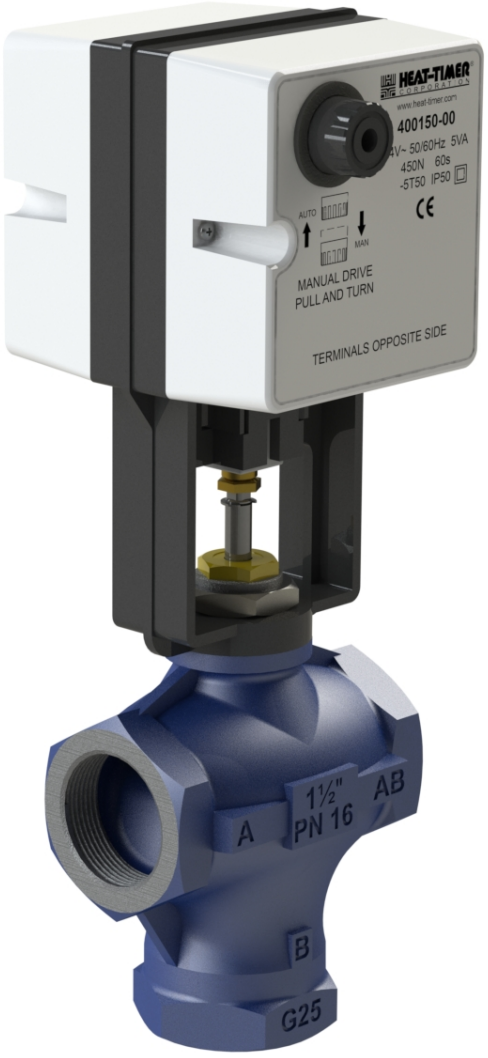
HEAT-TIMER®

Installation and Operation Manual

3-Way and 2-Way Motorized Valves

for Hot Water,Steam, and Vacuum



⚠ WARNING

This Heat-Timer valve is strictly an operating valve; 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 any Heat-Timer equipment.

059440-00 Rev. B

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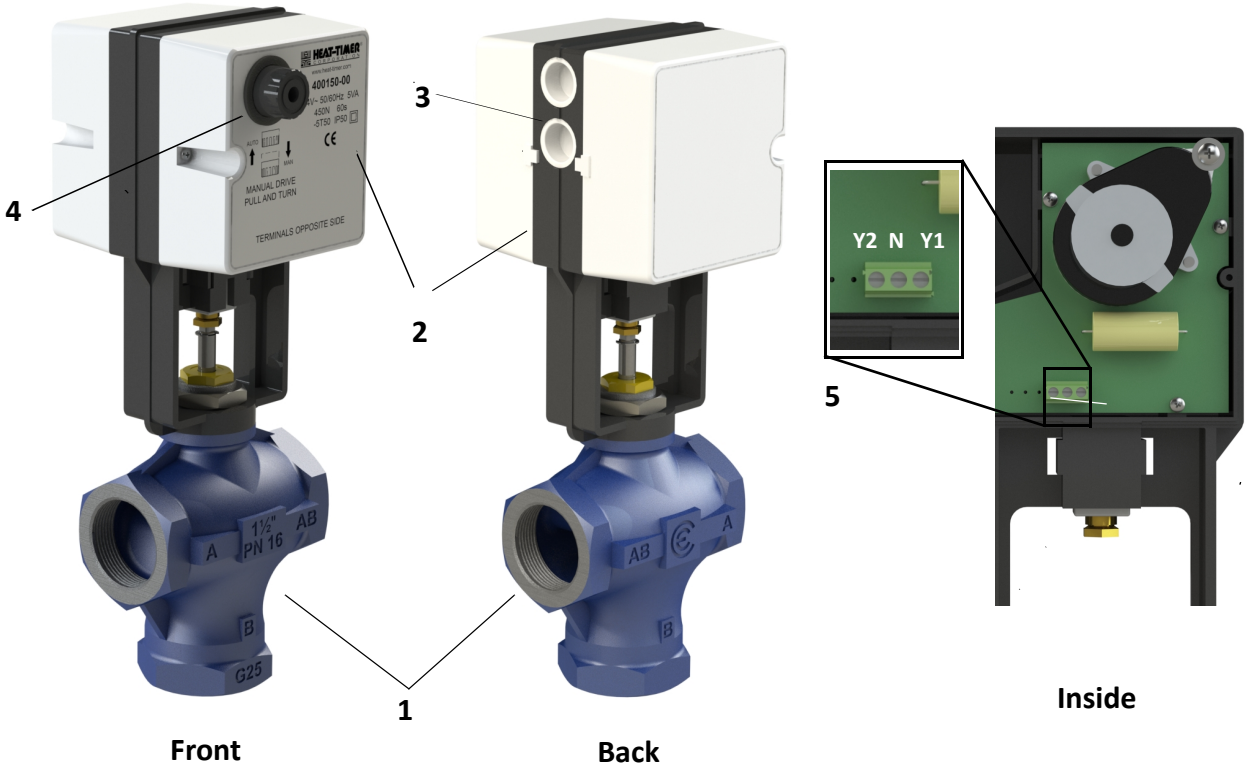
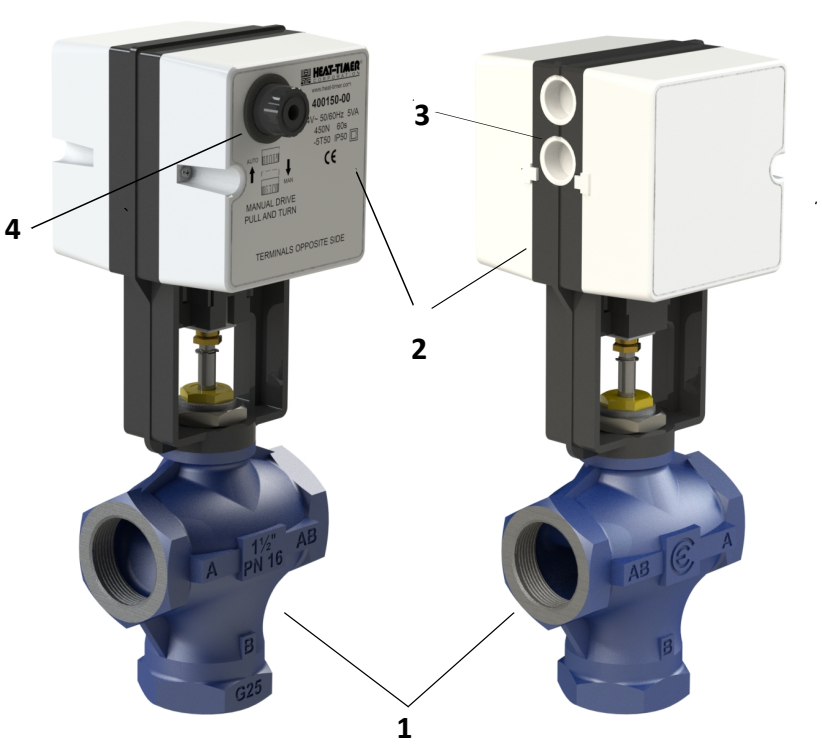
Figure 1: 3-Way and 2-Way Motorized Valves Controls, Indicators, and Connections - Floating Signal Actuator (PN 400150-00)



