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# The Complete Erie Product Family

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### Application

PopTop™ Series valve bodies and actuators provide easy installation for a variety of heating and cooling applications.

Valve's actuator can be installed after valve body has been installed onto fan coil, baseboard or air handler.

VS Series valves are available for low pressure steam applications.

### Features

- Direct replacement for all existing two-position PopTop applications
- Hysteresis synchronous motor for long life
- Spring return operation
- Valve body rated for 300 psig static pressure
- Available in a variety of voltages
- Actuator mounts directly onto the valve body without the need for linkages or calibration
- Manual override lever (normally closed only)
- Actuator can be replaced without any tools, or removal of the valve from the system
- VS Series valve available for low pressure steam

### Actuator Specifications

**Voltage:** 24 Vac @ 50/60 Hz., 110 Vac @ 50 Hz. and 120 Vac @ 60Hz., 230 Vac @ 50 Hz. and 240 Vac @ 60 Hz., 208 Vac @ 50/60 Hz., 277 Vac @ 50/60 Hz.

**Power Requirements:** 6.5 watts, 7.5 Va.

**End Switch:** 24 to 240 Vac Models: 24 to 240 Vac/101 mA minimum to 5 A maximum, and 9 to 36 Vdc @100 mA maximum.

277 Vac Models: 277 Vac/101 mA minimum to 5 A maximum.

**Control Signal:** On/off, 2 position, spring return.

**Timing, Full Open to Full Close:** 25 Sec maximum for 60 Hz; 30 Sec maximum for 50 Hz; and 9 Sec maximum spring return.

**Materials:** Stainless steel base plate, aluminum cover.

**Ambient Temperature Limits:**

**Shipping & Storage,**

-40 to 160 °F (-40 to 71 °C).

**Operating,**

Refer to Table 1.

**Humidity:** 5 to 95% relative humidity, non-condensing.

**Agency Listings:** *UL873:* Underwriters laboratories (File #E9429 Category Temperature Indicating and Regulating Equipment) *CUL:* UL Listed for use in Canada by Underwriters Laboratory. Canadian Standards C22.2 No. 24. *European Community:* EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC). *Australia:* This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radio Communications Act of 1992.

**Shipping Weight (Actuator/Valve Assy.):** 2.25 lbs (1020 g).



**VT/VS Series Valve with General Close-Off Actuator AG Series**



**VT/VS Series Valve with High Close-Off Actuator AH Series**

**TABLE 1. Operating Temperature Range**

| Model   | Valve Body Temperature Range  |
|---------|---|
| VTxxxx  | 32 to 200 °F (fluid) @ 104 °F (Ambient) (0 to 93 °C @ 40 °C)  |
| VSxxxx  | 32 to 250 °F (fluid) @ 169 °F (Ambient) (0 to 121 °C @ 76 °C), and/or 15 PSI (103 kPa) Steam <sup>a</sup> |
| Model   | Actuator Temperature Range  |
| Axx3xxx | 32 to 200 °F (fluid) @ 104 °F (Ambient) (0 to 93 °C @ 40 °C)  |
| Axx4xxx | 32 to 250 °F (fluid) @ 169 °F (Ambient) (0 to 121 °C @ 76 °C), and/or 15 PSI (103 kPa) Steam <sup>a</sup> |

<sup>a</sup> For steam applications, both valve body and valve actuator must be rated for high temperature.

### Specifications for Valve Body Assemblies

**Service:** Hot and chilled water models, up to 50% glycol.

Steam models up to 15 psi (both valve body and valve actuator must be rated for steam).

**System Static Pressure Limits:** 300 psig (2068 kPa).

**Close-off:** Refer to Table 3.

**Fluid/Ambient Temperature Limits:** Refer to Table 1.

**Seat Leakage:** ANSI class IV (0.01%) with pressure at inlet (B-port/A-port if 3-way).

**Body :** Forged brass.

**Stem:** Nickel-plated.

**Seat:** Brass.

**Paddle (VT series):** Buna N.

**Paddle (VS series):** Highly saturated nitrile.

### Accessories

|           |  |
|-----------|--|
| 436-214-1 | Union nut & elbow assembly, female for 1/2" (5/8" O.D.) copper, 15/16" long      |
| 436-214-4 | Union nut & elbow assembly, male for 1/2" (5/8" O.D.) copper, 1-15/16" long      |
| 436-220   | Union nut & coupling assembly, female for 1/2" (5/8" O.D.) copper, 1-1/16" long  |
| 436-229-3 | Union nut & nipple assembly, male for 1/2" (5/8" O.D.) copper, 3" long           |
| 436-252   | Union nut & coupling assembly, female for 3/4" (7/8" O.D.) copper, 1-27/32" long |
| 436-256   | Union nut & coupling assembly, female for 1" (1-1/8" O.D.) copper, 1-3/8" long   |

