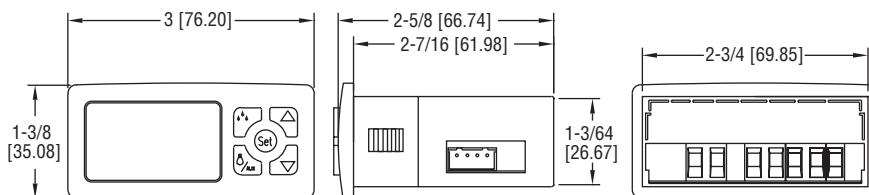




## Series TS3 Digital Temperature Switch

### Specifications - Installation and Operating Instructions



The **Series TS3 Digital Temperature Switch** is the ideal control for on/off heating or cooling applications. This generation of controls has field selectable engineering units and temperature probe types in order to reduce the combination of parts that need to be stocked. A built in real time clock is used for HACCP logging of temperature alarms caused by temperatures outside of their set limits or loss of power. For refrigeration applications, the defrost cycle can be initiated based on time or using the front panel keys. For programming multiple units, the model TS2-K configuration key can be used to quickly download parameter settings.

#### INSTALLATION

NOTE: Unit must be mounted away from vibration, impacts, water and corrosive gases.

- Cut hold in panel 71 x 29 mm (2.80 x 1.14 in).
- Use the supplied gasket or apply silicone around the perimeter of the hole to prevent leakage.
- Insert unit into hole from the front side of the panel.
- Slide the mounting bracket securely against the panel from the rear of the unit.
- Wiring diagram is displayed on the top of the control.

#### Wiring

Avoid installing the temperature probe cables and the digital input wires in close proximity of any power cables. If the length of the probe cables is longer than 100 meters, a recalibration adjustment may be made using the P1 parameter.

#### SPECIFICATIONS

##### Probe Range:

PTC: -58 to 302°F (-50 to 150°C)

NTC: -58 to 230°F (-50 to 110°C).

**Input:** PTC (1000Ω @ 25°C) / NTC (10KΩ @ 25°C).

**Output:** R1 SPDT Relay Resistive Load 16A, Inductive Load 10 FLA, 60 LRA @ 240 VAC.

**Horsepower Rating:** 1HP @ 240 VAC.

**Control Type:** On/Off.

**Power Requirement:** 115 VAC, 230 VAC, 12 VAC/VDC, 24 VAC/DC (±10%) depending on model.

**Power Consumption:** 3.6VA (115/230/24 V), 1.5VA (12V).

**Accuracy:** ±1% FS.

**Display:** 3 Digits Plus Sign.

**Resolution:** 0.1°.

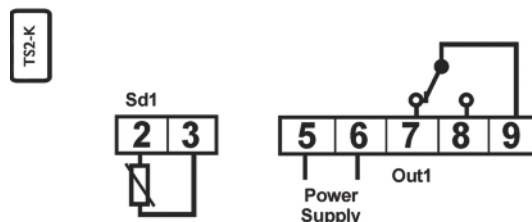
**Memory Backup:** Non-Volatile Memory.