Item	Description	Item	Description
1	Valve Body	4	Actuator Manual Adjustment Knob
2	Valve Actuator	5	Wiring Connections • Terminal Y1 – Drives Valve Stem Up • Terminal N – 24Vac Common • Terminal Y2 – Drives Valve Stem Down
3	Wiring Entry Fittings		

Controls, Indicators, and Connections

Figure 1A: 3-Way and 2-Way Motorized Valves Controls, Indicators, and Connections - Floating Signal Actuator w/ Feedback (PN 400155-00)



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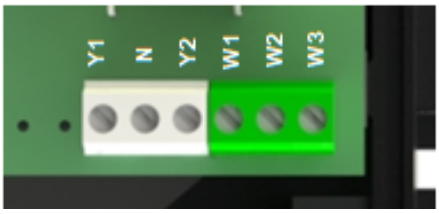


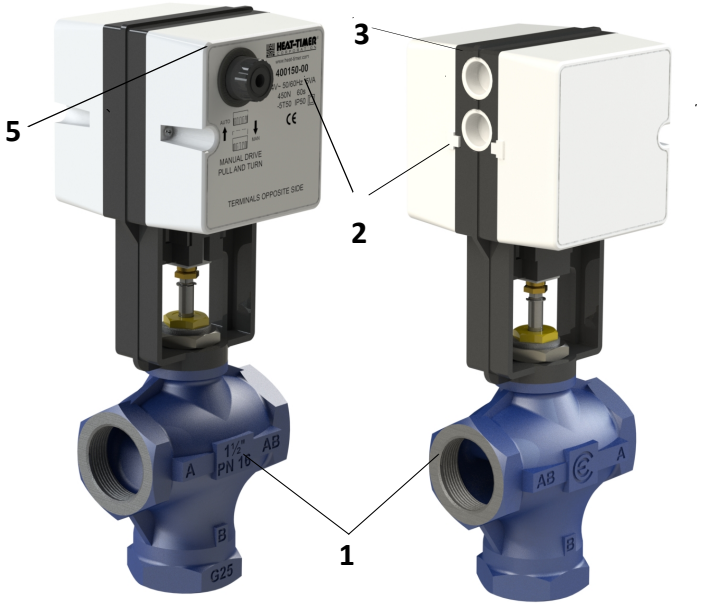
Inside - Terminals

Item	Description
1	Valve Body
2	Valve Actuator
3	Wiring Entry Fittings

Item	Description
4	Actuator Manual Adjustment Knob
5	Wiring Connections • Terminal Y1 – Drives Valve Stem Up • Terminal N – 24Vac Common • Terminal Y2 – Drives Valve Stem Down • Terminal W1 – Valve OPEN Signal • Terminal W2 - Common • Terminal W3 – Valve CLOSE Signal

Controls, Indicators, and Connections

Figure 1B: 3-Way and 2-Way Motorized Valves Controls, Indicators, and Connections - Current Voltage Actuator (PN 400160-00)



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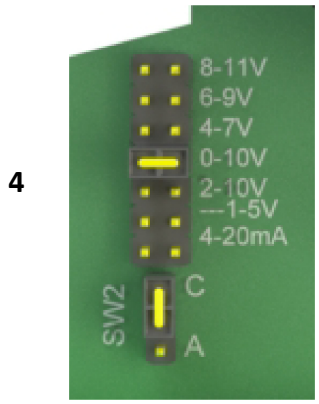


Inside - Terminals

Item	Description	Item	Description
1	Valve Body	5	Actuator Manual Adjustment Knob
2	Valve Actuator	6	Wiring Connections • Terminal L1 – 24Vac Connection • Terminal L2 – 24Vac Connection • Terminal M – Common • Terminal V+ – 15V Output • Terminal Y – 0-10V Control Signal Input • Terminal S1 – Feedback Common • Terminal S2 – 0-10V/0-200µA Output Signal • Terminal S3 – 10-0V/0-200µA Output Signal
3	Wiring Entry Fittings		
4	Input Signal Selection and Valve Direction • 8 - 11V • 6 - 9V • 4 - 7V • 0 - 10V (Factory Default) • 2 - 10V • 1 - 5V • 4 - 20mA • C - 10V Drives Valve Stem Down • A - 10V Drives Valve Stem Up		

Detailed Operation

Overview

The 3-Way and 2-Way Motorized Valves work with any of the following hot water, steam, or vacuum system applications:

- 3-Way Configured Valves
  - 3-Way Converted Hot Water Heating Application
- 2-Way Configured Valves
  - 2-Way Low-Pressure Steam Valve Application
  - 2-Way Vacuum Steam Valve Application

3-Way Hot Water Heating Application

The standard 3-way single-seated valve configuration is used to mix heating water to a desired temperature. The hot water from the boiler is blended with the correct proportion of cooler water returning from the system to maintain the target temperature as the HWR Platinum or Digi Span HWE control resets the hot water temperature based on outside temperature. The operation of the actuator allows the hot supply and the cold supply to be interchangeable, allowing additional flexibility in the installation of the valve.

2-Way Converted Low-Pressure Steam Valve Application

The standard 3-way single-seated valves can be converted for use as a 2-way valve simply by adding a plug to the bottom of the valve body. This type of application with a 2-way valve configuration is generally a low pressure (< 10 psig) system in which the valve can turn on or off the flow of steam from the boiler (or other source) in a steam distribution system. A typical application would be where steam is used for heating radiators in a one or two-pipe steam heated building using the MPC Platinum or EPU-D controller.

