



SPECIFICATIONS

Display

4 + 4 digit, 7 segment digital display

LED Indications

1: Output 1 ON

2: Output 2 ON

T: Auto tune

S: Dwell timer

Keys

3 keys for digital setting

INPUT SPECIFICATIONS

Input Signal

Thermocouple (J,K,T,R,S) / RTD (Pt100)

Sampling time

250 ms

Input Filter (FTC)

0.2 to 10.0 sec

Resolution

0.1/1° for TC/RTD input (fixed 1° for R & S type TC input)

Temperature Unit

°C / °F selectable

Indication Accuracy

For TC inputs: 0.25% of FS ±1°

For R & S inputs: 0.5% of FS ± 2°

(20 min of warm up time for TC input)

For RTD inputs: 0.1% of FS ±1°

FUNCTIONAL SPECIFICATIONS

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)

CONTROL OUTPUT

Relay 1 Contact (SPST)

5 A resistive@250 VAC / 30 VDC

Relay 2 Contact (SPST)

5 A resistive@250 VAC / 30 VDC

OPTIONAL:

SSR Drive Output (Voltage Pulse)

12 VDC, 20 mA

POWER SUPPLY

Supply Voltage

85 to 270 VAC/DC (AC: 50 or 60 Hz)

OPTIONAL - 24 VAC/DC

Power Consumption

6 VA max @230 VAC

Temperature

Operating: 0 to 50°C ; Storage: -20 to 75°C

Humidity (non-condensing)

95% RH

Weight

142 gms

SAFETY PRECAUTIONS

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.

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

WARNING: Risk of electric shock.

WIRING GUIDELINES

WARNING:

- 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.
- 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.
- 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.
- 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 (5Ω max per line) and no resistance differentials among three wires.
- A better anti-noise effect can be expected by using standard power supply cable for the instrument.

MAINTENANCE

- The equipment should be cleaned regularly to avoid blockage of ventilating parts.
- Clean the equipment with a clean soft cloth . Do not use Isopropyl alcohol or any other cleaning agent.

INSTALLATION GUIDELINES

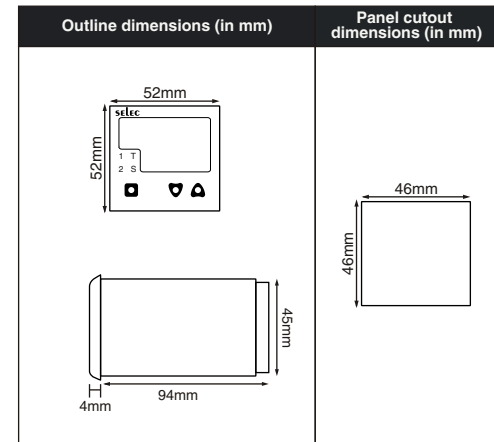
CAUTION:

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

WARNING:

- When powering up for the first time, disconnect the output connections.
- 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: 275VAC,1A for electrical circuitry is highly recommended)
- 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 BSEN61010 respectively.
- 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.
- The output terminals shall be strictly loaded to the manufacturer specified values/range.

MECHANICAL INSTALLATION



- Prepare the panel cutout with proper dimensions as shown above.
- Remove the clamp from the controller and push the controller into the panel cutout. Insert the clamp from the rear side until the main unit is securely fit into the panel.

- 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.

CAUTIONS ON WIRING:

- Use the specified size of crimp terminals (M3.5 screws) to wire the terminal block. Tighten the screws on the terminal block using the tightening torque within the range of 1.2 N.m.
- Do not connect anything to unused terminals.

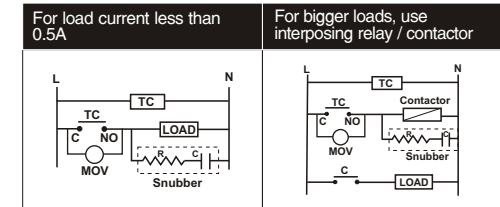
EMC Guidelines:

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

LOAD CONNECTIONS

CAUTION:

- The service life of the output relays depends on the switching capacity and switching conditions. Consider the actual application conditions and use the product within the rated load and electrical service life.
- Although the relay output is rated at 5 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.
- Always use a separate fused supply for the "power load circuit" and do not take this from the live and neutral terminals supplying power to the controller.



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:

- Use of snubber circuits across loads as shown above, is recommended.
- Use separate shielded wires for inputs.

? SERVICE DETAILS

This device contains no user serviceable parts and requires special equipment and specialized engineers for repair.