**Ambient Temperature:** 32 to 131°F (0 to 55°C).

**Weight:** 2.3 oz (65 g).

**Front Protection:** IP65.

**Agency Approvals:** CE, UL.



**Parameter List (°C)**

| Operation                         | Parameter | Description                                  | Units   | Range             | Factory Setting |
|-----------------------------------|-----------|--|---------|-------------------|-----------------|
| Compressor/<br>Set Point<br>(COn) | SEt       | Set Point                                    | Degrees | R1 to R2          | 3.0             |
|                                   | r0        | Differential or Hysteresis                   | Degrees | 0.1 to 20         | 1.0             |
|                                   | r1        | Minimum Value for Set Point                  | Degrees | -99.9 to R2       | -50.0           |
|                                   | r2        | Maximum Value for Set Point                  | Degrees | R1 to 302         | 150             |
|                                   | c0        | Minimum Compressor<br>Stoppage Time          | Minutes | 0 to 240          | 1               |
|                                   | c1        | Continuous Cycle Time                        | H-M     | 0.0 to 18         | 1.0             |
|                                   | c2        | On Time of Fault Cycle                       | Minutes | 0 to 999          | 5               |
|                                   | c3        | Off Time of Fault Cycle                      | Minutes | 0 to 999          | 5               |
|                                   | c4        | Minimum On Time of Compressor                | Minutes | 0 to 240          | 0               |
|                                   | c5        | Minimum Time Between<br>Compressor Starts    | Minutes | 0 to 240          | 1               |
| Defrost (dEF)                     | d0        | Heating or Cooling                           | Range   | Re/In             | Re              |
|                                   | d1        | Temperature to Stop Defrosting               | Degrees | 99.9 to 302       | 80              |
|                                   | d2        | Maximum Defrosting Time                      | Minutes | 0 to 240          | 30              |
|                                   | d3        | First Hour of Day for Defrost                | H-M     | 00.0 to 18.0      | 00.0            |
|                                   | d4        | Delay of First Defrost                       | Minutes | 0 to 999          | 0               |
|                                   | d5        | Display During Defrost                       | Range   | Off/on/-d-        | -d-             |
|                                   | d6        | Display Return Limit                         | Minutes | 0 to 240          | 15              |
|                                   | d7        | Compressor Drip Time                         | Minutes | 0 to 240          | 0               |
|                                   | d8        | Interval Between Defrosts                    | H-M     | 00.0 to 18.0      | 8.0             |
|                                   | d11       | Minimum Defrosting Time                      | Minutes | 0 to 240          | 0               |
|                                   | d14       | Units to Count Defrost Cycle                 | Option  | CT/RT             | RT              |
|                                   | HdE       | Next Defrost Time                            | Hours   | Read only         |                 |
| Display (PrO)                     | ndE       | Next Defrost Time                            | Minutes | Read only         |                 |
|                                   | P0        | Temperature Scale                            | Option  | F/C               | C               |
|                                   | P1        | Ambient Probe Adjustment                     | Degrees | -20.0 to 20.0     | 0.0             |
| Alarm<br>(ALA)                    | P4        | Decimal Point                                | Option  | 0.1 to 20.0       | No              |
|                                   | A0        | Alarm Differential                           | Degrees | 0.1 to 99.9       | 4.0             |
|                                   | A1        | Maximum Alarm Temperature                    | Degrees | 0.1 to 99.0       | 8.0             |
|                                   | A2        | Minimum Alarm Temperature                    | Degrees | 0.0 to 18.0       | 8.0             |
|                                   | A3        | Time without alarm after<br>Continuous Cycle | H-M     | 0.0 to 18.0       | 1.1             |
|                                   | A4        | Time Without Alarm After Defrost             | H-M     | 0.0 to 18.0       | 1.1             |
| Initial Setup<br>(Ini)            | A6        | Time Without Alarm After Power On            | H-M     | 0.0 to 18.0       | 1.1             |
|                                   | A7        | Alarm Verification Time                      | H-M     | 0.0 to 18.0       | 1.1             |
|                                   | Hor       | Real Time Hours                              | Hours   | 0 to 23           | 0               |
|                                   | nin       | Real Time Minutes                            | Minutes | 00 to 59          | 00              |
|                                   | E0        | Configure Digital Input                      | Option  | Off/A1/In/DEF/Rst | Def             |
|                                   | H0        | Factory Default                              | Range   | 0 to 2            | 0               |
|                                   | H1        | Assign Master/Slave                          | Option  | Mst/Slv           | Mst             |
|                                   | H2        | Keypad Protection                            | Option  | yes/No            | No              |
|                                   | H3        | Delay Time on Connecting                     | Seconds | 0 to 240          | 0               |
|                                   | H4        | Serial Communication Address                 | Range   | 0 to 999          | 0               |
|                                   | H5        | Keypad Code                                  | Range   | 0 to 999          | 0               |
|                                   | H6        | Type of Probe                                | Option  | PTC/NTC           | PTC             |
|                                   | H11       | HACCP Activated                              | Option  | Yes/No            | No              |
|                                   | dAt       | Real Time Date                               | Range   | dxx, nxx, yxx     | d01, n01, y00   |
|                                   | td        | Display Refresh Rate                         | Seconds | 0-999             | 0               |