# Two Position Zone Valve with Actuator, Spring Return AG, AH Series



**TABLE 2.** Water Valve Sizing (gallons per minute)

|                                   | $\Delta P$ | 1.0 Cv | 1.5 Cv | 2.5 Cv | 3.0 Cv | 3.5 Cv | 4.0 Cv | 5.0 Cv | 7.5 Cv | 8.0 Cv |
|-----------------------------------|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Differential Pressure, $\Delta P$ | 1 PSI      | 1.0    | 1.5    | 2.5    | 3.0    | 3.5    | 4.0    | 5.0    | 7.5    | 8.0    |
|                                   | 2 PSI      | 1.4    | 2.1    | 3.5    | 4.2    | 4.9    | 5.7    | 7.1    | 10.6   | 11.3   |
|                                   | 3 PSI      | 1.7    | 2.6    | 4.3    | 5.2    | 6.1    | 6.9    | 8.7    | 13.0   | 13.9   |
|                                   | 4 PSI      | 2.0    | 3.0    | 5.0    | 6.0    | 7.0    | 8.0    | 10.0   | 15.0   | 16.0   |
|                                   | 5 PSI      | 2.2    | 3.4    | 5.6    | 6.7    | 7.8    | 8.9    | 11.2   | 16.8   | 17.9   |

$$GPM = Cv \sqrt{\Delta P}$$

**TABLE 3.** AG, AH Series Flow Coefficients and Maximum Close-Off Pressure

| Valve Size | Connection Type      | 2-way Cv (kv) | 3-way Cv (kv) | (G) <sup>a</sup> Close-Off $\Delta P$<br>PSI (kPa) | (H) <sup>b</sup> Close-Off $\Delta P$<br>PSI (kPa) |
|------------|----------------------|---------------|---------------|--|--|
| 1/2"       | NPT, SW, SAE, and Rp | 1.0 (0.9)     | 1.5 (1.3)     | 60 (414)   | 75 (517)   |
| 3/4"       | IFL                  |               |               |  |  |
| 1/2"       | NPT, SW, SAE, and Rp | 2.5 (2.2)     | 3.0 (2.6)     | 40 (276)   | 50 (344)   |
| 3/4"       | NPT, SW, IFL, and Rp |               |               |  |  |
| 1/2"       | NPT, SW, SAE, and Rp | 3.5 (3.0)     | 4.0 (3.4)     | 25 (172)   | 30 (208)   |
| 3/4"       | NPT, SW, IFL, and Rp |               |               |  |  |
| 1"         | SW                   | 5.0 (4.3)     | 5.0 (4.3)     | 20 (137)   | 25 (172)   |
| 3/4"       | NPT, SW, and Rp      |               |               |  |  |
| 1"         | SW                   | 7.5 (6.5)     | 7.5 (6.5)     | 17 (117)   | 20 (137)   |
| 3/4"       | NPT, SW, and Rp      |               |               |  |  |
| 1"         | SW                   | 8.0 (6.9)     | 8.0 (6.9)     | 17 (117)   | 20 (137)   |
| 1"         | NPT and Rp           |               |               |  |  |
| 1-1/4"     | SW                   |               |               |  |  |

## Valve Body Legend

NPT — Threaded (female)  
 SW — Sweat  
 IFL — Inverted Flare  
 SAE — Society Automotive Engineers Flare (male)  
 Rp — "Metric" Threaded (female)

