Instruction Manual

XMT-7100 Intelligent Temperature Controller

Figure 1

1. Product Highlights

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
Three built-in algorithms that fit most control objects and various applications.
Temperature can be set to display in either Fahrenheit or Celsius degrees.

2. Specifications

Supply voltage: 18-265V AC or DC
Power consumption: < 2 Watts.
Sampling speed: 4/sec.
SSR activated voltage: open circuit: 10V; short circuit: 40mA.
Accuracy: 0.2% of full scale.
LED Display: Red, 0.28 inch
Out of range indication: “EEEE”.
Ambient temperature requirements: 0 to 50 C (32 to 122 F)
Humidity requirement: < 85% RH.
Relay Contact: 220VAC, 3A.
Controller dimensions: 48 x 24 x 75 (mm).
Opening for installation: 44 x 20 (mm)

3. Panel Illustration and Description

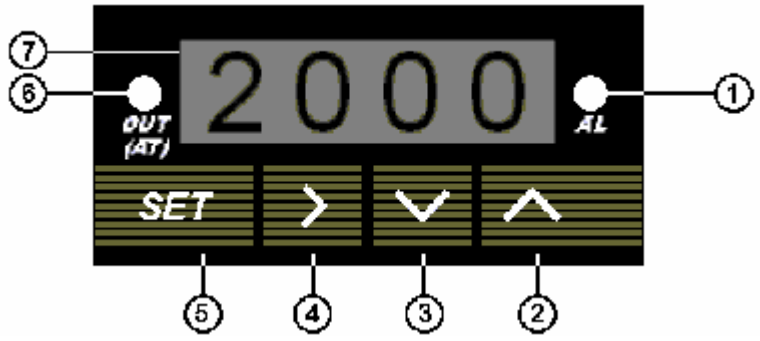

Figure 2

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) Blinking during auto-tuning process.

7 – Temperature reading, degrees F or degrees C (as chosen)

4. Parameter Setting

a) Press (SET) to enter setting mode.

b) Press (>), (v) and/or (^) to enter and select parameters.

c) Press (SET) again to confirm entry or selection.

i.) To enter initialization parameter setting mode press (SET), then enter code "**0089**", press (SET) again.

Table 1 - Initialization Parameters

Symbol	Description	Range	Default	Setting	Comment
Inty	Temperature Sensor Type	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	Temperature Sensor Correction	-100 to +100 degrees F, 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	-270 ~ 400 C	Internal Resistant
r	R Thermocouple	-50 ~ 1768 C	Internal Resistant
J	J Thermocouple	-210 ~ 1200 C	Internal Resistant
WrE	WRe Thermocouple	0 ~ 2300	Internal Resistant
b	B Thermocouple	0 ~ 1820 C	Internal Resistant
S	S Thermocouple	-50 ~ 1768 C	Internal Resistant
K	K Thermocouple	-270 ~ 1372 C	Internal Resistant
E	E Thermocouple	-270 ~ 1000 C	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. No Contact controlled output.

Note 2:

This controller has 3 types 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: Fuzzy logic control suitable for system with oscillation and sensing signal delay.

