TEMPERATURE CONTROLLER



Operating Instruction

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TABLE OF CONTENT

A) OVERVIEW 1
1. Features. 1
2. Ordering information 1

B) SPECIFICATIONS 2

C) INSTALLATION. 3
1. Safety Information 5
2. Terminal connections 7
3. Sensor input wiring 7
4. Control output wiring 8

D) PROGRAMMING.
1. Function menu 9
2. Key's description 10
3. Level 0 11
4. Level 1 14
5. Level 2 15
6. Level 3 16
7. Online parameters 17

E) USER GUIDE 18

F) CALIBRATION CERTIFICATE 24



96 x 96



72 x 72



48 x 48

Salient features

- **Tuning (Auto, Self & Adaptive)**
  For better performance, auto and self tuning features are added.

- **Compliance -** CE

Others

- Digital filtering
- Sensor break indication
- 90 to 270V AC/DC supply

Ordering information

Product code	Output 1		Output 2	Supply voltage	Certification
	Relay	SSR			
TC544C-P	Relay (5A)	SSR (12VDC)	Relay (5A)	90 - 270V AC/DC	CE
TC544C-24V-P	Relay (5A)	SSR (12VDC)	Relay (5A)	24V AC/DC	CE
TC244CX-P	Relay (5A)	SSR (12VDC)	Relay (5A)	90 - 270V AC/DC	CE
TC344CX-P	Relay (5A)	SSR (12VDC)	Relay (5A)	90 - 270V AC/DC	CE

Technical specifications		
Display	4+4 digits (White + Green) 7 segment digital display Display height:- For TC544C-P / TC544C-24V-P White display:- 15.3 mm Green display:- 8 mm	4+4 digits (White + Green) 7 segment digital display Display height:- For TC244CX-P / TC344CX-P White display:- 16.7 mm Green display:- 9 mm
LED indications	For TC544C-P: 1: Output 1 ON 2: Output 2 ON 3: Output 3 ON T: Auto tune A: Adaptive tuning S: Dwell timer	For TC244CX / TC344CX: OUT1: Output 1 ON OUT2: Output 2 ON OUT3: Output 3 ON AT: Auto tune ADT: Adaptive tuning SOAK: Dwell timer
Keys	3 keys for digital setting	

Input				
Input signal	Thermocouple: J, K, T, R, S RTD (PT100)			
Sampling time	40ms			
Input filter (FTC)	0.2 to 10.0 sec			
Resolution	0.1 / 1° for TC / RTD inputs (Fixed 1° for R & S input)			
Temperature unit	°C / °F selectable			
Indication accuracy	**Thermocouple type**	**Temperature range**	**Claimed accuracy**	**Claimed accuracy**
	J, K, T	-100 to 600 °C	0.1% of full scale ±2 °C	0.1% of full scale ±2 °C
		<-100 & >600 °C	0.25% of full scale ±2 °C	0.25% of full scale ±2 °C
	R, S	100 to 1000 °C	0.25% of full scale ±3 °C	0.25% of full scale ±3 °C
		<100 to >1000 °C	0.50% of full scale ±3 °C	0.50% of full scale ±3 °C
	RTD (PT100)	-150 to 850 °C	0.1% of full scale ±1 °C	0.1% of full scale ±1 °C

Function	
Control method	1) PID control with auto tuning 2) ON-OFF control 3) Heat-Cool (With auto-tuning)
Proportional band (P)	1.0 to 400.0°
Integral time (I)	0 to 9999 sec
Derivative time (D)	0 to 9999 sec
Cycle time	0.1 to 99.9 sec
Hysteresis width	0.1 to 99.9°
Dwell timer	0 to 9999 min
Manual reset value	-19.9 to 19.9°

Heat cool PID	
Control method	PID
Proportional band - Cool	0.0 to 400.0°
Cycle time - Cool	0.1 to 99.9 sec
Dead band	SPLL to SPHL (Programmable)

