USER'S OPERATING MANUAL FOR DIGITAL TEMPERATURE CONTROLLER

(Models: AI 5442 / 5742 / 5942)

AI - 5442
(48 X 48)

AI - 5742
(72 X 72)

AI - 5942
(96 X 96)

SPECIFICATIONS : -

1. **DISPLAY TYPE** : 4- Digit 7 segment LED (Bright White)

Model no.	AI-5442	AI-5742	AI-5942
Display height	0.36"	0.56"	0.56"

STATUS LED'S : OP1 : Main Control Output
OP2 : Alarm Status
: Auxiliary control output

2. **INPUT**

Sensor Input : TC:J,K,R,S & RTD: Pt-100
Range : Refer below table

Sensor Type	Range	Resolution	Accuracy
Fe-k(J) T/C	0 ~ 760°C	1 °C	± 1 °C
Cr-AL(K) T/C	-99 ~ 1300°C	1 °C	
(R) T/C	0 ~ 1700°C	1 °C	
(S) T/C	0 ~ 1700°C	1 °C	
Pt-100(RTD)	-100 ~ 450°C	1 °C	
Pt-100(RTD 0.1)	-99.9 ~ 450.0°C	0.1 °C	± 0.3 °C

Sampling Time : 125 msec.
Resolution : 1°C/0.1°C(Only for RTD)
CJC for TC : Built in automatic
LWC for Pt-100 : Built in upto 18E max.
Digital Filter : 1 to 10 Sec.

3. **RELAY OUTPUT**

Contact type : N/O, CM, N/C
Contact Rating : 5A @ 250VAC or 30 VDC
Life expectancy : > 5,00,000 operations
Isolation : Inherent

4. **SSR DRIVE OUTPUT**

Drive Capacity : 12V @ 30mA.
Isolation : Non-Isolated.

5. **FUNCTION**

Output 1 : Main Control output
Output 2 : Programmable
1) Auxiliary control 2) Alarm
Control Action : ON-OFF/T.P (Select)
Control Mode : Heat/Cool (Select)
Compliance : ----

6. **ENVIRONMENTAL**

Operating Range : 0 ~50°C, 5~90% Rh
Storage Humidity : 95% Rh (Non-condensing)

7. **POWER SUPPLY**

Supply Voltage : 90~270VAC, 50/60Hz.
Consumption : 4W Maximum.

8. **PHYSICAL**

Housing : ABS Plastic

Model no.	AI-5442	AI-5742	AI-5942
Weight (gms.)	130	200	240

SAFETY INSTRUCTION :

This controller is meant for temperature control applications. It is important to read the manual prior to installing or commissioning of controller. All safety related instruction appearing in this manual must be followed to ensure safety of the operating personnel as well as the instrument.

GENERAL

- The controller must be configured correctly for intended operation. Incorrect configuration could result in damage to the equipment or the process under control or it may lead personnel injury.
- The controller is generally part of control panel and in such a case the terminals should not remain accessible to the user after installation.

MECHANICAL

- The Controller in its installed state must not come in close poximity to any corrosive/combustible gases, caustic vapors, oils, steam or any other process by-products.
- The Controller in its installed state should not be exposed to carbon dust, salt air, direct sunlight or radiant heat.
- Ambient temperature and relative humidity surrounding the controller must not exceed the maximum specified limit for proper operation of the controller.
- The controller in its installed state must be protected against excessive electrostatic or electromagnetic interferences. Ventilation holes provided on the chassis of the instrument are meant for thermal dissipation hence should not be obstructed in the panel.

ELECTRICAL

- The controller must be wired as per wiring diagram & it must comply with local electrical regulation.
- Care must be taken not to connect AC supplies to low voltage sensor input.
- Circuit breaker or mains s/w with fuse (275V/1A) must be installed between power supply and supply terminals to protect the controller from any possible damage due to high voltage surges of extended duration.
- Circuit breaker and appropriate fuses must be used for driving high voltage loads to protect the controller from any possible damage due to short circuit on loads.
- To minimize pickup of electrical noise, the wiring for low voltage DC and sensor input must be routed away from high current power cables. Where it is impractical to do this, use shielded ground at both ends.
- The controller should not be wired to a 3-Phase supply with unearthed star connection. Under fault condition such supply could rise above 264 VAC which will damage the controller.
- The Electrical noise generated by switching inductive loads might create momentary Fluctuation in display, alarm latch up, data loss or permanent damage to the instrument.
  To reduce this use snubber circuit across the load.
- It is essential to install a over Temp. Protection device to avoid any failure of heating system. Apart from spoiling the product, this could damage the process being controlled.

