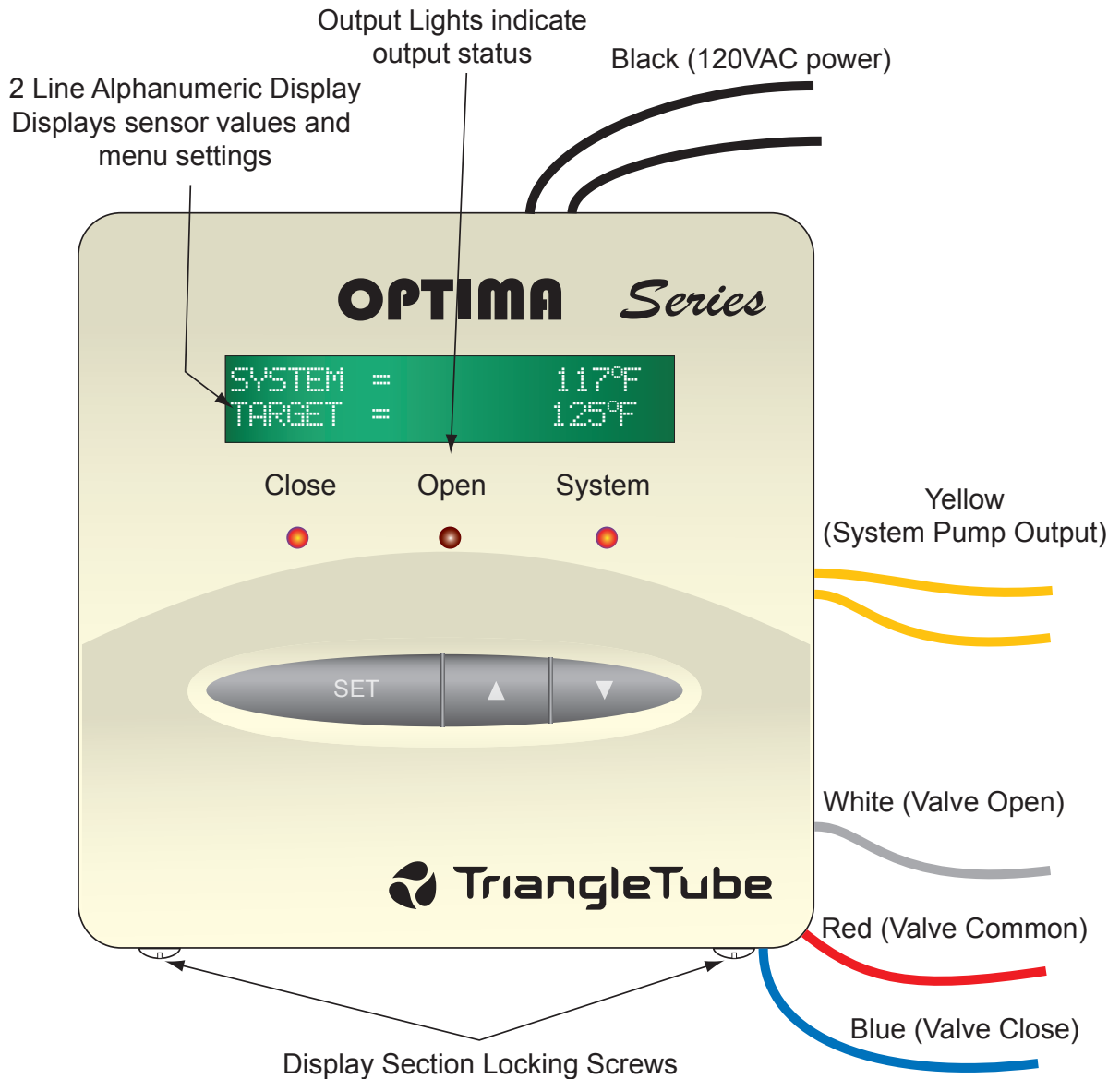


OPTIMA *Series***⚠ WARNING**

This Triangle Tube control is strictly an operating control. It **CANNOT** be used as a limit control. All equipment must have all safety and limit controls required by code. It is the responsibility of the installer to verify that all the safety and limits are working properly.

Operating Concept

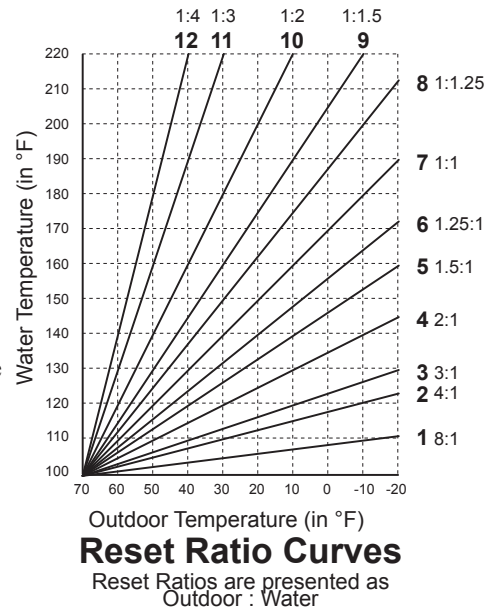
The SMV modulates a motorized three way valve to precisely maintain the required set point of the lower temperature zones in the heating system. The secondary loop temperature is increased by opening the valve to allow more water to enter from the higher temperature primary loop.

The SMV can be used to maintain either a fixed set point or operate using the outdoor reset function. The outdoor reset function utilizes fixed reset curves as well as providing the option for custom user defined heating curves. The included Outdoor Sensor can be used to provide an outdoor cutoff function in either set point or outdoor reset modes. The SMV also includes an external setback input which can be used to lower the set point when less heat is required such as on nights and weekends.

Because of the many different physical characteristics of buildings, and the type of radiation, i.e., baseboard or radiant, the heat loss varies. In one building, a 1-degree temperature change outdoors may require a change of 1 degree in heating water temperature; for another it may require a change of 2, 3, or even 4 degrees in order to gain the desired comfort level. This is known as the Reset Ratio. The Reset Ratio Curves chart shows the wide range of Reset Ratios available for the SMV.