<sup>a</sup> G = General close-off actuator

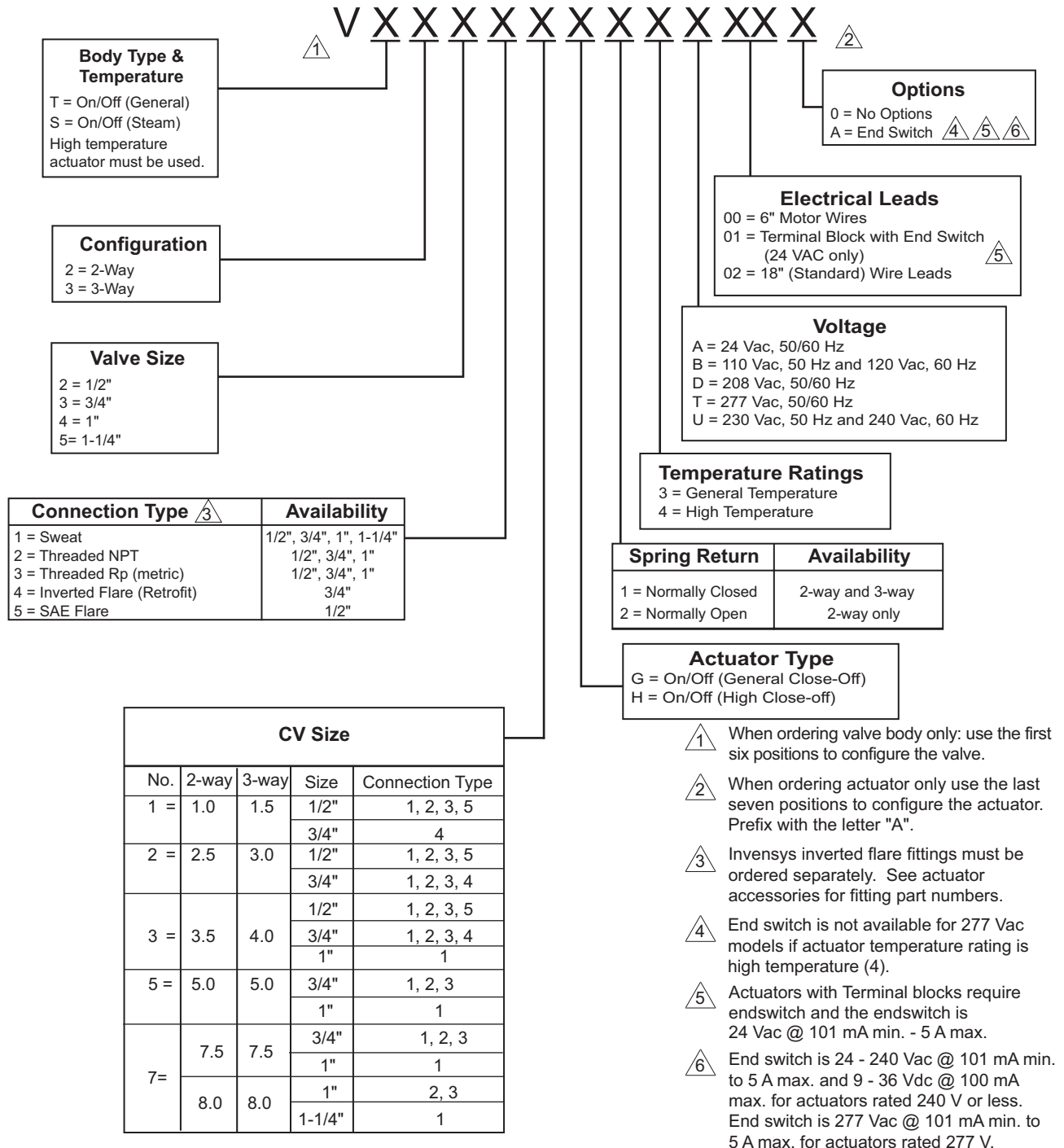
<sup>b</sup> H = High close-off actuator





# Two Position Zone Valve Two-Way and Three-Way VT, VS Series

## Part Numbering System Two Position Zone Valves, Spring Return Actuators



### Body & Actuator Combination Requirements

#### Temperature Configurations

Body Configuration

V I X X X X

T = General

S = Steam

If body configuration is T, actuator temp rating can be 3 or 4.

If body configuration is S, actuator temp rating must be 4.

Actuator Spring Return Mode

A X X 3 X X X X

3 = General Temperature

4 = High Temperature

If actuator temp rating is 3, body style must be T.

If actuator temp rating is 4, body style can be S or T.

# Two Position Zone Valve Two-Way and Three-Way

## VT, VS Series



**Two-Way Zone Valve**



**Three-Way Zone Valve**

**TABLE 4.** PopTop On/Off Actuator Model Number Selection Guide.

| VT          | 2             | 2                       | 1                              | 1   |                 |
|-------------|---------------|-------------------------|--------------------------------|-----|-----------------|
| Temp Rating | Configuration | Size                    | Connection                     | Cv  | 2-Way 3-Way     |
|             |               | 2 = 1/2"                | 1 = Sweat                      | 1 = | 1.0 1.5         |
| T = General | 2 = 2-Way     | 3 = 3/4"                | 2 = NPT (female)               | 2 = | 2.5 3.0         |
| S = Steam   | 3 = 3-Way     | 4 = 1"                  | 3 = Rp (female)                | 3 = | 3.5 4.0         |
|             |               | 5 = 1-1/4" (Sweat Only) | 4 = Inverted Flare (3/4" only) | 5 = | 5.0 5.0         |
|             |               |                         | 5 = SAE Flare (1/2" only)      | 7 = | 7.5/8.0 7.5/8.0 |

| Catalog Part Number                                      | Fitting Size | Type           | Cv  |
|--|--------------|----------------|-----|
| <b>2-Way PopTop On/Off Two Position, Valve Body Only</b> |              |                |     |
| VT2211   | 1/2"         | Sweat          | 1.0 |
| VT2212   |              |                | 2.5 |
| VT2213   |              |                | 3.5 |
| VT2221   |              | NPT            | 1.0 |
| VT2222   |              |                | 2.5 |
| VT2223   |              |                | 3.5 |
| VT2231   |              | Rp             | 1.0 |
| VT2232   |              |                | 2.5 |
| VT2233   |              |                | 3.5 |
| VT2251   |              | SAE            | 1.0 |
| VT2252   |              |                | 2.5 |
| VT2253   |              |                | 3.5 |
| VT2312   | 3/4"         | Sweat          | 2.5 |
| VT2313   |              |                | 3.5 |
| VT2315   |              |                | 5.0 |
| VT2317   |              |                | 7.5 |
| VT2322   |              | NPT            | 2.5 |
| VT2323   |              |                | 3.5 |
| VT2325   |              |                | 5.0 |
| VT2327   |              |                | 7.5 |
| VT2332   |              | Rp             | 2.5 |
| VT2333   |              |                | 3.5 |
| VT2335   |              |                | 5.0 |
| VT2337   |              |                | 7.5 |
| VT2341   |              | Inverted Flare | 1.0 |
| VT2342   |              |                | 2.5 |
| VT2343   |              |                | 3.5 |
| VT2415   | 1"           | Sweat          | 5.0 |
| VT2417   |              |                | 7.5 |
| VT2427   |              | NPT            | 8.0 |
| VT2437   |              | Rp             |     |
| VT2517   | 1-1/4"       | Sweat          |     |