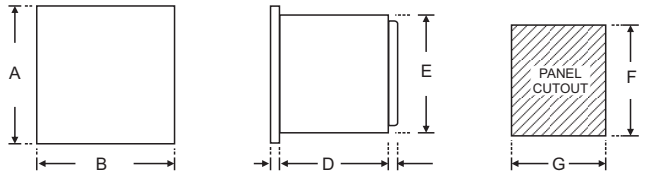
⚠**CAUTION: To prevent the risk of electrical shock, switch off the power before making/removing any connection or removing the controller from its enclosure.**

MECHANICAL INSTALLATION

The label on the controller identifies the serial number, wiring connections and batch number.

OVER ALL DIMENSIONS & PANEL CUT OUT (IN MM)

MODEL:-AI-5442/5742/5942



MODEL : AI - 5842

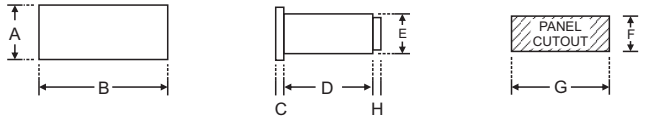


TABLE : 1

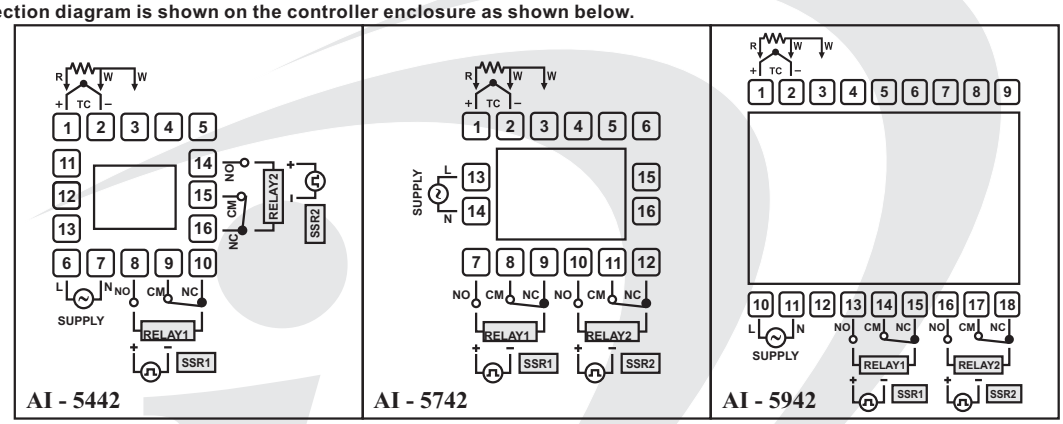
Model \ Dim	A	B	C	D	E	F	G	H
AI-5442	48	48	8	75	43	44	44	9
AI-5742	72	72	10	65	66	68	68	9
AI-5942	96	96	10	45	89	92	92	9