Output	
Control output	For TC544C-P/TC544C-24V-P Relay contact (SPDT) 5A @250V AC/30V DC, Resistive For TC244CX-P/TC344CX-P Relay contact (SPDT) 5A@250V AC/28V DC, Resistive
	SSR drive output (Voltage pulse) 12V DC @30 mA
Power supply	
Supply voltage	90 to 270V AC/DC 50/60 Hz For TC544C-24V-P: (24V AC/DC)
Power consumption	5 VA max @230V AC
Temperature	Operating: 0 to 50°C Storage: -20 to 75°C
Humidity	95% RH (Non-condensing)
Weight	TC544C-P/TC544C-24V-P: 116 gms TC244CX-P: 164 gms TC344CX-P: 217 gms

All safety related codifications, symbols and instructions that appear in this operating manual or on the equipment must be strictly followed to ensure the safety of the operating personnel as well as the instrument.

If the equipment is not handled in a manner specified by the manufacturer it might impair the protection provided by the equipment.

Read complete instructions prior to installation and operation of the unit.

⚠ **Warning:** Risk of electric shock.

WIRING GUIDELINES

⚠ **WARNING:**

1. To prevent the risk of electric shock power supply to the equipment must be kept OFF while doing the wiring arrangement. Do not touch the terminals while power is being supplied.

2. To eliminate electromagnetic interference use short wire with adequate ratings, twists of the same in equal size shall be made. For the input and output signal lines, be sure to use shielded wires and keep them away from each other.

3. Cable used for connection to power source, must have a cross section of 1mm² or greater. These wires shall have insulation capacity made of at least 1.5kV.

4. When extending the thermocouple lead wires, always use thermocouple compensation wires for wiring. For the RTD type, use a wiring material with a small lead resistance (50 max per line) and no resistance differentials among three wires.

5. A better anti-noise effect can be expected by using standard power supply cable for the instrument.

MAINTENANCE

1. The equipment should be cleaned regularly to avoid blockage of ventilating parts.

2. Clean the equipment with a clean soft cloth. Do not use Isopropyl alcohol or any other cleaning agent.

1. This equipment, being built-in-type, normally becomes a part of main control panel and in such case the terminals do not remain accessible to the end user after installation and Internal wiring.

2. Do not allow pieces of metal, wire clippings, or fine metallic fillings from installation to enter the product or else it may lead to a safety hazard that may in turn endanger life or cause electrical shock to the operator.

3. Circuit breaker or mains switch must be installed between power source and supply terminals to facilitate power 'ON' or 'OFF' function. However this switch or breaker must be installed in a convenient position normally accessible to the operator.

4. Use and store the temperature controller within the specified ambient temperature and humidity ranges as mentioned in this manual.

⚠ CAUTION

1. When powering up for the first time, disconnect the output connections.

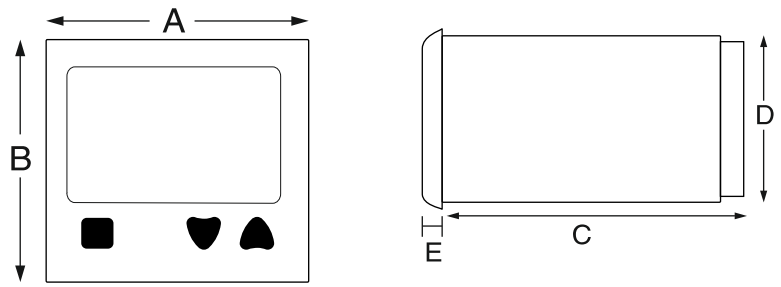
2. Fuse Protection: The unit is normally supplied without a power switch and fuses. Make wiring so that the fuse is placed between the mains power supply switch and the controller. (2 pole breaker fuse - rating: 275V AC,1A for electrical circuitry is highly recommended)

3. Since this is a built-in-type equipment (finds place in main control panel), its output terminals get connected to host equipment. Such equipment shall also comply with basic EMI/EMC and other safety requirements like BSEN61326-1 and BSEN 61010 respectively.