The installer adjusts the SMV to a specific building by changing the Reset Ratio curve. With curve 4 (2:1 reset ratio) a 2-degree change in outdoor temperature will change the circulating hot water temperature by 1 degree; at curve 11 (1:3 reset ratio) an outdoor change of 1 degree will change the water temperature by 3 degrees. Most buildings with baseboard radiation require curve 6, 7, or 8. Radiant heat applications usually require a lower curve. An external T-Stat input can be used to shutdown the SMV when the thermostat is satisfied. Another, is a Setback input that will switch the heating system to a lower set point determined by the Set Back setting.

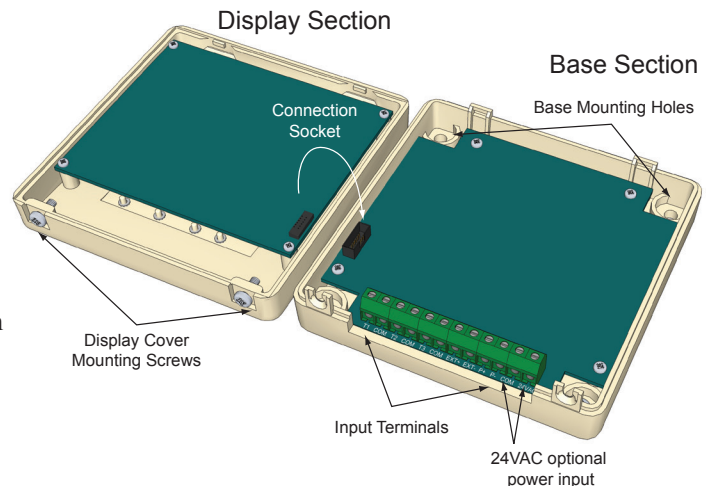
An optional Boiler Return water sensor can be used to avoid thermal shock to the boiler and, therefore, to help prolong boiler life. If the sensor registers that the boiler return water is below the minimum return temperature setting, the SMV immediately lowers the temperature of the circulating heating water to reduce the load on the boiler, allowing the return water temperature to rise.



Type of Radiation in Building	Reset Ratio	Offset
Radiators (Steel & Cast Iron)	1.00 (OD) : 1.00 (SYS)	0°F
Baseboard (Finned copper tube & Cast Iron)	1.00 (OD) : 1.00 (SYS)	0°F
Radiant (High Mass/Concrete)	4.00 (OD) : 1.00 (SYS)	-10°F
Radiant (Low Mass/Joists)	2.00 (OD) : 1.00 (SYS)	-10°F
Fan Coils & Air Handlers	1.00 (OD) : 1.00 (SYS)	20°F

Mounting the Controller

- The SMV is designed to mount on a 1900 (4"x4") deep electrical box.
- If additional room is needed for wiring use the extension skirt provided in the box.
- Place the SMV in a convenient location near the unit to be controlled.
- Mount the SMV indoors and away from excessive heat or cold.
- Partially unscrew the Display Cover Mounting screws. This allows for its removal.
- Lifting the Display Section away from the base will unplug it from the Base section.
- Proceed with the power and output wiring instructions.
- Use the screws provided to mount the SMV to the 1900 box or the extension skirt.
- Mount Display Section back to the Base Section. Tighten the Display Cover Mounting Screws.



Wiring

Wiring Power Input

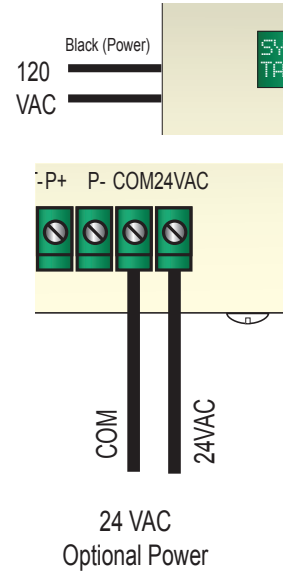
The SMV is designed to accept **ONLY A SINGLE POWER SOURCE**. It can be wired to either 120VAC using the two Black wires or 24VAC using the right most two terminals on the terminal block on bottom of the control. Triangle-Tube recommends the installation of a Surge Suppressor and a Power Switch before the Power Line connection for safety and ease of service.

120VAC

- Attach line voltage, 120VAC, to the two Black wires extending from the back of the SMV. Remember to use the power line from a different source than the equipment being controlled.

24VAC

- Use a dedicated transformer with at least a 5VA output.
- Bring 24VAC to the two right most terminals on the front of the SMV marked *24VAC* and *COM*.

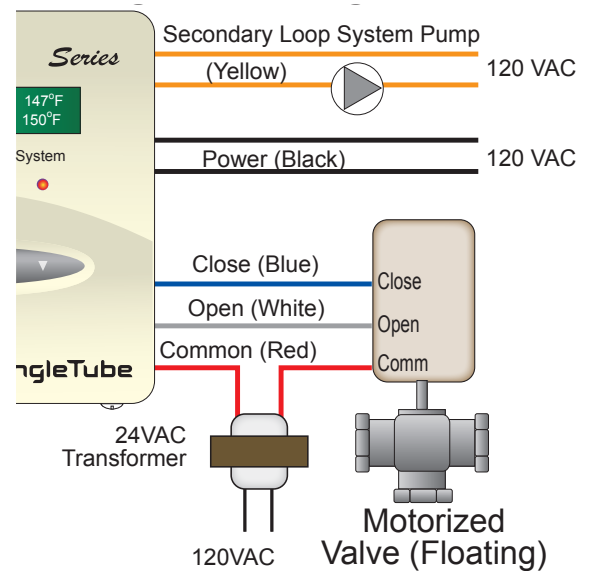


Wire Colors and Output Lights

- The SMV has three S.P.S.T. (Single-pole single-throw N.O.) output relays. Each output is rated at 1A (1/8 HP).
- The SMV has three lights that follow the output relays operation. When a relay energizes, its LED will turn on.
- The outputs are dry contacts only. They do not source any power.
- The Blue wire represents the Valve Close Output relay and the left LED.
- The White wire represents the Valve Open Output relay and the middle LED.
- The two Yellow wires represent System Output relay and the Right LED.
- The Red wire represents Valve Common.

Wiring the System Pump Output

- The System Pump is the one circulating water in the Secondary Loop.
- The SMV will control the System Pump (maximum 1 Amp or 1/8 HP).
- Connect the two Yellow wires to the System Pump circuit.
- The SMV does not source any output power to the pump. The relay makes when energized to switch the power to the pump.