INSTALLATION GUIDELINES

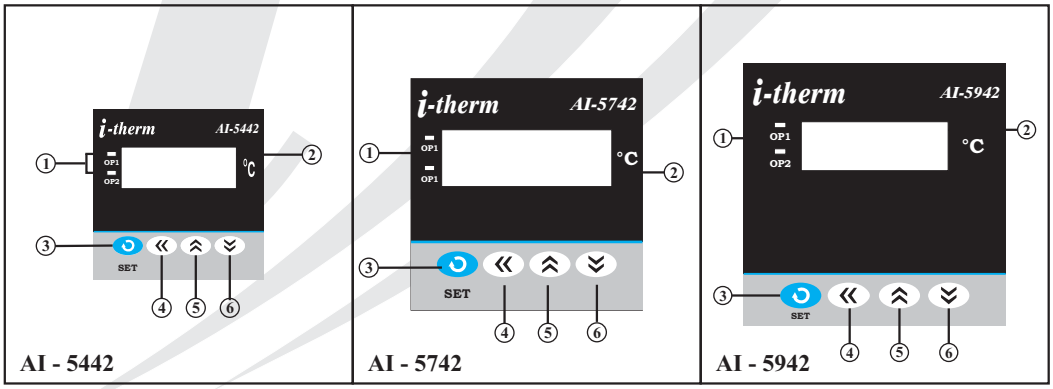
1. Prepare the cut-out with proper dimension as shown in figure.
2. Remove clamp from controller.
3.Push the controller through panel cut-out and secure the controller in its place by tightening the side clamp.

ELECTRICAL INSTALLATION

The electrical connection diagram is shown on the controller enclosure as shown below.



FRONT PANEL LAYOUT

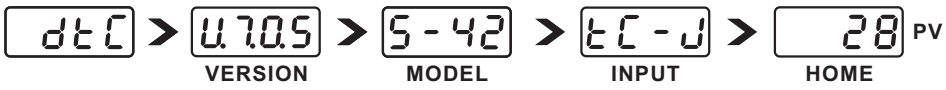


FRONT PANEL LAYOUT DESCRIPTION :

Sr.	NAME	FUNCTION
1	OP1 LED	Glows when OP1 is ON & flashes when delay time (dly1) is in operation (if selected mode is ON-OFF)
	OP2 LED	Glows when OP1 is ON & flashes when alarm condition persists even after acknowledged or delay time (dly2) is in operation (if selected mode is ON-OFF).
2	DISPLAY	It will display: (1) Measured value of selected input or Error massages. (2) SP (Main set point) / SP2 value in run mode. (3) Parameters Value/code in program mode.
3	SET KEY	(1) For SP programming. (2) To access Control mode along with DN Key. (3) To access Configuration mode along with UP key. (4) To scroll the parameter & to store its value.
4	SHIFT KEY	(1) To increase/alter parameter value in program mode with Up / Dn Key. (2) Press for 3Sec in Programming this will help to go back to previous parameter.
5	UP KEY	(1) To increase/alter parameter value in program mode. (2) To Enter in configuration mode (with SET key). (3) To acknowledge Alarm.
6	DOWN KEY	(1) To decrease/alter parameter value in program mode. (2) To Enter control mode along with SET Key.

POWER UP :

At power on, following sequence will be prompted on the display for 1 sec. till it reaches to Home display mode.



In Home display mode, by pressing SET key once, user can view SP value.

PROGRAMMING

USER LIST : To access the user list Press & Release SET key once.

(All following selected parameter's code shown in shaded will be displayed for 1 sec. followed by their values / options)

PARA METER	DISPLAY	RANGE	DESCRIPTION	DEFAULT
CONTROL SET POINT	SP1 > 100	LSPL ~ HSPL	User can change the SP1 value using UP/ DOWN keys. Holding the key will change the value at a faster rate. Press SET key to store the value and move on to the next parameter.	0°C
SET POINT2	SP2 > 100	LSPL ~ HSPL	This parameter is prompted only if Output 2 is configured as... (1) Either absolute auxiliary control or as an alarm (High/Low) mode. (2) Either deviation auxiliary control or as a deviation alarm mode. (3) As a band alarm.(For all above SP2 has to be enable)	0°C

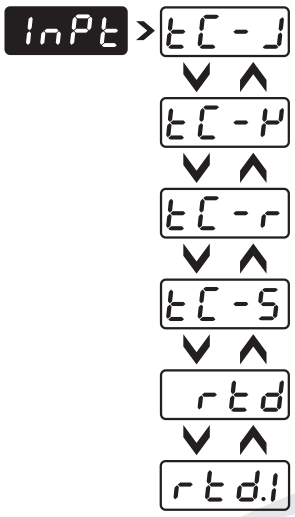
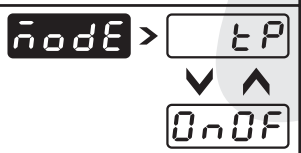
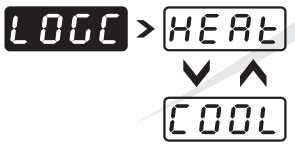
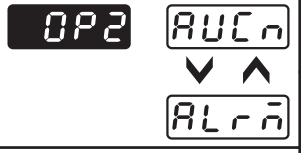
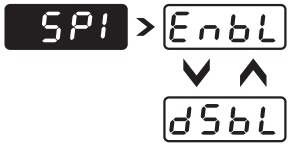
CONTROL LIST : To enter in this mode press SET & DOWN key simultaneously for 3 sec. User can then set the control parameters.