| Catalog Part Number                                      | Fitting Size | Type           | Cv  |
|--|--------------|----------------|-----|
| <b>3-Way PopTop On/Off Two Position, Valve Body Only</b> |              |                |     |
| VT3211   | 1/2"         | Sweat          | 1.5 |
| VT3212   |              |                | 3.0 |
| VT3213   |              |                | 4.0 |
| VT3221   |              | NPT            | 1.5 |
| VT3222   |              |                | 3.0 |
| VT3223   |              |                | 4.0 |
| VT3231   |              | Rp             | 1.5 |
| VT3232   |              |                | 3.0 |
| VT3233   |              |                | 4.0 |
| VT3251   |              | SAE            | 1.5 |
| VT3252   |              |                | 3.0 |
| VT3253   |              |                | 4.0 |
| VT3312   | 3/4"         | Sweat          | 3.0 |
| VT3313   |              |                | 4.0 |
| VT3315   |              |                | 5.0 |
| VT3317   |              |                | 7.5 |
| VT3322   |              | NPT            | 3.0 |
| VT3323   |              |                | 4.0 |
| VT3325   |              |                | 5.0 |
| VT3327   |              |                | 7.5 |
| VT3332   |              | Rp             | 3.0 |
| VT3333   |              |                | 4.0 |
| VT3335   |              |                | 5.0 |
| VT3337   |              |                | 7.5 |
| VT3341   |              | Inverted Flare | 1.5 |
| VT3342   |              |                | 3.0 |
| VT3343   |              |                | 4.0 |
| VT3415   | 1"           | Sweat          | 5.0 |
| VT3417   |              |                | 7.5 |
| VT3427   |              | NPT            | 8.0 |
| VT3437   |              | Rp             |     |
| VT3517   | 1-1/4"       | Sweat          |     |

**TABLE 5.** Options Available: Modify model numbers as shown.

| Options | Select             |
|---------|--------------------|
| V_XXXX  | For Steam, use "S" |

# Two Position Spring Return Actuators

## AG, AH Series



**AG Series Actuator**



**AH Series Actuator**

**TABLE 6.** PopTop On/Off Actuator Model Number Selection Guide.

| AG  | 1   | 3  | A  | 02  | 0  |
|---|---|--|--|---|--|
| Type/Close-Off  | Action  | Temp                                       | Voltage  | Electrical Connection   | Options                                  |
| <b>G</b> = On/Off General Close-Off<br><b>H</b> = On/Off "HCO" High Close-Off | <b>1</b> = Normally Closed (2-Way and 3-Way)<br><b>2</b> = Normally Opened (2-Way only) | <b>3</b> = General<br><b>4</b> = High Temp | <b>A</b> = 24 V @ 50/60 Hz<br><b>B</b> = 110 @ 50 Hz<br>120 V @ 60 Hz<br><b>D</b> = 208 V @ 50/60 Hz<br><b>U</b> = 230 V @ 50 Hz<br>240 V @ 60 Hz<br><b>T</b> = 277 V @ 50/60 Hz | <b>00</b> = 6" Motor Wires<br><b>01</b> = Terminal Block, w/End Switch<br><b>02</b> = 18" Wires | <b>0</b> = None<br><b>A</b> = End Switch |

| General Close-Off, Two-Position, Power Open or Close (25 Sec. Maximum @ 60 Hz), Spring Return Open or Close (9 Sec. Maximum) |          |            |             |                            |          |            |             |
|--|----------|------------|-------------|----------------------------|----------|------------|-------------|
| Normally Closed <sup>a</sup>   |          |            |             | Normally Open <sup>b</sup> |          |            |             |
| Model No.  | Volts AC | End Switch | Wiring      | Model No.                  | Volts AC | End Switch | Wiring      |
| AG13A01A   | 24       | •          | Term. Block | AG23A01A                   | 24       | •          | Term. Block |
| AG14A01A   | 24       | •          | Term. Block | AG24A01A                   | 24       | •          | Term. Block |
| AG13A020   | 24       |            | 18" Leads   | AG23A020                   | 24       |            | 18" Leads   |
| AG13A02A   | 24       | •          |             | AG23A02A                   | 24       | •          |             |
| AG14A02A   | 24       | •          |             | AG24A02A                   | 24       | •          |             |
| AG13B020   | 120      |            |             | AG23B020                   | 120      |            |             |
| AG13B02A   | 120      | •          |             | AG23B02A                   | 120      | •          |             |
| AG14B02A   | 120      | •          |             | AG24B02A                   | 120      | •          |             |
| AG13D020   | 208      |            |             | AG23D020                   | 208      |            |             |
| AG13D02A   | 208      | •          |             | AG23D02A                   | 208      | •          |             |
| AG14D02A   | 208      | •          |             | AG24D02A                   | 208      | •          |             |
| AG13T020   | 277      |            |             | AG23T020                   | 277      |            |             |
| AG13T02A   | 277      | •          |             | AG23T02A                   | 277      | •          |             |
| AG13U020   | 230      |            |             | AG23U020                   | 230      |            |             |
| AG13U02A   | 230      | •          |             | AG23U02A                   | 230      | •          |             |
| AG14U02A   | 230      | •          |             | AG24U02A                   | 230      | •          |             |
| AG14A020   | 24       |            |             | AG24A020                   | 24       |            |             |
| AG14B020   | 120      |            |             | AG24B020                   | 120      |            |             |
| AG14D020   | 208      |            |             | AG24D020                   | 208      |            |             |
| AG14T020   | 277      |            |             | AG24T020                   | 277      |            |             |
| AG14U020   | 230      |            |             | AG24U020                   | 230      |            |             |