Wiring Motorized Valve

- The output relays are dry-contacts only. They do not source any power.
- The Red wire is Common. It is necessary to wire in a power source for the valve. One side of the valve power source is connected to the valve Common, and the other side is connected to the SMV Red wire Common. Check wiring instructions for the specific valve before making any connections.
- The White wire connects to the valve Open terminal.
- The Blue wire connects to the valve Close terminal.

Wiring Input Terminals

System Sensor Installation (T1, COM)

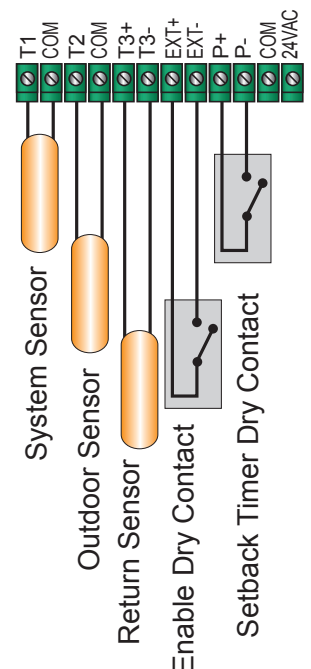
- Place the System Sensor in the Secondary Loop where it will register the output of the motorized valve before any takeoffs.
- Only use the Standard Brass Tube sensor provided.
- The sensor wires can be extended up to 500' using a shielded 2-conductor cable (Belden #8760 or equivalent (#18/2)). Do not connect the shield at the sensor but at the control using the *COM* terminal.
- Do not run sensor wires in conduit with line voltage wiring.

Immersion System Sensor Installation

- Install a 3/8"ID 1/2"NPT immersion well.
- Insert the supplied sensor probe into the well.

Strap-On System Sensor Installation

- Strap the sensor to the pipe using metal clamps. Do not over tighten the clamp.
- Strap pipe insulation around the sensor and the pipe.

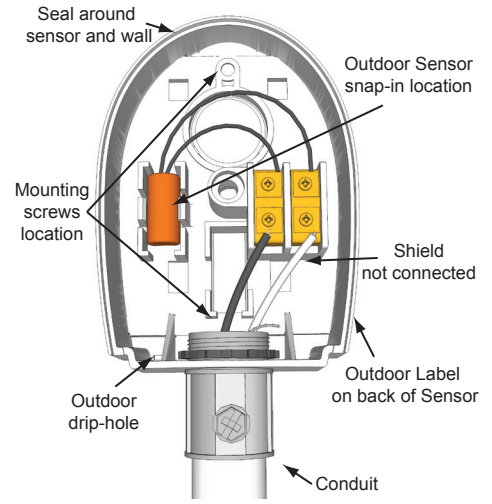


⚠️ ALERT

Determining the proper location for the Outdoor Sensor is very important. The SMV will base the heat on the outdoor temperature information it receives from this location. If the sensor is in the sun, or covered with ice, its reading will be different from the actual outdoor temperature.

Outdoor Sensor Installation (T2, COM)

- The Outdoor Sensor must be used when Outdoor Reset is selected from the Startup menu. However, in Set Point mode, the Outdoor Sensor is optional and can be used as an Outdoor Cutoff only.
- Only use the Triangle Tube Outdoor Sensor provided.
- Place the sensor in the shade on the north side of the building.
- Be sure the location is away from doors, windows, exhaust fans, vents, or other heat sources.
- The sensor should be mounted approximately 10' feet above ground level.
- Adhere the Outdoor Label provided to the back of the sensor base.
- The sensor wires can be extended up to 500' using shielded 2-conductor cable. Do not connect the shield at the sensor. Connect the Shield to the control *COM* terminal.
- Do not run sensor wires in conduit with line voltage wiring.

**Boiler Return Sensor Installation (T3+, T3-)**

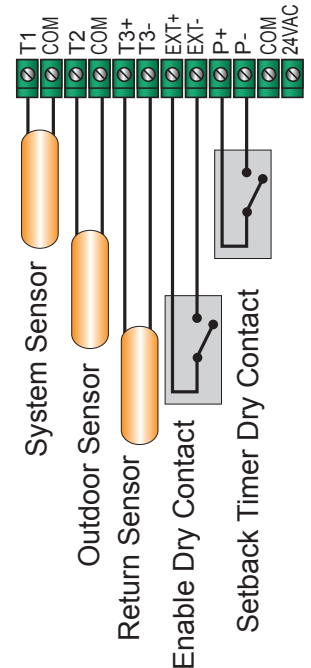
- The Boiler Return Sensor is optional. It is designed to be installed in a 3/8" ID well.
- If the sensor is installed as a Strap-On, good contact and insulation will ensure accurate reading.
- Place the sensor in the boiler return piping. The sensor should be located where it will register the correct return from all loops.
- The sensor wires can be extended up to 500' by splicing with 18 gauge shielded wire.
- Connect either sensor wire to the terminal marked *T3+*. Connect the other sensor wire and the shield to the terminal marked *T3-*.
- Do not run sensor wires in conduit with line voltage wiring.

Wiring the Enable/Disable (EXT+, EXT-)

- The *EXT±* terminals can be used to enable or disable the system by connecting it to a thermostat, external control, or a switch. It accepts dry contact input only.
- If no thermostat or control is connected to the *EXT±* terminals, leave the jumper supplied connected.
- The SMV will provide heat when the *EXT±* terminals are closed/shorted. It will close the valve when the terminals are opened.

Wiring the Setback/Boost (P+, P-)

- The Setback can be used to provide a lower temperature Set Point when less heat is required.
- A typical use for Setback is to provide less system temperature during the night or on the weekends, but heat is still required. See "Setback" on page 8.
- The Setback is activated by closing/shorting the *P±* terminals.
- When the *EXT±* terminals are opened, the control will start the Boost period. See "Boost" on page 8.

