

PID TEMPERATURE CONTROLLER: SERIES: PR-43(96*96)

Dear Customer,
Thank you for purchasing PID Temperature Controller from GIC. To avoid problems & damages, please read leaflet carefully before operating the unit.

ORDERING INFORMATION:

**151M42B:(Relay : 1C/O 10A, SSR Drive :12VDC
30mA max, Relay : 1C/O 5A)**

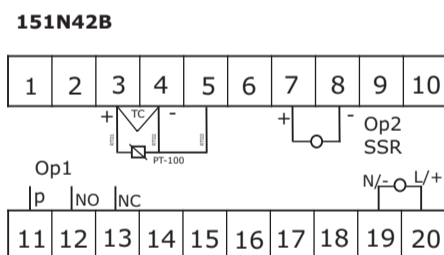
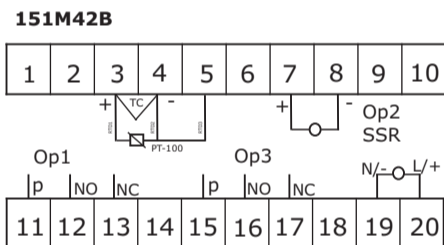
**151N42B:(Relay : 1C/O 10A,
SSR Drive : 12VDC, 30mA max)**



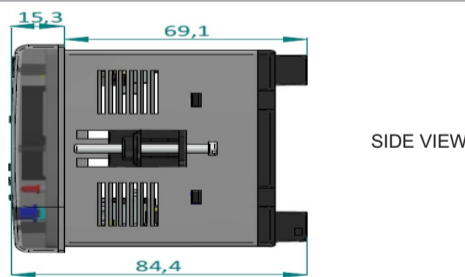
Features:

- Highly Accurate Performance.
- Luxurious Single 4-digit LED Display.
- Wide supply range:110-240 VAC/DC , -20 to +10% of Un.
- Front keypad with 4 keys.
- Thermocouple (J, K & T), RTD 3-wire (Pt-100) sensor inputs.
- Auto tune PID indication.
- Control Modes: PID, ON-OFF Asymmetric, ON-OFF Symmetric.
- °C & °F temperature unit selectable
- Selectable Output: Relay or SSR Drive
- Alarm Functionality (applicable for Cat_id 151M42B)

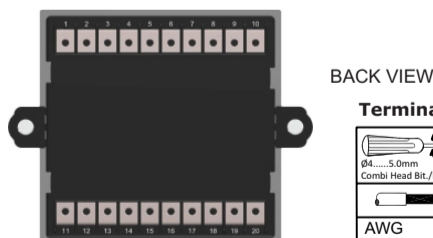
Connection Diagram:



Mechanical Dimensions (in mm):



SIDE VIEW



BACK VIEW

Terminal Details:

	0.5 N.m (4.4lb.in) to 0.7N.m (6.2lb.in)
	2 x 2.5 mm ² Solid / Standard Wire
AWG	20 to 12

Caution:

- Installation should be done by skilled person only.
- When extending the thermocouple lead wires always use thermocouple compensation wires for wiring.
- For RTD sensor, use a wiring material with a small lead resistance (5Ω max per line) & no resistance differentials among 3 wires.
- Product should be cleaned regularly to avoid blockage of ventilating parts.
- Clean the product with a clean soft cloth. Do not use isopropyl alcohol or any other cleaning agent.
- Use of contactors is recommended if load exceeds the contact rating. (Please see Inductive load category)
- For Thermocouple (J, K & T): To make output ON ensure that, CJC setting is ON. (20 min warm-up time after connecting TC) When replacing the sensor, please turn OFF the power.
- Product innovation being a continuous process, we reserve the right to alter specifications without any prior notice.

