

# Instructional Manual

## TET-7100 Intelligent Temperature Controller



Figure 1.

### 1. Product Highlight

Thermocouple: T, R, J, B, S, K, E, Wre3-Wre25.

Thermo Resistor: Pt100, Cu50.

1 Relay output, 1 SSR controlled output.

Time proportional PID controlled output to either Relay or SSR

Built-in 3 algorithms that fit most of control objects and various applications.

Temperature can be set to display in either Fahrenheit or Celsius.

### 2. Specifications

Operating supply voltage: AC18-265V or DC18-360V.

Power consumption:  $\leq$  2 Watt.

Sampling speed: 4/sec.

SSR activated voltage: open circuit: 10V; short circuit:40mA.

Accuracy: 0.2% of full scale.

LED Display: 0.28 inch; Red color.

Out of range indication: "EEEE".

Ambient temperature requirement: 0~+50 Deg C.

Humidity requirement:  $\leq$  85% RH.

Relay Contact volume: AC220V; 3A.

Controller dimension: 48x24x75(mm).

Opening for installation: 44x20(mm).

### 3. Panel Illustrations and Descriptions

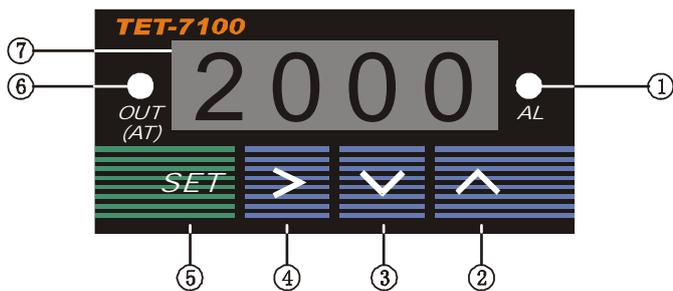


Figure 2.

- 1 -- AL, Relay J1 Indicator.
- 2 -- Select next parameter / value increment.
- 3 -- Selection previous parameter / value decrement.
- 4 -- Digit select / Auto tuning.
- 5 -- Setting / Confirm.
- 6 -- Output, controlled output indicator. (AT) Blanking during auto-tuning process.

### 4. Parameter Setting

- i Press (SET) to enter setting mode.
- ii Press (>), (v) and/or (^) to enter and select parameters.
- iii Press (SET) to confirm entry or selection.

a) To enter initialization parameter setting mode press (SET), then enter code “0089”, press (SET) again.

Table 1. Initialization Parameters:

Symbol	Description	Range	Default	Comment
Inty	Temp. sensor	See table 2	Pt100	
Outy	Method of controlled output	0,1,2	2	Note 1
Caty	PID algorithm	0,1,2	0	Note 2
PSb	Temp sensor error correction coefficient	-100~100 deg C	0	
Rd	Heating=0;Cooling=1	0,1	0	
CorF	Celsius=0;Fahrenheit=1	0,1	0	
End	Exit			

Table 2. Temperature Sensor Type:

Symbol	Description	Range	Comment
T	T Thermocouple	0 ~ 4000	Internal Resistant
R	R Thermocouple	0 ~ 1600	Internal Resistant
J	J Thermocouple	0 ~ 1200	Internal Resistant
WRe	WRe Thermocouple	0 ~ 2300	Internal Resistant
B	B Thermocouple	350 ~ 1800	Internal Resistant
S	S Thermocouple	0 ~ 1600	Internal Resistant
K	K Thermocouple	0 ~ 1300	Internal Resistant
E	E Thermocouple	0 ~ 900	Internal Resistant
P10.0	P100 Thermo Resistor	-2.000 ~ 6.000	Constant Output
P100	Pt100 Thermo Resistor	-200 ~ 600	Constant Output
Cu50	Cu50 Thermo Resistor	-500 ~ 1500	Constant Output

Note 1:

- 0: Relay J1 Alarm output; SSR Disabled, normally used for upper lower limit alarm trigger control.
- 1: Relay J1 PID controlled output: SSR Disabled. Contact controlled output.
- 2: Relay J1 as alarm output; SSR PID controlled 12 Volt output. Know as No Contact controlled output.