Another typical application in which a 2-way configured valve is used is in a steam-to-hot water heat exchanger. The 2-way steam valve is used to regulate the amount of steam entering a heat exchanger to maintain temperature of the hot water using the HWR Platinum or Digi Span HWE controller. As the hot water load changes, the steam valve is signaled to change the amount of steam entering the heat exchanger.

2-Way Converted Vacuum Steam Valve Application

2-way converted valves can modulate the flow of sub-atmospheric steam from the boiler (or other source) into a steam distribution system. Actuators are equipped with a position feedback signal. A typical example of this type of application would be using vacuum steam to heat radiators in a building. When the control, such as the SRC Platinum, calls to put heat into the system, the 2-way valve partially modulates open and steam flows into the radiators based on the outdoor air temperature. When the control determines that sufficient heat has entered the radiators, the control either marginally closes the 2-way valve, reducing the flow of steam or closes the valve completely.

Actuator Manual Operation

Motorized valves can be manually operated during power outages or when servicing the equipment.

> **⚠ CAUTION**
>
> **DO NOT manually operate the valve when power is supplied to the actuator. Manually operating the valve while the controller is also positioning the valve may result in damage to the equipment. Only manually operate the valve when power has been removed from the actuator.**
>
> **DO NOT attempt to force the manual control beyond the end of the actuator stroke.**

1. Ensure power has been removed from the valve actuator.
2. Push in and hold the actuator manual control knob (1).
3. While continuing to press in the actuator manual control knob, turn the knob until the valve is in the desired position.
   - Turning the knob clockwise moves the valve stem downwards.
     - 2-way converted valves: the valve opens
     - 3-way valves: the valve A port opens, B port closes
   - Turning the knob counterclockwise moves the valve stem upwards.
     - 2-way converted valves: the valve closes
     - 3-way valves: the valve A port closes, B port opens
4. When the valve is in the desired position, release pressure on the manual control knob.

Maintenance

Type	Notes
Lubrication	The valve and actuator do not require any formal maintenance to operate. The internal lubrication of the actuator is sufficient for the life of the actuator.
Cleaning	Any cleaning of the actuator external enclosure should be done with a light detergent with a low level of chemical aggressiveness.

Specifications

Actuator Specifications - Floating Actuator (PN 400150-00)

Input Signal: . . . . . 24Vac Floating

Power Consumption: 12VA

Operating Temperature: . . . . . Ambient 5°F to 122°F (–15°C to 50°C)

Locations: . . . . . NEMA Type 2 / IP50 Indoor Only

User Interface:. . . . . Manual Override Handle Status

Actuator Specifications - Floating Actuator with Feedback (PN 400155-00)

Input Signal: . . . . . 24Vac Floating

Power Consumption: 12VA

Operating Temperature: . . . . . Ambient 5°F to 122°F (–15°C to 50°C)

Locations: . . . . . NEMA Type 2 / IP50 Indoor Only

User Interface:. . . . . Manual Override Handle Status

Valve Position Feedback Signal. . . . . 0 - 1000 ohms

Actuator Specifications - Proportional (PN 400160-00)

Input Signal: .. . . 0 - 10V (default), 8-11V, 6-9V, 4-7V, 2-10, 1-5V, 4-20mA

Output Signal - Valve Position: . . . . . 0-10V or 0-200µA

Power Consumption: 12VA

Operating Temperature: . . . . . Ambient 5°F to 122°F (–15°C to 50°C)

Locations: . . . . . NEMA Type 2 / IP50 Indoor Only

User Interface:. . . . . Manual Override Handle Status

3-Way and 2-Way Single-Seated Valves

Valve Size	Heat-Timer P/N	Flow C_V Rating	Close Off Pressure Rating	Dimensions (inches)			Shipping Weight (lbs)	Motor Speed (minutes)
				A	B	C		
3/4"	928521-XX	7.3	38	3.3"	2.6"	9.3"	5	1
1"	928522-XX	11.6	25	3.7"	2.8"	9.5"	6	1
1 1/4"	928523-XX	18.5	16	4.2"	3.1"	9.7"	7	1
1 1/2"	928524-XX	25.4	12	4.7"	3.3"	10.0"	8.5	1
2"	928525-XX	46.2	9	7.6"	3.8"	10.1"	13.5	1

NOTE: Replace XX as follows: **00** for 24V Floating Actuator, **CV** for 0-10V Proportional Actuator, **VAC** for 24V Floating Actuator with Valve Position Feedback

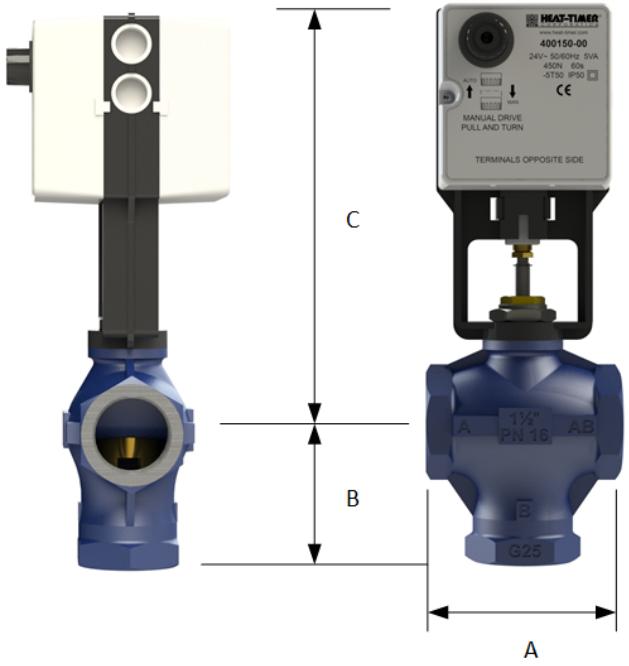


Figure 3: 3-Way Single-Seated Valve Body and Actuator Dimensions

Valve Specifications

Valve Body Material: . . . . . ANSI B16.1 Iron

Valve Connection: . . . . . NPT Threaded

Temperature Rating: . . . . . 14°F to 302°F (–10°C to 150°C)

Stem/Plug Material: . . . . . Stainless/Brass

Seat Closure: . . . . . Single-Seated ANSI - Class IV Shutoff

Packing Material: . . . . . Long-Life EPDM Rubber

Packing Temperature Rating: . . . . . 302°F (150°C)

Maximum Operating Pressure: . . . . . 200 psi @ 200°F
165 psi @ 302°F

Installation Instructions

The installation process for 2-Way and 3-Way Motorized Valves consists of the following basic steps:

1. Initial installation (see “Design Considerations” on page 11).
2. Installing the valve body (see page 13).
3. Wiring the actuator (see page 17).