(All following selected parameter's code shown in shaded will be displayed for 1 sec. followed by their values / options)

PARA METER	DISPLAY	RANGE	DESCRIPTION	DEFAULT
LOCK CODE	LOCY > 0	1 ~ 9999	Set this parameter to 15 (Default LOCK CODE) to access Control List. User has a choice to set different Lock Code via USER LOCK CODE in Config. List.	0
P. BAND	Pbnd > 5.0	0.5 to 999.9°C	This parameter will appear only if selected control action is T.P. It sets bandwidth over which the output power is adjusted depending upon the error (SV-PV).	5.0 °C
CYCLE TIME	CYCt > 16.0	1.0 to 100 Sec.	This parameter will appear only if selected control action is T.P. User can set this value based on process being controlled & type of output selected. For Relay O/P, cycle time should be more than 12sec & for SSR O/P, cycle time should be less than 5sec.	16.0 Sec.
CONTROL HYS.	HYS1 > 2	1 to 100 °C	This parameter will appear only if selected control action is ON-OFF. It sets the dead band between ON & OFF switching of the Output. Larger value of hysterisis minimize the number of ON-OFF operation of the load. This increases life of actuators like contactors but, also produces large errors (between PV & SV).	2°C
DELAY 1	dLY1 > 0	0 to 500 Sec.	This parameter will appear only if selected control action is ON-OFF. It sets the output restart time where O/P once turned OFF will turn ON only after restart time, regardless difference between PV & SP. If set to '0', O/P will be switched w/o delay. Also, Delay will be considered in case of every power ON.	0 Sec.
HYS. 2	HYS2 > 2	1 to 100°C	This parameter will appear only if selected control mode for output2 is Auxiliary control or an Alarm. Value of this parameter sets the dead band between ON & OFF switching of output load.	2°C
DELAY 2	dLY2 > 0	0 to 500 Sec.	This parameter will appear only if output 2 is configured as an Auxiliary control output. In this mode, output once turned off will restart only after set time regardless of the difference between PV and SP2. If time delay is set to 0, there is no delay executed between output switching.	0 Sec.
MANUAL OFFSET	SPOF > 0	-25 to 25 °C	This parameter will appear only if selected C.A is time proportional. (For more details refer user guide.)	0 °C

CONFIGURATION LIST :

(1) To Enter in this mode, Press and hold SET & UP key simultaneously for 3 sec.
(2) Press UP or DOWN key to scroll between parameter options.
(3) Press SET key to store the current parameter & move on to the next parameter.
(All following selected parameter's code shown in shaded will be displayed for 1 sec. followed by their values / options)