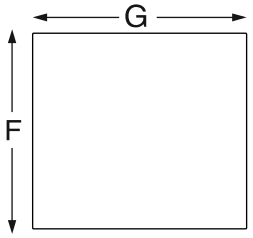
4. Thermal dissipation of equipment is met through ventilation holes provided on chassis of equipment Such ventilation holes shall not be obstructed else it can lead to a safety hazard.

5. The output terminals shall be strictly loaded to the manufacturer specified values / range.

NEW **Outline dimensions**



Panel cutout



MODELS / DIM	A	B	C	D	E	F	G
TC544C-P / TC544C-24V-P	52	52	76	45	3.5	46	46
TC244CX-P	76	76	44	67	4.5	69	69
TC344CX-P	99	99	39	90.5	3.5	92	92

1. Prepare the panel cutout with proper dimensions as Shown above.
2. Fit the unit into the panel with the help of clamp given.
3. The equipment in its installed state must not come in close proximity to any heating sources, caustic vapors, Oils, steam or other unwanted process by-products.
4. Use the specified size of crimp terminals (M3.5 screws) to wire the terminal block using the tightening torque within the range of 1.2 N.m.
5. Do not connect anything to unused terminals.

Panel thickness

0.5mm (minimum) and 2.5mm (maximum)

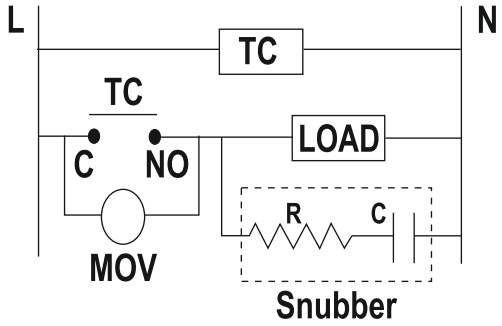
EMC guidelines:

1. Use proper input power cables with shortest connections and twisted type.
2. Layout of connecting cables shall be away from any internal EMI source.

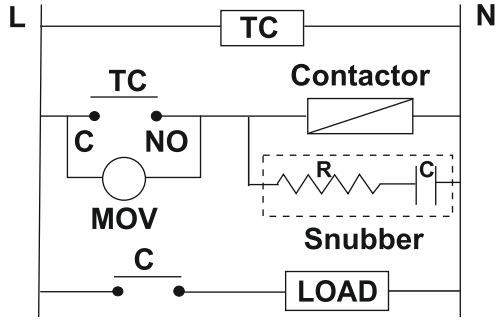
Load connections

1. The service life of the output relays depends on the switching capacity and switching conditions. Consider the actual applications and use the product within the rated load and electrical service life.
2. Although the relay output is rated at 10 amps. It is always necessary to use an interposing relay or contactor that will switch the load. This avoids damage to the controller in the event of a fault short developing on the power output circuit.
3. Always use a separate fused supply for the “power load circuit” and do not take this from the live and nuetral terminals supplying power to the contactor.

For load current less than 0.5A



For bigger loads, Use interposing relay / Contactor



Electrical precautions during use

Electrical noise generated by switching of inductive

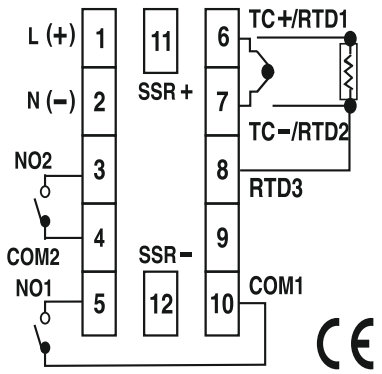
loads can create momentary disruption, Erratic display, Latch up, Data loss or permanent damage to the instrument.

To reduce noise

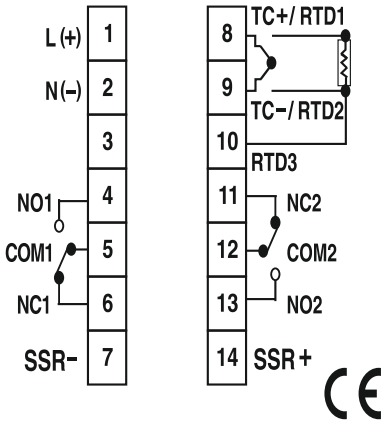
a) Use of snubber circuits across loads as shown above, is recommended.

b) Use separate shielded wires for inputs.