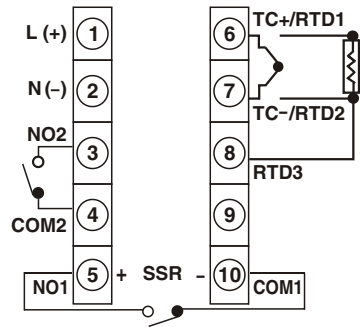
Please contact service center for repair on the following numbers:

Toll free: 1800 227353 (BSNL/MTNL subscribers only)

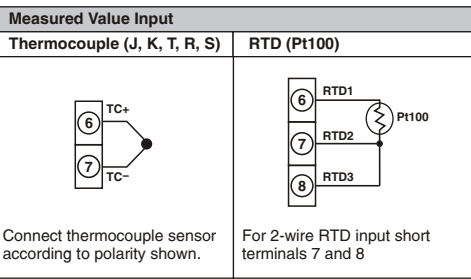
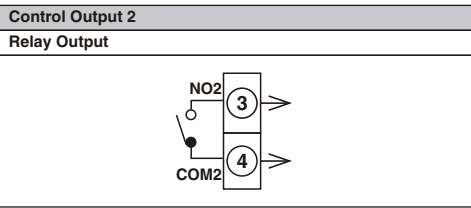
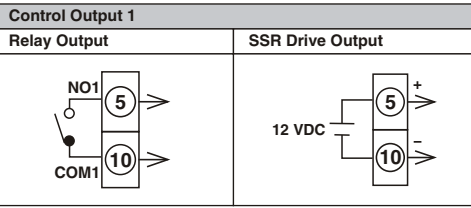
Others: 91-22-40394200 / 40394202

NO WARRANTY ON UNIT DAMAGED DUE TO WRONG POWER SUPPLY.

TERMINAL CONNECTIONS



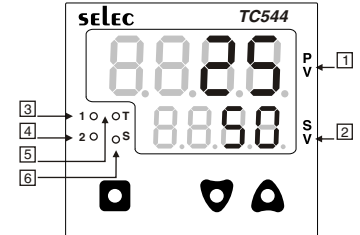
WARNING: Please check the power supply voltage and controllers output type ordered (with reference to the order code) before installation.



CAUTION: 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.

FRONT PANEL DESCRIPTION



| | | |
|---|---|---|
| 1 | 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 on page 4) |
| 2 | Parameter setting display | 1) Displays the parameter settings at configuration mode/online menu. |
| 3 | Control output 1 indication | The LED is lit when the control output 1 is ON |
| 4 | Control output 2 indication | The LED is lit when the control output 2 is ON |
| 5 | Tune | Auto tune: Blinking at faster speed. |
| 6 | 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 seconds. |
| To view Level 2 | Press ▲ key for 3 seconds. |
| To view Protection Level | Press ▲ + ▼ keys for 3 seconds. |
| To view online parameters | Lower display selectable between SET1/SET2/TIME using ▲ key. Note: Upper display shows parameter name for 1sec. |

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 seconds of no activity.

OR

By pressing the **▲** or **▼** or **▲** + **▼** keys for 3 seconds.

USER GUIDE

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 the correct location.

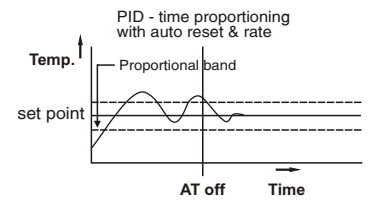
2. Filter Time Constant

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 tuning:

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

- While Auto-tune is in progress, 'T' LED will blink at a faster speed.
- After Auto-tuning is completed, the 'T' LED stops blinking.

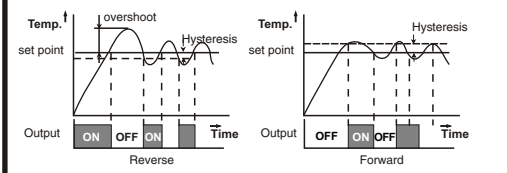


- If the power goes OFF before auto-tuning is completed, auto-tuning will be restarted at next power ON.
- If auto-tuning is not completed after 3-4 cycles, it is suspected to fail. In this case, check the wiring & parameters such as the control action, input type, etc.
- Carry out the auto-tuning again,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

4. ON/OFF control action (For Reverse Mode):

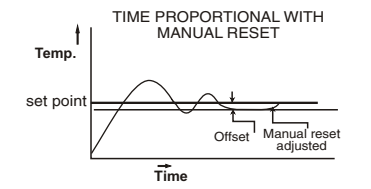
The relay is 'ON' up to the set temperature and cuts 'OFF' above the set temperature. As the temperature of the system drops, the relay is switched 'ON' at a temperature slightly lower than the set point.