Supplied Materials

The following materials are supplied with the valve body and actuator:

- 24Vac (40VA) Transformer (p/n 210006-00)
- Installation and Operation Manual (p/n 056700-00)
- Warranty Card (p/n 059115-00)

Required Materials (Not Supplied)

The following materials/tools are required for installation, but are not supplied:

- General tool kit (screwdrivers, wire strippers, power drill, pipe wrenches, etc.)
- 1/2", 14mm, and adjustable wrenches
- 18 AWG cable (Heat-Timer p/n 703001-01 or equivalent #18/2 cable) for actuator wiring
- Electrical conduit as required by local or state requirements

Design Considerations

When installing the system, certain design considerations must be taken into account. These include:

- Calculating the correct valve sizing (see “Calculating Valve Sizing” on page 12).
- Location of the valve and actuator
  - The valve actuator is not intended for outdoor installation.
  - The valve location should be where leakage from the piping field connections will not cause damage to the surrounding area.
  - Consider the location of any new or existing piping and electrical components.
- General piping guidelines:
  - All piping, including the piping of the valve body, must meet or exceed all applicable local, state, and/or federal guidelines, codes, regulations, and laws.
  - Support all piping using hangers. **DO NOT** support piping by the unit or its components.
  - Use isolation valves to isolate system components.
  - Use unions to allow for servicing and, if required, removal of the valve and other components.
  - Include drain valves to assist in servicing the valve.

Calculating Valve Sizing

Hot Water Valve Sizing

The selection of a hot water valve should be based on a C_v rating approximately 10% greater than the calculated requirement to maintain control at the maximum flow rate.

Use the following formula to calculate the C_v rating:

$$C_V = \frac{G.P.M}{\sqrt{\Delta P}}$$

NOTE: These calculations must use absolute pressures.

The objective is to minimize the pressure drop across the valve. The example below will calculate the C_v in a system that will pass 200 GPM of water while limiting the pressure drop to 3 PSIG.

$$C_V = \frac{200\ GPM}{\sqrt{3 + 14.7}} = 48 \qquad C_V = 48\ x\ 1.1 = 53$$

Refer to “Valve Specifications” on page 7 and select the valve size where the C_v matches or exceeds the 53. In this example, a 2 1/2" three-way valve.

Steam Valve Sizing - 10 psig or less

The selection of a steam valve in a zoning situation should be based on minimizing the drop across a 2-way valve. In the case of heat exchangers, the objective is to allow maximum capacity flow as specified by the heat exchanger and/or pump capacity.

Use the following formula to calculate the C_v rating:

$$C_V = \frac{Lb/hr}{2.1\sqrt{(P_1 - P_2)\ x\ (P_1 + P_2)}}$$

NOTE: These calculations must use absolute pressures.

The following example shows the C_v calculation in a system that will pass 5000 lb/hr of saturated steam when the inlet pressure is 7 PSIG and a 2 PSIG pressure drop is desired. Remember to use absolute pressures.

$$P_1 = 14.7\ PSI + 7.0\ PSIG = 21.7\ PSI$$

$$P_2 = 14.7\ PSI + (7.0\ PSIG - 2.0\ PSIG) = 19.7\ PSI$$

$$C_V = \frac{400}{2.1\sqrt{(21.7 - 19.7)\ x\ (21.7 + 19.7)}} = 21$$

Refer to “Valve Specifications” on top of page 9 and select the valve size where the Cv matches or exceeds the 12 in this example, a 1 1/2" valve.

Installing the Valve Body

> **⚠ CAUTION**
>
> **Use a two-wrench method (using one wrench to prevent the valve body from turning or twisting) when tightening piping onto the valve body connections. Failure to support the valve body in this manner may cause damage to the valve body or the actuator.**

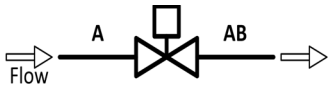
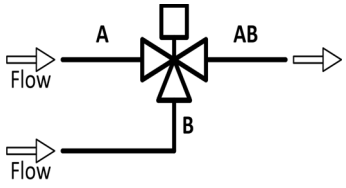
1. Ensure all debris (dirt, metal shavings, etc.) is flushed from the system before installing the valve body.
2. Ensure all service clearances are met. The installation should account for a minimum 12" (30.5cm) clearance to the valve and actuator. This space is needed to allow for servicing and the manual operation of the actuator. Refer to “Valve Specifications” on page 9 for dimension information.
3. Determine whether the installation requires a 3-way or 2-way based on the application of the valve

Figure 3: Single-Seat Valve – 3-Way or 2-Way Converted

- **To use the valve in a 3-way configuration:** No action is required
- **To use the valve in a 2-way configuration:** thread a plug fitting (by others) into the B port using proper pipe / thread sealant.

4. Install the valve body while observing the following precautions:
   - Reference the labeling and casting marks on the valve body to ensure proper direction of flow through the valve body.

Table 1: Flow Direction

Application	Direction of Flow
NOTE: For Converted 2-way valves, the actuator shaft moving DOWN opens the valve, moving UP closes the valve. All valve ports are marked with the letters "A" and "AB". **NOTE: For steam applications, the valve must be installed on the horizontal pipe.**	
Converted 2-Way Single-Seat Valve – Low-Pressure Steam	Install the valve so the direction of flow is from A to AB. 
NOTE: For 3-way valves, the actuator shaft moving DOWN opens valve port A and closes valve port B, moving UP closes valve port A and opens valve port B. All valve ports are marked with the letters "A", "B", and "AB". **CAUTION: For hot water applications, ensure the pump is installed after the valve discharge port. Installing the pump before the valve input ports may result in pump failure or damage to the valve when the valve is either fully open or closed.**	
3-way Single-Seat Valve – Hot Water	The default valve position is: • Port B—HOT supply • Port A—COLD supply • Port AB—MIXED outlet 3-way valves may also be installed in the alternate configuration with the A and B supplies reversed: • Port B—COLD supply • Port A—HOT supply • Port AB—MIXED outlet  **NOTE: If the 3-way valve is installed in the alternate configuration, reverse the actuator Open and Close connections (see “Wiring the Actuator” on page 17.**

- The preferred orientation of the valve stem and actuator is upright (vertically). However, where space restrictions dictate, the valve actuator assembly can be mounted in any position as long as the valve is not upside down or the actuator manual control knob is not facing up or down (see Figure 4).
- **DO NOT** install motorized valves upside down. Doing so can stress the valve stem.