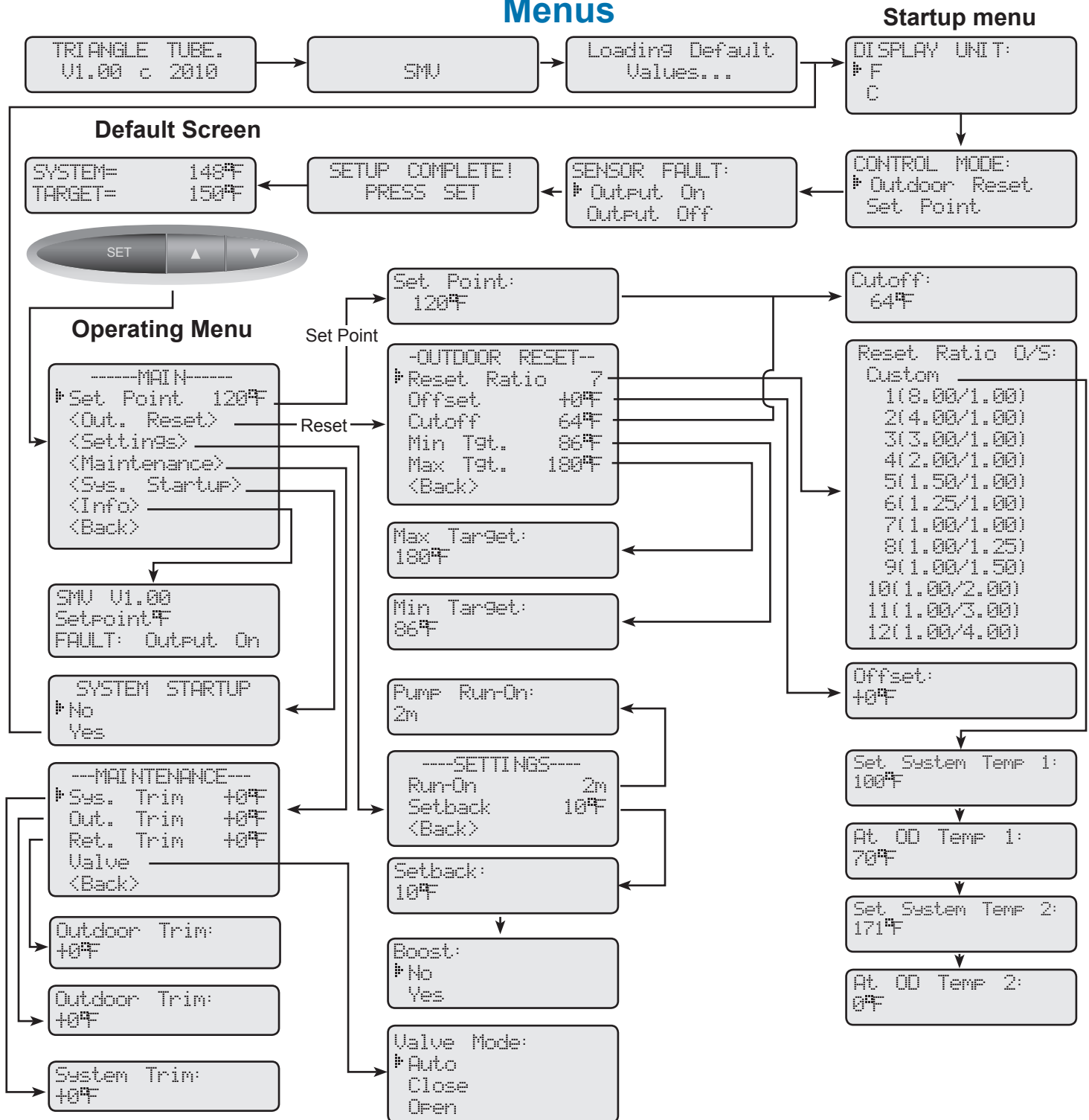
**Button and Navigating Menus**

The SMV has three buttons:

- The SET button function varies. When the Default Screen is displayed, pressing the SET button views the MENU. When in the menus and settings, the SET button accepts the selected entry or setting value.
- When in the menus, pressing the Up and Down buttons will scroll through the menu options. They can be used to change the setting of a specific function. I.e., change the Set Point, Differential, or System Trim. In addition, when in the Default Screen, the Up and Down buttons will display the outdoor temperature and Outdoor Cutoff when no return sensor is available, or the outdoor temperature and the return temperature when an active return sensor is connected.
- At the end of every Operation menu there is a <Back> option that allows the user to go back one menu level. If the SET button was held down for three seconds on the <Back> option, the display will go back to the Default Screen.



Menus



Startup Options

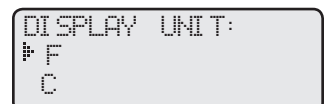
When the control is initiated for the first time or after a manual reset, it will start its operation with the Startup menu. Later, the Startup menu can be accessed as an option from the Operation menu. An option must be accepted in each screen in the Startup menu to go to the next menu level.

Display Unit

Options: °F, °C

/<System Startup>/Display Unit

Default: °F



- If °F is selected, all temperatures will display in Fahrenheit. If °C is selected, all temperatures will display in Celsius.

Control Mode

Options: Outdoor Reset, Set Point

Default: Outdoor Reset



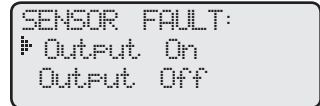
/<System Startup>/Display Unit/Control Mode

- The SMV has two heating logics. Outdoor Reset; varies the system set point/target based on outdoor temperature. This selection will add several menu options, Reset Ratio, Offset, Min Target, Max Target, and Outdoor Cutoff, to allow adjustment and fine tuning of the Reset Curve. In addition, a customized curve will be available for specialized applications.
- Set Point; Gives the installer the flexibility of selecting a fixed set point. The Outdoor Cutoff will be available if an Outdoor Sensor is installed.

Sensor Fault

Options: Output On, Output Off

Default: Output On



/<System Startup>/.../Sensor Fault

- The Sensor Fault will determine the operating status of the output relays when a sensor reads Short or Open. On sensor fault the display will show **FAULT TGT=ON** or **OFF** to indicate the condition of the output and the faulty sensor will read **OPEN** or **SHORT**.

Outdoor Reset Mode

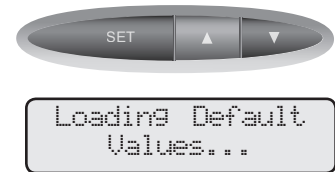
- When Output-On is selected, the SMV will energize the motorized valve open relay and system relay when system temperature reads **Short** or **Open** and the outdoor temperature is below the Outdoor Cutoff. However, if the Outdoor Sensor reads **Short** or **Open**, the SMV will change the Target Set Point to the Max Target temperature. See "Maximum Target" on page 8.
- When Output-Off is selected, the SMV will energize the motorized valve close relay when the System sensor reads **Short** or **Open**. However, when the Outdoor sensor fails, reads **Short** or **Open**, the SMV will change the Target Set Point to be the Min Target temperature. See "Minimum Target" on page 8.

