

# INSTALLATION/OPERATING INSTRUCTIONS

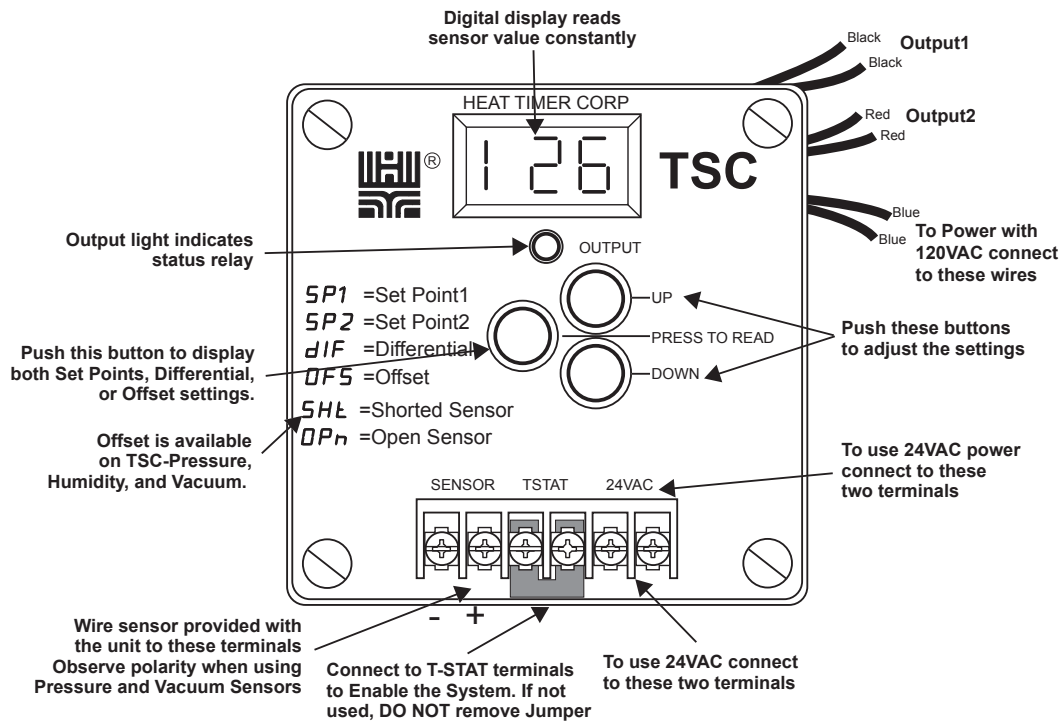
# DIGI-SPAN<sup>®</sup> TSC

## Two-Stage Set Point Control with External Activation Two-Stage Heating (Rotation Included) Two-Stage Cooling (Rotation Included) Change-Over Control (Heat/Cool)

Temperature Range 0 to 215°F (-20 to 100°C)

Pressure Ranges 0-30, 0-100, 0-200 PSI

Vacuum Range 0-30Hg



### ⚠ WARNING

This Heat-Timer control is strictly an operating control; it should never be used as a primary limit or safety control. All equipment must have its own certified limit and safety controls required by local codes. The installer must verify proper operation and correct any safety problems prior to the installation of this Heat-Timer control.

### LIMITED ONE YEAR WARRANTY

This Heat-Timer device was thoroughly tested for defects and workmanship before leaving our factory. We do warrant the equipment to be free of defects under normal use for a period of one year from the date of installation. Transportation charges for factory repairs must be prepaid. Damage to the Heat-Timer device or any of its components due to misuse, abuse, improper installation, or caused by power failures, fire, flood, or lightning are not covered by this warranty. The company assumes no liability for indirect or consequential damages of any nature. This Heat-Timer warranty applies only to the original purchaser/user, is not assignable or transferable, and does not cover damage to the device occurring in shipment. Any service, repairs, modifications or alterations to the unit not expressly authorized by the company will invalidate the warranty. This warranty is in lieu of all other warranties expressed or implied.

