Installation and Operation Manual

Electronic Steam Valve Control
Modulates One or Two Actuators

ESV

⚠ 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.

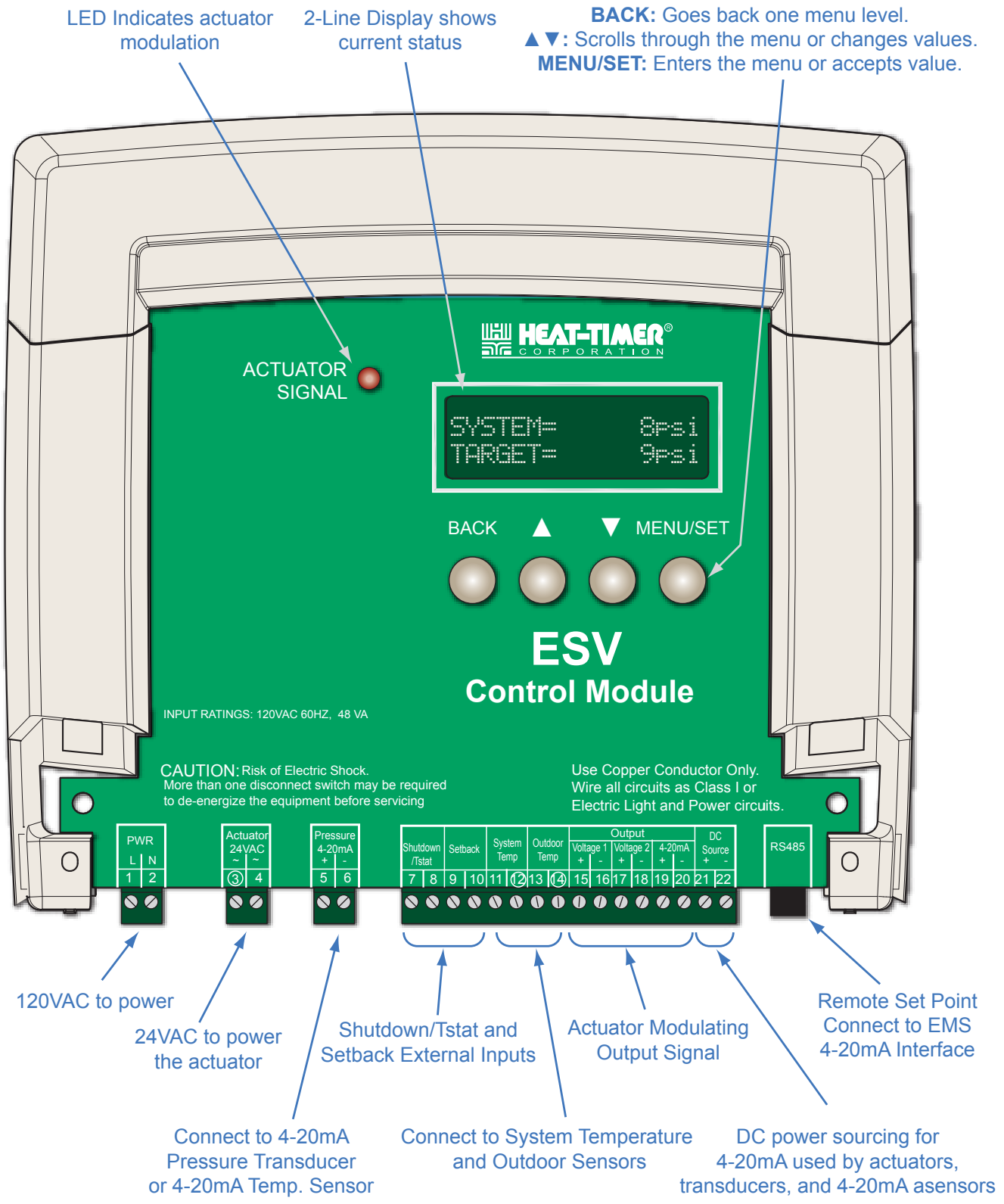
HEAT-TIMER® CORPORATION

HT# 059118-00 B

CONTENT

ESV Control Layout . . . 3
ESV Operating Concept . . . 4
2-Valve Sequencing Operation Concept . . . 4
ESV Control Installation . . . 4
Mounting the Enclosure . . . 5
Wiring the ESV Power . . . 5
Wiring the Actuators . . . 5
Single Actuator Voltage Wiring . . . 5
Two Actuator Voltage Wiring . . . 6
Single Actuator Current (4-20mA) Wiring . . . 6
Two Actuator Wiring (Voltage 1, Current 2) . . . 6
Wiring Input Terminals . . . 6
System Sensor . . . 6
System Temperature Sensor . . . 7
System 4-20mA Temperature Sensor . . . 7
System Pressure/Vacuum Sensor . . . 7
Outdoor Sensor . . . 8
Sensor Table . . . 8
Shutdown or Tstat . . . 8
Setback . . . 9
Wiring 4-20mA Remote Set Point . . . 9
Buttons and Navigation Menus . . . 9
LED . . . 9
Startup Menu . . . 10
Sensor Type . . . 10
Measuring Unit . . . 10
4mA and 20mA Temp Range . . . 10
Control Mode . . . 10
4mA and 20mA Set Point . . . 11
External Input . . . 11
Valve Operation . . . 11
Valve Signal . . . 11
Setting the ESV to Factory Default . . . 12
Default Display . . . 12
Operating Menu . . . 13
Set Point . . . 13
Outdoor Reset . . . 13
Custom Outdoor Reset Curve . . . 14
Offset . . . 14
Outdoor Cutoff . . . 14
Minimum Target . . . 15
Maximum Target . . . 15
Setback . . . 15
Boost . . . 15
Valve Modulation Settings . . . 16
Gain . . . 16
Valve Start Position . . . 16
Valve Start delay . . . 16
Valve Close Position . . . 16
Maintenance . . . 17
System and Outdoor Trim . . . 17
Valve Mode . . . 17
Sensor Fail Position . . . 17
Troubleshooting . . . 18
Wiring Diagrams . . . 20
Single Actuator (Volt) - Temp. Standard . . . 20
Single Actuator (Current)- Temp. Standard . . . 21
Two Actuators (Volt) - Temp. Standard . . . 22
Two Actuators (Volt and Current) - Temp. Standard 23
Single Actuator (Volt) - Temp. 4-20mA . . . 24
Single Actuator (Current) - Temp. 4-20mA . . . 25
Single Actuator (Volt) - Pressure . . . 26
Single Actuator (Current) - Pressure . . . 27
Two Actuators (Volt) - Pressure . . . 28
Two Actuators (Volt and Current) - Pressure . . . 29
Warranty . . . 30
Specifications . . . 31

ESV CONTROL LAYOUT



HT# 059118-00 B

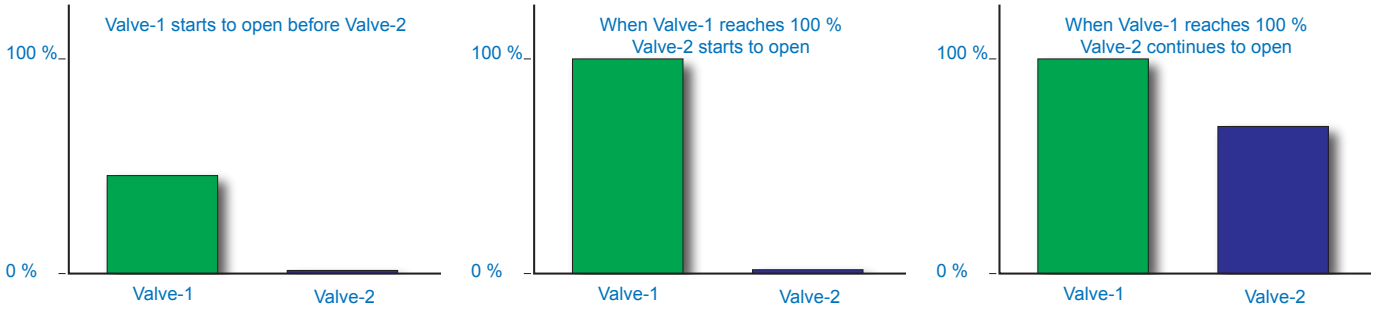
ESV OPERATING CONCEPT

The ESV control modulates one or two motorized valves to accurately maintain a set point; temperature, pressure, or vacuum. Well suited for steam heating and process applications, the ESV uses PID logic to vary the valve modulation in response to changes in the system sensor readings. It offers a current (4-20mA) or voltage (0-10V, 2-10V, 0-5V, or 1-5V) modulating signal to the actuators. When the Valve Operation is set to 2-Valves, the ESV can modulate the valves in parallel or using First-Open-First-Close logic. See “Valve Operation” on page 11. The ESV can connect to a temperature sensor, a 4-20mA temperature sensor, a pressure transducer, or a vacuum transducer. It constantly displays the system sensor and the target set point values. Additional control parameters can also be displayed with the simple press of a button. The LED light indicates a change in the output modulation. On a sensor fault (Short or Open), the ESV can be programmed to open each of the valves to different percent.

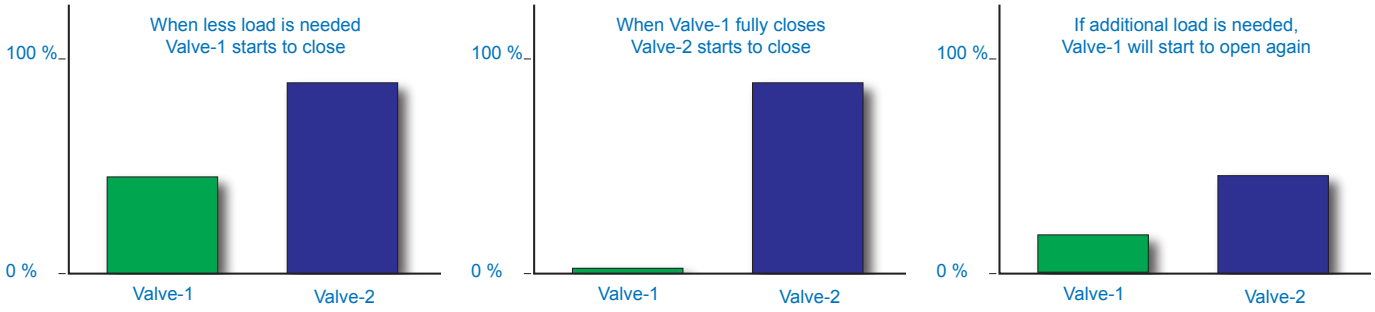
2-VALVE SEQUENCING OPERATION CONCEPT

This mode is also called First-Open-First-Close. This mode provides greater control over the output when the two valves are of different sizes. Finer control of the set point is achieved when Valve-1 output is wired to the smaller valve.

On a heat demand, the ESV will start to modulate Valve-1. When Valve-1 reaches its full 100% opening, the ESV will start to modulate Valve-2.



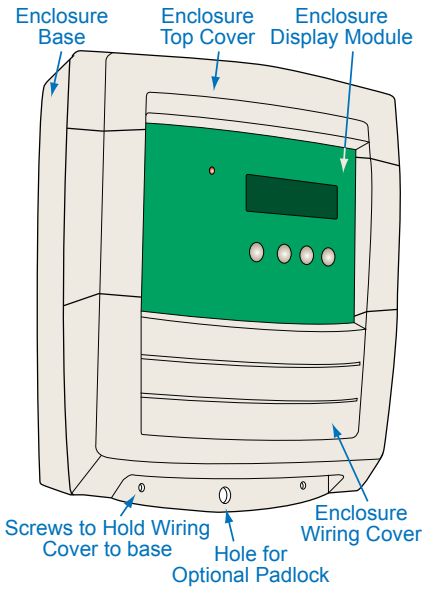
When less load is needed, the ESV will start to close Valve-1 first. Valve-2 will modulate close after Valve-1 fully closes.



ESV CONTROL INSTALLATION

Each ESV control consists of four primary enclosure components.

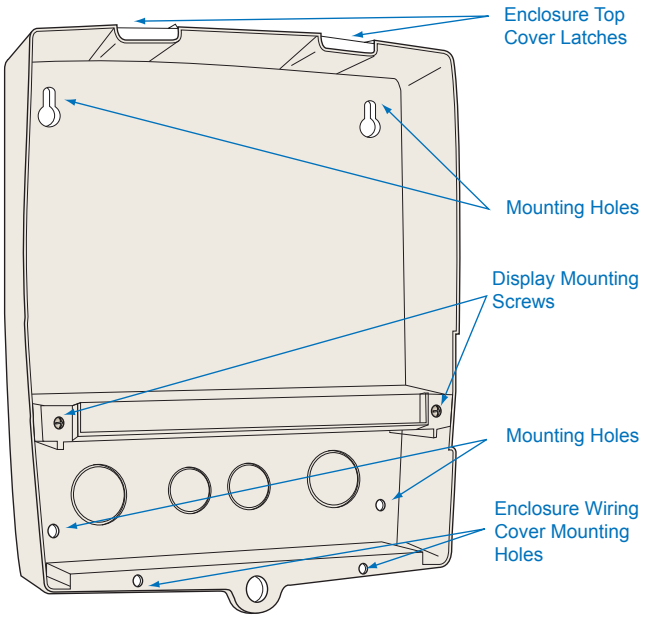
- The Enclosure Display Module: contains the display, buttons, LEDs, and electric wiring terminals. It has two screws to hold it to the base. The wiring terminals are of the plug-in type to ease installation and removal.
- The Enclosure Base: contains the holes to mount and hold the control against the wall or any flat surface. All other enclosure components mount onto the base. The Enclosure Base bottom section contains the wiring chamber with bottom knockouts for all input and output wiring connections.
- The Enclosure Wiring Cover: seals the wires from the external environment. It has two screws to hold it to the base. In addition, it has a hole that can be used with a padlock to secure the enclosure.
- The Enclosure Top Cover: seals the top of the Display Module. It is screwed to the Display Module from the inside.



HT# 059118-00 B

MOUNTING THE ENCLOSURE

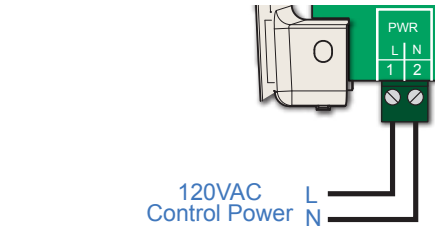
- Select a location near the equipment to be controlled.
- The surface should be flat, wide, and strong to support the ESV Control.
- Keep the control away from extreme heat, cold, or humidity.
- Remove the Enclosure Wiring Cover by removing the two screws holding it to the base.
- Remove the Enclosure Display Module with the Enclosure Top Cover by removing the 2 middle screws.
- It is easier to remove necessary knockouts before mounting the Enclosure Base.
- Screw the Enclosure Base to the surface using the upper and lower mounting holes on the back of the enclosure.
- Replace the Enclosure Display Module and the middle mounting screws.
- Do not replace the enclosure wiring covers until all wiring is done.
- When purchasing a padlock for the Bottom Enclosure Wiring Cover, the maximum shank diameter should not exceed ¼".