Set Point Mode

- Output On, the SMV will energize the motorized valve open relay when the system sensor reads **Short** or **Open**.
- Output-Off, the SMV will energize the motorized valve close relay when the system sensor reads **Short** or **Open**.
- The Outdoor Sensor Short or Open status will not affect the control operation in Set Point mode.

Setting the Control to Factory Default

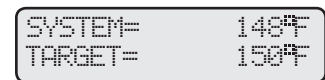
To Reset the SMV control to its original factory defaults, power down the control. Hold down the SET and DOWN buttons while powering the control back up until the Loading Default Values screen appears. The Display will direct you to the Startup menu after the defaults are loaded to program the control.



NOTE: When resetting the control to original factory defaults all control settings will be over written and will no longer exist.

Default Display

The default display will show the current System Temperature and the Target Temperature. In addition, by clicking the Up or Down button, the display will show the current Outdoor Temperature and the current Return Temperature, only if the return sensor is connected to terminals T3±. However, if no return sensor is connected, the control will display the current Outdoor Temperature and the Outdoor Cutoff.



Operating Menu Options

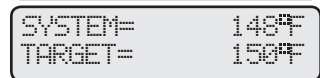
Set Point

(Available when Startup Control Mode = Set Point)

Default: 120°F/49°C

Options: From -10°F/-23°C to 230°F/110°C

/Set Point



- The Set Point option provides the user with an adjustable fixed Target Temperature to control the system. If an Outdoor Sensor was connected, the next menu option will display the Outdoor Cutoff option, otherwise there will be no Outdoor Cutoff option.

Outdoor Reset

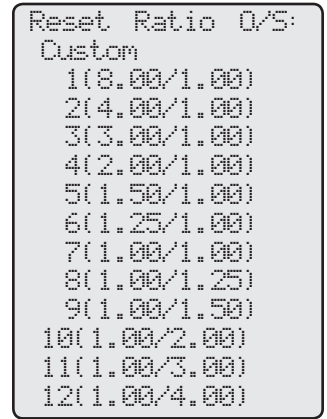
(Available when Startup Control Mode = Outdoor Reset)

Options: From 1(8.00° : 1.00°) to 12(1.00° : 4.00°), Custom

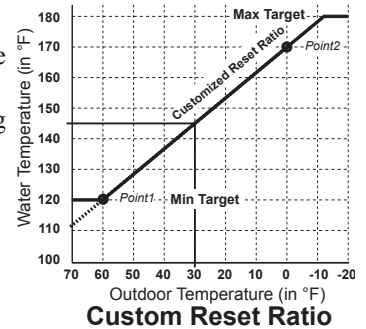
Default: 7(1.00° : 1.00°)

 /<Out. Reset>/Reset Ratio

- The Reset Ratio determines how the Secondary Loop system temperature will vary with outside temperature. With any of the ratios, the colder it becomes outside, the hotter the temperature of the system water. The Ratio is measured as; Outdoor : System Water temperature.
- With a 1.00 : 4.00 ratio, the System water temperature will increase rapidly as the outside temperature falls, hitting the Max Target of 180°F at 50°F outdoor temperature. With a 4.00 : 1.00 ratio, the System water temperature will increase slowly as the outside temperature falls.
- The Reset Ratio controls the amount of heat that enters the heating system based on the outdoor temperature. A higher numbered Reset Ratio will result in a higher Calculated water temperature. See "Type of Radiation in Building" on page 2.
- If required: **Adjust the RESET RATIO in cold weather.** If the ambient building temperatures are too cold in cold weather, move the ratio to a higher selection. That is, if 1.00 : 1.00 was initially selected, change the selection to 1.00 : 1.25. If the building temperatures are too warm in cold weather, move the ratio to a lower selection. That is, if 1.00 : 1.00 was initially selected, change the selection to 1.25 : 1.00.
- The Custom option gives the user the capability of creating a specialized Reset Ratio curve. Setting two points on the Reset Ratio chart generates the customized curve. Each point requires a System Water Temperature and an Outdoor Temperature. The line connecting the two points will be the customized reset ratio.
- Reset Ratios are adjustable based on the building and application. See "Type of Radiation in Building" on page 2.



Point1: System=120°F Outdoor=60°F Point2: System=170°F Outdoor=0°F



Custom Outdoor Reset Curve

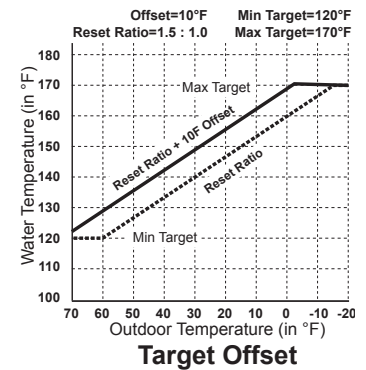
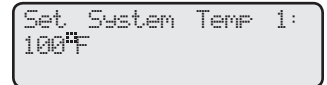
(Available when Startup Control Mode = Outdoor Reset)

Options: Sys Temp 1, 2 (-10°F/-23°C) to (210°F/99°C) Default: 1(100°F/38°C), 2(171°F/77°C)

Options: Outdoor Temp 1, 2 (-10°F/-23°C) to (100°F/38°C) Default: 1(70°F/21°C), 2(0°F/-18°C)

 /<Out. Reset>/Reset Ratio/Custom

- For situations where the provided reset ratios do not provide the perfect building heat-loss equilibrium, the customized option can be used.
- The Custom Reset Ratio is only available when Custom is selected from the Reset Ratio menu option. It provides the user with the capability of assigning two points on the reset ratio diagram and use the line that connects those two points as the customized reset ratio curve. Each of the two points will need a specific System and Outdoor Temperature to identify it on the diagram.
- To Set the first point, specify Sys Temp 1, and OD Temp 1. Then, specify Sys Temp 2, and OD Temp 2, to set the second point on the curve. The two points can be any where on the line, not necessarily at the ends.
- The chart shows an example of a customized curve 6 : 5 that do not exist in the standard curve options. If the outdoor temperature reaches 30°F, the system target will be 145°F.
- Remember that the Min Target and Max Target apply to all reset ratios including the customized reset ratio ones.