## Parameter Description

### Compressor / Set Point Menu

- SEt Sets the Ambient Temperature set point between r1 and r2  
r0 Differential or hysteresis for set point  
(For d0 = re)  
Ambient temperature  $\geq$  SEt + r0 Output On  
Ambient temperature  $\leq$  SEt Output Off  
(For d0 = in)  
Ambient temperature  $\leq$  SEt - r0 Output On  
Ambient temperature  $\geq$  SEt Output Off
- r1 Minimum value for set point  
r2 Maximum value for set point  
c0 Minimum time compressor must remain off before being restarted  
c1 Duration of cold cycle  
c2 During probe error, time that output is engaged  
c3 During probe error, time that output is disengaged  
c4 Minimum time compressor must stay on  
c5 Minimum time between compressors starts

### Defrost Menu

- d0 Selection for Heating or Cooling Operation  
re = Cooling  
in = Heating  
d2 Maximum time the control will be in defrost cycle. If set to zero, control will not defrost.  
d3 Hour of the day for the first defrost. No defrost cycles will take place before this time.  
d4 Upon powering on the control, delay time before first defrost cycle.  
d5 Display during defrost cycle.  
Off = Current temperature displayed.  
On = Temperature at start of defrost cycle displayed until defrost cycle ends and the temperature is less than or equal to starting temperature or after the time is set in d6.  
d6 Maximum time before the display returns to normal reading after a defrost cycle.  
d7 Time after defrost cycle before the compressor can be started.  
d8 Time between defrost cycles. If set to 0, defrost must be manually actuated.  
d11 Minimum duration the control remains in defrost cycle.  
d14 Units to count the defrost cycle  
rt = according to the time the controller was on.  
ct = according to the time the compressor was on.  
HdE Hours until next defrost cycle.  
ndE Minutes until next defrost cycle.

### Display Menu

- P0 Selection of Engineering Unit (F or C)  
P1 Ambient Probe Calibration Adjustment  
P4 Decimal Point Present

### Alarm Menu

- A0 Alarm Differential or hysteresis  
A1 High Alarm Set Point (Deviation Value)  
On when temperature reaches Set + A1 and off at Set + A1 - A0  
A2 Low Alarm Set Point (Deviation Value)  
A3 Time of Alarm Inhibit after Continuous Cool Cycle  
A4 Time of Alarm Inhibit after Defrost Cycle  
A6 Time of Alarm Inhibit after Power Up  
A7 Time since Alarm Initiated until Validated

## Initial Setup Menu

- Hor Real Time Hours  
nin Real Time Minutes  
H0 Restore Factory Configuration  
H2 Keypad Password Protected  
Yes = code is necessary to start/stop defrost or continuous cold cycle. One minute after entering the code, keypad is locked again  
No = Keypad not protected  
H3 Compressor delay time upon power up  
H4 Address for serial communications (Need Model TS485 communication module)  
H5 Input code to Parameters (factory set at 0)  
H6 Input Probe Types: PTC or NTC  
H11 HACCP Alarm recording enabled or disabled  
dAt Real Time Date can be programmed by holding the set key for 3 seconds. Then, use arrows to select day. Press set to store day; use arrows to access month and year  
td The display refreshes at 1 degree if actual temperature is greater than 1 degree higher td seconds before during defrost and open door conditions

## Front Panel Operation

### Set Point Setup

- Press the Set key once and Set will be displayed.
- Press Set key again and set point value will be shown.
- Uses the Up and Down arrows to adjust set point.
- Press the Set key to save the new set point.
- Press Set and Down arrow at same time to exit.

### Time Setup

- Press the Set Key once and Set will be displayed.
- Use the Up and Down arrow until Hor is displayed for adjusting the hours.
- Press the Set key to view the current value.
- Use the Up and Down arrow to adjust to current time.
- Press the Set key for 8 seconds to save the new time (Pro will flash on display once the value is saved).
- Press the Set key to return to the previous menu.
- Use the Up and Down arrow until Nin is displayed for adjusting the minutes.
- Repeat steps 3 through 6.
- Press the Set and Down arrow at the same time to exit.

## Parameter Programming

The parameters are organized into 6 programming menus (COn, dEF, PrO, ALA, HAC, and Ini) (HAC is only accessible when H11 = yes).

- Press the Set key for 8 seconds until 0 is displayed.
- Use the Up and Down arrows to reach the assigned security code (factory setting for this code is 0).
- Press the Set key to accept the code.
- Use the Up and Down Arrows to select programming menu to enter.
- Press the Set key to reach the parameters under each programming menu.
- Use the Up and Down Arrows to scroll through the parameters.
- Press the Set key to view the value of the parameters.
- Use the Up and Down Arrows to change the values of the parameters.
- Press the Set key to save the changes.
- Press the Set and Down Arrow to go back to the programming menu selection.
- Press the Set and Down Arrow a second time to exit.