# INSTALLATION

## Mounting the Controller

- The TSC is designed to mount on a 1900 (4"x4") electrical box.
- If the TSC is to be panel mounted, or if additional room is needed for wiring, an extension skirt is available ♦.
- Locate the TSC in a convenient location near the unit to be controlled.
- Mount the TSC away from excessive heat or cold. Ambient operating temperature is from 20 to 120°F.
- After completing all the wiring connections (see below) use the two screws provided to mount the TSC to the 1900 box.

## Installing the Temperature Sensor (Included with TSC-Temp)

- The temperature sensor wires can be extended up to 500' by splicing with 18 gauge shielded wire.
- Do not run wires in conduit with line voltage.
- If measuring liquid temperature, the sensor should be inserted into a 3/8" ID well (HT#904011 or equivalent).
- The TSC will operate based on the temperature it reads at the sensor location. Therefore, select a sensor location that is representative of the entire system.
- The wires can also be connected to the rear of the TSC using the Rear Wire connector\*. Connect the sensor wires to the orange and yellow Rear Wires.
- Polarity is not important. Either wire from the sensor can be connected to either TSC sensor input.

## Installing a Pressure or Vacuum Sensor (Included with TSC-Press or TSC-Vacuum)

- Attach a 1/4" brass isolation tube (pigtail) to the steam header.
- Screw the pressure or Vacuum sensor to the pigtail. The sensor has 1/4" NPT tapered threads.
- The BLACK and RED sensor wires can be extended up to 500' by splicing with 18 gauge shielded wire.
- Do not run wires in conduit with line voltage.
- The TSC will operate based on the pressure or vacuum sensor reading. Therefore, select a sensor location that is representative of the entire system.
- The sensor's BLACK wire should be connected to the terminal marked SENSOR (-).
- The RED wire from the sensor should be connected to the terminal marked SENSOR (+).
- The transducer wires can also be connected to the back of the TSC using the Rear Wire connector\*. Connect the BLACK sensor wire to yellow Rear Wire and the RED sensor wire to the orange Rear Wire.

## Connecting the T-STAT terminals

- The T-STAT input can be used to enable or disable the system by connecting it to either a thermostat or external control.
- The T-STAT input should be dry contact only.
- Polarity is not important. Either wire from the thermostat can be connected to either T-STAT terminal.
- If no thermostat or control is connected to the T-STAT terminals, leave the jumper supplied as a contact to the terminals.
- No outputs will be active unless the T-STAT terminals are closed.

### **⚠ WARNING**

T-STAT contacts must be closed (shorted) for the control to be active.

## Wiring the Power

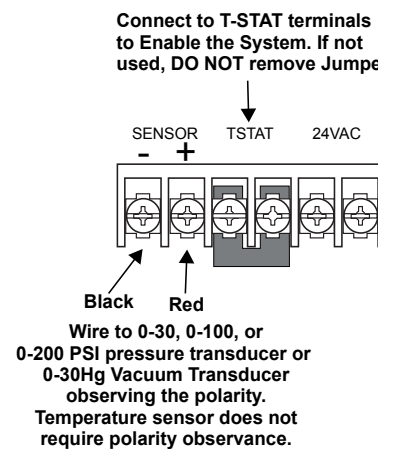
### TSC-Temp can use 120VAC or 24VAC

#### 120VAC

- Attach line voltage to the two blue wires extending from the back of the TSC.
- Use wire nuts, or wrap the connections with electrical tape.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 wiring.

#### 24VAC

- Use a dedicated transformer with at least a 5VA output.
- Bring 24VAC to the two screws on the front of the TSC marked 24VAC.
- 24VAC can also be connected to the rear of the TSC using the Rear Wire connector\*. Connect the 24VAC to the violet and gray Rear Wires.