Offset

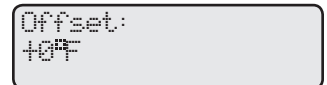
(Available when Startup Control Mode = Outdoor Reset)

Options: From -40°F/-22°C to +40°F/+22°C

Default: 0°F/0°C

 /<Out. Reset>/Offset

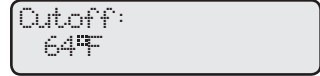
- The Offset setting lets you adjust the starting points of the Reset Ratio curves. This means that, regardless of the outdoor temperature or the Reset Ratio, when the Offset setting is changed, that change is directly added to or subtracted from the calculated target. For example, if the Set Point temperature was 130°F and the Offset was changed from 0° to +10°, then the Set Point would increase to 140°F
- If required: **Adjust the Offset in mild weather.** If the ambient building temperatures are too warm in the mild weather, decrease the Offset. If the ambient building temperatures are too cold in the mild weather, increase the Offset. The rule of thumb for baseboard radiation is to change the Offset 4°F for every 1°F you wish to change the building temperatures. In radiant heat applications, change the Offset 1°F or 2°F for every 1°F you wish to change the building temperature.



Outdoor Cutoff

Options: Off, 30°F/-1°C to 75°F/24°C, On

Default: 64°F/18°C
in Set Point
in Reset



/Set Point/Cutoff

/Set Point/<Out. Reset>/Cutoff

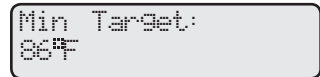
- In Set Point Mode, if the Outdoor Sensor is installed, the Outdoor Cutoff setting screen will automatically appear after the temperature Set Point has been selected and saved.
- The Outdoor and Cutoff temperatures can be viewed from the Default Screen by clicking the Up or Down buttons.
- When the outdoor temperature falls to the adjustable Outdoor Cutoff temperature, the SMV will control the System Pump and motorized valve relays to provide heat.
- When the outdoor temperature rises to the Outdoor Cutoff plus a 2°F differential, the SMV will energize the motorized valve close relay for 6 minutes to guarantee valve closure. The System relay will remain energized for the Run-On delay, then turn off.
- The Outdoor Cutoff can be set from 30°F to 75°F. In addition, the Setting can be set to ON or OFF. If ON is selected, the System relay will energize regardless of the outdoor temperature and the SMV will control the motorized valve to hold the Target Temperature. If OFF is selected, the System and open relays will always be off.

Minimum Target

(Available when Startup Control Mode = Outdoor Reset)

Options: From 70°F/21°C to 180°F/82°C

Default: 86°F/30°C



/Set Point/<Out. Reset>/Min. Tgt

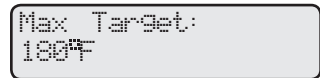
- The Minimum Target temperature must be set to the system design specification. The SMV will calculate the Target based on the outdoor temperature, the Reset Ratio, and the Offset value. The SMV will control the motorized valve to hold the higher of the calculated temperature and the Minimum Target temperature.
- The Minimum Target temperature must be at least 20°F lower than the Maximum Target temperature (See next setting).

Maximum Target

(Available when Startup Control Mode = Outdoor Reset)

Options: From 90°F/32°C to 240°F/116°C

Default: 180°F/82°C



/Set Point/<Out. Reset>/Max. Tgt

- This is the highest water temperature the SMV will circulate through the heating system.
- When using a radiation system, it should be set according to the tubing or floor manufacturer's specification.
- The Maximum Target temperature must be at least 20°F higher than the Minimum Target temperature (See Previous setting).

Run-On

Options: From 0 min to 60 min

Default: 2 min



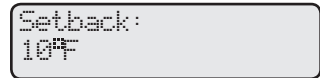
/Settings>/Run On

- The System relay will energize whenever the outdoor temperature is below the Outdoor Cutoff. When the outdoor temperature increases 2°F above the Outdoor Cutoff, the System relay will stay on for a period set by the System Run-On. This allows the Pump to dissipate the residual heat within the system back into the building.
- The System Run-On time should be set based on the size and type of the piping and pumps.

Setback

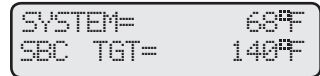
Options: From 0°F/0°C to 80°F/44°C

Default: 10°F/6°C



/Settings>/Setback.

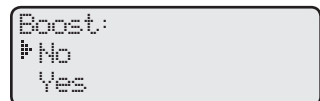
- The SMV offers the Setback feature to lower the Set Point when less heat is required.
- The lower Set Point will appear on the main display indicating SBC TGT=.
- For example; when the calculated temperature is 160°F and the Setback is set to 20°F, a setback call will change the Set Point to (160°F - 20°F) 140°F.
- A typical use for Setback is to provide less system temperature to a building during the night or on the weekends when the building is not occupied, but heat is still required.
- The Setback is activated by closing/shorting the P± terminals. See "Wiring the Setback/Boost (P+, P-)" on page 4.



Boost

Options: Yes, No

Default: No




/Settings>/Setback/Boost.

- The morning Boost is designed to return the building to comfortable ambient temperatures after the Setback period. The SMV will accomplish this by running elevated water temperatures (will add Setback setting to calculated water temperature) for 30 minutes after ending the setback call (terminals P±). That is, if the Target was 145°F and the Setback setting was 20°F, the boost will raise the system calculated temperature to 165°F for 30 minutes after the setback.

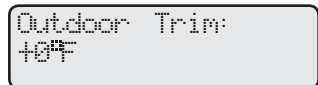
System, Outdoor, and Boiler Return Trim

Options: From -20F°/-11C° to +20F°/+11C°

Default: 0F°/0C°

 /<Maintenance>/Sys. Trm, Out. Trim, or Ret. Trim

- The Triangle Tube sensors are very accurate. However, sometime it might be beneficial to adjust the values to match and existing system. The System and Outdoor Trim values adjust the system sensor and Outdoor Sensor readings using positive or negative values.



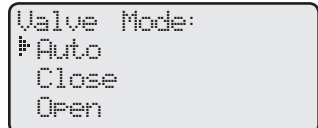
Valve Mode

Options: Auto, Close, Open

Default: Auto

 /<Maintenance>/Valve

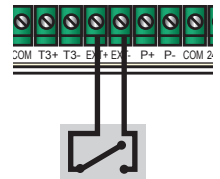
- The Auto option allows the SMV to modulate and pulse the valve open or close to achieve a specific Target Temperature.
- The Close option will energize the close relay constantly. This is useful when testing and repairing equipment.
- The Open option will energize the open relay constantly. This is useful when testing and repairing equipment.