<sup>a</sup> 2-way or 3-way valve.

<sup>b</sup> 2-way valve only.

| High Close-Off, Two-Position, Power Open or Close (25 Sec. Maximum @ 60 Hz), Spring Return Open or Close (9 Sec. Maximum) |          |            |             |                            |          |            |             |
|---|----------|------------|-------------|----------------------------|----------|------------|-------------|
| Normally Closed <sup>a</sup>  |          |            |             | Normally Open <sup>b</sup> |          |            |             |
| Model No.   | Volts AC | End Switch | Wiring      | Model No.                  | Volts AC | End Switch | Wiring      |
| AH13A01A  | 24       | •          | Term. Block | AH23A01A                   | 24       | •          | Term. Block |
| AH14A01A  | 24       | •          | Term. Block | AH24A01A                   | 24       | •          | Term. Block |
| AH13A020  | 24       |            | 18" Leads   | AH23A020                   | 24       |            | 18" Leads   |
| AH13A02A  | 24       | •          |             | AH23A02A                   | 24       | •          |             |
| AH14A02A  | 24       | •          |             | AH24A02A                   | 24       | •          |             |
| AH13B020  | 120      |            |             | AH23B020                   | 120      |            |             |
| AH13B02A  | 120      | •          |             | AH23B02A                   | 120      | •          |             |
| AH14B02A  | 120      | •          |             | AH24B02A                   | 120      | •          |             |
| AH13D020  | 208      |            |             | AH23D020                   | 208      |            |             |
| AH13D02A  | 208      | •          |             | AH23D02A                   | 208      | •          |             |
| AH14D02A  | 208      | •          |             | AH24D02A                   | 208      | •          |             |
| AH13T020  | 277      |            |             | AH23T020                   | 277      |            |             |
| AH13T02A  | 277      | •          |             | AH23T02A                   | 277      | •          |             |
| AH13U020  | 230      |            |             | AH23U020                   | 230      |            |             |
| AH13U02A  | 230      | •          |             | AH23U02A                   | 230      | •          |             |
| AH14U02A  | 230      | •          |             | AH24U02A                   | 230      | •          |             |
| AH14A020  | 24       |            |             | AH24A020                   | 24       |            |             |
| AH14B020  | 120      |            |             | AH24B020                   | 120      |            |             |
| AH14D020  | 208      |            |             | AH24D020                   | 208      |            |             |
| AH14T020  | 277      |            |             | AH24T020                   | 277      |            |             |
| AH14U020  | 230      |            |             | AH24U020                   | 230      |            |             |

<sup>a</sup> 2-way or 3-way valve.

<sup>b</sup> 2-way valve only.