WIRING THE ESV POWER

(Terminals 1, 2)

- Bring the 120 VAC 60 Hz power wires through the enclosure left bottom knockout.
- Connect the hot line to terminal 1 marked L.
- Connect the neutral line to terminal 2 marked N.
- The installation of the provided metal Grounding Plate is needed when using conduit.
- Heat-Timer recommends the installation of a power switch and a surge-suppressor before the power line connection for safety and ease of service.



⚠ WARNING

Class 1 voltage wiring (low voltage) must use a different knockout and conduit from any Class 2 voltage wiring (high voltage).

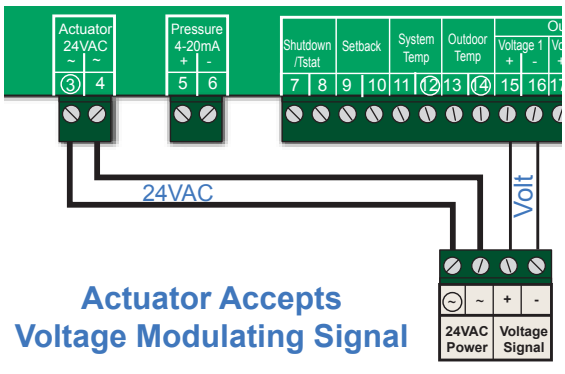
WIRING THE ACTUATORS

Single Actuator Voltage Wiring

(24VAC Power Terminals 3, 4)

(Actuator Voltage Signal Terminals 15, 16)

- The ESV control is designed to operate one or two actuators.
- Terminal ③ and 4 on the ESV power the actuators using 24VAC (maximum output 48 VA).
- If additional power is required, an external transformer can be used to power the actuator and the ESV can provide the modulating signal.
- Terminal 15 on the ESV control (Volt 1 +) connects to the 1st actuator voltage signal input.
- Terminal 16 on the ESV control (Volt 1 -) connects to the 1st actuator signal common input.



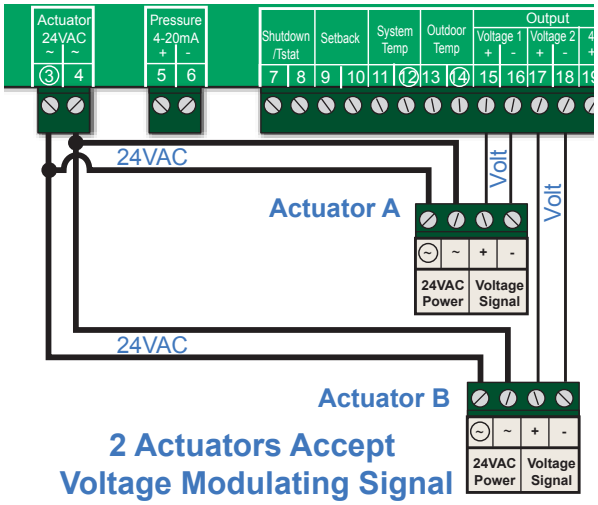
Actuator Accepts Voltage Modulating Signal

HT# 059118-00 B

Two Actuator Voltage Wiring

(24VAC Power Terminals 3, 4)
(1st Actuator Voltage Signal Terminals 15, 16)
(2nd Actuator Voltage Signal Terminals 17, 18)

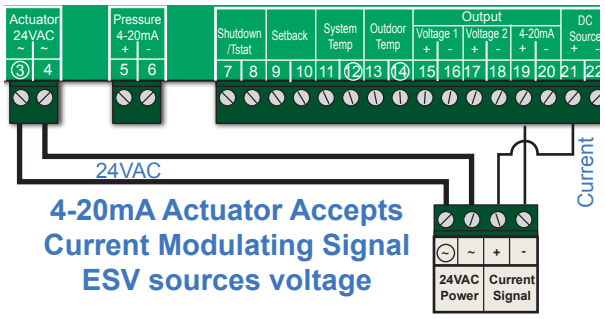
- Terminal ③ and 4 on the ESV power the actuators using 24VAC(maximum output 48 VA).
- If additional power is required, an external transformer can be used to power the actuators.
- To wire the first voltage actuator, follow “Single Actuator Voltage Wiring” on page 5.
- Connect terminals 17(+) and 18(-) to the second actuator voltage signal terminals as per the wiring diagram.



Single Actuator Current (4-20mA) Wiring

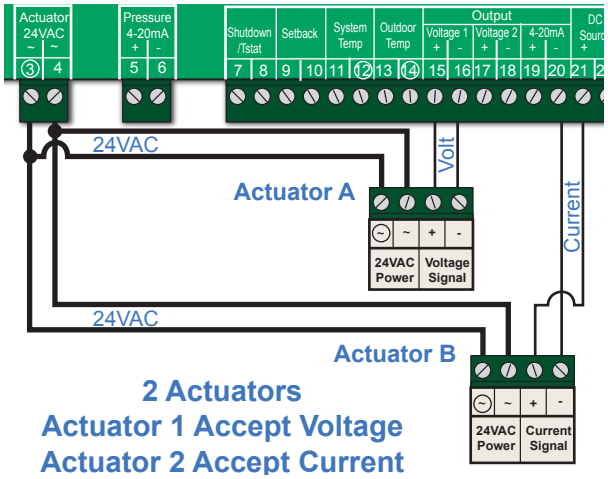
(ESV Provides sourcing voltage)
(24VAC Power Terminals 3, 4)
(ESV sourcing voltage for Current Signal Terminals 19, 21)

- The ESV control is designed to operate a single current actuator. Make sure that the actuator does not exceed the ESV’s maximum output rating of 48 VA.
- Terminal ③ and 4 on the ESV power the actuators using 24VAC.
- Terminal 19 on the ESV control (4-20mA +) connects to the actuator current signal input (Signal).
- Terminal 20 on the ESV control (4-20mA -) connects to the actuator current signal input (-).



Two Actuator (Voltage 1, Current 2) Wiring

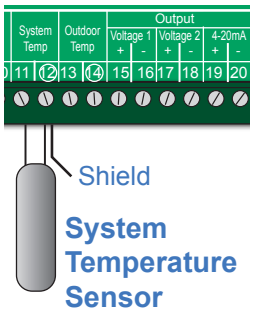
- Terminal ③ and 4 on the ESV power the actuators using 24VAC. Do not exceed the 48 VA capability of the ESV.
- If additional power is required, an external transformer can be used to power the actuators.
- In situation where one actuator uses current modulation while the other uses voltage modulation, the second actuator MUST use the current signal.
- To wire the first voltage actuator, follow “Single Actuator Voltage Wiring” on page 5.
- To wire the second current actuator, follow “Single Actuator Current (4-20mA) Wiring”.



WIRING INPUT TERMINALS

System Sensor

- The ESV is capable of accepting a pressure or vacuum transducer, a thermistor type temperature sensor, or a 4-20mA temperature sensor as the system input.
- Select the proper Sensor Type from the Startup menu
- The control will only measure the input terminals designated by the Sensor Type. See “Sensor Table” on page 8.

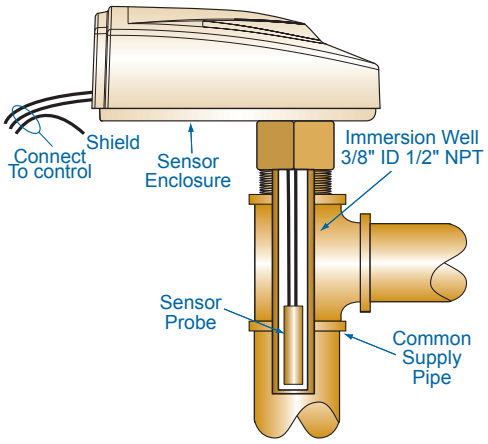


System Temperature Sensor Wiring

(Terminals 11, 12)

Sensor must be ordered separately.

- The ESV can accept a thermistor type system temperature sensor to modulate a 2-way steam valve feeding a steam to hot water heat exchanger.
- Set the Startup menu Sensor Type to Temp. Standard.
- The sensor must be inserted into a 3/8”ID 1/2”NPT immersion well (HT #904011-00). Install the system sensor well approximately 3’ to 5’ past the hot water output of heat exchanger but before any takeoffs.
- Only use the Heat-Timer sensors (HT# 904220-00 or 904250-00).
- Thermistor type temperature sensors are not polarity sensitive. Connect the sensor wires to terminals 11 and 12.
- The sensor wires can be extended up to 500’ using a shielded 2-conductor 18 AWG cable (Belden #8760 or equivalent).
- Connect the shield to terminal ⑫ . Do not connect the shield at the sensor end.



⚠ WARNING

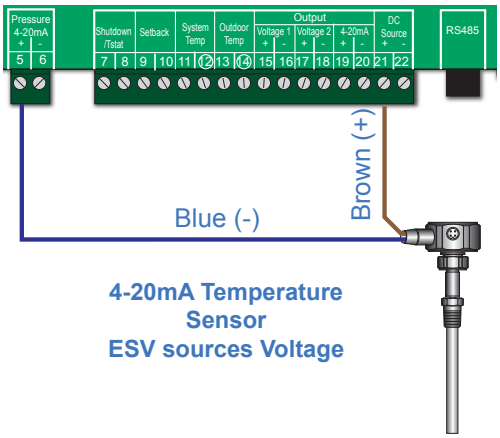
Class 1 voltage wiring (low voltage) must use a different knockout and conduit from any Class 2 voltage wiring (high voltage).

System 4-20mA Temperature Sensor Wiring

(Terminals 5, 21) ESV provides sourcing voltage to the Sensor

Sensor must be ordered separately.

- The ESV can accept a 4-20mA temperature sensor input to modulate a 2-way steam valve feeding a steam to hot water heat exchanger.
- The 4-20mA Temperature Sensor (HT# 904160-00) must be ordered separately. When ordering this sensor, contact Heat-Timer to specify the temperature range needed. Heat-Timer will configure the sensor to the required range. See sensor documentation for further specification and installation details.
- Set the Startup menu Sensor Type to Temp 4-20mA.
- The sensor wires can be extended up to 500’ by splicing with 18 gauge twisted pair wire.
- The sensor’s BLUE (-) wire should be connected to the ESV terminal (Pressure 5 +).
- The sensor’s BROWN (+) wire should be connected to the ESV terminal (DC Source 21 +).

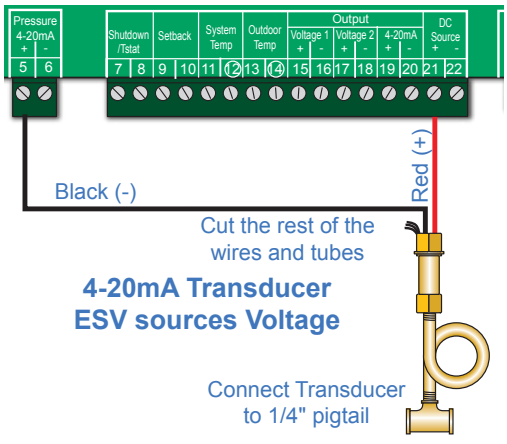


System Pressure/Vacuum Sensor Wiring

(Terminals 5, 21) ESV provides sourcing voltage to the Sensor

Sensor must be ordered separately.

- One of the ESV’s operating modes is designed to operate a 2-way modulating steam valve based on the system pressure/vacuum sensor reading. Therefore, select a sensor location that is representative of the entire system.
- Attach a 1/4” brass isolation tube (pigtail) to the steam/vacuum header (Straight HT# 135020-00 or Angle HT #135021-00).
- Fasten the transducer to the pigtail. See “Sensor Table” on page 8.
- The sensor wires can be extended up to 500’ by splicing with 18 AWG twisted pair wire.
- The sensor’s BLACK wire should be connected to the ESV terminal (Pressure 5 +).
- The sensor’s RED wire should be connected to the ESV terminal (DC Source 21 +).



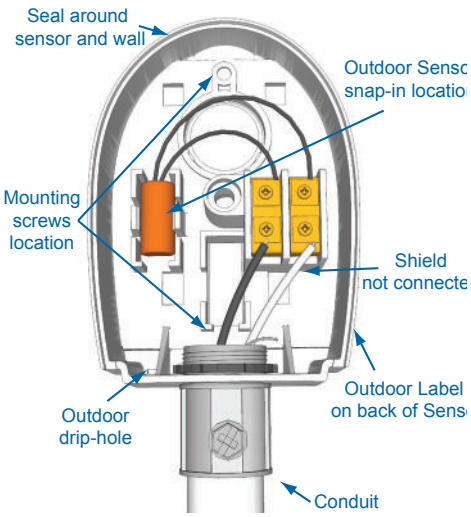
HT# 059118-00 B

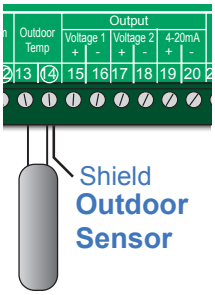
Outdoor Sensor Wiring

(Terminals 13, 14)

Sensor must be ordered separately.

- In Outdoor Reset Control Mode, an outdoor sensor must be used (HT# 904220-00). In other modes, connecting an outdoor sensor will only activate the Outdoor Cutoff feature. See “Control Mode” on page 10. Also, see “Outdoor Cutoff” on page 14.
- Locate the sensor in the shade on the building’s north side. The sensor should never be in direct sunlight. Be sure the location is away from doors, windows, exhaust fans, vents, and other possible 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.
- Use the Sensor Enclosure Base bottom knockout for the conduit. Use the locknut to hold the conduit and enclosure base together. Fasten the cover to the base.
- If screws are used to affix the enclosure to the wall, make sure to seal around the sensor and wall except from the bottom.
- The sensor wires can be extended up to 500’ using a shielded 2-conductor 18 AWG cable (Belden #8760 or equivalent).
- Connect the shield to terminal ⑭ . Do not connect the shield at the sensor end.