<table>
<tr><th>PARA METER</th><th>DISPLAY</th><th>DESCRIPTION</th><th>DEFAULT</th></tr>
<tr><td>LOCK CODE</td><td>  </td><td>Set this parameter to 15 (Default LOCK CODE) to access Config List.
User has a choice to set different Lock Code between 1 to 9999 via USER LOCK CODE in Config. List.</td><td>0</td></tr>
<tr><td>INPUT TYPE</td><td>  </td><td>This parameter value is set according to the type of sensor (Thermocouple or RTD Input) connected to the Controller's Input Terminals.
<table><tr><th>Sensor Type</th><th>Range</th><th>Resolution</th><th>Accuracy</th></tr><tr><td>Fe-k(J) T/C</td><td>0 ~ 760°C</td><td>1 °C</td><td rowspan="5">± 1 °C</td></tr><tr><td>Cr-AL(K) T/C</td><td>-99 ~ 1300°C</td><td>1 °C</td></tr><tr><td>(R) T/C</td><td>0 ~ 1700°C</td><td>1 °C</td></tr><tr><td>(S) T/C</td><td>0 ~ 1700°C</td><td>1 °C</td></tr><tr><td>Pt-100(RTD)</td><td>-100 ~ 450°C</td><td>1 °C</td></tr><tr><td>Pt-100(RTD 0.1)</td><td>-99.9 ~ 450.0°C</td><td>0.1 °C</td><td>± 0.3 °C</td></tr></table></td><td>tC-J</td></tr>
<tr><td>LOWER SP LIMIT</td><td>  </td><td>Sets the minimum limit for set point adjustment. It can be set from minimum specified range of selected sensor to HSPL value.</td><td>0 °C</td></tr>
<tr><td>HIGHER SP LIMIT</td><td>  </td><td>Sets the maximum limit for set point adjustment. It can be set from LSPL value to maximum specified range of selected sensor.</td><td>400 °C</td></tr>
<tr><td>PROCESS VALUE OFFSET</td><td>  </td><td>Function of this parameter is to add/subtract a constant value to the measured PV to obtain Final PV for control applications. This parameter value needs to be altered for one of the following reason :
(I) To compensate for known thermal gradient (ii)To match the display values with another recorder or indicator measuring the same PV.</td><td>0 °C</td></tr>
<tr><td>INPUT FILTER</td><td>  </td><td>The controller is equipped with an adaptive digital filter which is used to filter out any extraneous pulses on the PV. Filtered PV Value is used for all PV dependent functions. If PV signal is fluctuating due to noise, increase the filter time constant value.</td><td>4</td></tr>
<tr><td>CONTROL MODE FOR OUTPUT1</td><td>  </td><td>User can select between ON-OFF or T.P action algorithm to be adopted for output.</td><td>On-Off</td></tr>
<tr><td>CONTROL LOGIC FOR OP1</td><td>  </td><td>This parameter will appear only if selected control mode is ON-OFF.
User can select heating logic in which OP1 will remain ON till PV < SP.
(PV increases when output is ON)
This parameter will appear only if selected control mode is ON-OFF.
User can select cooling logic in which OP1 will remain ON till PV > SP.
(PV decreases when output is ON.)</td><td>HEAT</td></tr>
<tr><td>OUTPUT2 FUNCTION</td><td>  </td><td>This parameter allow the user to select output 2 as an 'Auxiliary' control.
For options refer Table 3.
This parameter allow the user to select output 2 as an 'Alarm' control.
For options refer Table 4.</td><td>AUX. CONTROL</td></tr>
<tr><td>SET POINT 2</td><td>  </td><td>If Enabled, User can View & edit the Set point1 in USER list.
If disabled, User can only View the Set Point1 but Can not edit it in USER list.</td><td>DSBL</td></tr>
</table>

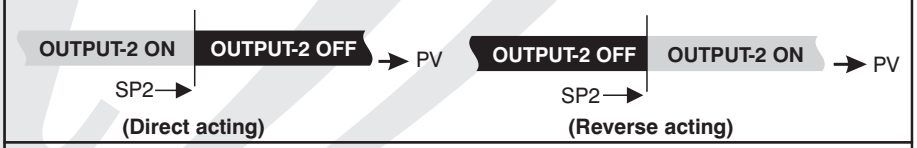
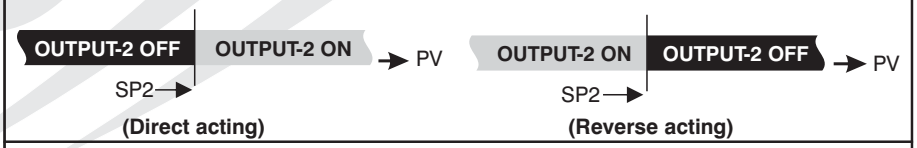
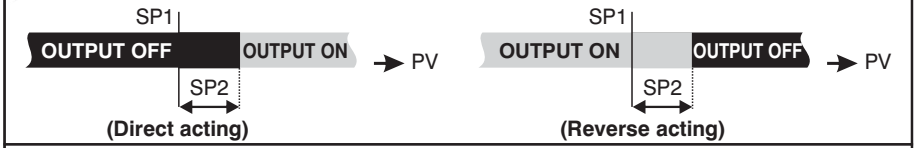
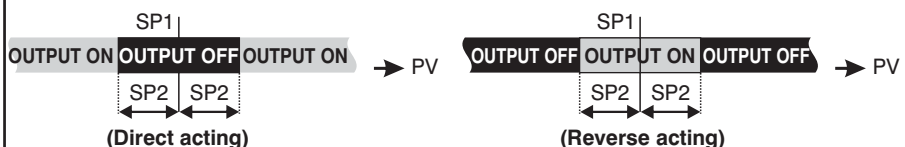
SET POINT 2	SP2 > EnbL / dSbL	If Enabled, User can View & edit the Set point2 in USER list. If disabled, User can only View the Set Point2 but Can not edit it in USER list.	**DSBL**
USER LOCK CODE	U.LOC > 15	Default USER LOCK CODE is 15 to access Control & Configuration List. User has a choice to set its own USER LOCK CODE between 1 to 9999, this is to prevent unauthorized access of Control & Configuration List.	**15**