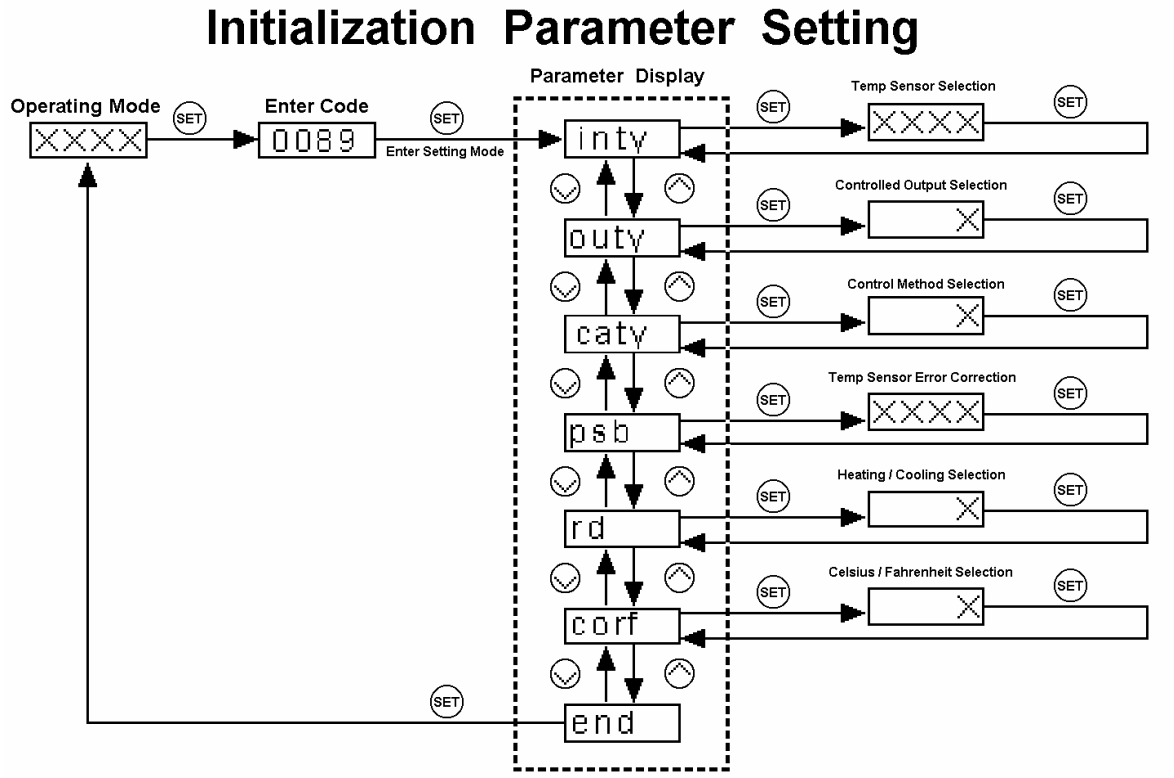

Figure 3

ii.) To enter the PID parameter setting mode, press (SET), then enter code "**0036**", press (SET) again.

Table 3 - PID and Relevant Parameters:

Symbol	Description	Range	Default	Setting	Comment
P	Proportional Band	0.1 ~ 99.9 (%)	5.0		Note 4
I	Integration Time	2 ~ 1999 (Sec)	100		Note 5
d	Differentiation 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 response time of the temperature controller. Auto-tuning is recommended for users who are not familiar with 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, response 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): As "ot" is set lower, the heating/cooling cycle is driven faster, and thus system responce speed is faster. When using contact control (Relay), the mechanical contacts will wear out faster.
When contact control (Relay) is used, normally set ot = 5~30.
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.

iii.) 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	Setting	Comments
SV	Target Temperature	Within testing range	80.0		
AH1	Relay Closed	Within testing range	80.0		
AL1	Relay Opened	Within testing range	90.0		
End	Exit				