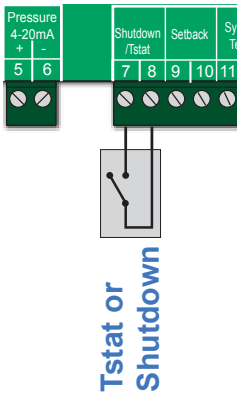
Sensor Table

SENSOR TYPE	SENSOR Part #	MEASURE UNIT	CONTROL MODE	SYSTEM SET POINT		SETBACK		TRIM	SENSOR TERMINALS
				Range	Default	Range	Default		
Temp. Standard (SYS)	904220-00 904250-00	English	• Outdoor Reset • Set Point • EMS 4-20mA	-10°F to 230°F	70°F	0°F to 80°F	10°F	±20F°	11, ⑫
		Metric		-23°C to 110°C	21°C	0°C to 44°C	6°C	±11C°	
Temp.4-20mA (SYS)	904160-00	English		-49°F to 932°F	500°F	50% of total	N/A	±10% of Sensor Range	5, 21
		Metric		-45°C to 500°C	260°C	50% of total	N/A		
Temp. Outdoor	904220-00	English		Read Only				±20F°	13, ⑭
		Metric						±11C°	
Pressure 30 PSI (SYS)	904310-00	English	• Set Point • EMS 4-20mA	0.0 to 30.0 PSI	10.0 PSI	0.0 to 10.0 PSI	3.0 PSI	±10% of Sensor Range	5, 21
		Metric		0 to 207 KPa	69 KPa	0 to 69 KPa	21 KPa		
Pressure 100 PSI (SYS)	904312-00	English		0 to 100 PSI	30 PSI	0 to 30 PSI	10 PSI		
		Metric		0 to 690 KPa	207 KPa	0 to 207 KPa	69 KPa		
Pressure 200 PSI (SYS)	904311-00	English		0 to 200 PSI	60 PSI	0 to 60 PSI	20 PSI		
		Metric		0 to 1379 KPa	414 KPa	0 to 414 KPa	138 KPa		
Pressure 300 PSI (SYS)	904313-00	English		0 to 300 PSI	80 PSI	0 to 90 PSI	30 PSI		
		Metric		0 to 2068 KPa	552 KPa	0 to 552 KPa	207 KPa		
Vacuum 30 Hg (SYS)	904317-00	English		0.0 to 30.0 Hg	10.0 Hg	0.0 to 10.0 Hg	3.0 Hg		
		Metric		0 to 762 mm	254 mm	0 to 254 mm	77 mm		

Shutdown or Tstat Wiring

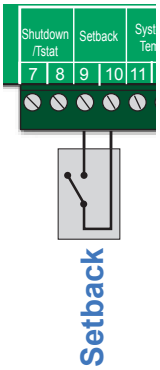
(Terminals 7, 8)

- These terminals functionality varies based on the Startup External Input setting. See “External Input” on page 11
- The Shutdown/Tstat terminals can be used to enable or disable the system by connecting it to a dry-contact switch. This feature can be used whenever it is desirable to turn on or off the ESV from a remote location or another controller. No voltage can be placed across the Shutdown/ Tstat terminals.
- If the Tstat was selected from the Startup menu, opening the terminals will close the valves and will not operate the outputs.
- If the Shutdown was selected from the Startup menu, shorting the terminals will close the valves and will not operate the outputs.



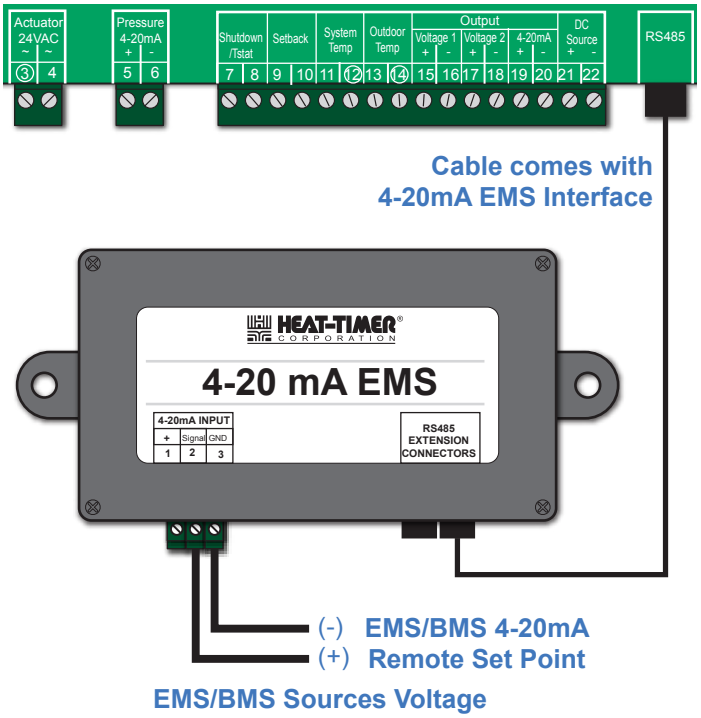
Setback Wiring
(Terminals 9, 10)

- This feature can be used whenever it is desirable to switch the ESV to lower the set point from a remote location during the night (i.e. EMS input or external time clock).
- When the Setback is enabled by closing a dry contact, the Target will be reduced by the Setback value. The display will indicate SBC TGT= 100F.
- The Setback signal must be a dry contact only. No voltage can be placed across the Setback terminals.



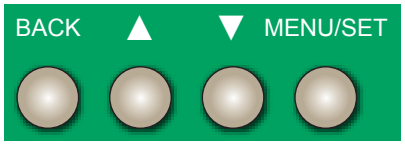
4-20mA Remote Set Point Wiring
(RS-485)

- This feature can be used whenever it is desirable to set the ESV set point from a remote location. The ESV must be connected to the 4-20mA EMS Interface (HT# 926741-00) using the cable provided with the interface. The interface must be ordered separately.
- The Control Mode must be set to `EMS 4-20mA` to `utilize` this capability. See "Control Mode" on page 10.



BUTTONS AND NAVIGATION MENUS

The ESV has four buttons.



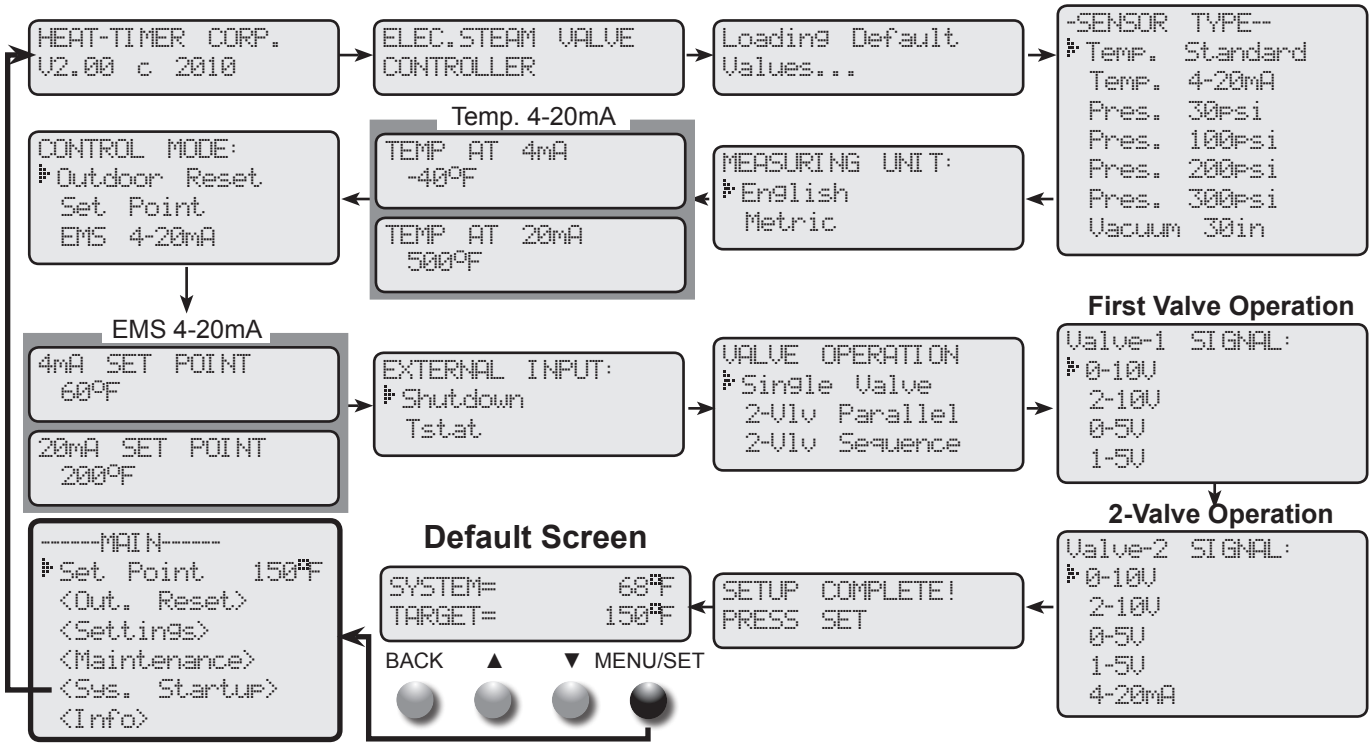
- MENU/SET: The MENU/SET button function varies. When in the Default Screen, pressing the MENU/SET Button views the MENU. When in the menus and settings, this button accepts the selected entry or setting value.
- ▲ ▼: When in the menus, pressing the Up and Down buttons will scroll through the menu options. They can be used to change the setting of a specific function. I.e., change the Set Point or System Trim.
- BACK: When in the Default Screen, this button will display the Outdoor Temperature and the Outdoor Cutoff (Only if the Outdoor Sensor was connected). When in the menus, this button will bring the user back one-menu level.

LED

The ESV has a single LED light that indicates a change in the valve-opening %. Hence, whenever the ESV changes the valve opening, the LED will turn on for a second. A steady lit LED means the ESV is sending the actuator a fully open signal.

HT# 059118-00 B

STARTUP MENU

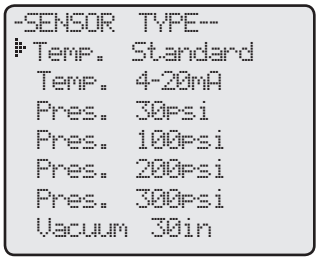


Sensor Type

Options: **Temp.Std, Temp.4-20mA, PSI (30, 100, 200, 300), Vac** **Default: Temp.Std**

Menu Button:*/<System Startup>/Sensor Type*

- Select the sensor type based on the sensor used. The ESV will measure only the sensor input terminals associated with the Sensor Type. See "Sensor Table" on page 8.
- The Temp. 4-20mA option offers an adjustable temperature range. Contact Heat-Timer for available 4-20mA temperature sensors.

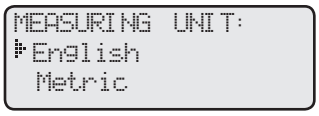


Measuring Unit

Options: **English or Metric** **Default: English**

Menu Button:*/<System Startup>/Sensor Type/Measuring Unit*

- This option changes the standard measurement system used by the control.



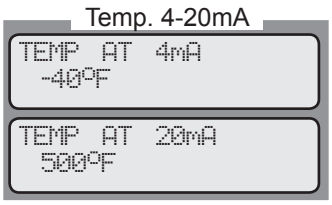
4mA and 20mA Temp Range

(Available only when Sensor Type = Temp. 4-20mA)

Each of the 4mA and 20mA is Adjustable from -49ºF/-45ºC to 932ºF/500ºC

Menu Button:*/<System Startup>/Sensor Type/Measuring Unit/Temp at 4mA/Temp at 20mA*

- The 4mA and 20mA settings adjust the control's temperature range to the sensor's mA temperature range.



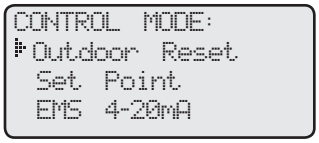
Control Mode

(Available only when Sensor Type = Temp. Standard)

Options: **Outdoor Reset, Set Point *, EMS 4-20mA*** **Default: Outdoor Reset**

Menu Button:*/<System Startup>/Sensor Type/Measuring Unit /Control Mode*

- The new ESV has two temperature heating logics. Outdoor Reset; varies the system temperature set point based on outdoor temperature. This selection adds several menu options to adjust and fine-tune the reset ratio curves: Reset Ratio, Offset, Min Water temp, Max Water temp, and Outdoor Cutoff. In addition, a customized reset ratio curve will be available for specialized applications.
- Set Point: gives the installer the flexibility of selecting a fixed set point. In this case, the Outdoor Cutoff option will be available only if an outdoor sensor was installed.



4mA and 20mA Set Point

(Available only when Control Mode = EMS 4-20mA)

4mA Set Point Adjustable from 60ºF/16ºC to 160ºF/12ºF, 0 PSI Default: 60ºF/16ºC

20mA Set Point Adjustable from 80ºF/27ºC to 200ºF/93ºF, Max PSIDefault: 200ºF /93ºC

Menu Button:*/<System Startup>/Sensor Type/Measuring../4mA Set Point /20mA Set Point/*

- This is used to match the signal scale (supplied by EMS).
- The EMS 4-20mA Interface (HT# 926741-00) must be connected to the ESV's RS-485 ports. The EMS 4-20mA Interface must be ordered separately. See "Wiring 4-20mA Remote Set Point" on page 9
- To shutdown the control using the EMS signal, send a signal that is above 22mA or below the 2mA. The display will show the message "Shutdown by EMS".
- The Pressure, Vacuum, and Temperature 4-20mA Sensor Types will use the maximum and minimum transducer/sensor values as the 4mA and 20mA set points.

EMS 4-20mA

```
4mA SET POINT
 60ºF
```

```
20mA SET POINT
 200ºF
```

External Input

Options: **Shutdown, Tstat** **Default: Shutdown**

Menu Button:*/<System Startup>/Sensor Type/Measuring .../ External Input*

- This selection dictates the function of terminals (Shutdown/Tstat 7 and 8). See "Shutdown or Tstat Wiring" on page 8.
- If Shutdown was selected, the control will close the valves when the terminals are shorted. The control will start to modulate the valves if the terminals were opened.
- If Tstat was selected, the control will close the valves when the terminals are opened. The control will start to modulate the valves if the terminals were shorted.

```
EXTERNAL INPUT:
▸Shutdown
 Tstat
```

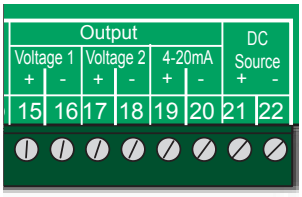
Valve Operation

Options: **Single Valve, 2-Valve Parallel, 2-Valve Sequence** **Default: Single Valve**

Menu Button:*/<System Startup>/Sensor .../ External Input/Valve Operation*

- The ESV can operate in a single or dual valve applications. See "Wiring the Actuators" on page 5.
- In the 2-Valve Parallel option, the ESV modulates both actuators at the same time and at the same rate as a single much larger valve.
- In the 2-Valve Sequence option, the ESV modulates the first valve open to satisfy the load. If the first valve opened 100% and still did not fully satisfy the load, the control will start to modulate the second valve open.
- When closing the valves, the control will modulate the first valve closed before modulating the second valve closed. See "2-Valve Sequencing Operation Concept" on page 4.
- When 2-Valve Sequence option is selected, the control will offer different valve settings for each individual actuator. This option will only start to open the second valve after the first has reached its maximum opening percent. When closing the valves, it will start to close the second valve after the first valve is fully closed. See "2-Valve Sequencing Operation Concept" on page 4.

```
VALVE OPERATION
▸Single Valve
 2-Vlv Parallel
 2-Vlv Sequence
```



Valve Signal

Options: **0-10V, 2-10V, 0-5V, 1-5V, and 4-20mA** **Default: 0-10V**

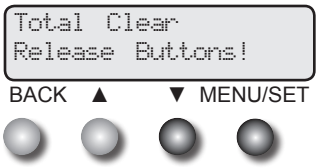
Menu Button:*/<System Startup>/Sensor ..../Valve Operation/Modulation Signal*

- The ESV can provide a variety of modulating output signals that range from voltage to current.
- When a Single Valve is selected, all voltage and current signal options will be available.
- When any of the 2-Valve options is selected from the Valve Operation menu, two menus will be available to select the modulation signal for each of the valves. In these cases, the ESV can modulate two voltage actuators or one voltage and one current actuators. The current actuator must be the second actuator. See "Wiring the Actuators" on page 5.

```
Valve-2 SIGNAL:
▸0-10V
 2-10V
 0-5V
 1-5V
 4-20mA
```

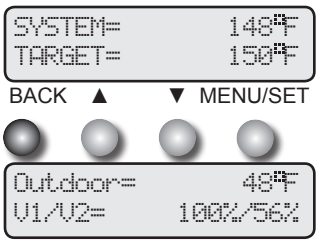
SETTING THE ESV TO FACTORY DEFAULT

To Reset the ESV control to its original factory defaults, power down the control. Hold down the **MENU/SET** and ▼ buttons while powering the control back up until the "Total Clear Release Buttons" message appears. The Display will direct you to the Startup menu after the defaults are loaded to program the control.