- ♦ The Optional Mounting Kit includes the extension skirt, the Rear Wire connector, and an input terminal cover. HT #908520.

## ⚠ WARNING

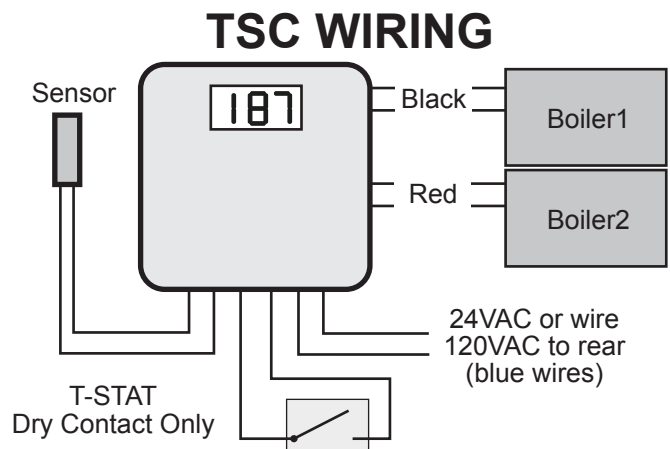
The TSC can accept only one source of power: 120VAC or 24VAC. If more than one power source is applied, the unit may be damaged.

### Wiring the Outputs

- The TSC has two SPST relay outputs each rated at 6A, 1/8HP.
- The outputs are dry contacts only. They do not source any power.
- The Black wires are the N.O. contacts for Output 1.
- The Red wires are the N.O. contacts for Output 2.
- Any Class 1 voltages must enter the enclosure through a different opening from any Class 2 wiring.

## Startup Settings

- Whenever the TSC is powered up, it will display the software version number and then the current operating mode. Each display will remain on the screen approximately 5 seconds. If the mode is correct, there is no need to make any adjustments.
- To change any startup setting push the Press to Read Button with the Up or Down Button. When released the TSC will wait for 5 seconds then switch to the second setting.
- After all settings have elapsed, the control will show the system actual temperature or pressure.
- Once the mode has been set for a particular application, it will be retained in memory and will not need to be reset.
- Note that if you do change an operating mode, you will need to reset all the settings.
- An operating mode can only be changed when it is being displayed in the start-up sequence. To restart the sequence it is necessary to remove power to the TSC and then power it again.
- Set the operating modes as described in sequence below:



### Temperature Operation °F Fahrenheit or °C Celsius (Temperature Models Only)

- If the display shows °F then the Digi-Span will operate in Fahrenheit degrees.
- If the display shows °C then the Digi-Span will operate in Celsius degrees.
- To change the mode, hold down the center button while pushing either the UP or DOWN button to toggle between the displays of °F and °C.
- When the correct temperature mode is selected, release the buttons and wait approximately 5 seconds.

### Pressure and Vacuum Range P03 (0-30 PSI), P10 (0-100 PSI), P20 (0-200 PSI), Hg (0-30 Hg of Vacuum) (Pressure Models Only)

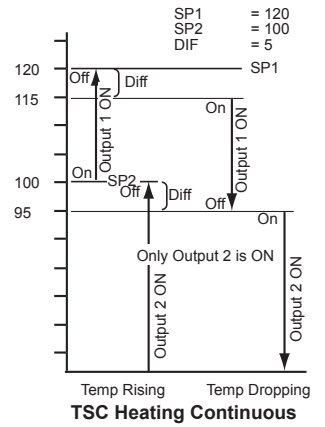
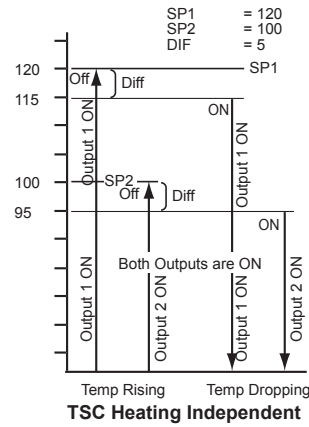
- If the display shows P03 then the range will be from 0 to 30 PSI and be displayed in 0.5 PSI increments. If the display shows P10 or P20, the range will be 0 to 100 PSI or 0 to 200 PSI and display in 1 PSI increments. If the display shows Hg, the range will be 0 to 30 Inches of mercury (for Vacuum Applications only) and display in 1 Hg increments
- To change the range, hold down the center button while pushing either the UP or DOWN button to toggle between pressure ranges.
- When the range is selected, release the buttons and wait approximately 5 seconds.