Technical Specifications:

	151M42B	151N42B
Supply Characteristics:		
Supply Voltage (Un)	110 - 240 VAC/DC	
Supply Tolerance	-20% to +10% of Un	
Supply Frequency	47 to 63 Hz	
Power Consumption	8 VA @ 265 VAC	
Reset Time (Relay ON)	50 to 500 ms	
Functional Characteristics:		
Menu Password	Password 60 (Default disabled)	
Sensor Inputs (IEC)	Thermocouple (J, K & T) RTD (Pt-100, 3-wire)	
Sensor Measurement Range	TC (J-type): -50 to 1000°C OR -58 to 1832°F TC (K-type): -50 to 1350°C OR -58 to 2462°F TC (T-type): -50 to 400°C OR -58 to 752°F RTD (Pt-100): -100 to 650°C OR -148 to 1202°F	
Resolution	1°C Fixed	
Measurement Accuracy	+/-0.5% of full scale for RTD, +/- 1% of full scale for TC	
Temperature Unit	°C/°F selectable	
Signal Sampling Time	2 ms	
Front Keypad	4 Keys as ESC (■), DOWN (▼), UP (▲), ENTER (↵)	
Key de-bounce time	≥ 40 ms	
Error Indications	5Ern5 Sensor open/Break error 0ur9 Over range error Unr9 Under range error ErRt Error in Auto-tuning noRt Auto-tuning not finished within 10 hour cbrh Loop Break interrupted	
Control output (151M42B)	Relay	SSR Drive
Control output (151N42B)	Relay	SSR Drive
Relay Output Characteristics:		
Contact Arrangement	1 C/O (SPDT)	
Contact Rating	10A RES. @250VAC /30VDC	5A(NO), 3A(NC), RES. @ 250VAC/ 30VDC
Contact Material	AgNi	
Utilization Category (AC-15)	Ue Rated Voltage (V) : 120 / 240 Ie Rated Current (A) : 3.0 / 1.5	
Switching Frequency	1800 Operations/Hour	
Electrical Life	50,000 Operations	
Mechanical Life	5,000,000 Operations	
SSR Output Characteristics:		
Output Voltage	12 VDC (13.82 V Max.)	
Load Current	30 mA (Max)	
Series Resistance	200 Ω (Internal)	
LED Indications:		
Op1 (Red LED)	ON	Relay output ON
Op2 (Red LED)	ON	SSR output ON
Op3 (Red LED)	ON	Relay output ON (Not applicable for 151N42B)
STATUS (Red LED)	Blink	Auto tuning ON
°F (Red LED)	ON	PV Value is ±3°C of SP
	ON	Display °F value
	OFF	Display °C value
Environmental Characteristics:		
Operating Temperature	0 to 50 °C	
Storage Temperature	-20 to 60 °C	
Operating Humidity	5 to 80 % RH (Non-Condensing)	
Operating Altitude	2000 m (max)	
Pollution Degree	II	
Degree of Protection	IP 20: Terminal & Enclosure IP 40: Front Facial	
Enclosure	Flame Retardant (UL 94 V-0)	
Other Characteristics:		
Mounting	96 x 96 mm Panel Mounting	
Weight (Un-Packed)	250 gm	
Operating Position	Horizontal (Readable)	
EMI/EMC Compliance:		
Harmonic Current Emission	IEC 61000-3-2 (Class A)	
Voltage Flicker	IEC 61000-3-3 (Class A)	
ESD	IEC 61000-4-2 (Level II)	
Radiated Susceptibility	IEC 61000-4-3 (Level III)	
Electrical Fast Transients (Power Ports)	IEC 61000-4-4 (Level IV)	
Surge	IEC 61000-4-5 (Level IV)	
Conducted Susceptibility	IEC 61000-4-6 (Level III)	
Power Frequency Magnetic Field	IEC 61000-4-8 (Class 4)	
Voltage Dips/Interruption	IEC 61000-4-11	
Conducted & Radiated Emission	CISPR 11 (Class A)	
Product Standard	IEC 61326-1	
Safety Compliance:		
Dielectric Strength (Input & Output)	IEC 60974-5-1 (2 kV)	
Impulse (Input & Output)	IEC 60974-5-1 (Level IV)	
Single Fault	IEC 61010-1	
Insulation Resistance	UL 508 (>50 kΩ)	
Leakage Current	UL 508 (< 3.5 mA)	
Environmental Compliance:		
Cold Heat	IEC 60068-2-1	
Dry Heat	IEC 60068-2-2	
Vibration	IEC 60068-2-6 (5g)	
Repetitive Shock	IEC 60068-2-27 (40g, 6ms)	
Non-Repetitive Shock	IEC 60068-2-27 (30g, 15ms)	

Front Facia:

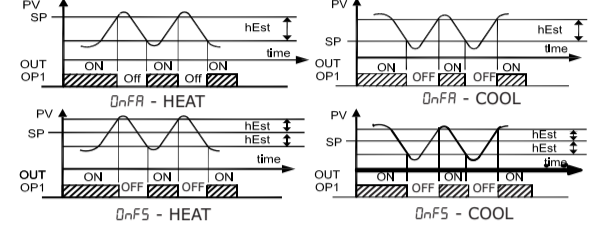


- Displays the 'Process Value' & 'Menu'.
- : "ESC" key (Press for >2 sec to view set point).
- ▼ : Scroll "DOWN" key.
- ▲ : Scroll up key.
(Press for >2 sec to view controller output).
- ↵ : "Enter" key(Press 2 sec for to view menu).
- Op1:LED indication for Relay output 1.
- Op2:LED indication for Relay output 2.
- Op3:LED indication for Relay output 3.
- STATUS: LED indication for Auto tuning ON & if PV value is ±3°C of SP.
- °F: This LED indicates °F unit setting.
- +▼: Press "ESC" key for 2 sec to view SP then simultaneously press "DOWN" key to decrement SP value and release the "ESC" key to set the new SP value
- +▲: Press "ESC" key for 2 sec to view SP then simultaneously press Up key to increment SP value and release the "ESC" key to set the new SP value.

Mode Functionality:

ON/OFF Control: Parameters regarding ON/OFF control are listed in group "rE9". This type of control can be set by programming parameter "cont"= OnF5 for ON-OFF action with symmetric hysteresis or OnFR for ON-OFF action with asymmetric hysteresis. It drives the output programmed as coP [in OP I], depending on the measured temperature value, on set point, function mode (FUnc) and on the hysteresis (H5t).

In case of reverse action i.e. HEAT being set on parameter "FUnc" in "rE9" menu, the controller activates the output when the process value "PV" goes below [SP-H5t]. It deactivates the output when the PV goes above "SP+H5t" in case of symmetric ON-OFF control and above "SP" in case of Asymmetric ON-OFF control. Similarly in case of direct action i.e. "Cool" being set on par. "FUnc", the controller activates the output when the process value "PV" goes below "SP-H5t" & deactivates the output when "PV" goes above "SP+H5t" in case of symmetric ON-OFF control & "SP" in case of Asymmetric ON-OFF control.



PID Control: Parameters regarding PID control are listed in group "rEG". This type of control can be set by programming parameter "cont"= PID for PID action. A PID controller depending upon the effective setpoint "SP", function "FUnc" and on the instrument's PID algorithm the control output is calculated. The PID control algorithm foresees the setting of following parameter:

Pb: Proportional band ,rs: Manual reset ,Int: Integral time, dEr: Derivative time.

Proportional band (Pb) : It is the area around set point where controller is actually controlling the process, output is at some level other than 100% or 0%. 'Pb' is expressed in terms of '°C/°F'. If controlling is not satisfactory by using default 'Pb' value, following adjustment can be done in 'Pb'.

Parameter	Problem Occurred	Adjustment
Proportional Band (Pb)	PV not reach SP/Slow response	Decrease 'Pb'
	High overshoot or Oscillations	Increase 'Pb'

Cycle time (Ct) : Also known as duty cycle, Total length of time for controller to complete one ON/OFF cycle. E.g.: If Ct=20 sec, TON=10 sec & TOFF=10 sec, then it represents a 50 % power output. In this case, controller will cycle ON & OFF while within the set proportional band "Pb".

Manual reset(r5) : Manual reset is not visible for On-OFF if "int" value is not equal to zero. when "int" value is equal to zero then manual reset(r5) is visible for PID.

Integral time (int) : this value is in minute, not visible for On-OFF control.

Derivative time (dEr) : this value is in seconds, not visible for On-OFF control.

Rate (rRE) & Offset (oF5t) : Product can be re-calibrated according to application needs, by using par. "oF5t" and "rRE". If "rRE" = 1.00, then using par "oF5t", it is possible to set positive or negative offset that is simply added to the value read by the probe.