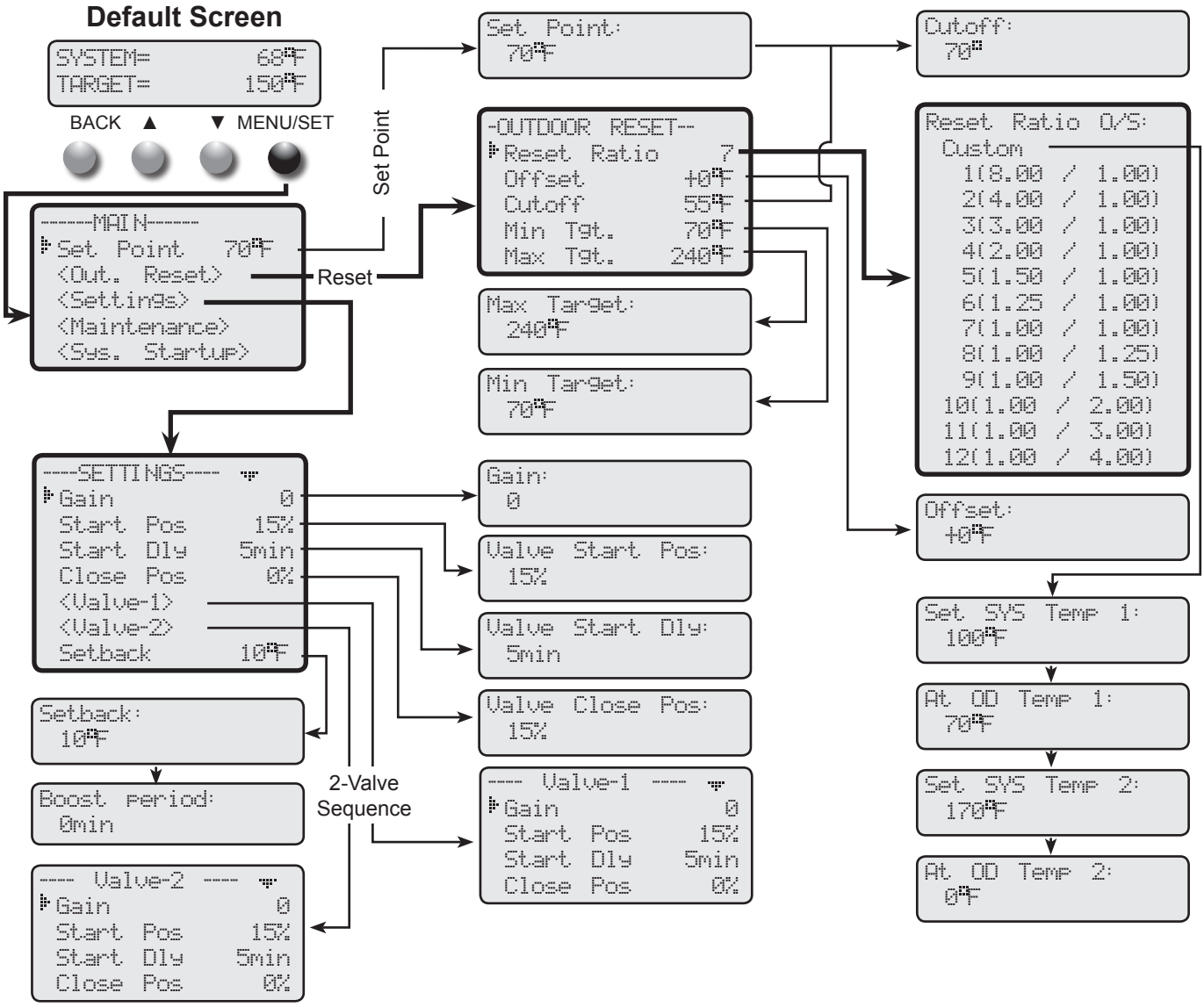


DEFAULT DISPLAY

The default display will show the current System temperature/pressure and the Target temperature/pressure. By clicking the **BACK** button, the display will show the current outdoor temperature and valve outputs.



OPERATING MENU

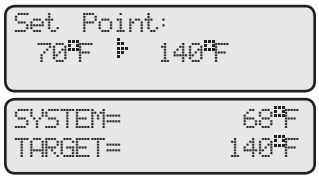


Set Point

(Available when Control Mode = Set Point)

Options: Varies. See "Sensor Table" on page 8.

Menu Button:*/Set Point*



- The Set Point option provides the user with an adjustable fixed Set Point to control the system.
- If the outdoor sensor was connected, the next menu option will show Outdoor Cutoff. Otherwise, there will be no Outdoor Cutoff option.

Outdoor Reset

(Available when Control Mode = Outdoor Reset)

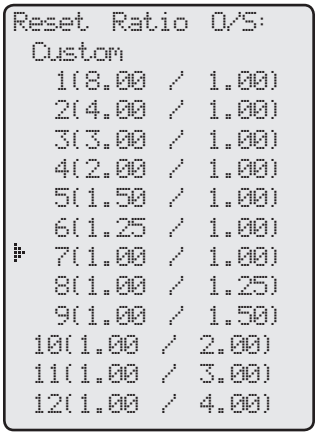
Options: **From 1(8.00º/1.00º) to 12(1.00º/4.00º), and Custom** **Default: 7(1.00º/1.00º)**

Menu Button:*/<Out. Reset>/Reset Ratio*

- The Reset Ratio determines how the System Target temperature will vary with outdoor temperature changes. The colder it gets outdoors, the hotter the Target will be. The Ratio is measured as; Outdoor(O) to System Water (S).
- With a 1.00 :4.00 ratio, the System water temperature will increase rapidly as the outdoor temperature falls hitting the maximum default water temperature of 240°F at 35°F outdoor temperature. With a 4.00 :1.00 ratio, the System water temperature will increase slowly as the outdoor temperature falls.

HT# 059118-00 B

- The Reset Ratio controls the amount of heat entering the heating system based on the outdoor temperature. A higher numbered Reset Ratio will result in a higher calculated water temperature. If the application has radiant heat, a lower numbered Reset Ratio curve should be selected.
- 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 reset ratio. The Offset, Minimum Target, and Maximum Target settings still apply to the customized curve.



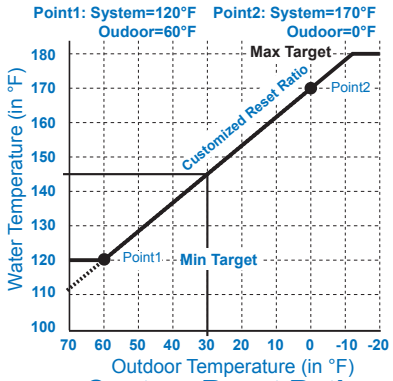
Custom Outdoor Reset Curve

Options: **SysTemp1,2 (70ºF/21ºC) to (210ºF/99ºC)Default: 1(100ºF/38ºC), 2(170ºF/77ºC)**

Options: **ODTemp1,2 (-10ºF/-23ºC) to (100ºF/38ºC) Default: 1(70ºF/21ºC), 2(0ºF/-18ºC)**

Menu Button:*/<Out. Reset>/Reset Ratio/Custom*

- For situations where the standard 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. 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. Each of the two points will need a specific System and Outdoor Temperatures to identify it on the diagram.
- To Specify the first point, set Sys Temp1 and OD Temp1. Then, set the second point (Sys Temp2 and OD Temp2). The two points can be any where on the line, not necessarily at the line ends.
- The chart shows an example of a customized curve 6:5. If the outdoor temperature reaches 30ºF, the system target will be 145ºF.
- Remember that the Minimum Target and Maximum Target apply to all reset ratios including customized reset ratios.



Custom Reset Ratio

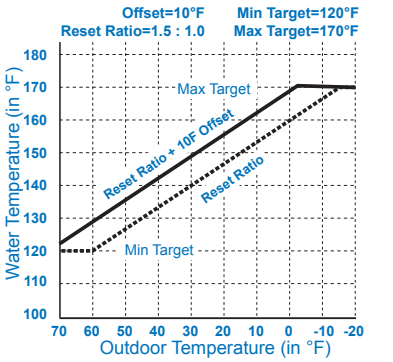
Offset

(Available when Control Mode = Outdoor Reset)

Options: **From -40ºF/-22ºC to +40ºF/+22ºC** **Default: 0ºF/0ºC**

Menu Button:*/<Out. Reset>/Offset*

- The Offset adjusts the Reset Ratio curves starting points. 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 temperature would increase to 140°F
- If required: Adjust the Offset in mild weather. If the ambient building temperature is too warm in the mild weather, decrease the Offset. If the ambient building temperature is 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 temperature. In radiant heat applications, change the Offset 1°F or 2°F for every 1°F you wish to change the building temperature.



Target Offset

Outdoor Cutoff

Options: **Off, 30ºF/0ºC to 75ºF/25ºC, On** **Default: 70ºF/21ºC**

Menu Button:*/Set Point/Cutoff* **in Set Point**

Menu Button:*/<Out. Reset>/Cutoff* **in Reset**

- The Outdoor and Cutoff temperatures can be viewed from the default screen by clicking the BACK button.

- When the outdoor temperature falls to the adjustable Outdoor Cutoff temperature, the ESV will control the valve actuator to provide heat.
- The Outdoor Cutoff setting has a built-in 2F° that is added to the Outdoor cutoff. Thus, when the outdoor temperature rises to the Outdoor Cutoff plus a 2°F differential, the ESV will modulate the output to 0%.
- In addition to the temperature range setting for the Outdoor Cutoff, it can be set to ON or OFF. If ON is selected, the control will modulate the output to hold the calculated target set point. If OFF is selected, the output will be modulated to 0%.

Minimum Target

(Available when Control Mode = Outdoor Reset)

Options: From 70ºF/21ºC to 170ºF/77ºC ***Default: 80ºF/27ºC***

Menu Button:*/<Out. Reset>/Min. Tgt*

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

Maximum Target

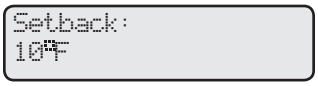
(Available when Control Mode = Outdoor Reset)

Options: From 90ºF/32ºC to 240ºF/116ºC ***Default: 240ºF/116ºC***

Menu Button:*/<Out. Reset>/Max. Tgt*

- This value is the highest Target temperature the ESV will circulate through the system.
- In radiant systems, this value should be set according to the tubing or floor manufacturer's specification.
- The Maximum Temperature must be at least 20°F higher than the Minimum Temperature.

Setback

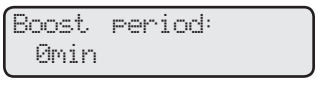


Options: **Varies. See "Sensor Table" on page 8.**

Menu Button:*/Settings>/Setback.*

- The Setback provides a lower set point when less output is required.
- The Setback Set Point will appear on the main display indicating SBC TGT=140°F.
- 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.
- For example; in a pressure application with a set point of 5 PSI and the Setback is set to 3 PSI, a setback will change the Set Point 2 PSI. The display will read SBC TGT=2 PSI.
- A typical use for the Setback is to provide a reduced system temperature or pressure 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 Setback terminals using an external timer, control, switch, or EMS Input Closure. See "Setback Wiring" on page 9.

Boost



Options: **From 0 minutes to 120 minutes** **Default: 0 minutes**

Menu Button:*/Settings>/Setback/Boost.*

- The morning Boost is designed to return the building to comfortable ambient temperatures after the night Setback period. The ESV will accomplish this by running an elevated set point (will add Setback setting to the calculated Target) for the Boost period after opening of the Setback terminals. That is, if the normal set point was 145°F and the Setback setting was 20°F, the boost will raise the system calculated temperature to 165°F for the Boost period after the Setback ends. See "Setback Wiring" on page 9.
- The Boost Set Point will appear on the main display indicating BST TGT=165°F.

VALVE MODULATION SETTINGS

Gain

Options: From -10 to +10 ***Default: 0***

Menu Button:*/<Settings>/Gain* **Single Valve or 2-Valve Parallel**

Menu Button:*/<Settings>/<Valve-1>or <Valve-2>/Gain* **2-Valve Sequence**

- The Gain adjusts the ESV PID logic's aggressiveness. The aggressiveness controls the amount of modulation change needed when the system sensor deviates from the Target.
- A Gain of 0 is a good starting point for all systems.
- If during normal load conditions, the system value tends to oscillate, decrease the Gain by two numbers (for example, from 0 to -2). Wait for at least 15 minutes before evaluating the change's effect on the system.
- If, during normal load conditions the system value tends to remain consistently below the Target, increase the Gain by two numbers (for example, from 0 to 2). Wait for at least 15 minutes before evaluating the change's effect on the system.
- In 2-Valve Sequence mode, each valve will have its own Gain setting.

Valve Start Position

Options: From 0% to 100% ***Default: 15%***

Menu Button:*/<Settings>/Start Pos* **Single Valve or 2-Valve Parallel**

Menu Button:*/<Settings>/<Valve-1>or <Valve-2>/Start Pos* **2-Valve Sequence**

- This setting in conjunction with the Valve Start Delay allows that valve to partially open and remain opened for the delay period every time the ESV starts heating.
- This is useful in applications where minimal flow is needed to reduce thermal shock or banging when the valve is to open from a fully closed position.
- In 2-Valve Sequence mode, each valve will have its own Valve Start Position adjustment.