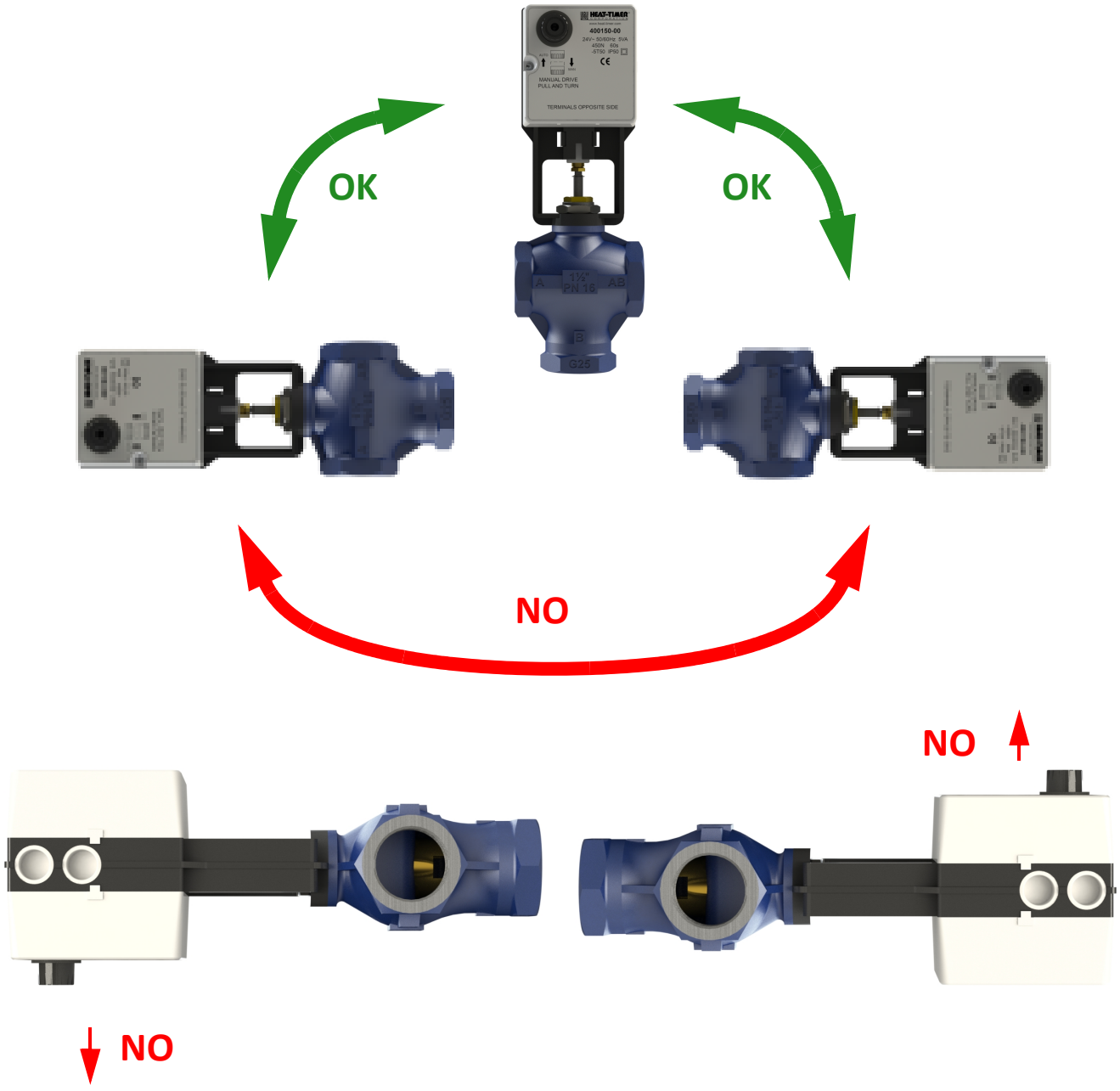


Figure 4: Acceptable Valve Body and Actuator Orientation

Mounting the Valve Actuator

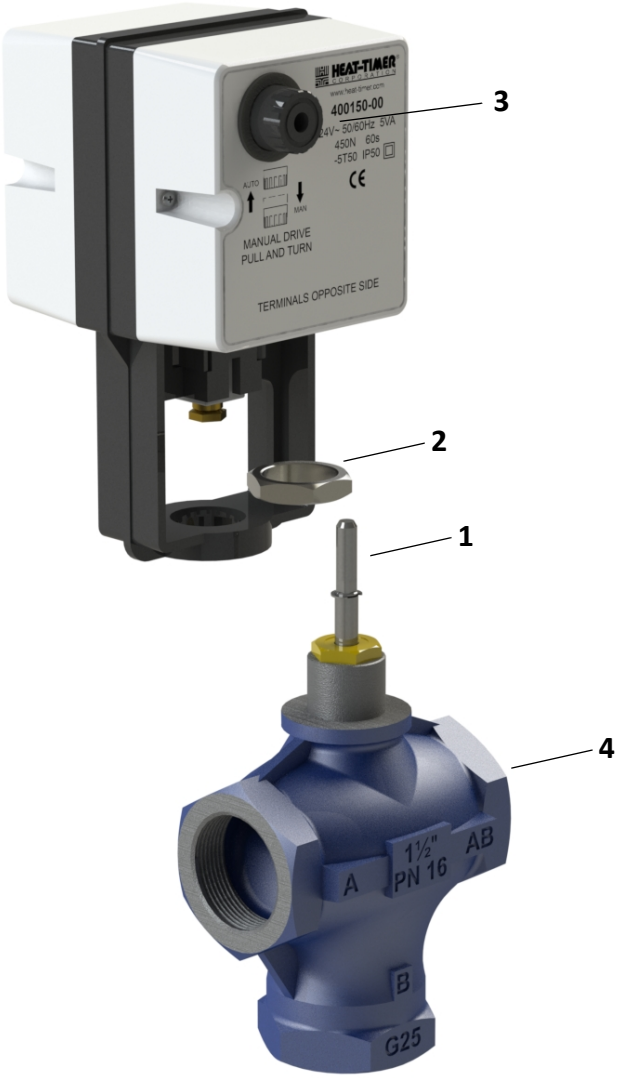


Figure 5: Mounting the Actuator to the Valve Stem

1. Manually push the valve stem (1) fully downward.
2. Remove the locking nut (2) from the valve body (4).
3. Manually position the actuator to its lowest position by pulling out and rotating the actuator control knob (3) clockwise - see page 5 for additional instructions on manual operation of the actuator.
4. Position the actuator onto the valve. Ensure the locking nut (2) is position between the actuator and valve.
5. Rotate the complete actuator CLOCKWISE to thread the valve stem extension onto the valve stem. **NOTE: Ensure the stem extension is fully screwed onto the valve stem and the actuator is seated on the valve body.**
6. Tighten the locking nut (2) onto the valve body so it is tightly securing the actuator to the valve body (4).

Wiring the Actuator

⚠ WARNING

ELECTRICAL SHOCK HAZARD! For your safety, to avoid the risk of electric shock, disconnect electrical power to the device before servicing or making any electrical connections. DO NOT re-connect electrical power until ALL wiring to the actuator is completed. Failure to do so may result in severe personal injury or death.

All wiring must meet or exceed all applicable local, state, and/or federal guidelines, codes, regulations, and laws.

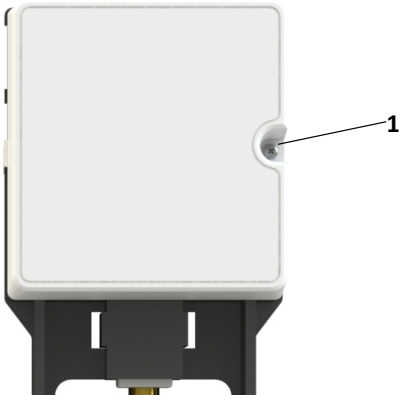
Mounting the Actuator Power Transformer

NOTE: Actuators must be powered using the provided 24Vac transformer(s). For configurations where a control device is operating two actuators in series, a single transformer can be used to power both actuators. If a control device is operating two actuators in parallel, external double-throw relays and two transformers (one for each actuator) must be installed.

1. Select an appropriate location to mount the provided 24Vac power transformer(s). The location must meet the following minimum requirements:
   - The location should be within close proximity of the actuator to reduce wiring length.
   - The mounting surface should be flat and strong enough to hold the weight of the transformer.
   - **DO NOT** mount the device in a location where it will be exposed to extreme heat, cold, humidity, or moisture.
2. Secure the transformer(s) to the mounting surface using two screws (not supplied).

Connecting the Actuator Wiring - Floating Actuator

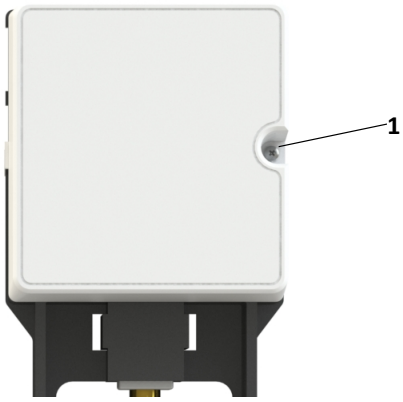