If the offset set is not to be constant for all measurements, it is possible to operate the calibration on any of two points. In this case, in order to decide which values to program on par. "oF5t" and "rRE", the following formulae must be applied:

$$rRE = (y2 - y1) / (x2 - x1)$$

$$oF5t = y2 - rate * x2$$

Where,

- y1 = Measured temperature 1
 - x1 = temperature displayed by instrument
 - y2 = Measured temperature 2
 - x2 = temperature displayed by instrument
- The instrument thus visualizes the temperature as:
- $$y = x * rRE + oF5t$$

where y = displayed value and x = measured value.

Cold Junction Compensation (CJC) : The cold junction, or reference junction, is the one that connects the thermocouple to the product. The product itself measures the cold junction temperature and adds it to the temperature differences measured from the thermocouple. CJC allows product to convert temperature differences to actual temperature. For compensation, "CJC" should kept 'ON' when thermocouple (J, K & T) is connected as a sensor.

NOTE: For Pt100 sensor "CJC" option is not visible in "rE9" menu.

Auto tuning: Parameters regarding Auto tuning are listed in group "rE9". This Auto tuning can be set by programming parameter "cont"= Pi d for Auto tune action with FUnc = "hERt" if using heater or "cool" if using cooler. It drives the output programmed as coP [in STATUS], depending on the setting,
"1" - Tune at every Power ON.
"2" - Tune at first power ON.
"3" - Tune manually.
"4" - Tune at every set point change.

The condition needs to satisfy for to start Auto tune, If "FUnc" is "hERt",
PV < [SP - |SP/3|]
If "FUnc" is "cool",
PV > [SP + |SP/3|]

If the PV condition is not satisfied at start of auto tune, display will shows "ErRt" message and device works according to previous set program of PID. If auto tune is not completed in 10 hours then device shows "noRt" on display.

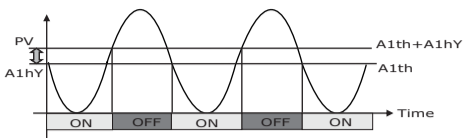
Note:
During auto tune process parameters are locked, only "tUn" parameter can be edited.
"ErRt" error message display conditions:
1. Sensor break during auto tuning.
2. Over range during auto tuning.
3. Under range during auto tuning.
4. Auto tune conditions are not matching.

Alarms Menu:

Alarm Types:

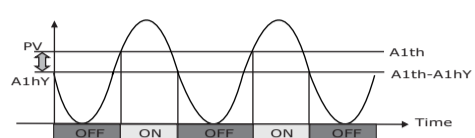
1. Absolute low ("AbLo" on display):
Alarm is activated if PV goes below A1th and is deactivated if PV goes above (A1th+A1hy).

Menu	Sub menu	Option
AL1	A1tY	AbLo



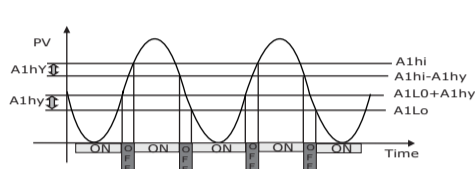
2. Absolute high ("AbHi" on display):
Alarm is activated if PV goes above A1th and is deactivated if PV goes below (A1th-A1hy).

Menu	Sub menu	Option
AL1	A1tY	Abhi



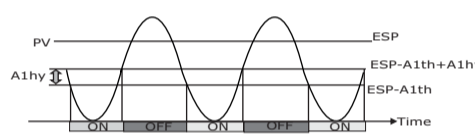
3. Absolute band ("Abba" on display):
Alarm is activated if PV goes above A1hi or below A1Lo. It is deactivated if it goes below (A1hi-A1hy) or above (A1Lo+A1hy).

Menu	Sub menu	Options
AL1	A1tY	Abba



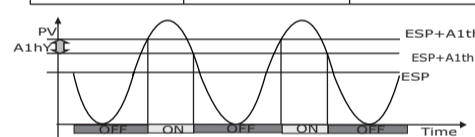
4. Deviation low ("dELo" on display):
Alarm is activated if PV goes below (Effective Set Point(ESP) - A1th) and is deactivated when it goes above (Effective Set Point(ESP)-A1th + A1hy).