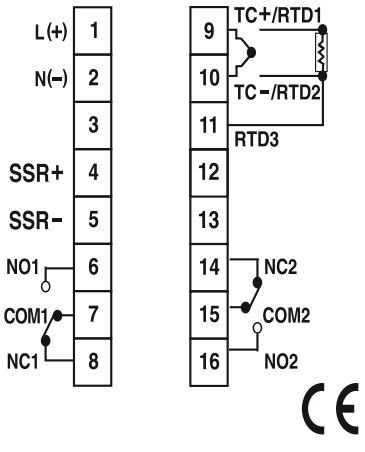
TC544C-P / TC544C-24V-P



TC244CX-P



TC344CX-P

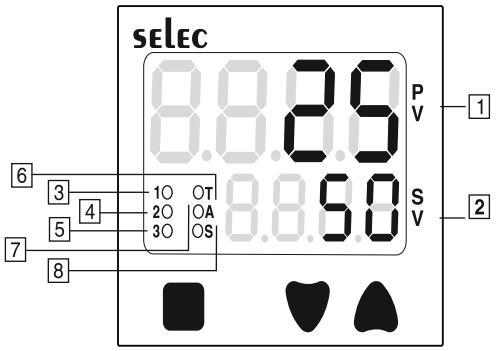


Use only the correct thermocouple wire or compensating cable from the probe to instrument terminals avoiding joints in the cable if possible.

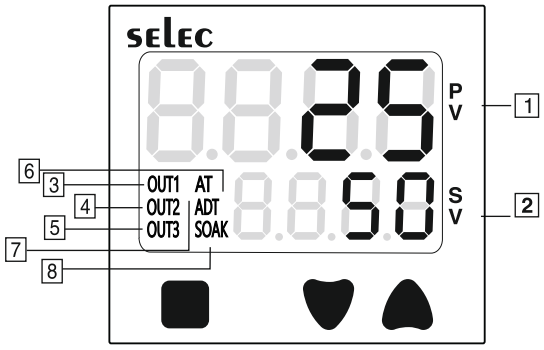
Failure to use the correct wire type will lead to inaccurate readings.

Ensure that the input sensor connected at the terminals and the input type set in the temperature controller configuration are the same.

FOR TC544C-P



FOR TC244CX-P / TC344CX-P



Indications and Display

1	**PV**	Process-value (PV) / Parameter name display	1) Displays a process value (PV). 2) Displays the parameter symbols at configuration mode / online menu. 3) Displays PV error conditions. (refer Table 2)
2	**SV**	Set-Value (SV) / Parameter setting display	Displays the parameter settings at configuration mode / online menu.
3	**OUT1**	Main output (OUT 1)	Indicates the status of main output
4	**OUT2**	Alarm 1 (OUT2)	Indicates the status of alarm output 1 (Relay 1)
5	**OUT3**	Alarm 2 (OUT3)	Indicates the status of alarm output 2 (Relay 2).
6	**TUNE**	Auto + Self tunning	Auto tune: Blinking (With faster rate) Self tune: Blinking (With slower rate)
7	**ADT**	Adaptive tunning	Blinking
8	**SOAK**	Dwell timer	Blinking: Dwell timer is in progress. Continuous ON: Time over.

FRONT KEYS DESCRIPTION

FUNCTIONS	KEY PRESS
ONLINE	
To view Level 1	Press ▼ key for 3 sec.
To view Level 2	Press ▲ key for 3 sec.
To view Protection Level	Press ▲ + ▼ keys for 3 sec.
To view online parameters	Lower display selectable between SET1/SET2/TIME using ▲ key.
Note: Elapsed time / Remaining time dependent on the selection of ONL parameter in level1.	
To change online parameter values	Press ■ + ▲ / ▼ to change parameter value.