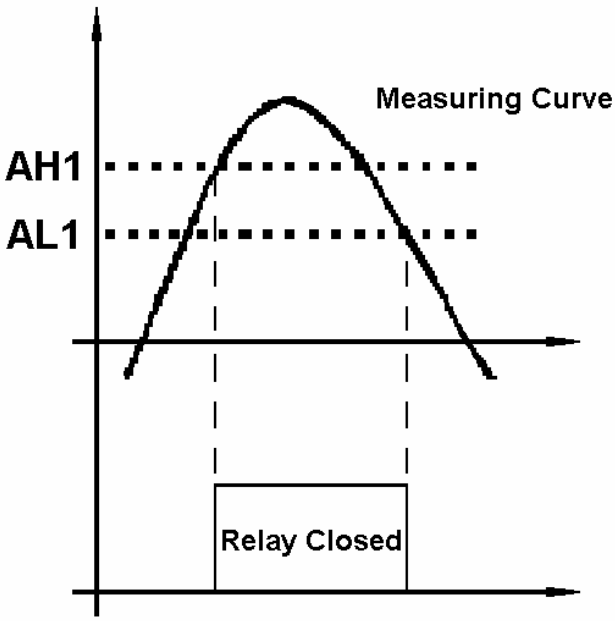

Figure 4

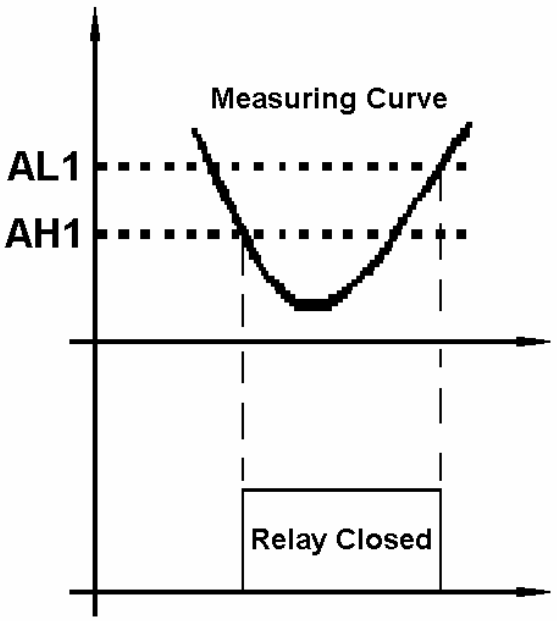

Figure 5

iv.) During Normal Operation mode, pressing (^) or (v), the display will show SV. Pressing (^) or (v) again would 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 pressing 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.

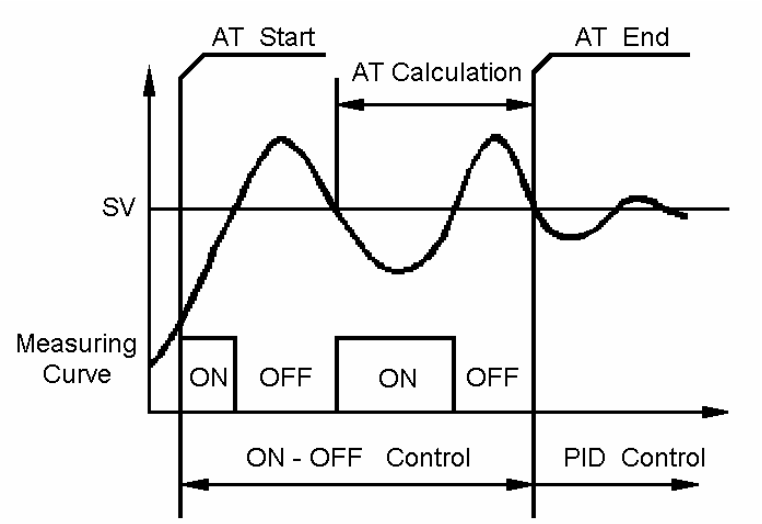

Figure 6

a) How to start and stop the 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 finishes, the “AT” indicator light turns off. Now newly calculated PID parameters are stored in memory and will be used by the controller.

ii. To EXIT during the auto-tuning process, press and hold (>) until “AT” indicator turns off. The previously entered PID parameters values are used by the controller.

6. Connection Terminals (back view).

Note that the polarity of power at terminals 1 and 2 does not matter.