1. De-energize the circuit that will provide power to the actuator transformer by turning off the appropriate circuit breaker.
2. Using a Phillips screwdriver, remove the actuator faceplate screws (1) and then remove the actuator faceplate to expose the circuit board and wiring terminal (2).
3. Run the wiring from the Control through one of the actuator wiring entry fittings (3).
4. Connect the wiring from the Control OPEN and CLOSE terminals to the actuator wiring terminal using one of the options below:
   - **If connecting to a 2-way valve, or to a 3-way valve in the standard configuration (port A cold, port B hot), see Figure 8:**
     a. Connect the Control OPEN terminal to actuator terminal Y1.
     b. Connect the Control CLOSE terminal to actuator terminal Y2.
   - **If connecting to a 3-way valve in the alternate configuration (port A hot, port B cold), see Figure 9:**
     a. Connect the Control OPEN terminal to actuator terminal Y2.
     b. Connect the Control CLOSE terminal to actuator terminal Y1.

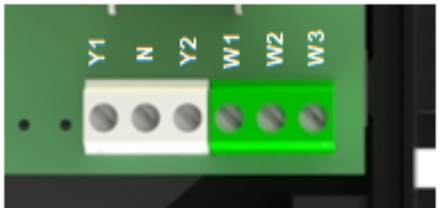


5. Connect the Control COMMON terminal to one of the transformer wires.
6. Run the other transformer wire through one of the actuator wiring entry fittings (3) and connect it to actuator terminal N.
7. Place the actuator faceplate on the actuator and secure it with four screws (1).
8. Restore power to the circuit powering the actuator transformer.

Connecting the Actuator Wiring - Floating Actuator with Feedback

1. De-energize the circuit that will provide power to the actuator transformer by turning off the appropriate circuit breaker.
2. Using a Phillips screwdriver, remove the four actuator faceplate screws (1) and then remove the actuator faceplate to expose the circuit board and wiring terminal (2).
3. Run the wiring from the Control through one of the actuator wiring entry fittings (3).
4. Connect the wiring from the Control OPEN and CLOSE terminals to the actuator wiring terminal using one of the options below:
   - **If connecting to a 2-way valve, or to a 3-way valve in the standard configuration (port A cold, port B hot), see Figure 8:**
     a. Connect the Control OPEN terminal to actuator terminal Y1.
     b. Connect the Control CLOSE terminal to actuator terminal Y2.
   - **If connecting to a 3-way valve in the alternate configuration (port A hot, port B cold), see Figure 9:**
     a. Connect the Control OPEN terminal to actuator terminal Y2.
     b. Connect the Control CLOSE terminal to actuator terminal Y1.