## STARTUP SETTINGS

1	Software Version	
2	Temp standard	Pressure standard
	F (Fahrenheit) C (Celsius)	P03 (30PSI) P10 (100PSI) P20 (200PSI) Hg (30in Vacuum)
3	Control mode	
	H (Heat) C (Cool) CC (Heat/Cool)	
	Operating mode	(Not available with Heat/Cool)
4	I (Independent) C (Consecutive)	
	Rotation mode	(Not available with Consecutive Operation or Heat/Cool)
5	LS (No Rotation) LR (Rotation)	
	Sensor Fault mode	(Not available with Heat/Cool)
6	FN (Enable) FD (Disable)	

**Two Stage Heating, Two Stage Cooling, or Heat/Cool (Change-Over) Mode**  $H\Delta$ ,  $\Delta O$ , or  $\Delta O\Delta$

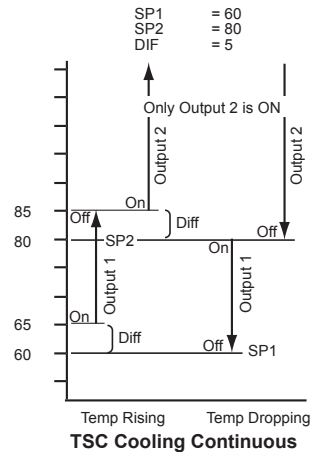
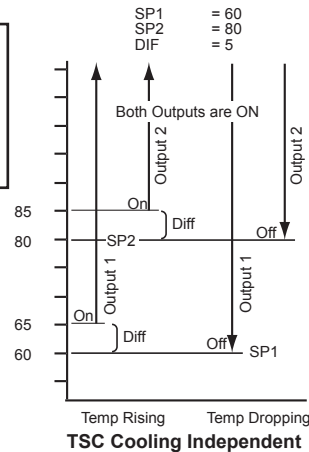
- If the display shows  $H\Delta$  then the TSC will be in a Two Stage Heating mode. The relays will close when the sensor temperature or pressure is below the set point.
- If the display shows  $\Delta O$  then the TSC will be in a Two Stage Cooling mode. The relays will close when the sensor temperature or pressure is above the set point.
- If the display shows  $\Delta O\Delta$  then the TSC will be in Heat/Cool (Change-Over) mode. The Output1 relay (Black wires) will close when the sensor temperature or pressure is above the Set Point SP1. The Output2 relay (Red wires) will close when the sensor temperature or pressure is below the Set Point SP2.
- On a sensor fault in Heat/Cool (Change-Over) mode  $\Delta O\Delta$ , all outputs will turn off.



**CAUTION**  
When in Heat/Cool (Change-Over) mode, Differential is additive to Set Point1. However, Differential is subtractive from Set Point2.