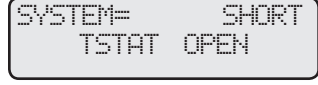
Enable/Disable Input

- The SMV will provide heat only if the EXT± terminals are shorted. If no external equipment or switch is connected to these terminals, leave the factory installed jumper.
- When the terminals are opened, the Target will display TSTAT OPEN.
- The EXT± terminals can be used as a Summer/Winter switch.

Enable/Disable Wiring



NOTE: On a sensor fault while the Enable /Disable EXT± terminals are opened, the control will follow the Enable /Disable state regardless of the sensor fault condition.



Troubleshooting

No Display or LED Lights

Check the power to the SMV. The SMV requires 120VAC power to the Black wires or 24VAC to the right most terminals. Turn the power off and back on to restore the display. If unsuccessful, make sure the control Display Cover is securely mounted to the Base.

System or Outdoor Reads OPEN or SHORT

If Open, short the sensor input terminals. The display should read **SHORT**. If it doesn't, the SMV may be damaged.

If Short, remove the wires from the input terminals. The display should read **OPEN**. If it doesn't, the SMV may be damaged.

System or Outdoor Reads an Incorrect Temperature

Remove the wires from the input terminals. The display should change to read **OPEN**. If it doesn't, the SMV may be damaged.

Take an ohm reading across the detached sensor wires. The ohm reading should correspond to the Temperature Sensor Chart. If the difference is within 5°F adjust the Trim for the sensor. Otherwise, the sensor may be damaged.

No Heat - All LEDs are OFF

Check the outdoor temperature and Outdoor Cutoff readings. If the outdoor temperature is above the Outdoor Cutoff, the SMV will not give heat. If the display shows **TSTAT OPEN** then, check the **EXT±** terminals. If the **EXT±** terminals are not jumped together, the SMV will not give heat. Finally, if the display shows **MANUAL CLOSE** then, the Valve Mode has been set to Close. Change Valve Mode to Auto.

No Heat - System Pump LED ON - Pump Not Running

Remove any connections to the Yellow wires for the System Pump. Test for continuity across the pair of Yellow wires. If the wires are continuous, the SMV is calling for the System Pump to run. The problem is not with the SMV. Check the power source and the pump.

No Heat - System Pump LED ON - Pump Running

Check that the boiler (or other hot water source) is providing hot water to the inlet of the motorized valve. If hot water is available, check that system temperature reading is lower than the Target. If it is, then, remove all wiring to the motorized valve and check for continuity across the SMV's Red and White wires when the Middle LED is ON. If continuity exists, the SMV is working properly, check the valve and motor.

Too Little Heat

First check if the Outdoor Sensor is reading **Short** or **Open**. If it does and Sensor Fault has been set to Output Off, the SMV will try to maintain the Minimum Target Temperature. Follow the System or Outdoor Reads Open or Short section. Repair or replace the faulty sensor. Otherwise, if all sensor readings are accurate, check if the Target Temperature is the same as the Maximum Target. If so, check the Maximum Target has not been set too low for the system (DO NOT increase the Maximum Target without consulting the installer or tubing/flooring manufacturer). Finally, adjust the Reset Ratio or Offset to increase the temperature of the circulating hot water. Note that, depending on the type of radiation, it may take several hours before the ambient temperature increases.

Too Much Heat

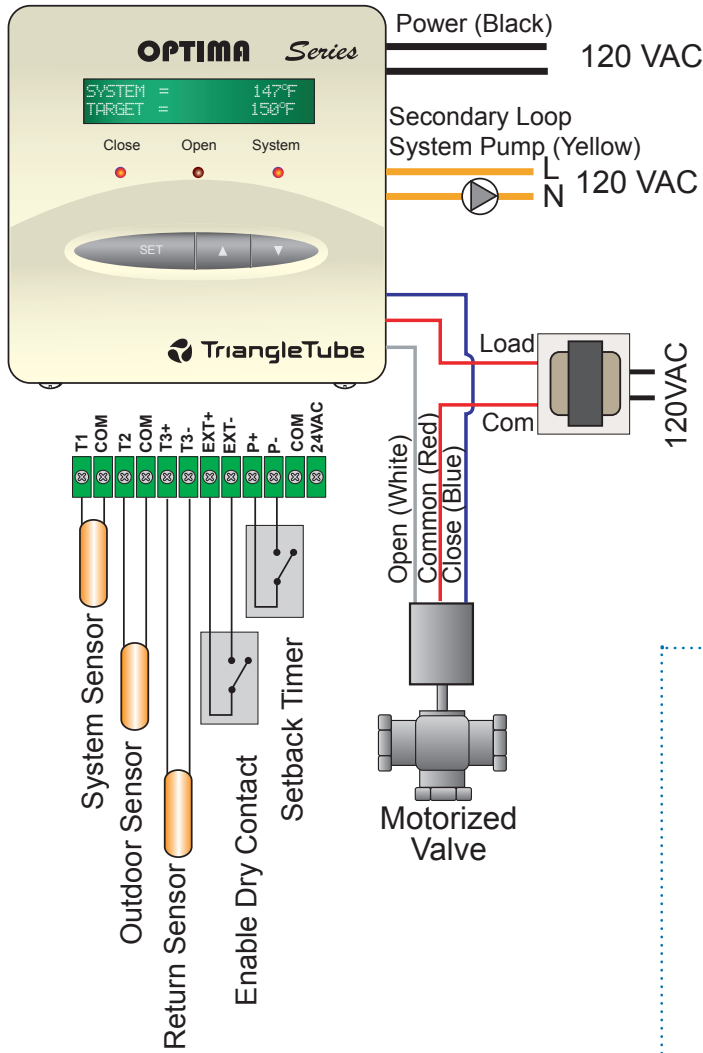
Check if the Outdoor or System sensor is not reading **SHORT** or **OPEN**. Follow the System or Outdoor Reads Open or Short section under this Troubleshooting. If Sensor Fault was set to **Output-ON**, the SMV will provide excess heat to the building. Repair or replace the faulty sensor. Otherwise, if all sensor readings are accurate, adjust the Reset Ratio or Offset to decrease the temperature of the circulating hot water.