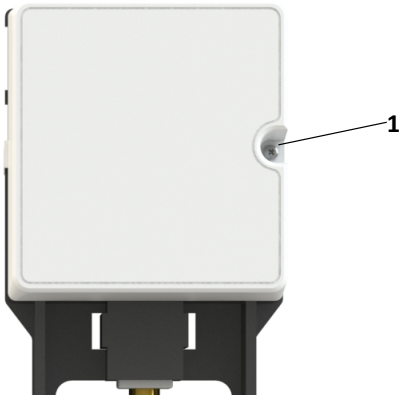




5. Connect the Control COMMON terminal to one of the transformer wires.
6. Run the other transformer wire through one of the actuator wiring entry fittings (3) and connect it to actuator terminal N.
7. Connect the Feedback signal wiring from the SRC Platinum Valve Position terminals to the actuator wiring terminal (4) as shown in Figure 10.
   SRC Platinum A4 terminal to Actuator W1 terminal - Valve OPEN
   SRC Platinum A5 terminal to Actuator W2 terminal - Common
   SRC Platinum A6 terminal to Actuator W3 terminal - Valve CLOSED
8. Place the actuator faceplate on the actuator and secure it with four screws (1).
9. Restore power to the circuit powering the actuator transformer.

Connecting the Actuator Wiring - Proportional

1. De-energize the circuit that will provide power to the actuator transformer by turning off the appropriate circuit breaker.
2. Using a Phillips screwdriver, remove the four actuator faceplate screws (1) and then remove the actuator faceplate to expose the circuit board and wiring terminal (2).
3. Run the wiring from the Control through one of the actuator wiring entry fittings (3).



4. Connect the 0-10V signal wiring from the Heat Timer Control voltage signal terminals to the actuator wiring terminal Y as shown in Figure 11.
   Ensure the Heat Timer Control voltage ground is wired to actuator terminal M as shown in Figure 11.

5. Connect the 24Vac power wiring from the Heat Timer Control terminals to the actuator terminals L1 and L2.
6. If the control input signal to the actuator is not 0-10V, the wiring remains the same as described in Step 4 and the selection of the input signal to the actuator must be revised as described in the section below. Otherwise skip to Step 7.
7. If the valve was installed as a 3-way valve in an alternate position as described on page 16, then the actuator direction setting must be revised. For detail instructions on actuator direction selection see section below. Otherwise skip to Step 8.
8. For valve position output signal, either 0 - 10V or 0-200 µA, the following terminals apply:
   - S1 is Common
   - S2 equals 10V or 200 µA when the valve stem is down
   - S3 equals 10V or 200 µA when the valve stem is up
8. Place the actuator faceplate on the actuator and secure it with four screws (1).
9. Restore power to the circuit powering the actuator transformer.

Selection of Input Signal - Proportional Actuator

Reference the SW1 terminals in Figure 6

The input signal for the actuator is factory default at 0-10V, however the actuator will accept other input signals. To set the actuator to other input signal settings, simply remove the jumper on 0-10V and move it to the appropriate selection.

For an input signal of 4-20mA, (2) jumpers are required. Move the jumper from the 0-10V setting and use the jumper currently at DIP.

Figure 6: SW1 Terminals

Selection of Valve Direction- Proportional Actuator

Reference the SW3 terminals in Figure 7

The actuator is currently defaulted to pull the valve stem up with a 10V signal or high input signal if other input signals are used. The actuator will push the valve stem down with a 0V signal or low input signal if other input signal is used.

If the valve is installed in an alternate 3-way configuration as describe in Table 1 on page 16 then the jumper placed on A terminal must be move to the C terminals. The terminal between A and C is a common terminal and must be included in either setting.

Figure 7: SW3 Terminals

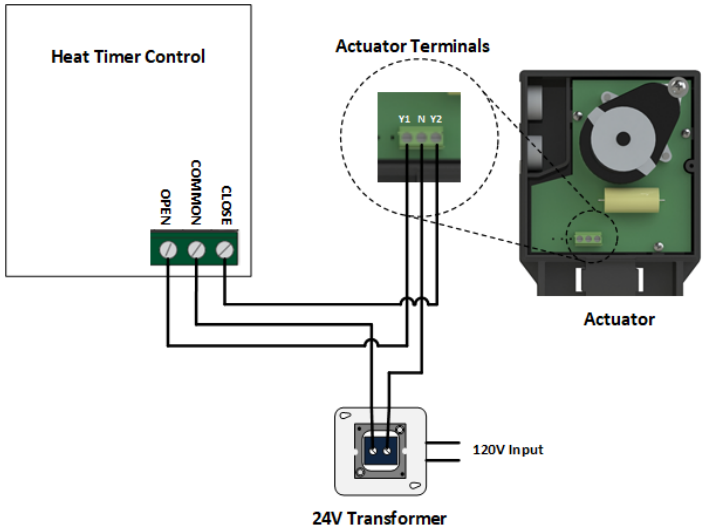


Figure 8: Actuator Wiring Diagram – 3-Way Valve or 2-Way Valve Standard Configuration