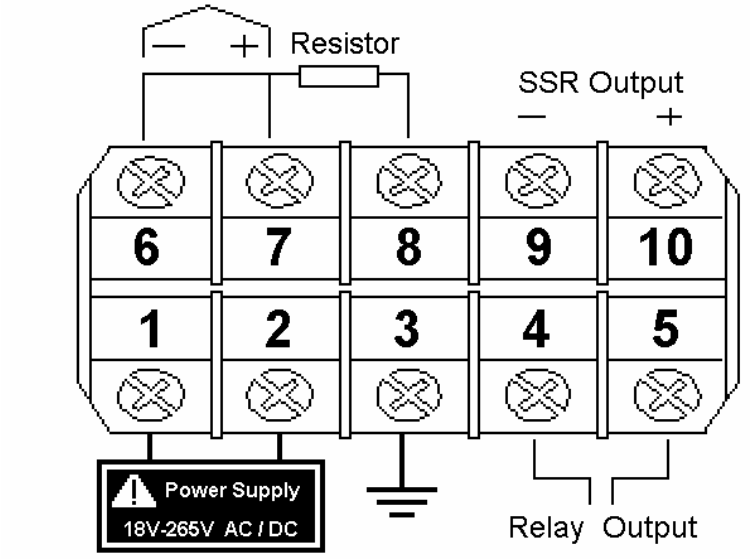

Figure 7

7. Device Application Example

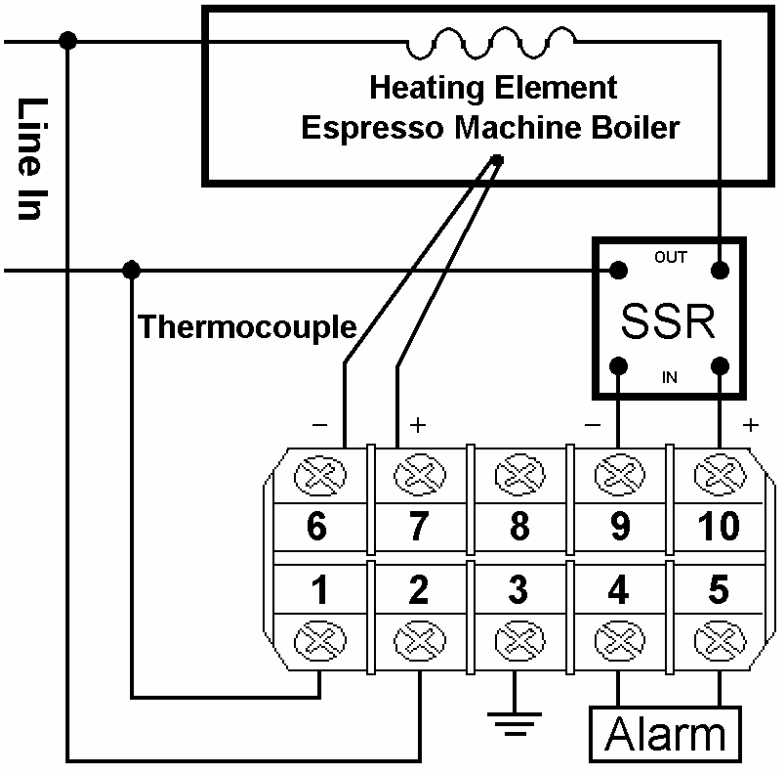

Figure 8

User wants to control internal temperature (T) of boiler by measuring the surface temperature of the boiler. A surface mounted, Type K thermocouple is chosen. Boiler surface is to be maintained at 225 deg F. System power supply is AC120V. Installation opening is 44 x 20(mm). A solid state relay (SSR) with a rating of 25A will be used to control the heating element.

a) Choose XMT-7100 with input from a Type T thermocouple.
b) See Figure 8 for connection diagram.
c) Parameter settings:

(Inty) = t

(Outy) = 2

(CAty) = 0

(PSb) = 0

(Rd) = 1

(CorF) = 1

(filt) = 0

(auto-tuning will be used to set PID parameters)

(SV) = 225 deg F

(AH1) = 325 deg F

(AL1) = 325 deg F

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