Menu	Sub menu	Options
AL1	A1tY	dELo



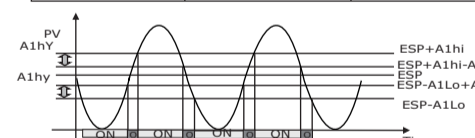
5. Deviation high ("dEHi" on display):
Alarm is activated when PV goes above Effective Set Point(ESP) + A1th) and is deactivated when it goes below (Effective Set Point(ESP) + A1th-A1hy).

Menu	Sub menu	Option
AL1	A1tY	dEHi



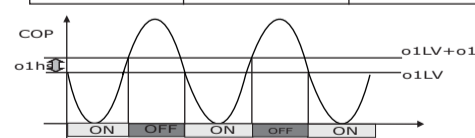
6. Deviation band ("dEbA" on display):
Alarm is activated when PV goes above (Effective Set Point(ESP) + A1hi) or below (Effective Set Point(ESP) - A1Lo) and is deactivated when PV goes below (Effective Set Point(ESP)+ A1hi - A1hy) or above (Effective Set Point(ESP) - A1Lo + A1hy).

Menu	Sub menu	Option
AL1	A1tY	dEbA



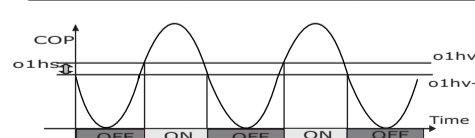
7. Output low ("OPLO" on display):
Alarm is activated if output goes below o1LV and deactivated when output goes above (o1LV+o1hs).

Menu	Sub menu	Option
AL1	A1tY	oPLO



8. Output high ("OPHi" on display):
Alarm is activated if output goes above o1hv and deactivated when output goes below (o1hv-o1hs).

Menu	Sub menu	Option
AL1	A1tY	oPHI



Menu	Sub menu	Options
AL1	A1tY	AbLo Abhi Abba dELo dEHi dEbA oPLO oPHI

Alarm Functions:

Sr.No	Value	Details	Applications
1	0	Normal Activation: When alarm condition occurs. Deactivation: When the alarm condition Disappear.	Normal
2	1	Acknowledge Activation: When alarm condition occurs. Deactivation: 1) When the alarm condition disappear. 2) When Configurable key programmed for alarm acknowledgment and press in alarm condition.	To ignore the alarm Condition
3	2	Delayed Activation: Delayed by time set in A1dL parameter after occurrence of the alarm condition. Deactivation: When the alarm condition disappear. Note: During the delay if the alarm condition disappears, alarm will not generated.	To delay the alarm generated, some times alarm can be generated for shorter time due to some disturbance in system
4	4	Latched Activation: When alarm condition occurs. Deactivation: When configurable key programmed for alarm acknowledgment & press once alarm generated. Note: Alarm will not automatically deactivated once generated.	To record or draw attention of alarm generation condition every time. since no automatic of alarm
5	8	No alarm at Power ON Activation: IF alarm condition exist at power on, alarm will not be activated. Once devices goes in no alarm condition after power on, there after alarm will be activated at every occurrence of the alarm condition. Deactivation: Alarm will be deactivated in no alarm condition.	To avoid alarm after power on. Since possibility of alarm condition after every power on.
6	16	No Alarm at SP change Activation: IF alarm condition generates after SP change, alarm will not be activated. Once device goes in no alarm condition after SP change, there after alarm will be activated at every occurrence of the alarm condition. Deactivation: Alarm will be deactivated in no alarm condition.	To avoid alarm after change in SP. Since possibility of alarm condition after every time change in SP
7	24=16+8	No alarm at SP change + No alarm at Power on Activation: If alarm condition exist at power on or if alarm condition generates after SP change, alarm will not be activated. Once devices goes in no alarm condition after SP change or power on, there after alarm will be activated at every occurrence of the alarm condition. Deactivation: Alarm will be deactivated in no alarm condition.	Note: We can club the different alarm functionality by doing the addition of the set value for those alarm functions

Note: Alarm types and functions are explained for alarm

- The explanation is same for alarm
- Binary addition of alarm function allows Combination of different function.

eg. If it is required to have no alarm at power On [8] and no alarm at sP change [16], set function as 24.