# Two Position Spring Return PopTop, Two-Way and Three-Way VT, VS General Assemblies



**VT/VS Series Valves with  
General Close-Off Actuator**

| General Close-Off Valve and Actuator Assemblies |        |            |     |                            |
|---|--------|------------|-----|----------------------------|
| 2-Way Normally Closed                           |        |            |     |                            |
| Catalog Part Number                             | Size   | Type       | Cv  | MOPD <sup>a</sup><br>(PSI) |
| VT2211G13A020                                   | 1/2"   | Sweat      | 1.0 | 60                         |
| VT2212G13A020                                   |        |            | 2.5 | 40                         |
| VT2213G13A020                                   |        |            | 3.5 | 25                         |
| VT2221G13A020                                   |        | NPT        | 1.0 | 60                         |
| VT2222G13A020                                   |        |            | 2.5 | 40                         |
| VT2223G13A020                                   |        |            | 3.5 | 25                         |
| VT2231G13U020                                   |        | Rp         | 1.0 | 60                         |
| VT2232G13U020                                   |        |            | 2.5 | 40                         |
| VT2233G13U020                                   |        |            | 3.5 | 25                         |
| VT2251G13A020                                   |        | SAE        | 1.0 | 60                         |
| VT2252G13A020                                   |        |            | 2.5 | 40                         |
| VT2253G13A020                                   |        |            | 3.5 | 25                         |
| VT2312G13A020                                   | 3/4"   | Sweat      | 2.5 | 40                         |
| VT2313G13A020                                   |        |            | 3.5 | 25                         |
| VT2315G13A020                                   |        |            | 5.0 | 20                         |
| VT2317G13A020                                   |        |            | 7.5 | 17                         |
| VT2322G13A020                                   |        | NPT        | 2.5 | 40                         |
| VT2323G13A020                                   |        |            | 3.5 | 25                         |
| VT2325G13A020                                   |        |            | 5.0 | 20                         |
| VT2327G13A020                                   |        |            | 7.5 | 17                         |
| VT2332G13U020                                   |        | Rp         | 2.5 | 40                         |
| VT2333G13U020                                   |        |            | 3.5 | 25                         |
| VT2335G13U020                                   |        |            | 5.0 | 20                         |
| VT2337G13U020                                   |        |            | 7.5 | 17                         |
| VT2341G13A020                                   |        | Inv. Flare | 1.0 | 60                         |
| VT2342G13A020                                   |        |            | 2.5 | 40                         |
| VT2343G13A020                                   |        |            | 3.5 | 25                         |
| VT2415G13A020                                   | 1"     | Sweat      | 5.0 | 20                         |
| VT2417G13A020                                   |        | NPT        | 7.5 | 17                         |
| VT2427G13A020                                   |        | Rp         | 8.0 | 17                         |
| VT2437G13U020                                   | 1-1/4" | Sweat      | 8.0 | 17                         |

| General Close-Off Valve and Actuator Assemblies |        |       |     |                            |
|---|--------|-------|-----|----------------------------|
| 3-Way Normally Closed                           |        |       |     |                            |
| Catalog Part Number                             | Size   | Type  | Cv  | MOPD <sup>a</sup><br>(PSI) |
| VT3211G13A020                                   | 1/2"   | Sweat | 1.5 | 60                         |
| VT3212G13A020                                   |        |       | 3.0 | 40                         |
| VT3213G13A020                                   |        |       | 4.0 | 25                         |
| VT3221G13A020                                   |        | NPT   | 1.5 | 60                         |
| VT3222G13A020                                   |        |       | 3.0 | 40                         |
| VT3223G13A020                                   |        |       | 4.0 | 25                         |
| VT3231G13U020                                   |        | Rp    | 1.5 | 60                         |
| VT3232G13U020                                   |        |       | 3.0 | 40                         |
| VT3233G13U020                                   |        |       | 4.0 | 25                         |
| VT3251G13A020                                   |        | SAE   | 1.5 | 60                         |
| VT3252G13A020                                   |        |       | 3.0 | 40                         |
| VT3253G13A020                                   |        |       | 4.0 | 25                         |
| VT3312G13A020                                   | 3/4"   | Sweat | 3.0 | 40                         |
| VT3313G13A020                                   |        |       | 4.0 | 25                         |
| VT3315G13A020                                   |        |       | 5.0 | 20                         |
| VT3317G13A020                                   |        |       | 7.5 | 17                         |
| VT3322G13A020                                   |        | NPT   | 3.0 | 40                         |
| VT3323G13A020                                   |        |       | 4.0 | 25                         |
| VT3325G13A020                                   |        |       | 5.0 | 20                         |
| VT3327G13A020                                   |        |       | 7.5 | 17                         |
| VT3332G13U020                                   |        | Rp    | 3.0 | 40                         |
| VT3333G13U020                                   |        |       | 4.0 | 25                         |
| VT3335G13U020                                   |        |       | 5.0 | 20                         |
| VT3337G13U020                                   |        |       | 7.5 | 17                         |
| VT3341G13A020                                   |        | SAE   | 1.5 | 60                         |
| VT3342G13A020                                   |        |       | 3.0 | 40                         |
| VT3343G13A020                                   |        |       | 4.0 | 25                         |
| VT3415G13A020                                   | 1"     | Sweat | 5.0 | 20                         |
| VT3417G13A020                                   |        | NPT   | 7.5 | 17                         |
| VT3427G13A020                                   |        | Rp    | 8.0 | 17                         |
| VT3437G13U020                                   | 1-1/4" | Sweat | 8.0 | 17                         |

<sup>a</sup> MOPD = Maximum Operating Pressure Differential

**TABLE 1.** Options Available: Modify model numbers as shown below.

| Options        | Select  |
|----------------|---|
| V_ xxxxGx4xxxx | For Steam, use "S".   |
| VT2xxxG_ xxxxx | For Normally Open (2-Way only) use "2".   |
| VTxxxxGxxx_    | For Terminal Block with End Switch use "01A".   |
| VTxxxxGxx_ xxx | For Voltage Selection use the following:<br>"A" = 24 Vac, 50/60 Hz "B" = 110 Vac, 50 Hz and 120 Vac, 60 Hz "D" = 208 Vac, 50/60 Hz<br>"T" = 277 Vac, 50/60 Hz "U" = 230Vac, 50 Hz and 240 Vac, 60 Hz. |
| VTxxxxGxxxxx_  | For End Switch use "A".   |