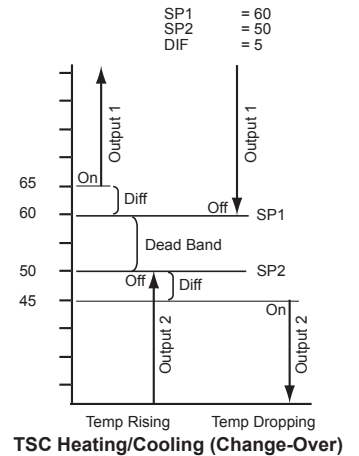
**Operating Mode: Independent ( $Ind$ ) or Continuous ( $\Delta On$ ) (Not Available in Heat/Cool (Change-Over) mode)**

- When the TSC is set to Independent mode  $Ind$ , both relays will energize when the sensor temperature is below both set points in heating mode or when the sensor temperature is above both set points in cooling mode.
- If the TSC is set to Heating and Continuous mode  $\Delta On$ , Output2 relay (red wires) will operate from the lowest sensor temperature to the Set Point2 SP2 Setting. However, Output1 relay (black wires) will operate from Set Point2 SP2 setting to the Set Point1 SP1 Setting. In other words, in Continuous mode, a maximum of one stage can be ON at any point.
- In Continuous mode  $\Delta On$ , a maximum of one output will be on at any point.
- In Continuous mode  $\Delta On$ , no rotation will be available.
- Continuous mode  $\Delta On$ , is great for applications where the outputs are not equal in capacity.



**Rotation Mode: No Rotation ( $\Delta S\Delta$ ) or 24-Hour Rotation ( $\Delta S_r$ ) (Not Available in Continuous Operating mode)**

- When the display shows  $\Delta S\Delta$ , the TSC will have a fixed lead stage and no rotation will take effect.
- When the display shows  $\Delta S_r$ , the TSC will rotate the lead stage every 24 hours. When the TSC's power is turned on, the first rotation will take place in 12 hours. The 24-hour rotation will take effect after the first rotation.
- No rotation will be available for Continuous  $\Delta On$  Operating mode. Nor will it be available for Heat/Cool (Change-Over) mode  $\Delta O\Delta$ .



**Sensor Fault Mode: Output On ( $FOn$ ) or Output Off ( $FOF$ ) (Not Available in Heat/Cool (Change-Over) )**

- The TSC allows you to choose how outputs should behave when sensor fails. By selecting  $FOn$  (Output ON) all outputs will be active when sensor fails when in Independent Operation mode  $Ind$ . In Continuous Operating mode  $\Delta On$ , only output1 (black wires) will be active.
- Using  $FOF$  (Output OFF) all outputs will be inactive when sensor fails.
- On a sensor fault in Heat/Cool (Change-Over) mode  $\Delta O\Delta$ , all outputs will turn off.

# Operation Settings

The following are the settings in which can be read or changed while the control is in operation. By pressing the **Press to Read** button multiple times the TSC will rotate its display between the available settings. After a setting symbol is displayed, its value will display after 3 seconds. A setting can be adjusted during the display of its value by pressing the Up and Down buttons. The display will revert to display System temperature/pressure *545* after approximately 10 seconds. When system temperature/pressure *545* is satisfied and relay had closed, the display will show *OFF*. You can read the System temperature/pressure by pressing the **Press to Read** button until *545* is displayed.