Functional Parameters:

Parameter	Description	Default
Product Version:		
Pi d	PID Controller	-
XX.X	Version 'XX.X'	eg. 25.0
Error Indications:		
oUr9	Over range (If PV > Specified Range)	-
Unr9	Under range (If PV < Specified Range)	-
SEn5	Sensor Break/Open	-
ErRt	Error in Auto-tuning	-
noRt	Auto-tuning not finished in 10 hours	-
SP Menu:		
SPLL	Set Point LOW range settable as: TC (J-type): '-50°C (-58°F) to SP1' TC (K-type): '-50°C (-58°F) to SP1' TC (T-type): '-50°C (-58°F) to SP1' RTD (Pt-100): '-100°C (-148°F) to SP1'	-50
SPhL	Set Point HIGH range settable as: TC (J-type): 'SP1 to 1000°C (1832°F)' TC (K-type): 'SP1 to 1350°C (2462°F)' TC (T-type): 'SP1 to 400°C (752°F)' RTD (Pt-100): 'SP1 to 650°C (1202°F)'	1000
SP1	'Set point 1' settable as 'SPLL to SPhL'	50
Pi d Menu:		
En	Password Enable	
d15	Password Disable	d15
i nP Menu:		
SEn5	Sensor input setting	
Pt1	Pt-100	J
J	J-type	
K	K-type	
T	T-type	
Un1t	Temperature Unit	
oC	°C Unit	oC
oF	°F Unit	
oF5t	Offset Range: '-100 to 100'	0
rRtE	Rate Range: 0.010 to 2.000	1.00
OP Menu:		
CoP	Controller output Range: Op1,Op2 & OFF	oP1
OP3	Relay output setting (applicable for Cat_ID: 151M42B) Range: ALM, OFF, brkL & Senb	ALM
brRt	Loop break time Range: OFF (0) to 9999 sec	OFF
rEG Menu:		
ConT	Controlling action	Pi d
oNFS	On-off Symmetric	
oNFR	On-off Asymmetrical	
Pi d	PID Controller	
CJC	CJC Settings (Only for 'J', 'K' & 'T' type)	
On	CJC ON	On
OFF	CJC OFF	
FUnC	Controlling mode	HEt
HErT	Heat mode	
CoOL	Cool mode	
Pb	Proportional band (Only for 'Pi d') Range: 1 to 850	10
Ct	Cycle Time (Only for 'Pi d' action) Range: 1 to 130 sec	20
HYS	Hysteresis (Only for 'OnFS' & 'OnFR') Range: OFF (0) to 100	1
rS	Manual Reset (Only for 'Pi d') Range: (0) to 100	0
tUn	Auto tune (Only for 'Pi d') Range: OFF: Auto tuning OFF 1 - Auto tuning at every power ON. 2 - Auto tuning at first power ON. 3 - Start Auto tuning manually. 4 - Auto tune at every set point change.	2
int	Integral Time (Only for 'Pi d') Range: (0) to 99.9 min.	2.0
dEr	Derivative Time (Only for 'Pi d') Range: (0) to 999 sec.	30
rSt Menu:		
rSt	To reset device for default value	no
cnF	To confirm reset device	no