**Note:** For complete part number configuration see the Part Numbering System on page 3.



**VT/VS Series Valves with  
High Close-Off Actuator**

| High Close-Off Valve and Actuator Assemblies |        |            |     |                            |
|--|--------|------------|-----|----------------------------|
| 2-Way Normally Closed                        |        |            |     |                            |
| Catalog Part Number                          | Size   | Type       | Cv  | MOPD <sup>a</sup><br>(PSI) |
| VT2211H13A020                                | 1/2"   | Sweat      | 1.0 | 75                         |
| VT2212H13A020                                |        |            | 2.5 | 50                         |
| VT2213H13A020                                |        |            | 3.5 | 30                         |
| VT2221H13A020                                |        | NPT        | 1.0 | 75                         |
| VT2222H13A020                                |        |            | 2.5 | 50                         |
| VT2223H13A020                                |        |            | 3.5 | 30                         |
| VT2231H13U020                                |        | Rp         | 1.0 | 75                         |
| VT2232H13U020                                |        |            | 2.5 | 50                         |
| VT2233H13U020                                |        |            | 3.5 | 30                         |
| VT2251H13A020                                |        | SAE        | 1.0 | 75                         |
| VT2252H13A020                                |        |            | 2.5 | 50                         |
| VT2253H13A020                                |        |            | 3.5 | 30                         |
| VT2312H13A020                                | 3/4"   | Sweat      | 2.5 | 50                         |
| VT2313H13A020                                |        |            | 3.5 | 30                         |
| VT2315H13A020                                |        |            | 5.0 | 25                         |
| VT2317H13A020                                |        |            | 7.5 | 20                         |
| VT2322H13A020                                |        | NPT        | 2.5 | 50                         |
| VT2323H13A020                                |        |            | 3.5 | 30                         |
| VT2325H13A020                                |        |            | 5.0 | 25                         |
| VT2327H13A020                                |        |            | 7.5 | 20                         |
| VT2332H13U020                                |        | Rp         | 2.5 | 50                         |
| VT2333H13U020                                |        |            | 3.5 | 30                         |
| VT2335H13U020                                |        |            | 5.0 | 25                         |
| VT2337H13U020                                |        |            | 7.5 | 20                         |
| VT2341H13A020                                |        | Inv. Flare | 1.0 | 75                         |
| VT2342H13A020                                |        |            | 2.5 | 50                         |
| VT2343H13A020                                |        |            | 3.5 | 30                         |
| VT2415H13A020                                |        | Sweat      | 5.0 | 25                         |
| VT2417H13A020                                |        |            | 7.5 | 20                         |
| VT2427H13A020                                |        | NPT        | 8.0 | 20                         |
| VT2437H13U020                                |        |            | 8.0 | 20                         |
| VT2517H13A020                                | 1-1/4" | Sweat      | 8.0 | 20                         |

<sup>a</sup> MOPD = Maximum Operating Pressure Differential

| High Close-Off Valve and Actuator Assemblies |        |       |     |                            |
|--|--------|-------|-----|----------------------------|
| 3-Way Normally Closed                        |        |       |     |                            |
| Catalog Part Number                          | Size   | Type  | Cv  | MOPD <sup>a</sup><br>(PSI) |
| VT3211H13A020                                | 1/2"   | Sweat | 1.5 | 75                         |
| VT3212H13A020                                |        |       | 3.0 | 50                         |
| VT3213H13A020                                |        |       | 4.0 | 30                         |
| VT3221H13A020                                |        | NPT   | 1.5 | 75                         |
| VT3222H13A020                                |        |       | 3.0 | 50                         |
| VT3223H13A020                                |        |       | 4.0 | 30                         |
| VT3231H13U020                                |        | Rp    | 1.5 | 75                         |
| VT3232H13U020                                |        |       | 3.0 | 50                         |
| VT3233H13U020                                |        |       | 4.0 | 30                         |
| VT3251H13A020                                |        | SAE   | 1.5 | 75                         |
| VT3252H13A020                                |        |       | 3.0 | 50                         |
| VT3253H13A020                                |        |       | 4.0 | 30                         |
| VT3312H13A020                                | 3/4"   | Sweat | 3.0 | 50                         |
| VT3313H13A020                                |        |       | 4.0 | 30                         |
| VT3315H13A020                                |        |       | 5.0 | 25                         |
| VT3317H13A020                                |        |       | 7.5 | 20                         |
| VT3322H13A020                                |        | NPT   | 3.0 | 50                         |
| VT3323H13A020                                |        |       | 4.0 | 30                         |
| VT3325H13A020                                |        |       | 5.0 | 25                         |
| VT3327H13A020                                |        |       | 7.5 | 20                         |
| VT3332H13U020                                |        | Rp    | 3.0 | 50                         |
| VT3333H13U020                                |        |       | 4.0 | 30                         |
| VT3335H13U020                                |        |       | 5.0 | 25                         |
| VT3337H13U020                                |        |       | 7.5 | 20                         |
| VT3341H13A020                                |        | SAE   | 1.5 | 75                         |
| VT3342H13A020                                |        |       | 3.0 | 50                         |
| VT3343H13A020                                |        |       | 4.0 | 30                         |
| VT3415H13A020                                |        | Sweat | 5.0 | 25                         |
| VT3417H13A020                                |        |       | 7.5 | 20                         |
| VT3427H13A020                                |        | NPT   | 8.0 | 20                         |
| VT3437H13U020                                |        |       | 8.0 | 20                         |
| VT3517H13A020                                | 1-1/4" | Sweat | 8.0 | 20                         |