250°F/120°C Temperature Sensor Chart

TEMPERATURE		Value (in Ohms)
°F	°C	
OPEN		150000
-30	-34	117720
-20	-29	82823
-10	-23	59076
0	-18	42683
10	-12	31215
20	-7	23089
25	-4	19939
30	-1	17264
35	2	14985
40	4	13040
45	7	11374
50	10	9944
55	13	8714
60	16	7653
70	21	5941
80	27	4649
90	32	3667

TEMPERATURE		Value (in Ohms)
°F	°C	
100	38	2914
110	43	2332
120	49	1879
130	54	1524
140	60	1243
150	66	1021
160	71	842
170	77	699
180	82	583
190	88	489
200	93	412
210	99	349
220	104	297
230	110	253
240	116	217
250	121	187
SHORT		100

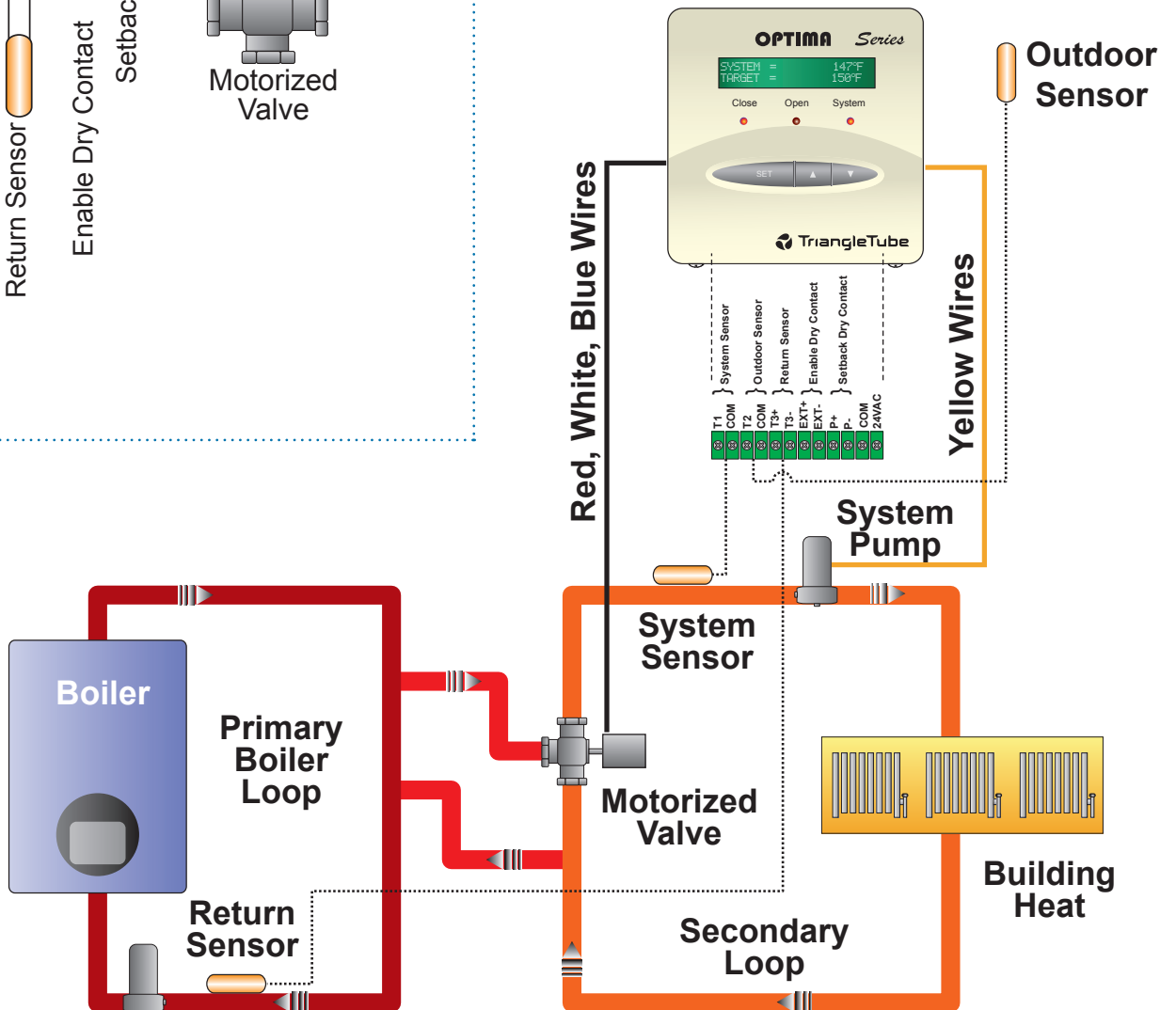
SMV Plumbing and Wiring Diagrams



Electrical

NOTE: These diagrams are conceptual only. Triangle Tube is aware that each installation is unique, however, the diagrams in this document are to represent control operation concept. It is the installer responsibility to comply with local codes and to install safety controls.

Mechanical



Specifications

Voltage Input:	120 VAC 60 Hz(2 Black wires) /24VAC 60 Hz (24VAC terminals) (Only One Power Source)
Power Consumption:	3 VA Max
Operating Temperature:	20°F/-7°C to 120°F/49°C
Operating Humidity:	20% to 80%
Dimensions:	4"W x 4"H x 2½"
Weight:	1 pound
Display:	Back Lite (2 rows x 16 char. each) Alphanumeric
Display Units:	Fahrenheit (°F) and Celsius (°C)
Outputs:	3 S.P.S.T (Yellow = System Pump.), (White = Open MOV.), (Blue = Close MOV), (Red = MOV Common)
Output Relay Ratings:	1 Amp inductive (Maximum of ⅛ HP), 6Amp resistive at 120 VAC 60 Hz
Control Modes:	Outdoor Reset, Set Point
Reset Ratios:	12 Standard ranging from 8:1 to 1:4 (Outdoor: System), and one Custom
Offset:	-40°F/-22°C to 40°F/+22°C
Minimum Target:	70°F/21°C to 180°F/82°C
Maximum Target:	90°F/32°C to 240°F/116°C
Set Point:	-10°F/-23°C to 230°F/110°C
Pump Run-On:	0 to 60 minutes
Minimum Boiler Return:	120°F (49°C) Requires a Return Sensor (Optional)
Valve Mode:	Auto, Close, Open
Setback:	0°F/0°C to 80°F/44°C
Boost:	Yes, No
Sensor Fault Operating Options:	Output On or Output Off
Sensor Operating Range:	-35°F/-37°C to 250°F/121°C
LED:	3 representing the Output Relays
Buttons:	3 (Set, Up, Down)
Enable/Disable:	Terminals EXT+, EXT-
Setback Input:	Terminals P+, P-