Note 2:

This controlled has 3 type of auto-tuning control methods already built-in.

- 0: Universal PID control suitable for increase/decrease fast speed of change of temperature application.
- 1: Gradual change PID control is suitable for applications that require steady change of temperature and speed of temperature change is not critical.
- 2: Fussy logic control suitable for system with oscillation and sensing signal delay.

### Initial lization parameter setting

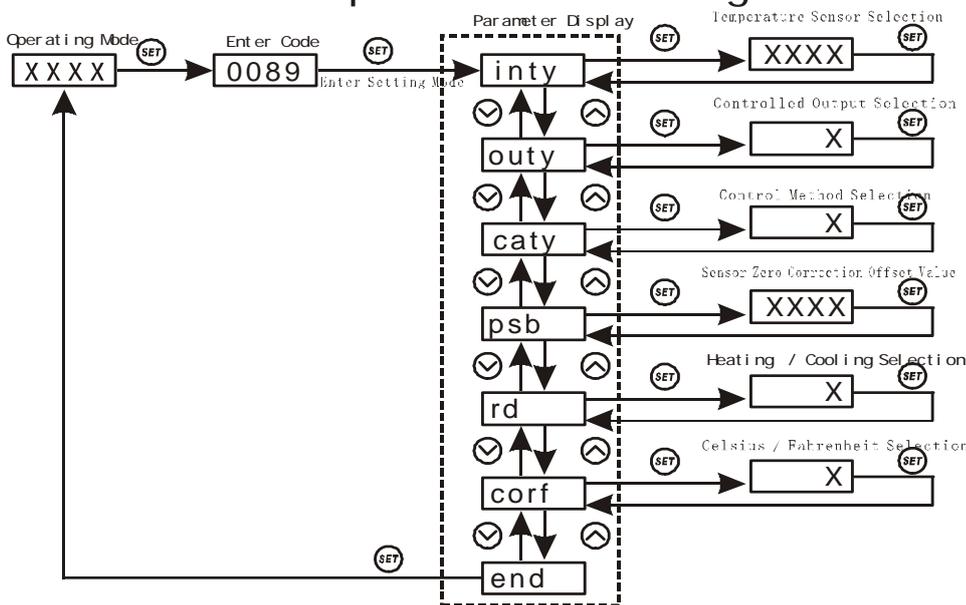


Figure 3.

Table 2. Temperature Sensor Type:

Symbol	Description	Range	Comment
T	T Thermocouple	0 ~ 4000	Internal Resistant
R	R Thermocouple	0 ~ 1600	Internal Resistant
J	J Thermocouple	0 ~ 1200	Internal Resistant
Wre	Wre Thermocouple	0 ~ 2300	Internal Resistant
B	B Thermocouple	350 ~ 1800	Internal Resistant
S	S Thermocouple	0 ~ 1600	Internal Resistant
K	K Thermocouple	0 ~ 1300	Internal Resistant
E	E Thermocouple	0 ~ 900	Internal Resistant
P10.0	P100 Thermo Resistor	-2.000 ~ 6.000	Constant Output
P100	Pt100 Thermo Resistor	-200 ~ 600	Constant Output
Cu50	Cu50 Thermo Resistor	-.500 ~ 1.500	Constant Output

b) To enter PID parameter setting mode press (SET), then enter code “0036”, press (SET) again.

Table 3. PID and Relevant Parameters:

Symbol	Description	Range	Default	Comment
P	Proportional Band	0.1 ~ 99.9 (%)	5.0	Note 4
I	Integration Time	2 ~ 1999 (Sec)	100	Note 5
D	Diffenciation Time	0 ~ 399 (Sec)	20	Note 6
SF	Integration Range	1 ~ 999 (Deg)	40	Note 7
Bb	On/Off Control Range	1 ~ 999 (Deg)	40	Note 8
Ot	Control Period	2 ~ 199 (Sec)	2	Note 9
Filt	Digital Filtering Strength	0 ~ 3	0	Note 10
End	Exit			

P,I and d parameters control the accuracy and respond time of the temperature controller. Auto-tuning is recommended for user who do not familiar PID control theory. P, I and d values should only be adjusted by professionals.