### Date Setup

- Access the Data Parameter (dAt) in the Initial Setup Menu.
- Press the Set key once to display the day (dXX).
- Press and hold the Set button for 8 seconds will cause the digits to flash and allow the value to be changed.
- Use the Up or Down arrow to adjust the value for the day.
- Press and hold the Set button for 8 seconds to store the value (Pro will flash when the value has been stored).
- Use the Up or Down arrows to switch from day (dxx) to month (nxx) or year (yxx).
- Follow the same steps to adjust the month and year values.

### Factory Default

- Go to H0 menu in the Initial Setup Menu.
- Adjust value to 0.
- Press the Set key for 8 seconds.

### Manual Default

Press the  key for 8 seconds to activate / deactivate defrost cycle.

### Continuous Cold Cycle

Press the Down key for 8 seconds to activate or deactivate a continuous cold cycle. (CON will flash upon starting cycle and COF will flash upon completion of cold cycle).

### Resetting Keypad Security Code

Press the Set key during power up will reset the security code to 0.

### Alarm Validation

Pressing the Down Arrow and the Set Key simultaneously will acknowledge an alarm condition. The Alarm indicator and the buzzer will turn off after acknowledging the alarm condition.

### LED Indicators



Indicates that the Compressor is engaged. It will blink when there is a call for the compressor to turn on during minimum compressor stoppage.



Indicates defrost cycle is active.



Indicates an error or Alarm or error condition.

**HACCP** Indicates that a HACCP event is being recorded.

### Display Messages

In normal operation the probe temperature will be displayed. The display blinks when waiting for a parameter to be saved or when there is an error saving a parameter to memory. The following messages can also appear:

|      |  |
|------|--|
| Err  | Memory Reading Error                                   |
| ERP1 | Probe Error (check wiring or replace probe)            |
| Eri  | Internal Parameter Error (factory default programming) |
| ALH  | High Temperature Alarm                                 |
| ALL  | Low Temperature Alarm                                  |
| ooo  | Open Probe Error                                       |
| ---  | Short Circuited Probe Error                            |
| DON  | Defrosting Activated                                   |
| DOF  | Defrosting Finished                                    |
| CON  | Continuous Cold Cycle Activated                        |
| COF  | Continuous Cold Cycle Finished                         |
| -d-  | Defrosting Cycle                                       |

During Probe error, the compressor will be cycled according to parameters c2 and c3. Manual defrosting and manual continuous cold cycle operations can be activated.

During memory error, the compressor will be cycled 5 minutes on and 5 minutes off. Manual defrosting and manual continuous cold cycle operations can not be activated.

### HACCP

If this option is activated, the digital temperature switch can register up to 5 alarms which could be high, low, or blackout. These alarms can be seen in the menu registry of alarms (HAC).

This first value that appears is the number of registered alarms. Afterwards, for each alarm (if any have occurred), the value of the temperature and time the alarm occurred will be displayed. Once the alarm returns to normal state, the temperature will be recorded along with the amount of time it took to return to this temperature will be displayed.

When the elapsed time is shown, it will appear as xxd for the number of days. Pressing the Up arrow will display xxH for the number of hours, followed by xxn for the number of minutes. Pressing the Up and Down Arrows together for 2 seconds will delete the current record being displayed. If the Up and Down arrows are pressed for 2 seconds while in the HAC menu, all of the records will be erased.

### Defrosting Cycles

The amount time between defrost can be based off the total time that the instrument is on or it can be limited to the amount of time the compressor is running. The first defrost will be performed at the hour of the day set with d3 and the following cycles will occur in intervals of d8 after the initial defrost.

### Communication Connector

The communication connector can be used with the TS2-K to read or write the parameter configuration to the Series TS3. The connector can also be used with a TS485 module to communicate with a computer or other device.

### MAINTENANCE

Upon final installation of the Series TS3 Digital Temperature Switch, no routine maintenance is required. Clean the surface of the display controller with a soft and damp cloth. Never use abrasive detergents, petrol, alcohol or solvents. Upon final installation of the TS3 Temperature Digital Controller, no routine maintenance is required. A periodic check of the system calibration is recommended. The Series TS3 is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.