TABLE 3 : Below listed options will appear only if OP2 is selected as an Auxiliary control mode .
(All following selected parameter's code shown in shaded will be displayed for 1 sec. followed by their values / options)

PARA METER	DISPLAY	DESCRIPTION	DEFAULT
OUTPUT 2 MODE	SP2 > AbS / dEvn	This parameter will appear only if OUTPUT 2 is selected as an Auxiliary control output. In this mode, User can set SP2 value independently. The instrument works as 2-Set point controller. This parameter will appear only if OUTPUT 2 is selected as an Auxiliary control output. In this mode, User can set SP2 value which is always related to SP. User can set SP2 value with the deviation of ± 99°C w.r.t SP.	**AbS**
OUTPUT 2 LOGIC	OP2L > HEAt / COOL	User can select heating logic in which OP2 will remain ON till PV < SP2. (PV increases when output2 is ON) User can select cooling logic in which OP2 will remain OFF till PV < SP2. (PV decreases when output2 is ON)	**HEAT**

TABLE 4 : Below listed parameters will appear only if OUTPUT 2 is selected as ALARM. In ALARM mode, Controller continuously compares PV with either SP (for Deviation or Band alarm) or an independent ALARM SP2 (for process high and process low Alarm). Alarm will occur when PV falls outside the set Alarm limits. Also, OP2 will energize or de-energize under Alarm condition as per the Alarm logic(AL.LG) selected. HYS2 in Control list decides when to switch OFF the Alarm. Instrument supports four types of Alarm as described below : -

(All following selected parameter's code shown in shaded will be displayed for 1 sec. followed by their values / options)

PARA METER	DISPLAY	DESCRIPTION	DEFAULT
ALARM TYPE	AL.TY > LOY / HIGh / dEvn / bAnd	Low Alarm : OP2 activates when PV<SP2.  High Alarm : OP2 activates when PV>SP2.  Deviation Alarm : OP2 activates when PV exceeds SP1 ± set deviation value.  Band Alarm : OP2 activates when PV falls outside the band w.r.t. SP1 in either direction. 	**DEVIATION**
ALARM LOGIC	AL.LG > dIr / rEv	If this parameter is set as 'Direct', Relay/SSR energizes under Alarm condition & remains De-energized otherwise. Generally 'Direct' setting is used for Audio/Visual Alarm Output. If this parameter is set as 'Reverse', Relay/SSR de-energizes under Alarm conditions & remains energized otherwise. Generally 'Reverse' setting is used for tripping the process under Alarm conditions.	**DIRECT**

ALARM INHIBIT	AL.IH > YES / nO	Setting this parameter value to 'YES', will inhibit (suppress) Alarm activation on power-up condition. From Power-up, the Alarm system remains disabled until PV is found with in the limits.	**NO**
		If Alarm activation is desired even under Power-up condition, Set this parameter value to 'NO'.	
ALARM ACK.	AL.AP > AUTO / nAUL / bOTH	Once Alarm is activated, User has following three options to de-activate it. When PV falls within the programmed limits, Alarm will be de-activated automatically.	**AUTO**
		Once Alarm is activated, it remains activated until manually acknowledged by UP key.	
		Once Alarm is activated, it can be de-activated either by pressing UP key or when PV falls within the alarm limits.	