PROGRAMMING MODE	
To view parameters on the same level.	▲ or ▼ key once to view the next or previous function in operational menu.
To increase or decrease the value of a particular parameter.	■ + ▲ to increase and ■ + ▼ to decrease the function value. **Note:** Parameter value will not alter when respective level is locked.
Note: The unit will auto exit programming mode after 30 sec. of inactivity. **OR** By pressing the ▲ or ▼ or ▲ + ▼ keys for 3 sec.	

Input ranges (Table 1)

For RTD

Input		Ranges	
Resolution		1	0.1
PT100	°C	-150 to 850	-150.0 to 850.0
	°F	-238 to 1562	-199.0 to 999.0

For THERMOCOUPLE

Input		Ranges	
Resolution		1	0.1
J	°C	-199 to 750	-199.0 to 750.0
	°F	-328 to 1382	-199.0 to 999.0
K	°C	-199 to 1350	-199.0 to 999.0
	°F	-328 to 2462	-199.0 to 999.0
T	°C	-199 to 400	-199.0 to 400.0
	°F	-328 to 750	-199.0 to 750.0
R & S	°C	0 to 1750	N/A
	°F	32 to 3182	N/A

ERROR DISPLAY (Table 2)

When an error has occured, the upper display indicates error codes as given below.

Error	Meaning	Control Output Status
S.brK	Sensor break / Over range condition	OFF
S.rEv	Sensor reverse / Under range condition	OFF

Programming online parameters

Setpoint 1 — **Default: 50**

Range: SPLL to SPHL
If upper display is selected as then, Pressing ■ key will show on Upper display:

Press ■ + ▲ / ▼ keys to increment / Decrement SEt1 value.

Setpoint 2 / Dead band — **Default: 0**

Range: SPLL to SPHL
If upper display is selected as SEt2 /db then, Pressing key ■ will show on Upper display: SEt2 /db

Lower display: <0>
Press ■ + ▲ / ▼ keys to increment / Decrement SEt2 /db value.

Dwell Timer — **Default: OFF**

Range: OFF, 1 to 9999 min
If upper display is selected as t.rEA t.ELP then, Pressing key ■ will show on Upper display: tIME

Lower display: <OFF>
Press ■ + ▲ / ▼ keys to increment / Decrement dwEL time value.

1. Display Bias:

This function is used to adjust the PV value in cases where it is necessary for PV value to agree with another recorder or indicator, or when the sensor cannot be mounted in correct location.

2. Filter time constant:

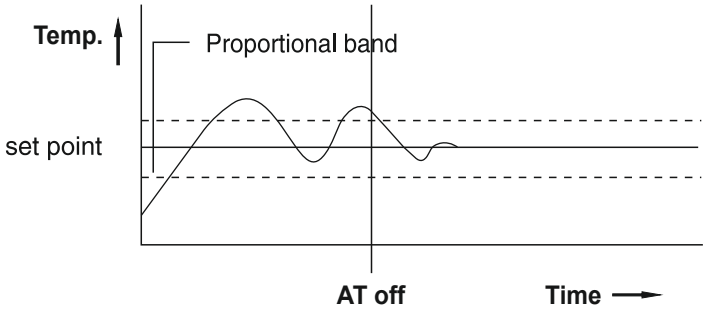
The input filter is used to filter out quick changes that occur to the process variable in a dynamic or quick responding application which causes erratic control. The digital filter also aids in controlling processes where the electrical noise affects the input signal. Larger the value of FTC entered, greater the filter added and the slower the controller reacts to the process and vice versa.

3. Auto Tune (AT):

The Auto-tuning function automatically computes and sets the proportional band (P), integral time (I), Derivative time (D), ARW% and cycle time (CY.T) as per process characteristics.

- Tune LED blinks at faster rate when auto-tuning is in progress.
- At the completion of Auto-tuning, Tune LED stops blinking.