Push Press to Read button	Display
Set Point1 <i>SP1</i>	Set Point1 is the temperature or pressure that is used to control Output1 (black wires). The temperature Set Point is adjustable between 0°F to 215°F. Default is 70°F. Pressure and Vacuum Set Points is depends on the startup setting. <i>P03</i> (0-30 PSI) with a default of 10 PSI, <i>P10</i> (0-100 PSI) with a default of 30 PSI, <i>P20</i> (0-200 PSI) with a default of 60 PSI. <i>Hg</i> (0-30 Hg Vacuum) with a default of 10 PSI.
Set Point2 <i>SP2</i>	Set Point2 is the temperature or pressure that is used to control Output2 (red wires). The temperature Set Point is adjustable between 0°F to 215°F. Default is 70°F. Pressure and Vacuum Set Points is depends on the startup setting. <i>P03</i> (0-30 PSI) with a default of 10 PSI, <i>P10</i> (0-100 PSI) with a default of 30 PSI, <i>P20</i> (0-200 PSI) with a default of 60 PSI. <i>Hg</i> (0-30 Hg Vacuum) with a default of 10 PSI.
Differential <i>dIF</i>	The Differential is the number of degrees, PSI, or Hg above and below the Set Point where sensor input can fluctuate. The Temperature Differential is adjustable between 1°F to 40°F. Default is 2°F. Pressure or Vacuum Differential depends on the startup setting. <i>P03</i> (0.5- 5 PSI) with a default of 2 PSI, <i>P10</i> (1-20 PSI) with a default of 7 PSI, <i>P20</i> (1-20 PSI) with a default of 7 PSI, <i>Hg</i> (0.5- 5 PSI) with a default of 2 Hg.
Offset ♦♦ <i>OFFS</i>	The Offset calibrates the pressure or vacuum sensor reading by the number of pounds or inches of mercury selected. The Offset range depends on the startup setting. For <i>P03</i> (-3 - +3 PSI) with a default of 0PSI, <i>P10</i> (-10 - +10 PSI) with a default of 0PSI, <i>P20</i> (-20 - +20 PSI) with a default of 0PSI, <i>Hg</i> (-3 - +3 Hg) with a default of 0Hg.
System ♦ <i>545</i>	System temperature, pressure, or vacuum. Will read <i>OFF</i> when relay is fully closed. Will read <i>OPn</i> or <i>SHL</i> when sensor fails.

- ♦ Value is Read only and cannot be changed.
- ♦♦ Only available in TSC Pressure or Vacuum controls.

## Output Light

### Independent Mode:

- The output light will flash whenever the TSC has one output on.
- The output light will be ON whenever both outputs are on.

### Continuous Mode and Heat/Cool (Change-Over) Mode:

- The output light will flash whenever Output1 (black wires) is on.
- The output light will be ON whenever Output2 (red wires) is on

# Troubleshooting

## No Display

Check the power to the TSC. The TSC can run on any of the power sources described on page 2. Recycle the power.

## OPN Display

The TSC does not see a sensor connected. Check the wires are continuous from the sensor to the TSC controller. Then follow the procedure for Incorrect Temperature or Pressure Display.

## SHL Display

The TSC sees a short across the input terminals. If you remove the sensor wires from the TSC terminals, the display should change to read OPN. If the display does not change to OPN, the TSC may be damaged.

## OFF Display

Both set points are satisfied or the T-STAT terminals are open.

## Incorrect Temperature Display

Remove the wires from the SENSOR screws. The display should change to read OPN. If it doesn't, the TSC may be damaged. Take an ohm reading across the detached sensor wires. The ohm reading should correspond to the chart on the opposite page. If the ohm reading is significantly different, the sensor may be damaged.

## Incorrect Pressure or Vacuum Display

Remove the wires from the SENSOR screws. The display should change to read OPN. If it doesn't, the TSC may be damaged. Use a voltmeter to measure across the SENSOR screws. There should be 24VDC across the two terminals. If there isn't, the TSC may be damaged. Finally, reconnect the sensor with a mA meter in series with one sensor wire. The mA reading should correspond to the Pressure Sensor Chart on the opposite page. You can use the Offset (see pg. 5) to make small adjustments to the pressure reading.

## Output Red Light is not Active

Check the set points and differential values. In a heating application, the stage will not come on until the temperature drops below the set point minus the differential. In a cooling application, the stage will come on when the temperature rises to the set point.

## TSC Does Not Activate the Output

First check the OUTPUT light to see which stages should be active. If the OUTPUT light is OFF, no stages are active. If the OUTPUT light is flashing or on, check page 5 to see which output wires should be continuous. Remove all connections to the Black and Red output wires. Check the appropriate wires for continuity. If the wires are continuous, the Digi-Span is working properly. Check the unit the Digi-Span is controlling to determine why it is not running.