Valve Start delay

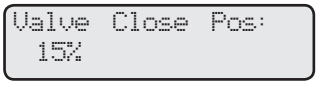
Options: **From 0 to 60 minute** **Default: 5 minute**

Menu Button:*/<Settings>/Start Dly* **Single Valve or 2-Valve Parallel**

Menu Button:*/<Settings>/<Valve-1>or <Valve-2>/Start Dly* **2-Valve Sequence**

- This setting in conjunction with the Valve Start Position allows that valve to partially open and remain opened for the delay period every time the ESV starts heating.
- This is useful in applications where minimal flow is needed to reduce thermal shock or banging when the valve is to open from a fully closed position.
- In 2-Valve Sequence mode, each valve will have its own Valve Start Delay adjustment.

Valve Close Position



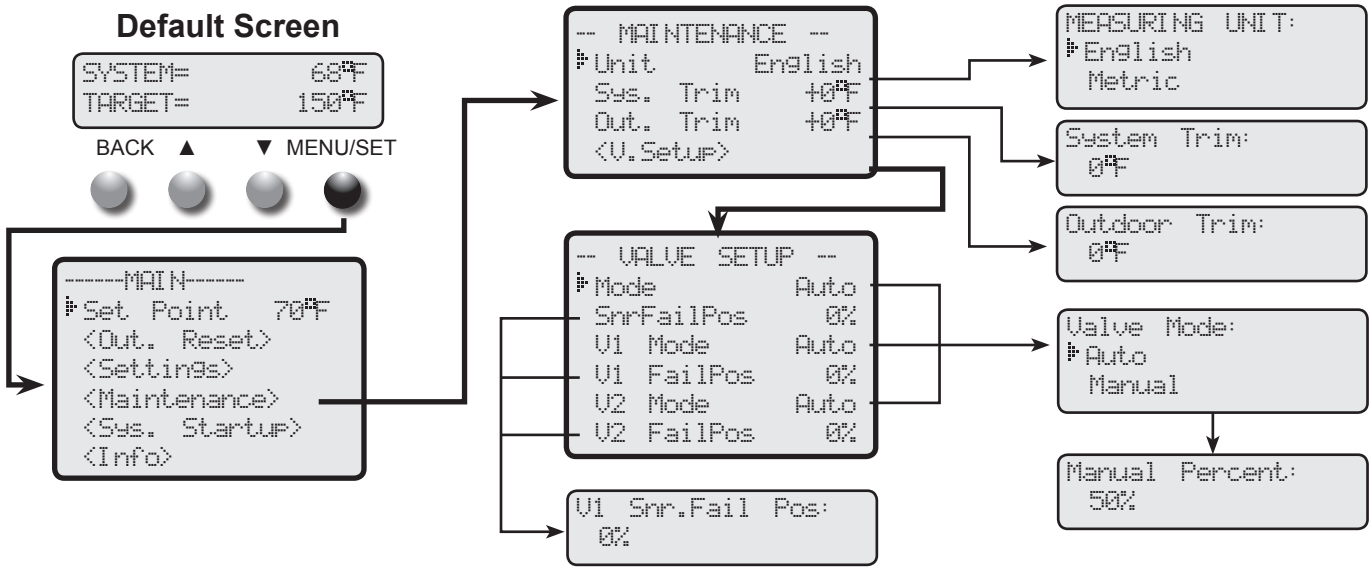
Options: **From 0% to 100%** **Default: 15%**

Menu Button:*/<Settings>/Close Pos* **Single Valve or 2-Valve Parallel**

Menu Button:*/<Settings>/<Valve-1>or <Valve-2>/Close Pos* **2-Valve Sequence**

- The Valve Close Position feature prohibits the valve from fully closing. Thus, reducing the banging when reopening the valve in retrofit applications. This feature will be activated after the valve opens to provide heat.
- In 2-Valve Sequence mode, each of the valves will have its own Valve Close Position adjustment.
- The valve will fully close if the Shutdown was shorted, the TStat was opened, or the EMS Shutdown signal was activated. See "Shutdown or Tstat Wiring" on page 8. Also, see "4-20mA Remote Set Point Wiring" on page 9.

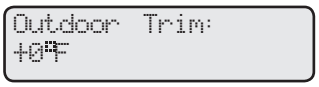
MAINTENANCE



System and Outdoor Trim

Options: Varies based on Sensor Type

Menu Button:*/<Maintenance>/Sys. Trim or Out. Trim*

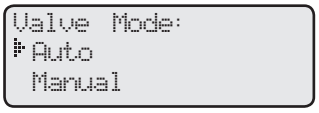


- The Heat-Timer pressure and temperature type sensors are very accurate, and normally require no calibration. However, sometimes it may be desirable to make small adjustments.
- Do not use the Trim setting to make the Outdoor sensor match the one reported on the radio or TV. The outdoor temperature can vary widely over a broadcast range.
- The Outdoor Trim will be available when Outdoor Reset was the Control Mode or when an outdoor sensor is used in Set Point.

Valve Mode

Options: Auto, Manual (0% to 100% default: 50%) ***Default: Auto***

Menu Button:*/<Maintenance>/<V.Setup>/Mode or V Mode*



When Manual is Selected

- The Valve Mode provides a way to bypass the control PID logic and adjust the modulating output manually to an adjustable percent of the full range.
- The Valve Mode is primarily used for equipment testing and troubleshooting.
- When set to Manual, the Manual Percent is adjusted as a percent of the full range.
- When in Manual mode the output will modulate to the set percent regardless of the Shutdown or Tstat status.
- To revert to control PID operation, the Valve Mode must be set to Auto.
- In any of the 2-Valve modes, each of the valves will have its own Valve Mode adjustment.

Sensor Fail Position

Options: **From 0 to 100%** **Default: 50%**

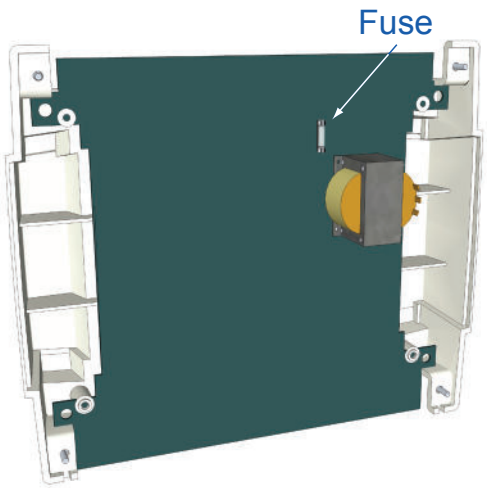
Menu Button:*/<Maintenance>/<V.Setup>/SnrFailPos or V FailPos*

- This setting determines the valve position when the system sensor reads Short or Open.
- When the outdoor sensor fails, the valve will maintain its last opening position until the outdoor sensor fault has been corrected.
- In any of the 2-Valve modes, each of the valves will have its own Sensor Fail Position adjustment.
- If the system sensor fails, the control display will display “FailPo: 0% 0%”, where each percent represents the respective valve‘s fail position.

TROUBLESHOOTING

No Display

- Check the power to the ESV. It requires 120 VAC power to terminals 1 and 2. Turn the power off and back on.
- If unsuccessful, make sure Fuse is working by checking it with a continuity meter. The fuse can be found on the back of the Enclosure Display Module. If no continuity, replace with 20 mm 2.5 amp fuse



Temperature Sensor Reads OPEN or SHORT

- If the sensor reads Open, short the sensor input terminals. The display should read Short. If it doesn't, the ESV may be damaged. If it does, either the sensor is damaged or its wiring is not continuous.
- If the sensor reads Short, remove the wires from the input terminals. The display should read Open. If it doesn't, the ESV may be damaged. If the display reads Open, the sensor is damaged and needs to be replaced.

Incorrect Temperature Sensor Reading

- Remove the sensor wires from the input terminals. The display should change to read Open. If it doesn't, the ESV 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 sensor Trim. Otherwise, replace the sensor.

Incorrect Pressure Sensor Reading

- First, make sure that the pressure transducer installed matches the Sensor Type selected from the Startup Menu. See "Sensor Type" on page 10. Then, check if the reading is within the Trim range, adjust it using the System Trim.
- Check the transducer wiring. An voltage source must be used, either through the ESV or using an external source to power the signal. See "System Pressure/Vacuum Sensor Wiring" on page 7.
- If the reading is Short, remove the wires from the sensor terminals. The display should change to read Open. If it does not, the ESV may be damaged. Otherwise, if it does, then the pressure transducer is damaged and needs to be replaced.

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

TEMPERATURE		Value (in Ohms)
°F	°C	
90	32	3667
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

Pressure Sensor Chart

INPUT (in mA)	0-30 Range (in PSI)	0-100 Range (in PSI)	0-200 Range (in PSI)	0-300 Range (in PSI)
2	Open			
4	0	0	0	0
4.08			1	
4.16		1	2	
4.53	1			10
5.07	2			20
5.6	3	10	20	30
7.2	6	20	40	60
8.8	9	30	60	90

INPUT (in mA)	0-30 Range (in PSI)	0-100 Range (in PSI)	0-200 Range (in PSI)	0-300 Range (in PSI)
10.4	12	40	80	120
12	15	50	100	150
13.6	18	60	120	180
15.2	21	70	140	210
16.8	24	80	160	240
18.4	27	90	180	270
20	30	100	100	300
22	Short			

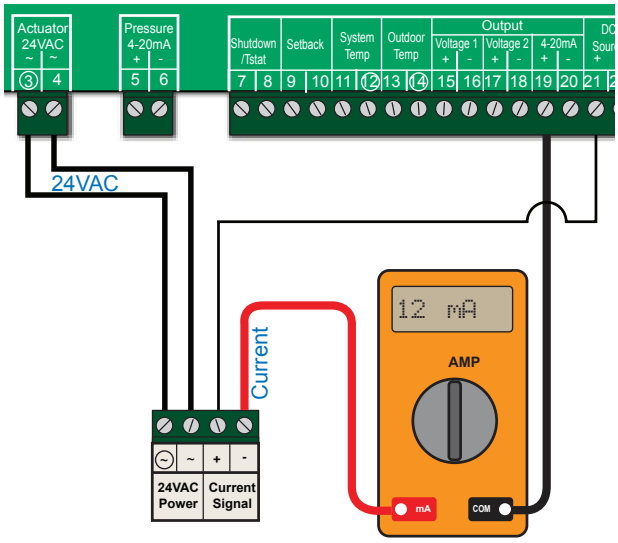
No Heat

- Check the outdoor temperature and the Outdoor Cutoff values. If the outdoor temperature is above the Outdoor Cutoff, the ESV will not give heat. See “Outdoor Cutoff” on page 14.
- If the display shows TSTAT OPEN or SHUTDOWN, the ESV will not give heat. See “Shutdown or Tstat Wiring” on page 8.

Actuator Response

ESV Does Not Move the 4-20mA Actuator

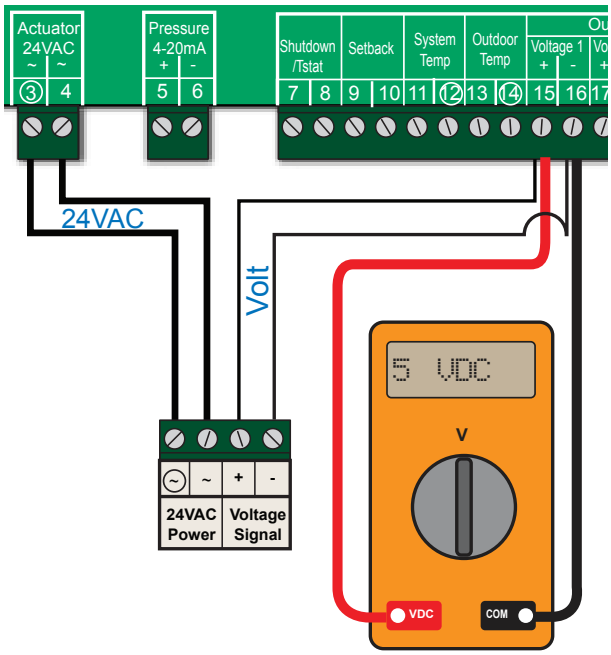
- Check the Set Point settings (See “Set Point” on page 13). If the System Sensor reading is within the logic tolerance, the ESV may not adjust the modulation position.
- If this is not the case, check for 24 VAC across terminals 3 and 4. If reading is within ±4 VAC, the power output to the actuator is working properly. Otherwise, if the voltage is not accurate, the ESV may be damaged. Contact Heat-Timer.
- Check that the ESV Valve Signal matches the actuator signal. See “Valve Signal” on page 11
- Check the actuator 4-20mA wiring to the ESV. Make sure to use either an external signal voltage source or use the ESV DC source. See “Wiring the Actuators” on page 5.
- Use a multi-meter to measure the current to the actuator. First, set the actuator Mode to Manual 50%. The meter should register within the 4-20mA range. If it does not, the ESV may be damaged. Otherwise, check the actuator position to see if it corresponds to the ESV output.