PID - time proportioning with auto reset & rate



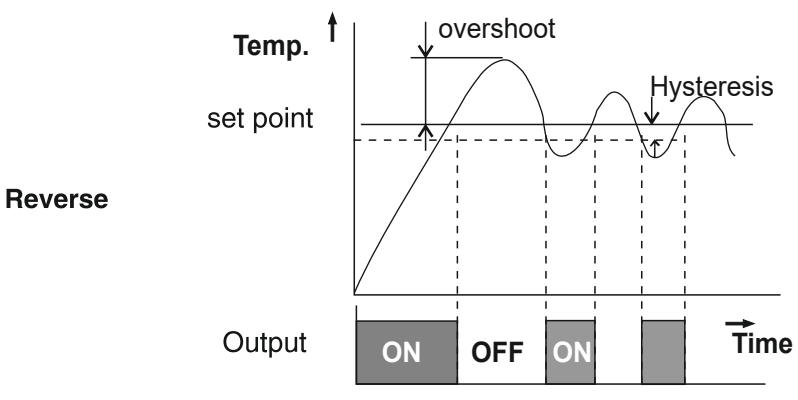
- If the power goes OFF before auto-tuning is completed, Auto-tuning will be restarted at next power ON
- If auto-tuning is not completed after 3-4 cycles, the auto-tuning is suspected to fail. In this case, check the wiring & parameters such as the control action, input type, etc.
- Carry out the auto-tuning again, if there is a change in setpoint or process parameters.

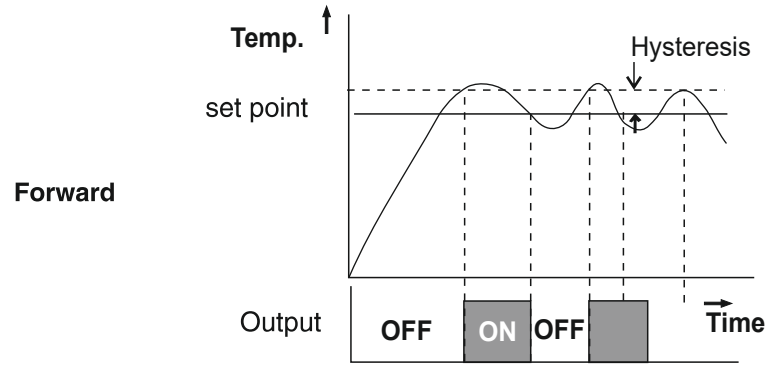
4. ON/OFF control action (For reverse mode):

The relay is ‘ON’ up to the set temperature and cuts ‘OFF' above the set temperature. As the temperature of the system drops, the relay is switched ‘ON' at a temperature slightly lower than the set point.

HYSTERESIS:

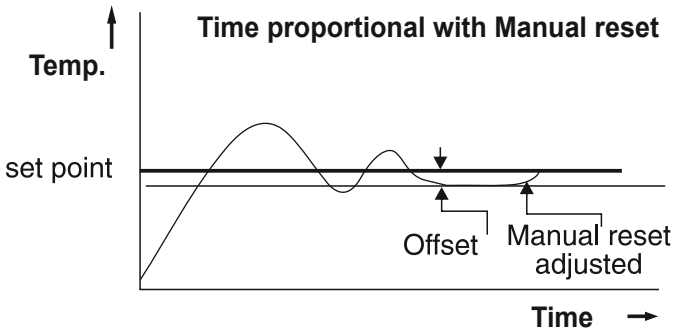
The difference between the temperature at which relay switches ‘ON’ and at which the relay switches ‘OFF’ is the hysteresis or dead band.





5. Manual reset (for PID control & I = 0):

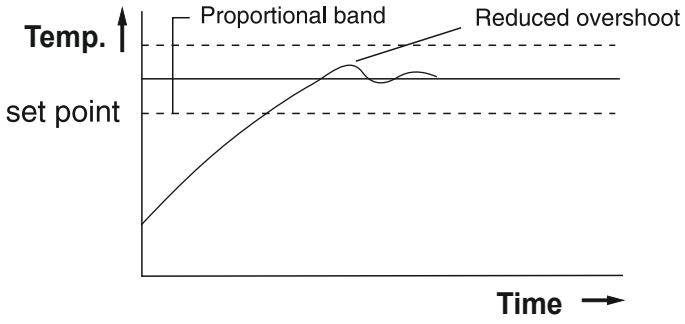
After some time the process temperature settles at some point and there is a difference between the set temperature & the controlled temperature. This difference can be removed by setting the manual reset value equal & opposite to the offset.