### Temperature Sensor Chart

TEMPERATURE (in Degrees °F)	Value (in Ohms)
-10	59075
0	42683
10	31215
20	23089
25	19939
30	17264
35	14985
40	13040
45	11374
50	9944
55	8714
60	7653
70	5941
80	4649
90	3667
100	2914
110	2332
120	1879
130	1524
140	1243
150	1021
160	842
170	699
180	583
190	489
200	412
210	349
220	297
230	253

### Pressure and Vacuum Sensor Chart

Input (in mA)	0 - 30 PSI Pressure Range	0 - 100 PSI Pressure Range	0 - 200 PSI Pressure Range	0 - 30 Hg Vacuum Range
4	0	0	0	0
4.08			1	
4.16		1	2	
4.53	1			1
5.07	2			2
5.6	3	10	20	3
7.2	6	20	40	6
8.8	9	30	60	9
10.4	12	40	80	12
12	15	50	100	15
13.6	18	60	120	18
15.2	21	70	140	21
16.8	24	80	160	24
18.4	27	90	180	27
20	30	100	200	30

# Specifications

<b>Voltage Input:</b>	120 VAC 60 Hz, 24VAC. (All Controls)
<b>Power Consumption:</b>	10 VA Max
<b>Relay Ratings:</b>	1 Amp inductive, 6Amp resistive at 120 VAC 60 Hz
<b>Outputs:</b>	2 N.O. S.P.S.T
<b>Temperature Display:</b>	Fahrenheit or Celsius.
<b>Pressure Display:</b>	0 - 30 PSI, 0 - 100 PSI, 0 - 200 PSI, and 0 - 30 Hg (Vacuum).
<b>Heating Modes:</b>	Heating (Ht), Cooling (Co), and Heat/Cool (Change-Over (COC)).
<b>Operating Modes:</b>	Independent (Ind) (2 stages can be on at once) Consecutive (CO) (Only one stage can be on at any point in time.
<b>Rotation Option:</b>	Optional 24 Hour Rotation in Independent mode.
<b>Output Relay Ratings:</b>	1 Amp inductive, 6Amp resistive at 120 VAC 60 Hz, 15A total for all circuits
<b>Display:</b>	3 Digit 7 segment character
<b>Output Light:</b>	1 LED red light.
<b>Set Point Ranges:</b>	Temperature - 0°F to 215°F (-20°C to 100°C) 30 PSI Pressure - 0 to 30 PSI 100 PSI Pressure - 0 to 100 PSI 200 PSI Pressure - 0 to 200 PSI 30 Hg Vacuum - 0 to 30 Hg
<b>Differential Ranges:</b>	Temperature - 0°F to 40°F (0°C to 20°C) 30 PSI Pressure - 0.5 to 5.0 PSI 100 PSI Pressure - 1 to 20 PSI 200 PSI Pressure - 1 to 20 PSI 30 Hg Vacuum - 0.5 to 5.0 Hg
<b>Pressure Offset Ranges:</b>	30 PSI Pressure - Minus 3.0 to +3.0 PSI 100 PSI Pressure - Minus 10.0 to +10.0 PSI 200 PSI Pressure - Minus 20.0 to +20.0 PSI 30 Hg Vacuum - Minus 3.0 to +3.0 Hg
<b>External Input:</b>	Enable/Disable Terminals
<b>Sensor Fault Options:</b>	Outputs On or Outputs Off (Not Available in Heat/Cool (Change-Over (COC)))
<b>Dimensions:</b>	4" x 4" x 1-1/32"

Heat-Timer Controls for the HVAC/R & Plumbing Industry

Steam Heating Controls  
Hydronic Heating Controls  
Sequencing & Modulating Controls  
Radiant Heat Controls  
Digital Set Point Controls  
Precision Tempering Valves  
Electronic Tempering Valves  
VARIVALVE<sup>®</sup> Air Vents  
2, 3, and 4-way Motorized Valves  
Snow Melt Controls