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 sometime, the process temperature settles at a 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. Heat-Cool:

By using a heating and cooling output, a process is able to quickly bring the temperature to setpoint in both directions and limit the amount of overshoot.

Heat-cool control is a very effective way of controlling exothermic processes. (processes that generate their own heat, or processes where ambient temperature is not adequate or fast enough in returning a process back to setpoint)

Cycle time-cool (CYT.C): Generally select 0.2-2 sec if SSR is used, and 10-20 sec if relay output is used. Cycle time-cool is ignored if linear output is used.

Proportional band-cool (PB-C): The cooling proportional band is measured by degrees with range 0.0 to 400.0.

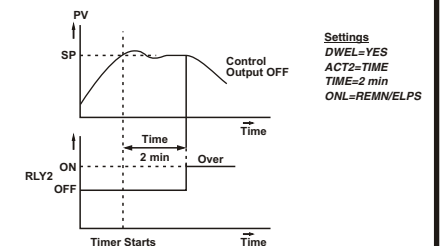
- If cooling action is to be enhanced then decrease PB-C
 - If cooling action is too strong then increase PB-C.
- Note:** The ON-OFF control may result in excessive overshoot and undershoot in the process. It is recommended to use PID control for the heat-cool control to produce a stable & zero offset process value.

DB programming (DB): Deadband (+ve DB) is that area where neither outputs are energized. Overlap (-ve DB) is that area where both the outputs are energized.

- If more positive value of DB is used, an unwanted cooling action can be avoided but an excessive overshoot over the setpoint will occur.
- If more negative value of DB is used, an excessive overshoot over the setpoint can be minimized but an unwanted cooling action will occur.

7. Dwell Timer

A dwell timer is used to control a process at a fixed temperature for a defined period. Once the process reaches the setpoint, dwell timer starts to count from zero until time out. After the time is completed, control output goes OFF and auxiliary output energies as an alarm.

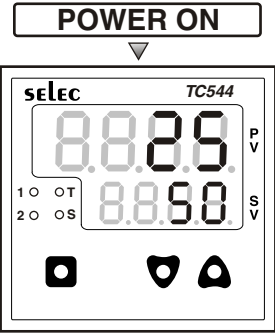


Note: S LED blinking indicates dwell timer is in progress. It switches to continuous ON when dwell timer over.

CONFIGURATION INSTRUCTIONS



OPERATIONAL MENU



Note
At power ON lower display shows (momentary) input type selected in Level 1.

Press key for 3 seconds

Press key for 3 seconds

Press + keys for 3 seconds

| Level 1 | | | | |
|---------|---|---------------|--------------------------------------|---|
| Display | Description | Default Value | Range | Display Condition |
| INPE | Input type (Refer Table 1) | J | J/K/T/R/S/RTD | — |
| RESL | Display Resolution | 1 | 1/0.1 | Not prompted for R & S type |
| UNIT | Temperature unit | °C | °C/°F | — |
| SPLL | Set point low limit | -199 | Min range of sensor selected to SPHL | — |
| SPHL | Set point high limit | 750 | SPLL to Max range of sensor selected | — |
| FTE | Filter time constant (Refer user guide) | 1.0 | 0.2 to 10.0 sec | — |
| RC1 | Control action for relay 1 | RE | RE/FD | Not prompted for HC=YES |
| CLL | Control logic | PID | PID/ONF | — |
| DWEL | Dwell mode enable | NO | NO/YES | — |
| HC | Heat-cool mode selection (Refer user guide) | NO | NO/YES | — |
| RC2 | Control action for relay 2 | RE | RE/FD/TIME | When HC=NO, TIME prompted when DWEL=YES |
| REL2 | Relay 2 type | DEV | DEV/ABS | When HC=NO |
| ONL | Online menu for timer | REMN | REMN/ELPS | When DWEL=YES |
| ARW | Anti-reset windup % | 25.0 | 1.0 to 100.0% | When CNTL=PID |
| FACT | Factory default (Reset all) | NO | NO/YES | — |