Note 4

Proportional Band (P): When P increases, fluctuation of object being controlled decreases. When P decreases, fluctuation of object being controlled increases. When P value is too small, system may become non-converge.

Note 5

Integration time (I): its purpose is to reduce static error. When I decrease, respond speed is faster but system is less stable. When I increase, respond speed is slower, but system is more stable.

Note 6

Differentiation time (d): its purpose is to control in advance and compensate delay. Setting d-value too small or too large would decrease system stability, oscillation or even non-converge.

Note 7

Integration control range (SF): It defines integration range limits. When  $|SV-PV| < SF$ , integration control is activated.

Note 8

Full power/complete off range (bb): It defines temperature range limits that the heating/cooling element is either fully on or fully off. When  $|SV-PV| > bb$ , heating/cooling element could be either full power heating or complete not power.

Note 9

Control Period (ot): When ot gets smaller, heating/cooling cycle is drive faster, system respond speed is faster. But when using contact control (Relays), contacts wear out faster.

When contact control (Relay) is used, normally set  $ot=5\sim30$ .

When non-contact control (SSR) is used, normally set  $ot=2$ .

Note 10

Digital Filtering (Filt): Filt=0, filter disabled; Filt=1, weak filtering effect; Filt=3, strongest filtering effect; Stronger the filtering, more stable the readout, but has more readout display delay.

c) To enter temperature and alarm parameter setting mode press (SET), then enter code “0001”, press (SET) again.

Table 4. Temperature Setting and Alarm Related Parameters:

Symbol	Description	Range	Default	Comment
SV	Target Temperature	With testing range	80.0	
AH1	Relay Closed	With testing range	80.0	
AL1	Relay Opened	With testing range	90.0	
End	Exit			

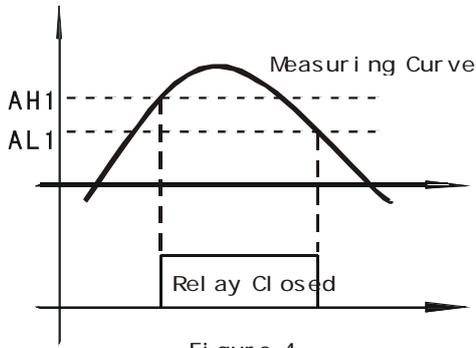


Figure 4

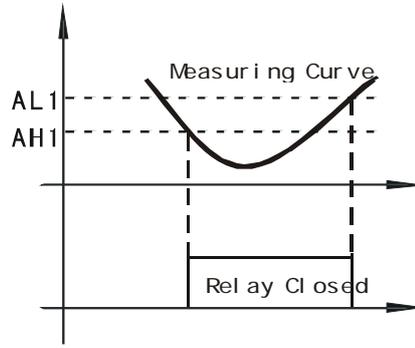


Figure 5

d) During Normal Operation mode, pressing (^) or (v), the display would show SV. Press (^) or (v) again increase or decrease SV by 1 degree.

- a) Set AH1=AL1, relay is disabled.
- b) Set AH1>AL1: Normally used for upper limit alarm trigger. See Figure 4.
- c) Set AH1<AL1: Normally used for lower limit alarm trigger. See Figure 5.

### 5. Auto-Tuning

By simply press a single button the built-in artificial intelligent is activated to automatically calculate and set parameters (P,I,d,SF,bb,ot) that fit the condition to be controlled.