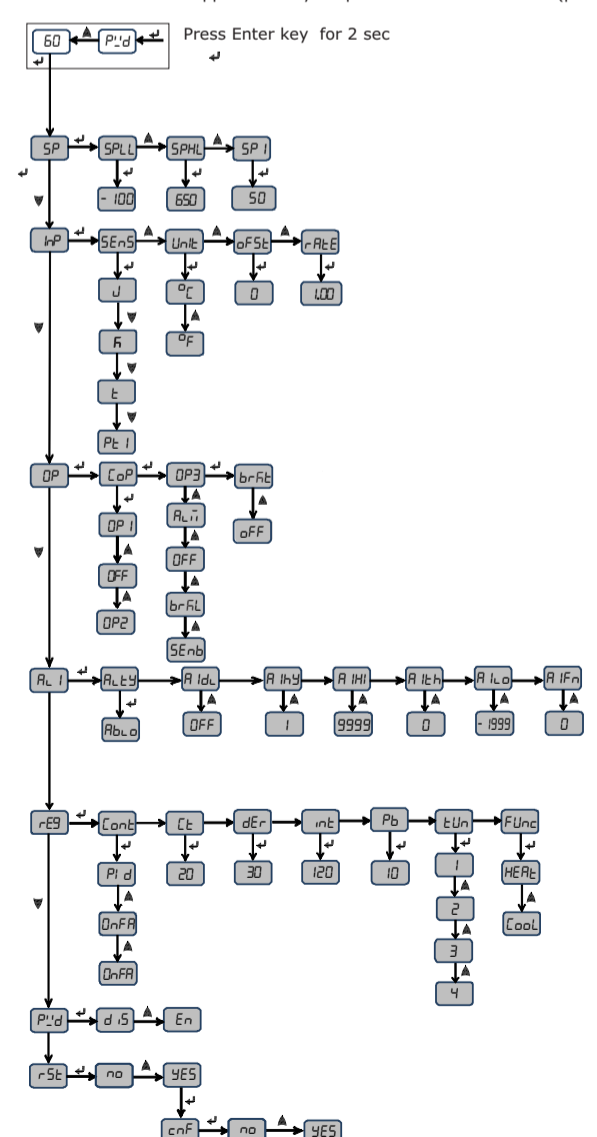
AL1 Menu: This Menu is applicable for cat_id 151M42B		
R lty	Alarm 1 type: Range: 1. AbLo: Absolute low 2. Abhi: Absolute high 3. Abba: Absolute band 4. dELo: Deviation low 5. dEHi: Deviation High 6. dEbA: Deviation band 7. oPLO: Output low 8. oPHI: Output High	AbLo
R iFn	Alarm 1 function: 0 : Alarm on Error +1: Acknowledge alarm +2: Delayed alarm +4: Latch alarm +8: No alarm at power on +16: No alarm at set-point change Range: 0-31	0
R iLo	Alarm 1 low level Range: -1999 to A1th	-1999
R lth	Alarm 1 Threshold Range: A1Lo to A1Hi	0
R ihi	Alarm 1 high level Range: A1th to 9999	9999
R ihy	Alarm 1 hysteresis Range: OFF to 9999	1
o1Lv	Output 1 low value Range: 0.0% to o1HV Range: -100.0% to o1HV	0.0
o1hv	Output 1 high value Range: o1LV to 100.0 %	100.0
o1h5	Output 1 hysteresis Range: OFF to 100.0 %	1
R iDL	Alarm 1 delay Range: OFF to 9999 s	OFF

Frequently Asked Questions (FAQ's):

- Q.1:** Which parameters can affect the product accuracy?
A.1: a. Check whether the correct sensor input is selected on product (Check "SEn5" parameter in "i nP" menu.)
b. Check whether power lines & Sensor lines are routed through the same conduit. Due to this sensor wires can get affected by noise from the power line. (Route the sensor lines & power lines separate)
c. If thermocouple wires are extended with copper wires, product accuracy can affect (Either connect thermo-couple leads directly or use suitable compensating conductors.)
- Q.2:** What is "rRtE" and "oF5t" parameter in the "i nP" menu?
A.2: If it is required to apply slope and/or offset to the temperature measured by the instrument, it can be done by using the above parameters. Any value set on above parameter allows device to see temperature as below:
Display temp. = rRtE * Measured Temp + oF5t
This helps to re-calibrate the instrument.
- Q.3:** Output not operates when Thermocouple input is configured?
A.3: "CJC" is Cold Junction Compensation given for thermocouple. When thermocouple is selected "CJC" must be ON.
If "CJC" is OFF then "OP" Relay remains OFF for Thermocouple input.
- Q.4:** How to change "SP" value directly, without entering in the Edit menu?
A.4: If it is required to edit the SP value in RUN mode.
a. Press ESC (■) key for 2 sec., then SP value is shown.
b. Press ESC (■) + UP (▲) key to increment SP value.
c. And ESC (■) + Down (▼) key to decrement SP value.
d. And release the ESC (■) key to set the new SP value.
- Q.5:** How to reset device to get factory defaults ?
A.5: To reset device ,
a. Press Enter button for 2sec.
b. It will display the main menu, press UP key for reset menu.
c. Press enter key on "rSt" menu.
d. If press "no" then it will get back to main screen. Press "yES" to continue , It will display the "cnF" menu. Press "yES" to confirm and it will reset your device.

Function Menu:

This Screen is applicable only for password enable selection (pwd - en)



NOTE: For alarm types please refer alarm menu table.