| Level 2 | | | | |
|---------|---------------------------------|---------------|-----------------|--------------------------------|
| Display | Description | Default Value | Range | Display Condition |
| TUNE | Tune (Refer user guide) | OFF | OFF/ON | For CNTL=PID |
| P | Proportional band | 10 | 1.0 to 400.0° | For CNTL=PID |
| I | Integral time | 120 | 0 to 9999 sec | For CNTL=PID |
| D | Derivative time | 30 | 0 to 9999 sec | For CNTL=PID |
| CYCL | Cycle time mode | AUTO | AUTO/USR.F | For CNTL=PID |
| CYC | Cycle time | 15.0 | 0.1 to 99.9 sec | For CNTL=PID |
| HYS1 | Hysteresis 1 | 1.0 | 0.1 to 99.9° | For CNTL=ONF |
| MANR | Manual reset | 0.0 | -19.9 to +19.9° | For CNTL=PID & I=0 |
| PB.C | Proportional band-cool | 10 | 1.0 to 400.0° | HC=YES |
| CYCL.C | Cycle time-cool | 15.0 | 0.1 to 99.9 sec | HC=YES |
| HYS2 | Hysteresis 2 | 1.0 | 0.1 to 99.9° | For HC=NO or HC=YES & CNTL=ONF |
| DWEL | Dwell time (Refer user guide) | 0 | 0 to 9999 min | When DWEL=YES |
| DISP | Display bias (Refer user guide) | 0.0 | -19.9 to 19.9° | — |

| Protection Level | | | | |
|------------------|-----------------------------|---------------|-----------|------------------------|
| Display | Description | Default Value | Range | Display Condition |
| SP | Lock setpoint (SET1 & SET2) | UNLK | UNLK/LOCK | — |
| LVL1 | Lock level 1 | UNLK | UNLK/LOCK | — |
| LVL2 | Lock level 2 | UNLK | UNLK/LOCK | — |
| DWEL | Lock dwell time | UNLK | UNLK/LOCK | Prompted when DWEL=YES |

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 seconds.

Programming online parameters

Setpoint 1 Default: 50
 Range: SPLL to SPHL
 If upper display is selected as 5 E t 1 then,
 Pressing **█** key will show on Upper display: 5 E t 1
 Lower display: <50>
 Press **█ + Δ / ▽** keys to increment/decrement 5 E t 1 value.



Setpoint 2/Dead band Default: 0
 Range: SPLL to SPHL
 If upper display is selected as 5 E t 2 / d b then,
 Pressing **█** key will show on Upper display: 5 E t 2 / d b
 Lower display: <0>
 Press **█ + Δ / ▽** keys to increment/decrement 5 E t 2 / d b value.



Dwell Timer Default: 0
 Range: 0 to 9999 min
 If upper display is selected as t . P E n / t . E L P then,
 Pressing **█** key will show on Upper display: t i n E
 Lower display: <0>
 Press **█ + Δ / ▽** keys to increment/decrement d P E L time value.

INPUT RANGES (Table 1)

| FOR RTD | | | | FOR THERMOCOUPLE | | | |
|-------------------|----|--------------|-------------|-------------------|----|--------------|-------------|
| Input | | Ranges | | Input | | Ranges | |
| Resolution | | 1 | 0.1 | Resolution | | 1 | 0.1 |
| Pt100 | °C | -150 to 850 | -150 to 850 | J | °C | -199 to 750 | -199 to 750 |
| | °F | -238 to 1562 | -199 to 999 | | °F | -328 to 1382 | -199 to 999 |
| | °C | -199 to 1350 | -199 to 999 | K | °C | -199 to 1350 | -199 to 999 |
| | °F | -328 to 2462 | -199 to 999 | | °F | -328 to 2462 | -199 to 999 |
| | °C | -199 to 400 | -199 to 400 | T | °C | -199 to 400 | -199 to 400 |
| | °F | -328 to 750 | -199 to 750 | | °F | -328 to 750 | -199 to 750 |
| | °C | 0 to 1750 | N/A | R & S | °C | 0 to 1750 | N/A |
| | °F | 32 to 3182 | N/A | | °F | 32 to 3182 | N/A |

ERROR DISPLAY (Table 2)

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

| Error | Meaning | Control Output Status |
|-------|--|-----------------------|
| S.b P | Sensor break / over range condition | OFF |
| S.P E | Sensor reverse / under range condition | OFF |

CALIBRATION CERTIFICATE

Date:

Model No: TC544

Claimed Accuracy:
 For TC inputs: 0.25% of FS ±1°
 For R & S inputs: 0.5% of FS ±2°
 (20 min of warm up time for TC input)
 For RTD inputs: 0.1% of FS ±1°

Sources calibrated against:
 Hinditron Multimeter Model 86, Sr. No.:1094

Multimeter calibration report no: 2009 S&C 631
 ERTL(W), Mumbai, INDIA **Date:** 11/05/2009

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

| SENSOR | CALIBRATION TEMP (°C) (0.1 resolution) | DISPLAY VALUE (°C) |
|--------------|--|--------------------|
| K | 35.0 | 35.0 |
| | 700.0 | 700.0 |
| | 1350 | 1350 |
| PT100 | 0.0 | 0.0 |
| | 500.0 | 500.0 |
| | 800.0 | 800.0 |

The thermocouple / RTD curves are linearised in this microprocessor 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.

CHECKED BY:

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