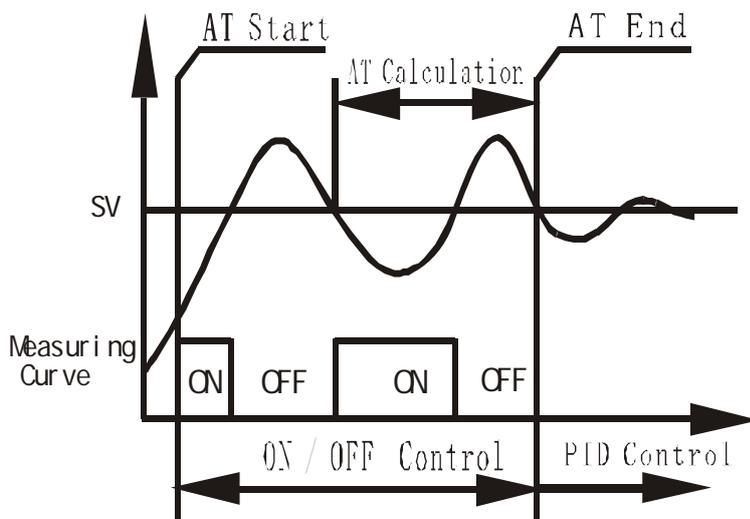


Figure 6.

a) How to Start and stop auto-tuning process:

- i. To activate auto-tuning, press and hold (>) until “AT” indicator blinks, which indicates auto-tuning is in progress. When auto-tuning finish, “AT” indicator is off. Now newly calculated PID parameters are remembered and start to be used.
- ii To EXIT during auto-tuning process, press and hold (>) until “AT” indicator turns off. Then previous PID parameters values are resumed.

**6. Connection Terminals (back view).**

Polarity of power at terminal 1 and 2 do not matter

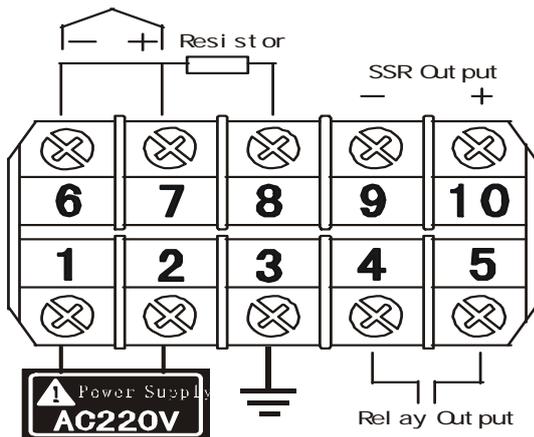


Figure 7.

**7. Device Application Example**

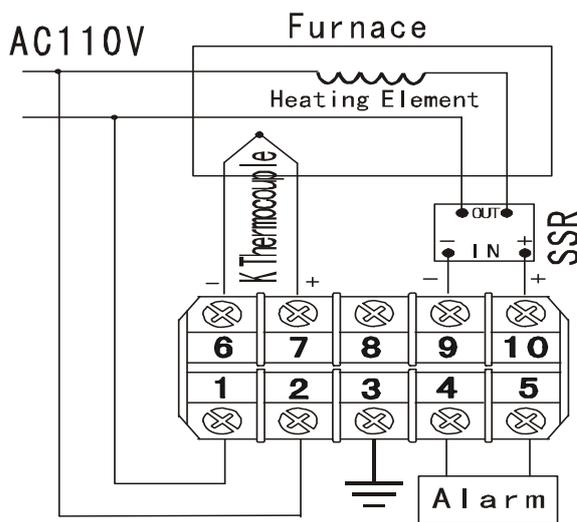


Figure 8.

User want to control temperature (T) of furnace, 0 ~ 1000 deg Celsius sensor range is required. Furnace is to be maintained at 800 deg C. Alarm will go off if T>850 deg C. System power supply is AC110V. Installation opening is 44x20(mm). SSR will be used to control the heating element.

a) Choose TET-7100 with K-type thermocouple.

b) See figure for connection diagram.

c) Parameter setting:

(Inty)=K

(outy)=2

(caty)=0

(psd)=0

(rd)=0

(filt)=0

(auto-tuning is used to set PID parameters)

(SV)=800 deg C

(AH1)=850 deg C

(AL1)=848 deg C

d) Power up the controller. Keep pressing (>) to activate auto-tuning. When “AT” stop blinking, new PID parameters are generated for the new system. The controller is in normal operation mode.