USER GUIDE:

1) ON-OFF ACTION:

In this mode, Output (Relay/SSR) remains ON till actual temperature reaches to Set point value. On reaching SP, output turns OFF & remains OFF till actual temperature drops down (in heat logic) Or raises (in cool logic) equal to hysterisis set by user. (As shown in Fig. 3.1 & 3.2).

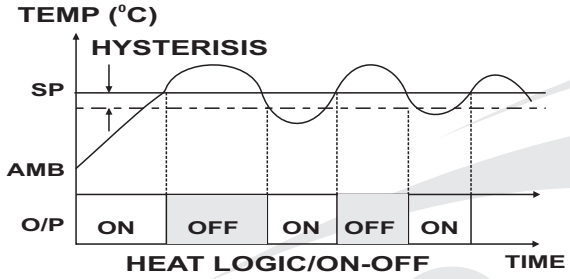


Fig: 3.1

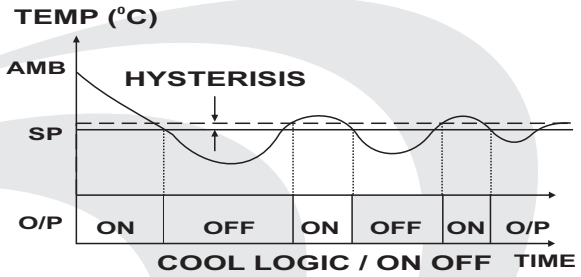


Fig: 3.2

2) TIME PROPORTIONAL ACTION:

In this mode, ON & OFF time of Output (Relay/SSR) varies proportionally in every cycle (cycle time Settable by user) depending on the deviation of PV w.r.t. SP. This action starts/continues only when PV enters or is within the band. (Fig. 3.3)

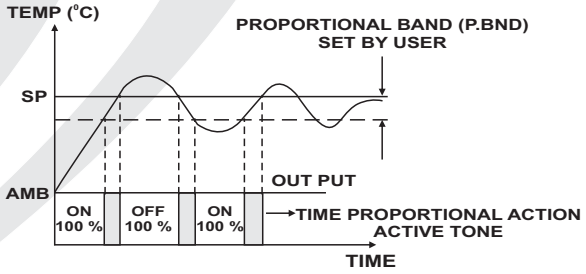


Fig: 3.3

3) MANUAL RESET (OFFSET ADJUSTMENT):

In some application, after adopting-Time proportionating action system may stabilize at particular temperature over a period of time which can be different than the set value. This steady state (Error) offset can be eliminated by setting the value of this parameter equal and opposite to the existing offset. (As shown in Fig.3.4)

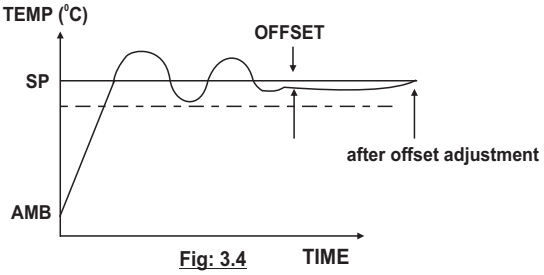


Fig: 3.4

ABBREVIATION :

C.A.	: Control Action	NC	: Normally Close terminal of relay	SP	: Set Point Value(set temp.)
CJC	: Cold junction compensation	NO	: Normally Open terminal of relay	SSR	: Solid State Relay
CM	: Common terminal of relay	OP1	: Output 1	T.P.	: Time Proportional
LWC	: Lead wire (Length) compensation	OP2	: Output 2	T/C	: Thermocouple

Mfgd by: Innovative Instruments & Controls LLP
338, New Sonal Link Service Industrial Premises Co-op Society Ltd,
Building No.2, Link Road, Malad (W), Mumbai - 400064.
Tel: 022-66939916/17/18;
E-mail : sales@itherm.co.in
Website : www.itherm.co.in