Test Current Signal

ESV Does Not Move the Voltage Actuator

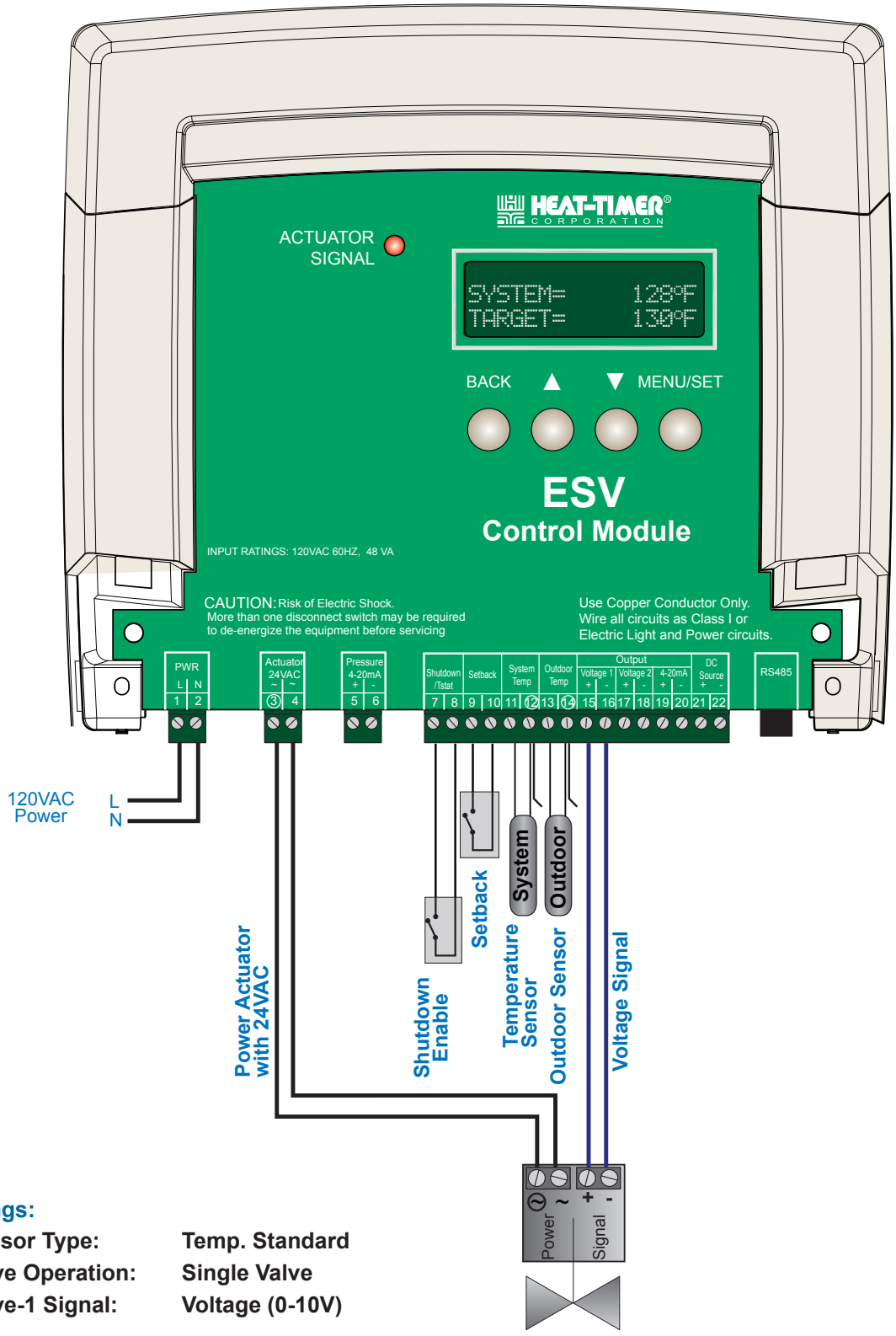
- Check the Set Point settings (See “Set Point” on page 13). If the System Sensor reading is within the logic tolerance, the ESV may not adjust the modulation position.
- If this is not the case, check for 24 VAC across terminals 3 and 4. If reading is within ±4 VAC, the power output to the actuator is working properly. Otherwise, if the voltage is not accurate, the ESV may be damaged. Contact Heat-Timer.
- Use a DC voltmeter to measure voltage signal. First, set the actuator Mode to Manual 50%. The meter should register a voltage within the voltage range selected from the Modulation Signal in the Startup menu. If it does not, the ESV may be damaged. Otherwise, check the actuator position to see if it corresponds to the ESV output.



Test Voltage Signal

WIRING DIAGRAMS

Single Actuator (Volt) - Temp. Standard

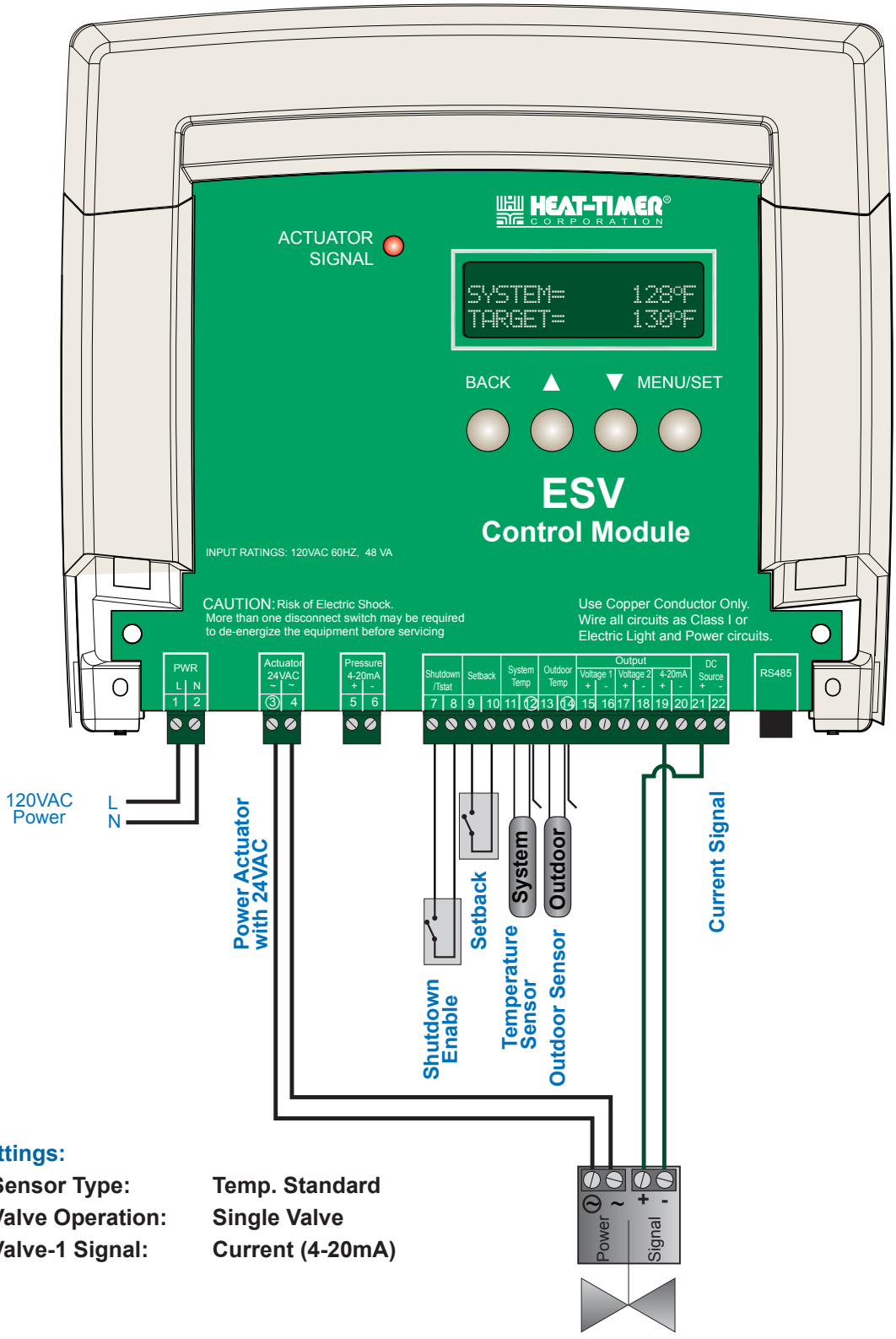


Settings:

- **Sensor Type:** **Temp. Standard**
- **Valve Operation:** **Single Valve**
- **Valve-1 Signal:** **Voltage (0-10V)**

HT# 059118-00 B

Single Actuator (Current)- Temp. Standard



Settings:

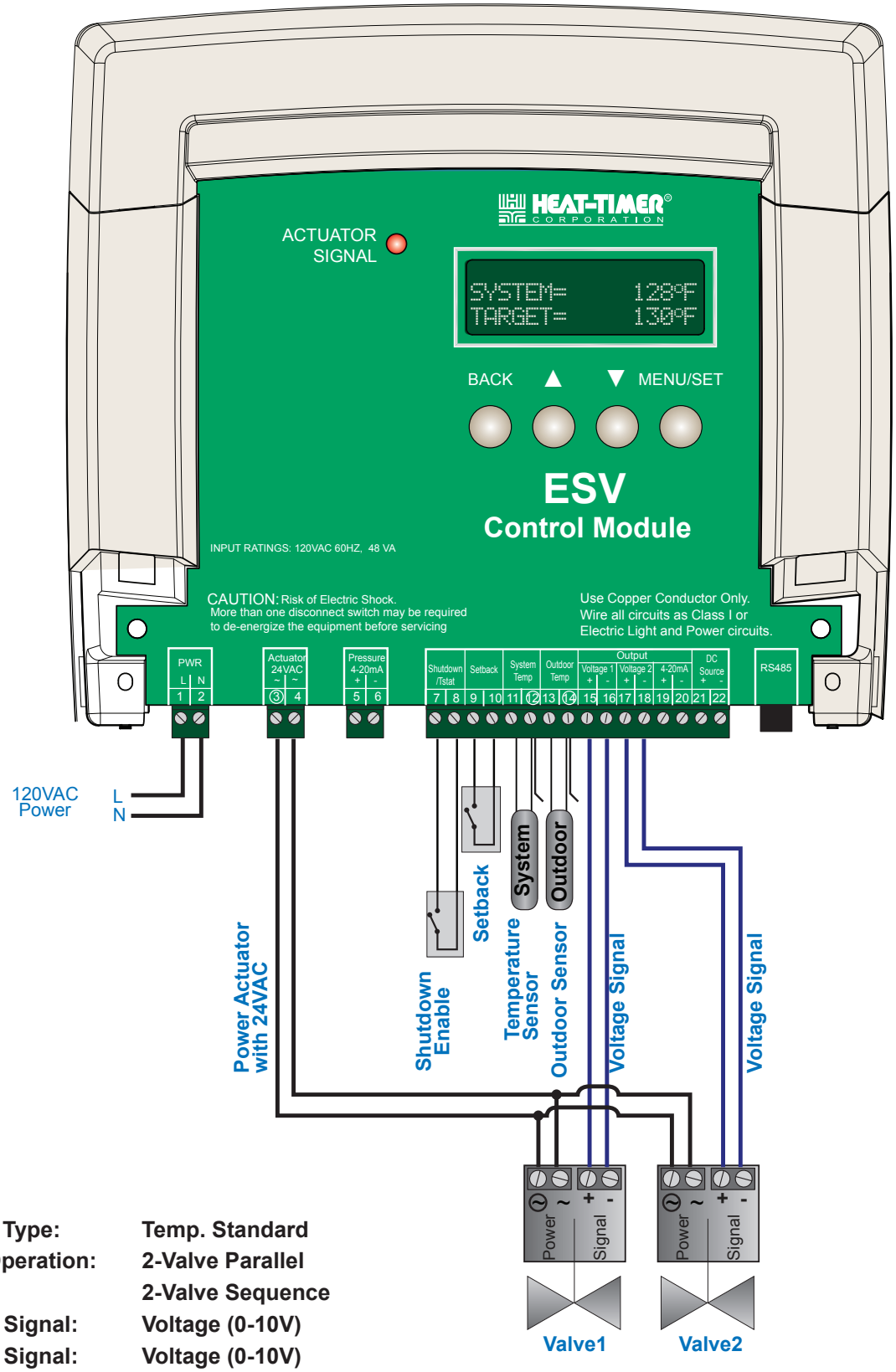
- **Sensor Type:** **Temp. Standard**
- **Valve Operation:** **Single Valve**
- **Valve-1 Signal:** **Current (4-20mA)**

⚠ ALERT

Due to the uniqueness of each installation, Heat-Timer Corp. is not responsible for any installation that is based on any generated electrical or piping diagram. The provided illustrations are to demonstrate the control's operating concept only.

HT# 059118-00 B

Two Actuators (Volt) - Temp. Standard

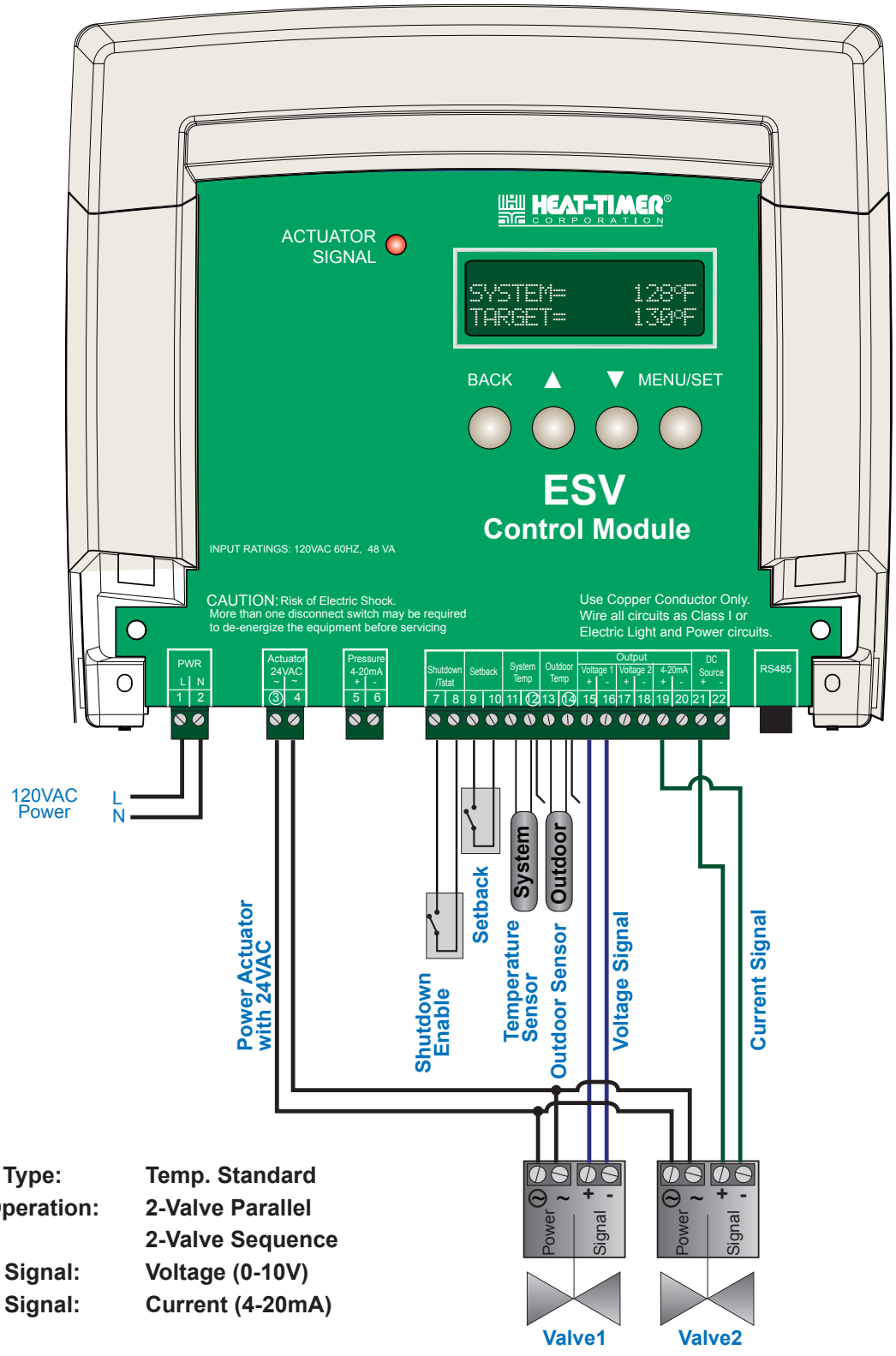


Settings:

- **Sensor Type:** **Temp. Standard**
- **Valve Operation:** **2-Valve Parallel**
  2-Valve Sequence
- **Valve-1 Signal:** **Voltage (0-10V)**
- **Valve-2 Signal:** **Voltage (0-10V)**

HT# 059118-00 B

Two Actuators (Volt and Current) - Temp. Standard



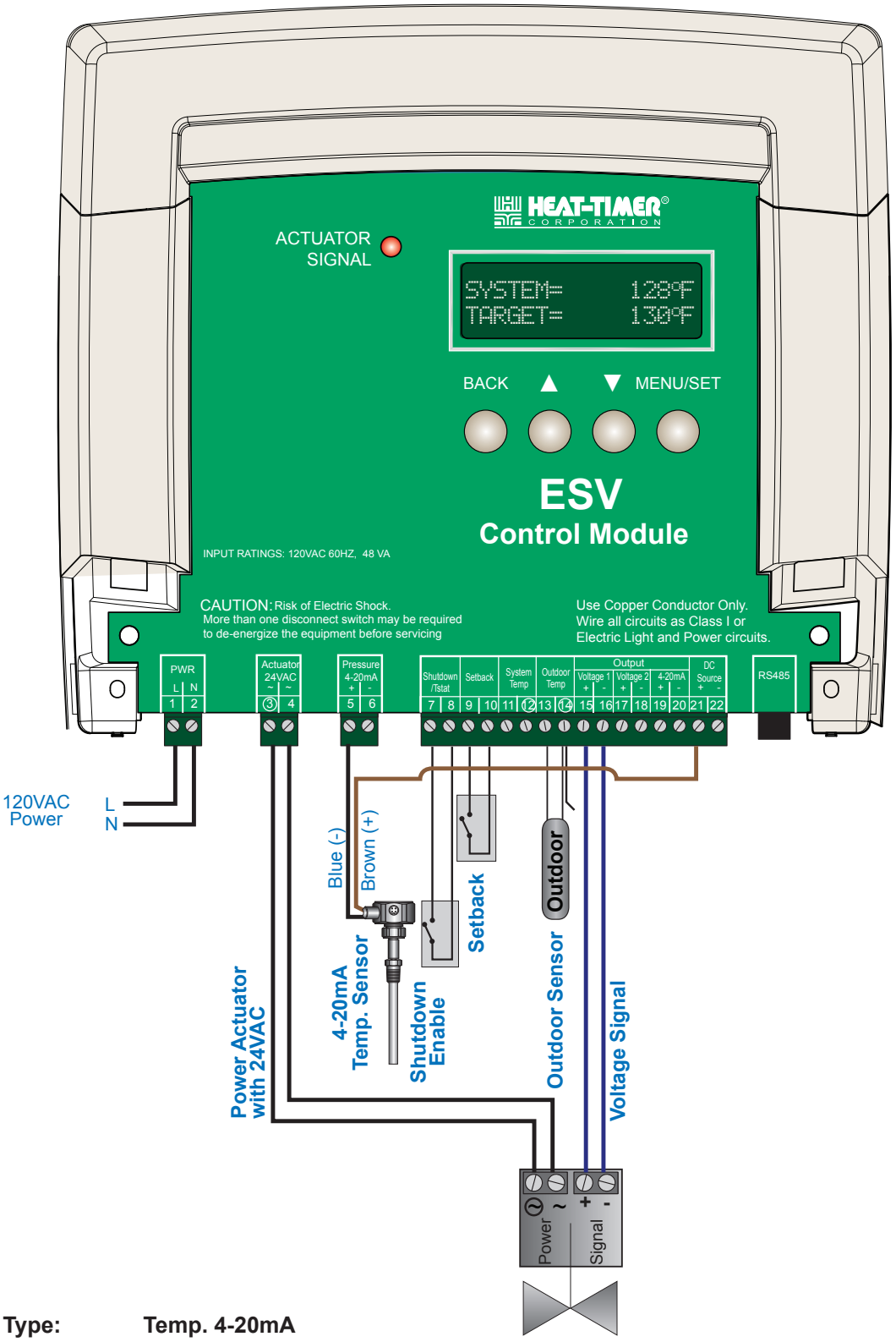
Settings:

- **Sensor Type:** **Temp. Standard**
- **Valve Operation:** **2-Valve Parallel**
  2-Valve Sequence
- **Valve-1 Signal:** **Voltage (0-10V)**
- **Valve-2 Signal:** **Current (4-20mA)**

⚠ ALERT

Due to the uniqueness of each installation, Heat-Timer Corp. is not responsible for any installation that is based on any generated electrical or piping diagram. The provided illustrations are to demonstrate the control's operating concept only.

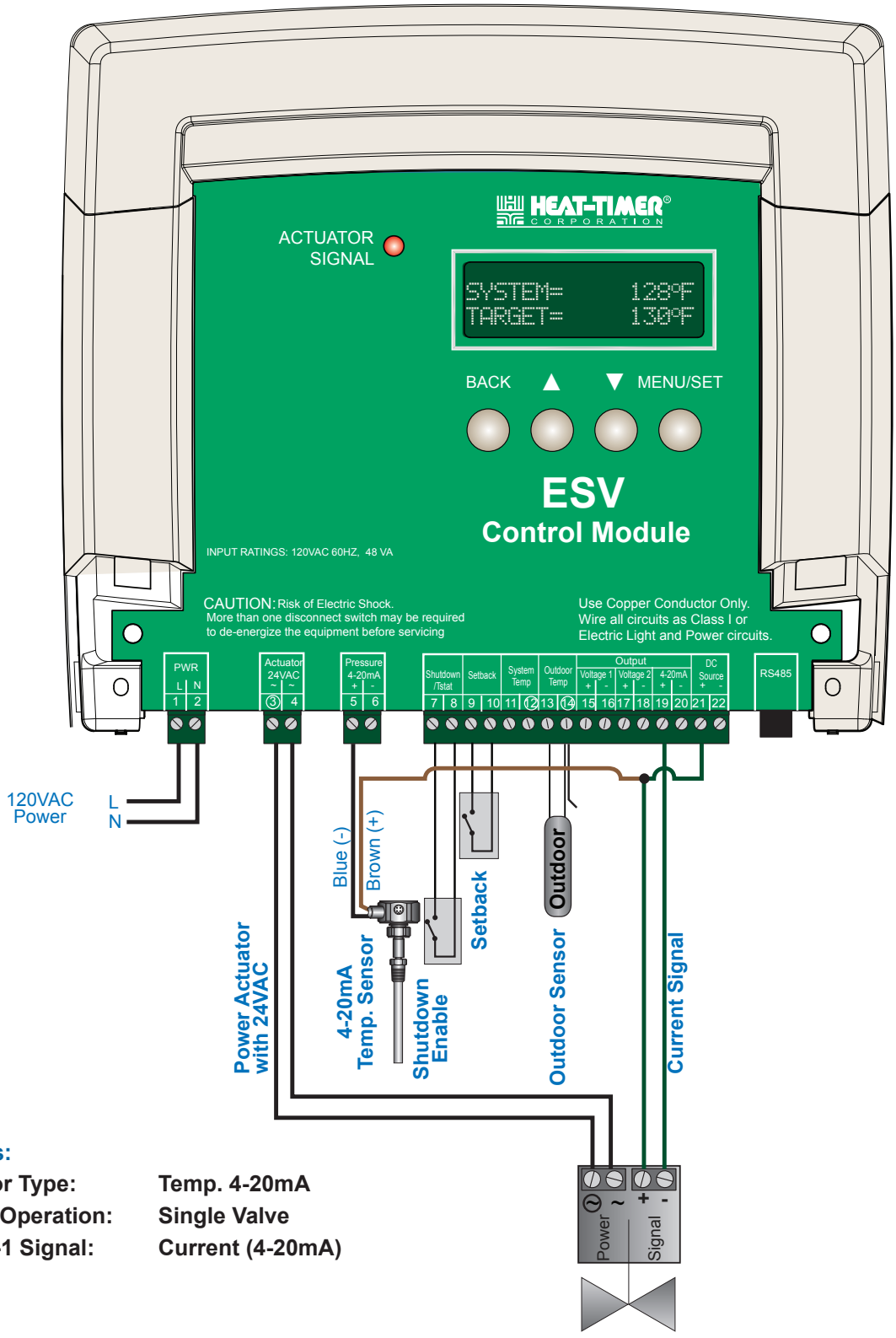
Single Actuator (Volt) - Temp. 4-20mA



Settings:

- **Sensor Type:** **Temp. 4-20mA**
- **Valve Operation:** **Single Valve**
- **Valve-1 Signal:** **Voltage (0-10V)**

Single Actuator (Current) - Temp. 4-20mA



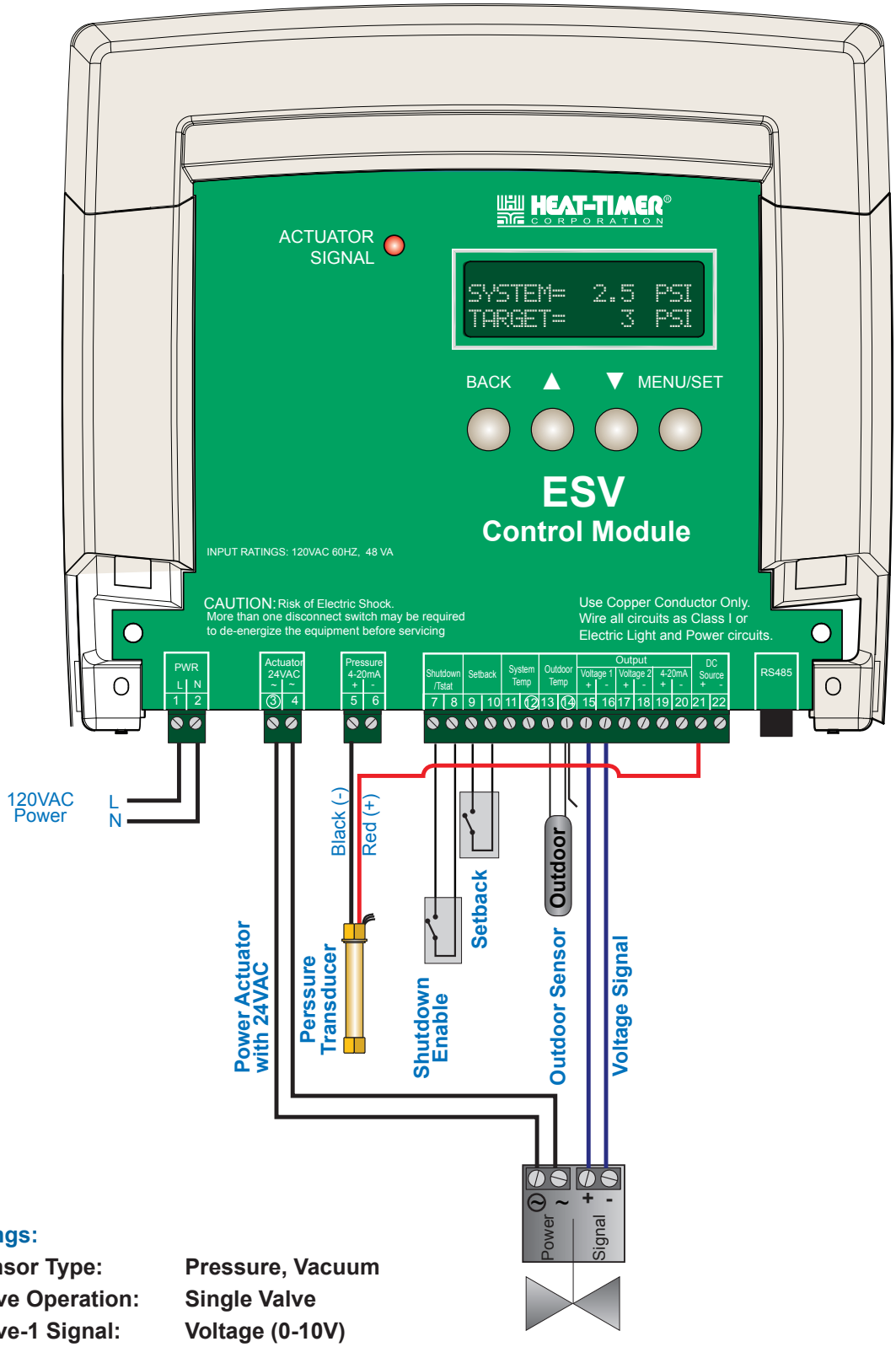
Settings:

- **Sensor Type:** **Temp. 4-20mA**
- **Valve Operation:** **Single Valve**
- **Valve-1 Signal:** **Current (4-20mA)**

⚠ ALERT

Due to the uniqueness of each installation, Heat-Timer Corp. is not responsible for any installation that is based on any generated electrical or piping diagram. The provided illustrations are to demonstrate the control's operating concept only.