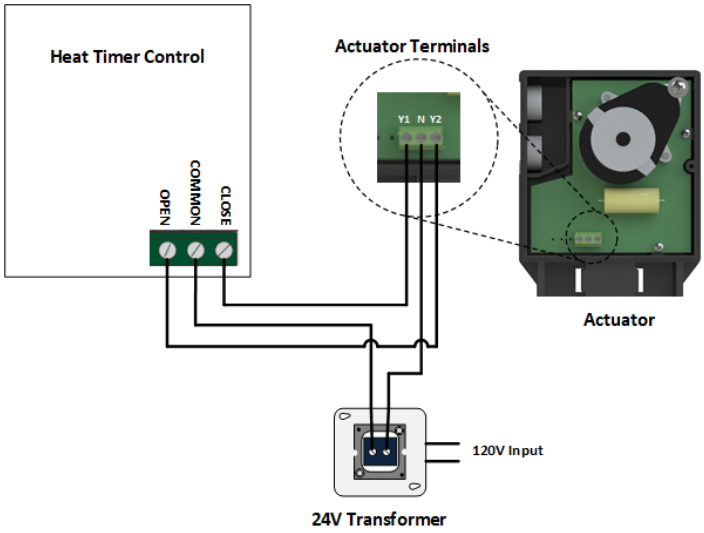


Figure 9: Actuator Wiring Diagram – 3-Way Valve Alternate Configuration

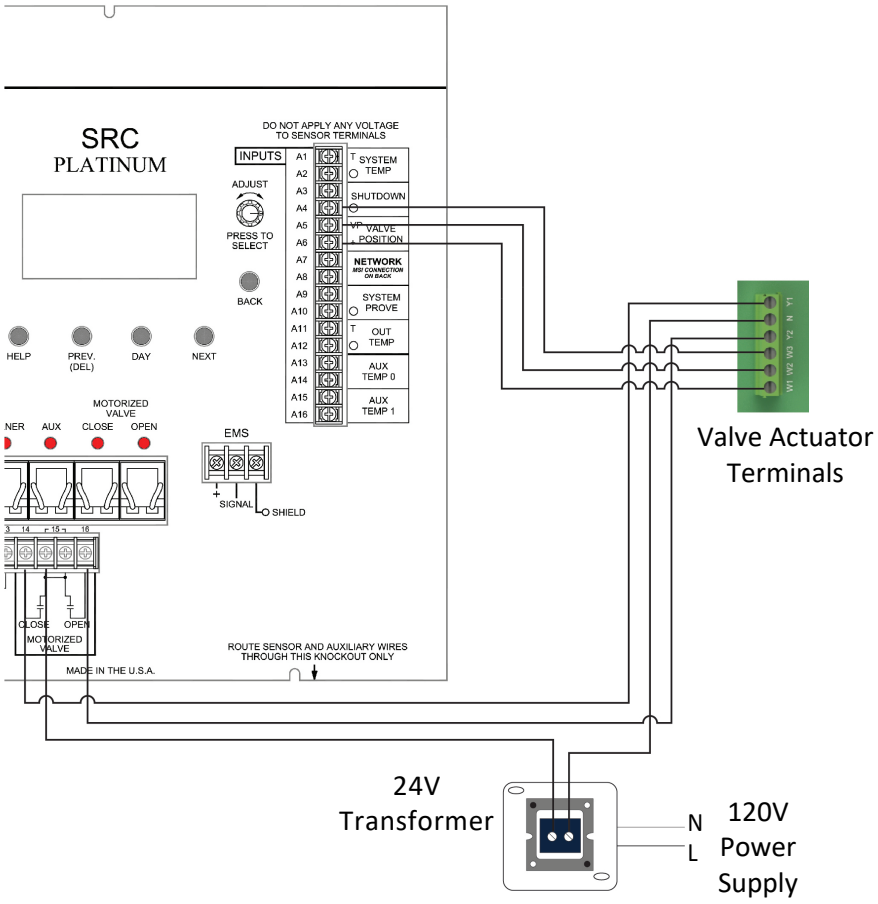


Figure 10: Actuator Wiring Diagram – Floating Actuator with Feedback and SRC Platinum

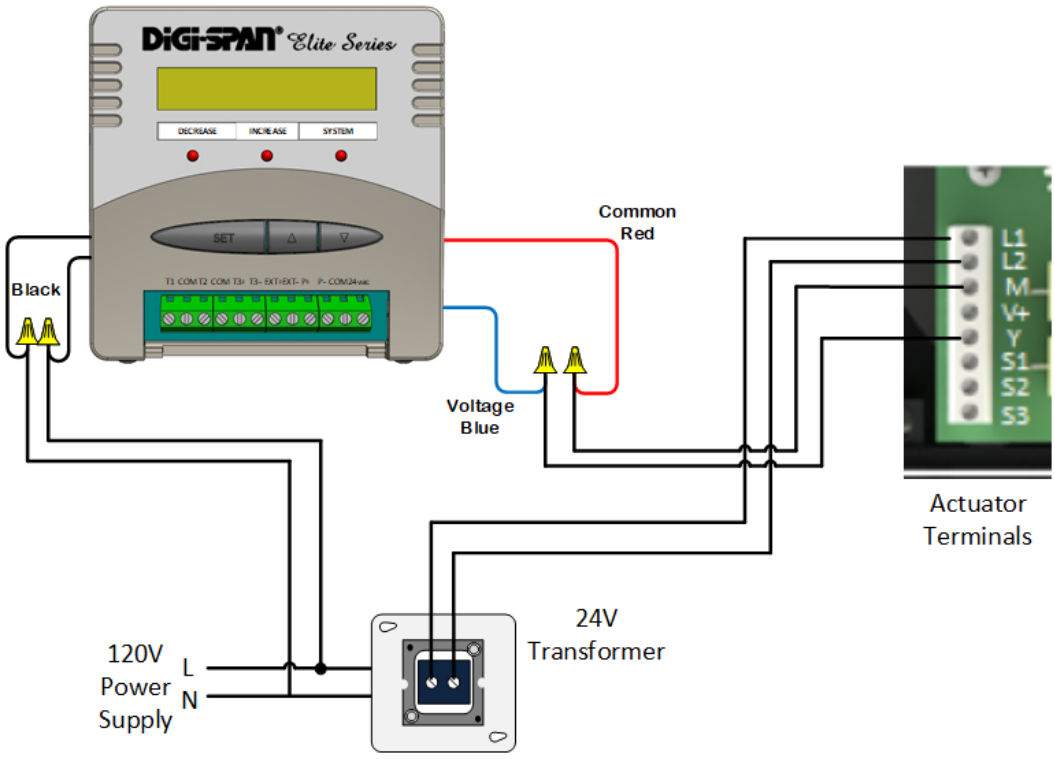


Figure 11: Actuator Wiring Diagram – Proportional Actuator and Digi Span MCA

Troubleshooting

2-Way Converted Actuator Valve Installations

Symptom	Possible Cause	Recommended Action(s)
Loud banging noise.	Valve not installed on a horizontal pipe.	Verify the valve is installed on a horizontal pipe . Refer to the precautions listed on page 14.
	Condensate draining back against the valve when closed, causing steam to flash the condensate when the valve opens.	Ensure no condensate will drain back against the valve when closed.

3-Way Actuator Valve Installations

Symptom	Possible Cause	Recommended Action(s)
Water getting hotter when the valve closes.	Incorrect valve port used.	Ensure the valve was installed using the correct valve ports . Refer to Table 1 on page 14.
Difficult to control water temperature.	Pump installed before any hot or cold water input ports.	Ensure the pump is installed after the valve discharge port. **CAUTION! Installing the pump before the input ports may result in pump failure or damage to the valve when the valve is either fully open or closed.** Refer to the precautions listed on page 14.
Valve does not close.	Pump installed before the hot water input port. Valve actuator does not have the force to close the valve against pump flow.	Ensure the pump is installed after the valve discharge port . Refer to the precautions listed on page 14.

NOTES

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