6. Self Tune (ST):

It is used where modification of PID parameters is required repeatedly due to frequent change in process condition eg. Setpoint.

- Tune LED blinks at slower rate when Self-tuning is in progress.
- At the completion of self-tuning, Tune LED stop blinking.



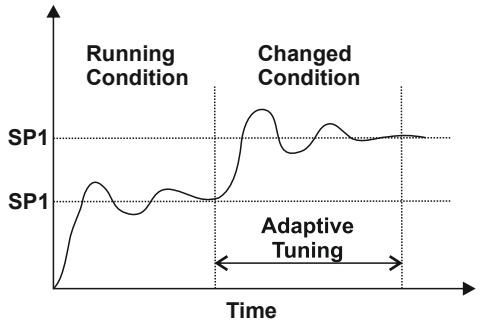
- Self-tuning is initiated under the following conditions :
  1) When setpoint is altered.
  2) When tune mode is altered. (TUNE=ST)
- ST will start only if PV < 50% of setpoint.
- ST will work only when ACT=RE.

7. Adaptive tune (ADT):

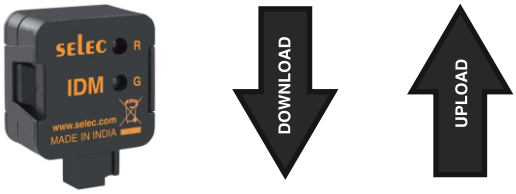
It is used where modification of PID parameter is required.

repeatedly due to frequent change in process condition eg. Setpoint, Adaptive. Tune LED (ADT) blink's at faster rate when Adaptive tuning is in progress.

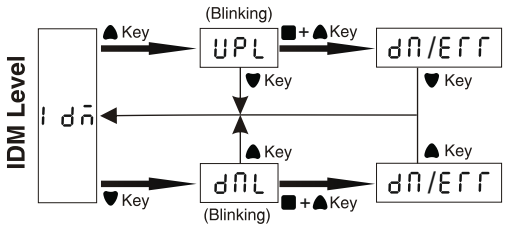
At the completion of Adaptive-Tuning, ADT LED stop blinking.



Independent downloader module (IDM) :



IDM Level



Display	Parameter description
IdN	Independent downloader module
UPL	Upload from product to IDM
dNL	Download from IDM to product
dN	Operation successful
ErR	Operation unsuccessful

Note:

1) IDM level - IDM should be connected before powering on the unit to enter in IDM level.
2) Long press ▲ and ▼ key for 3 sec to exit from IDM mode.

Caution: After downloading, switch off the unit and then remove the IDM

Level 0

Display	Name & Description	Range	Display condition	Default value
INPt	Input type (Refer Table 1)	J / K / t / r / S / rtd	———	J
rESL	Display resolution	1 / 0.1	Not prompted for R & S type	1
UNIt	Temperature unit	°C / °F	———	°C
SPLL	Set point low limit	Min.range of sensor to set point high limit.	———	-199
SPHL	Set point high limit	Set point low Limit to max range of sensor.	———	750
FtC	Filter time constant	0.2 to 10.0 sec	———	1.0
ACt1	Control action for relay 1	rE / Fd	Not prompted for HC=YES	rE
CNtL	Control logic	Pid / ONF	———	Pid
OUt	Control Output selection	rLY / SSr	———	rLY
dwEL	Dwell mode enable	nO / YES	———	nO
HC	Heat-cool mode selection	nO / YES	———	nO
AL1	Alarm 1 mode selection	OFF / DVHI / DVLO / BAND / FSHI / FSLO / S.BR / TIME	When HC=NO. TIME prompted prompte when DWEL =YES	dUH1
AL2	Alarm 2 mode selection	OFF / DVHI / DVLO / BAND /FSHI / FSLO / S.BR / TIME	When OUT=SSR, TIME Prompted When Dwell-Yes	OFF
ONL	Online menu for timer	REMN / ELPS	When DWEL = YES	rEAn
Arw	Anti-reset windup %	1 to 100	CNT=PID	25
rSt	Factory default (Reset all)	nO / YES	———	nO