Single Actuator (Volt) - Pressure

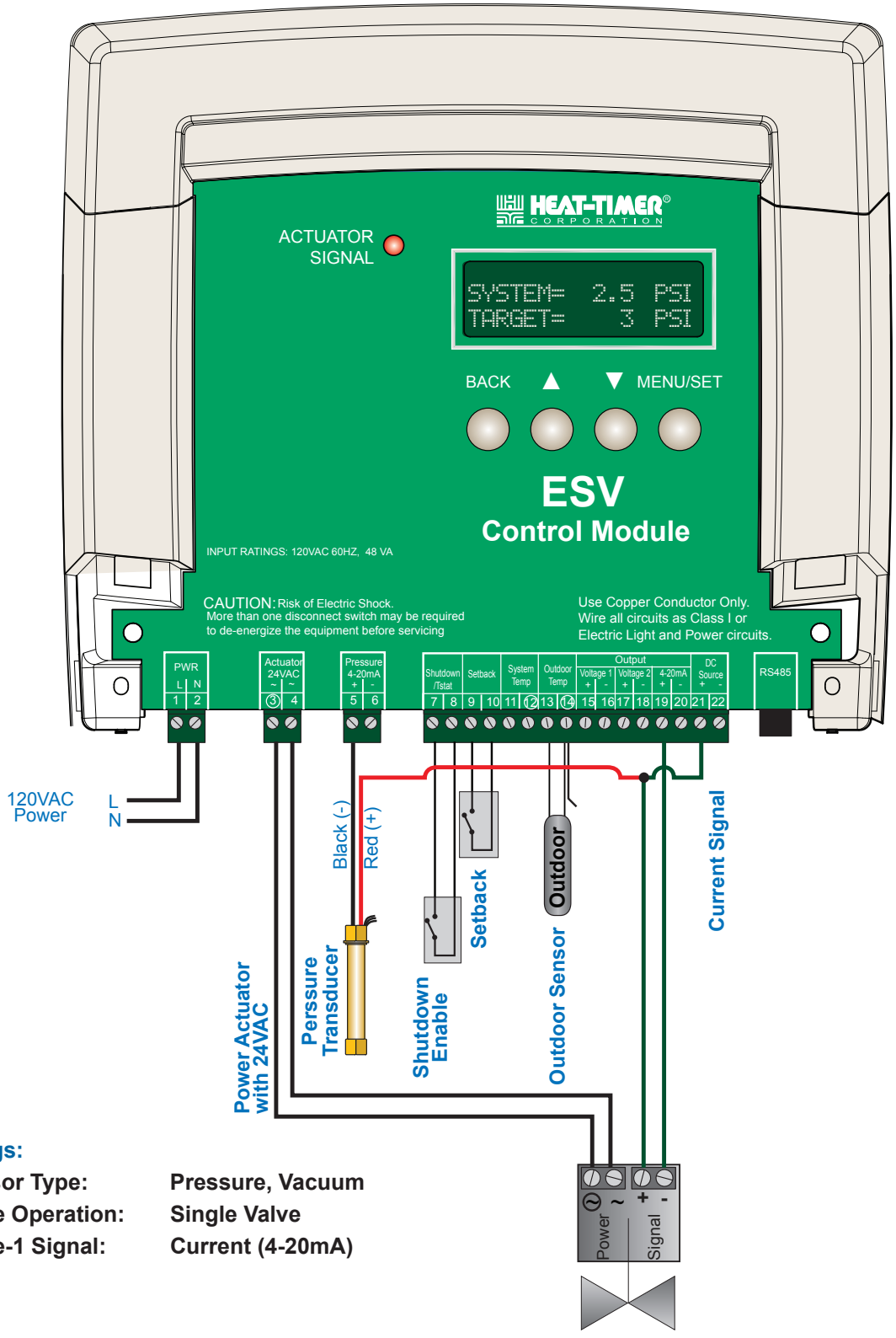


Settings:

- **Sensor Type:** **Pressure, Vacuum**
- **Valve Operation:** **Single Valve**
- **Valve-1 Signal:** **Voltage (0-10V)**

HT# 059118-00 B

Single Actuator (Current) - Pressure



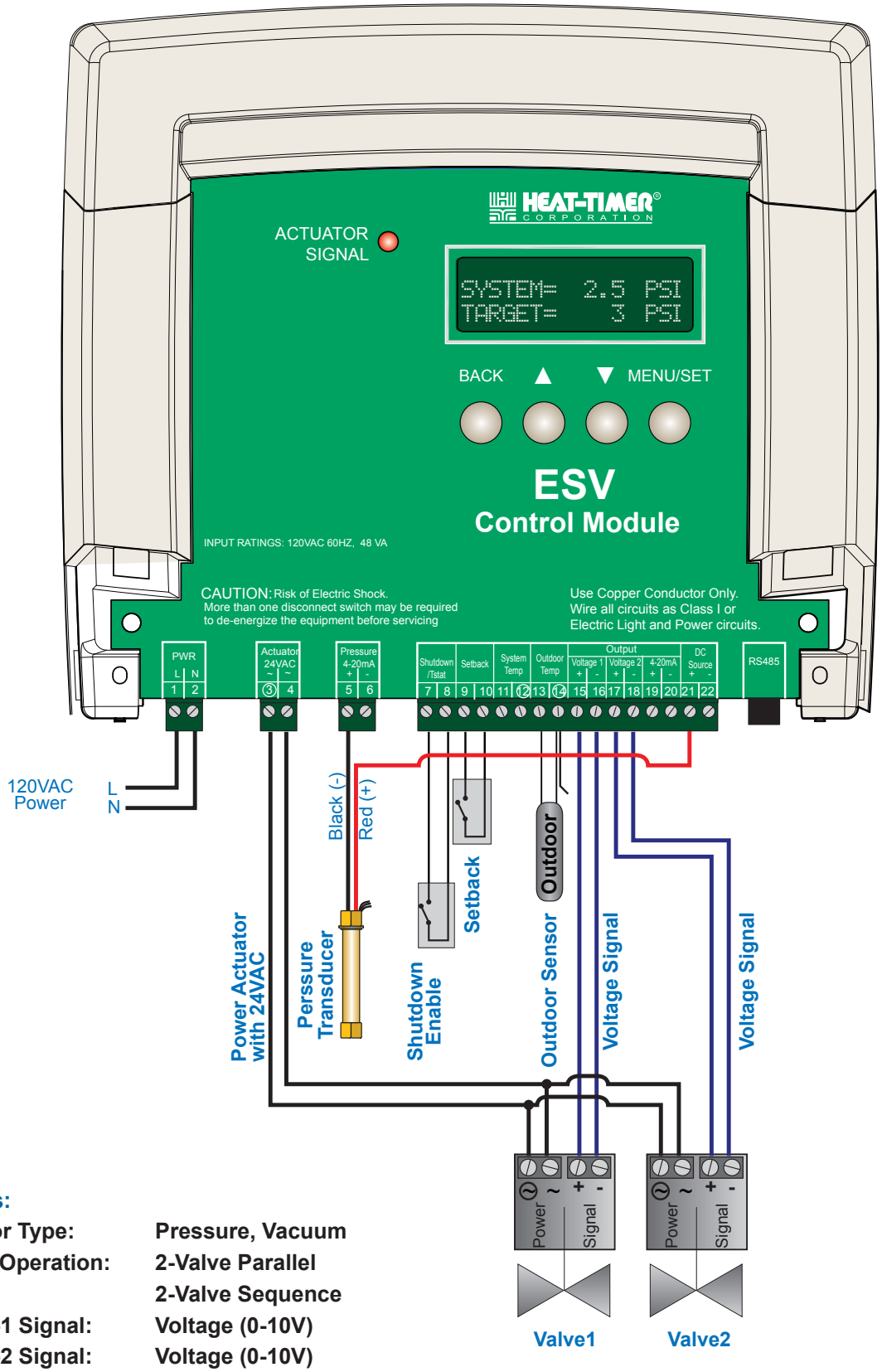
Settings:

- **Sensor Type:** **Pressure, Vacuum**
- **Valve Operation:** **Single Valve**
- **Valve-1 Signal:** **Current (4-20mA)**

⚠ ALERT

Due to the uniqueness of each installation, Heat-Timer Corp. is not responsible for any installation that is based on any generated electrical or piping diagram. The provided illustrations are to demonstrate the control's operating concept only.

Two Actuators (Volt) - Pressure

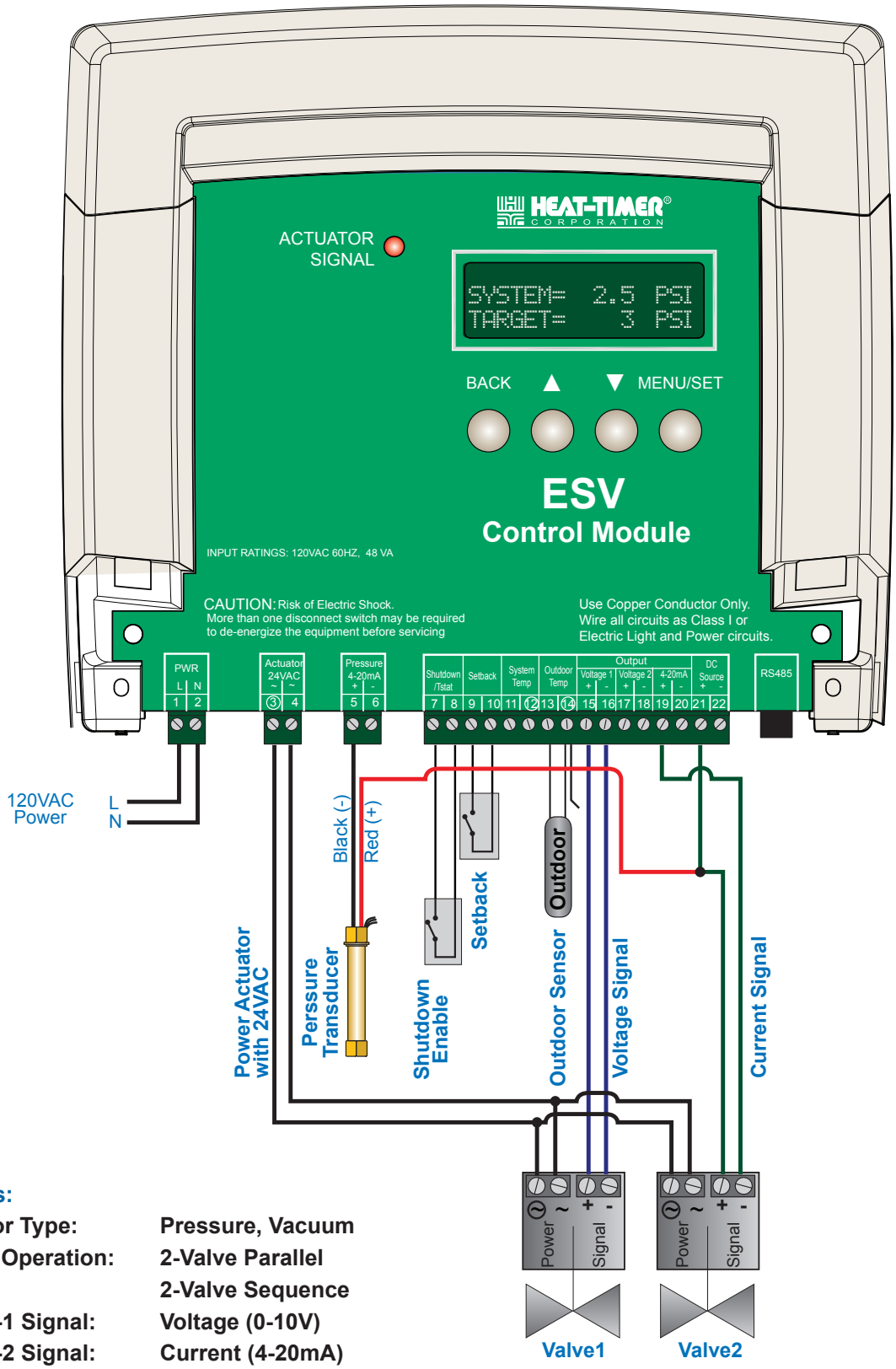


Settings:

- **Sensor Type:** **Pressure, Vacuum**
- **Valve Operation:** **2-Valve Parallel**
  2-Valve Sequence
- **Valve-1 Signal:** **Voltage (0-10V)**
- **Valve-2 Signal:** **Voltage (0-10V)**

HT# 059118-00 B

Two Actuators (Volt and Current) - Pressure



Settings:

- **Sensor Type:** **Pressure, Vacuum**
- **Valve Operation:** **2-Valve Parallel**
  2-Valve Sequence
- **Valve-1 Signal:** **Voltage (0-10V)**
- **Valve-2 Signal:** **Current (4-20mA)**

⚠ ALERT

Due to the uniqueness of each installation, Heat-Timer Corp. is not responsible for any installation that is based on any generated electrical or piping diagram. The provided illustrations are to demonstrate the control's operating concept only.

WARRANTY

WARRANTIES AND LIMITATIONS OF LIABILITY AND DAMAGE: Heat-Timer Corporation warrants that it will replace, or at its option, repair any Heat-Timer Corporation manufactured product or part thereof which is found to be defective in material workmanship within one year from the date of installation only if the warranty registration has been properly filled out and returned within 30 days of the date of installation. Damages to the product or part thereof due to misuse, abuse, improper installation by others or caused by power failure, power surges, fire, flood or lightning are not covered by this warranty. Any service, repairs, modifications or alterations to the product not expressly authorized by Heat-Timer Corporation will invalidate the warranty. Batteries are not included in this warranty. This warranty applies only to the original user and is not assignable or transferable. Heat-Timer Corporation shall not be responsible for any maladjustments of any control installed by Heat-Timer Corporation. It is the users responsibility to adjust the settings of the control to provide the proper amount of heat or cooling required in the premises and for proper operation of the heating or cooling system. Heat-Timer Corporation shall not be required to make any changes to any building systems, including but not limited to the heating system, boilers or electrical power system, that is required for proper operation of any controls or other equipment installed by Heat-Timer Corporation or any contractor. Third Party products and services are not covered by this Heat-Timer Corporation warranty and Heat-Timer Corporation makes no representations or warranties on behalf of such third parties. Any warranty on such products or services is from the supplier, manufacturer, or licensor of the product or service. See separate Terms and Conditions of Internet Control Management System (“ICMS”) services, including warranties and limitations of liability and damages, for ICMS services.

THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED AND HEAT-TIMER CORPORATION SPECIFICALLY DISCLAIMS ANY AND ALL WARRANTIES OF MERCHANTABILITY FOR A PARTICULAR PURPOSE. UNDER NO CIRCUMSTANCES SHALL HEAT-TIMER CORPORATION, ITS AUTHORIZED REPRESENTATIVES, AFFILIATED OR SUBSIDIARY COMPANIES BE LIABLE FOR SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES, EXCEPT AS SPECIFICALLY STATED IN THESE TERMS AND CONDITIONS OF SALE. THE SOLE REMEDY WITH RESPECT TO ANY PRODUCT OR PART SOLD OR INSTALLED BY HEAT-TIMER CORPORATION SHALL BE LIMITED TO THE RIGHT TO REPLACEMENT OR REPAIR F.O.B. FAIRFIELD, NJ. HEAT-TIMER CORPORATION SHALL NOT BE LIABLE OR RESPONSIBLE FOR LOSS OR DAMAGE OF ANY KIND RESULTING FROM DELAY OR INABILITY TO DELIVER FOR ANY REASON, INCLUDING BUT NOT LIMITED TO FIRE, FLOOD, LIGHTNING, POWER FAILURE OR SURGES, UNAVAILABILITY OF PARTS, STRIKES OR LABOR DISPUTES, ACCIDENTS AND ACTS OF CIVIL OR MILITARY AUTHORITIES.

REV. 03122010

SPECIFICATIONS

Voltage Input:	120 VAC 60 Hz
Maximum Input Rating:	48 VA Max
Fuse:	20mm 2.5 Amp
Display:	Back Lite 2 Line Alphanumeric LCD Display
Display Units:	Fahrenheit (ºF) and Celsius (ºC)
Set Point:	See “Sensor Table” on page 8
Setback:	See “Sensor Table” on page 8
Gain:	from -10 to +10
Modulation Output Signal:	0-10V, 2-10V, 0-5V, 1-5V, 4-20mA
Valve Operation:	Single Valve, 2-Valve Parallel, or 2-Valve Sequence
Valve Start Position:	0% to 100%
Valve Start Delay:	0 minute to 60 minutes
Valve Close Position:	0% to 100%
LED:	1 Actuator Signal
Inputs:	System Temperature, Outdoor Temperature, Pressure input, Shutdown/Tstat Input, Setback Input
Buttons:	4 (BACK, ▲, ▼, MENU/SET)
Dimensions:	8 ⅝”W x 10”H x 3 ½”
Weight:	.2 pounds

HT# 059118-00 B