auto Tuning (AT)

With auto tuning, we can find optimized PID parameters for most control system.

Auto tuning step:
1. Set driving power rate (percent of full heater power rate, U73), or set it in step 4.
2. Set Set-point (SP).
3. In control status (not setting status), keep〖▲〗and〖▼〗depressed for 5 seconds to enter into auto tuning mode. U73’s value displays, ⊖ blinks.
4. Press〖▲〗and〖▼〗to set the amplitude value (U73).
5. Press〖P〗to start auto tuning.



The measured temperature will rise, vibrate around SP for several times.
When ⊖ disappears,
if “At1/At2/At3” displays, auto tuning fails;
if “SUc” displays, auto tuning finished, and the PID parameters got.
Press any key, the “At1/2/3, SUc” disappeared, and start temperature control.
If ⊖ never disappears, if it is because of lower power rate, set bigger value of U73, tune again.

Note:

a. PID control, or hysteresis control?

Try hysteresis control 1st (U74 = 1):

1. *Now is full power rate heat*ing. If room temperature is not able to reach SP at reasonable time, increase the heater power rate.
2. If the temperature overshoot to SP ≤ 0.2℃, or over falling to (SP – U14) ≤ 0.2℃: auto tuning is not able to get the PID parameters correctly. In fact, this kind of system may be unnecessary for PID control.
3. If all are ok, try PID auto tuning.

Try auto tuning (U74 = 0). If the PID control result is good, then use PID control.
The following will also make auto tune failure, or get wrong parameters:

- The room temperature vibration amplitudes differ too much.
- The room temperature vibration periods differ too much.
- The room temperature changes not smoothly, because of some interference.

b. Try to get best parameters

When:
the environment temperature changed a lot, the heat dissipating speed changed,
object inside changed a lot, the heat volume changed,
the heater changed, the heat inertia changed,
air flow speed inside changed a lot, sensing speed changed
and so on,
it needs auto tuning again.

c. PTC heater

PTC has a Curie point parameter. When PTC's temperature is high than Curie point, its power rate will be reduced to almost zero, the PID control will fail.
With higher Curie PTC heater, with good dissipator for heater, with high air flow speed around heater to avoid the failure.

d. Manual tuning principle

Manual tuning could change the control result.
Increase Kp (U70), increase the speed of control, but more overshoot and bigger vibration.
Increase Ti (U71), get more accurate temperature, but need longer time to reach SP after stating heating.
Increase Td (U72), fast reaction to temperature changes, but add more "small noise" to the control result.

Installation

Attention

- Wiring work should be manipulated by certified technicians.
- Wrong connection could damage the controller, and the loads.
- Sensor and input signal wires should not be laid together with power supply wire, and even in same pipe.
- Sensor wire is better as short as possible. Not wind the redundant length wire to electrical noise equipment.
- The loads should be within the specification of the controller output driving ability. If using ac/dc module as load, or tungsten lamp, or motor, following the below requirements to avoid surging current damaging or shorten the life time of the controller outputs:

For ac/dc module as load, the rated current should be no more 1/10th of output specification **under pure resistance**.
For tungsten lamp as load, the rated current should be no more 1/15th of output specification **under pure resistance**.
For motor, the rate current should be no more 1/5th of output specification **under pure resistance**.

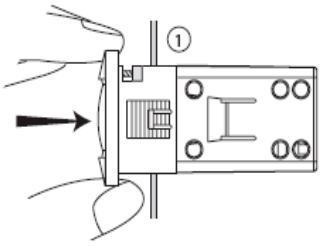
For example: if drive a 1100W tungsten lamp with 5A (**pure resistance** spec.) relay, the **relay contactor will be burnt immediately**.

- Don't touch inside components;
- Avoid installing controller in the following environment:

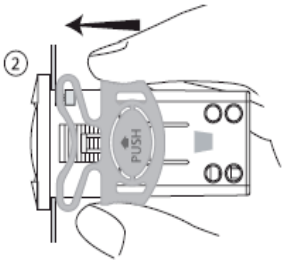
More wet than 90%RH, or easily dew; Vibrating, or will be shocked; Possible sprayed; Under erosive air; Under explosive air.

Step

1st: Insert into drilling hole



2nd: Clamp



Electrical Wiring