Level 2

Display	Name & Description	Range	Display condition	Default value
tUNE	Tune	OFF / St / At / Adt	If CNT= PID	St
P	Proportional band	1 to 400°		10
I	Integral time	0 to 9999 sec		120
d	Derivative time	0 to 9999 sec		30
CYC.A	Cycle time mode	AUtO / USr.F		AUtO
CYC.t	Cycle time	0.1 to 99.9 sec		15.0
HYS 1	Hysteresis 1	0.1 to 99.9°	CNT=ONF	1.0
rMLr	Manual reset	-19.9 to 19.9°	CNT=PID & I=0	0.0
Pb.C	Proportional band-cool	1 to 400°	CNT=PID & HC=YES	10
CYt.C	Cycle time-cool	0.1 to 99.9 sec	CNT=PID & HC=YES	15.0
HYS2	Hysteresis 2	0.1 to 99.9°	For HC = NO or HC=YES & CNTL=ONF	1.0
HYS3	Hysteresis 3	0.1 to 99.9°	For OUT= SSR or HC = YES & CNTL= OFF	1.0
t inE	Dwell time	OFF, 1 to 9999 min	When DWEL = YES	OFF
dSP.b	Display bias	-19.9 to 19.9°	———	0.0

Protection Level

Display	Name & Description	Range	Display condition	Default value
SP 1	Lock setpoint 1	UNLY / REAd	———	UNLY
SP2	Lock setpoint 2	UNLY / REAd / LOCY	———	UNLY
SP3	Lock setpoint 3	UNLY / REAd / LOCY	Prompted when OUT = SSR	UNLY
LUL 1	Lock level 1	UNLY / REAd / LOCY	———	UNLY
LUL2	Lock level 2	UNLY / REAd / LOCY	———	UNLY
dYEL	Lock dwell time	UNLY / REAd / LOCY	Prompted when DWELL = YES	UNLY

Note:

1. Locking parameters (LVL1 or LVL2 or SP or DWEL) will not permit change in the value of respective level parameters. Time value (online) can be altered only when DWEL is not locked in protection level.
2. Continuous operation of ■+▲/▼keys for SP or other parameters makes update speed faster in 3 stages after 3 sec.
3. Compensation parameter applicable only for Thermocouple type sensor.

CALIBRATION CERTIFICATE

Model No: TC544C-P / TC244CX-P / TC344CX-P

Claimed Accuracy:

	Thermocouple type	Temperature range	Claimed accuracy (Typical)	Claimed accuracy (Max)
Indication accuracy	J, K, T	-100 to 600 °C	0.1% of full scale ±2 °C	0.5% of FS ±2°C
		<-100 & >600 °C	0.25% of full scale ±2 °C	0.5% of FS ±2°C
	R, S	100 to 1000 °C	0.25% of full scale ±3 °C	0.5% of FS ±3°C
		<100 to >1000 °C	0.50% of full scale ±3 °C	0.5% of FS ±3°C
	RTD (PT100)	-150 to 850 °C	0.1% of full scale ±1 °C	0.2% of FS ±1 °C

Standard used for calibration of the product is traceable to NABL

The calibration of this unit has been verified at the following values:

SENSOR	Adjustment	CALIBRATION TEMP (°C)	DISPLAY VALUE (°C)
K	Z OFF	25.0	25.0
	Mid	-	508.0
	Span	970.0	970.0

SENSOR	Adjustment	CALIBRATION TEMP (°C)	DISPLAY VALUE (°C)
PT100	Z OFF	0.0	0.0
	Mid	-	323.0
	Span	800.0	800.0

The thermocouple curves are linearised in this microcontroller based product, and hence the values interpolated between the readings shown above are also equally accurate, at every point in the curve.

Unit is accepted as accuracy is within the specified limit of claimed accuracy and certificate is valid upto one year from the date of issue.

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