**TABLE 2.** Options Available: Modify model numbers as shown below.

| Options               | Select  |
|-----------------------|---|
| <b>V_ xxxxHx4xxxx</b> | <b>For Steam use "S".</b>   |
| VT2xxxH_XXXX          | For Normally Open (2-Way only) use "2".   |
| VTxxxxHxxx_           | <b>For Terminal Block with End Switch use "01A".</b>  |
| VTxxxxHxx_XXX         | For Voltage Selection use the following:<br>"A" = 24 Vac, 50/60 Hz "B" = 110 Vac, 50 Hz and 120 Vac, 60 Hz "D" = 208 Vac, 50/60 Hz<br>"T" = 277 Vac, 50/60 Hz "U" = 230Vac, 50 Hz and 240 Vac, 60 Hz. |
| VTxxxxHxxxxx_         | For End Switch use "A".   |

# Two Position Zone Valves with Actuators, Spring Return

## AG, AH Series



**Note:** For complete part number configuration see the Part Numbering System on page 3.

### DIMENSIONAL DATA

Dimensions are in inches (mm).

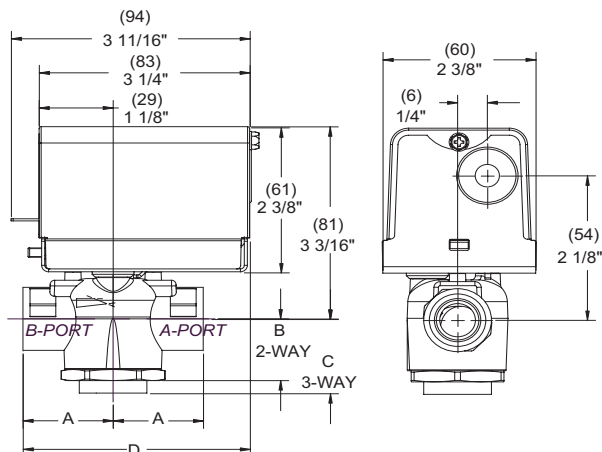


Figure 1 VT/VS Series General Close-off.

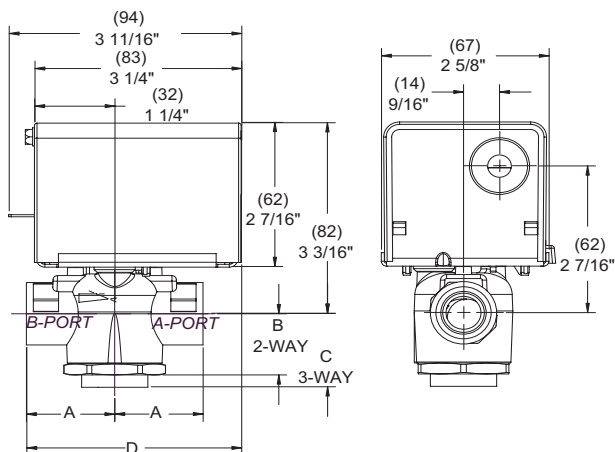


Figure 2 VT/VS Series High Close-off.

**TABLE 3.** Dimensions - inches (mm).

| Valve Body Size | A                          | B          | C            | D (General Close-Off)      | D (High Close-Off) |
|-----------------|----------------------------|------------|--------------|----------------------------|--------------------|
| 1/2" Sweat      | 1-5/16 (33)                | 15/16 (23) | 1-5/16 (33)  | 3-5/16 (84)                | 3-5/8 (92)         |
| 3/4" Sweat      | 1-3/8 (35)                 | 15/16 (23) | 1-11/16 (43) | 3-3/8 (86)                 | 3-3/4 (95)         |
| 1" Sweat        | 1-11/16 (43)               | 15/16 (23) | 1-11/16 (43) | 3-5/8 (92)                 | 4 (102)            |
| 1-1/4" Sweat    | 1-7/8 (47)                 | 1 (25)     | 1-13/16 (46) | 3-11/16 (94)               | 4-1/8 (105)        |
| 1/2" NPT, Rp    | 1-3/8 (35)                 | 15/16 (23) | 1-5/16 (33)  | 3-3/8 (86)                 | 3-5/8 (92)         |
| 3/4" NPT, Rp    | 1-11/16 (43)               | 15/16 (23) | 1-7/16 (37)  | 3-5/8 (92)                 | 4 (102)            |
| 1" NPT, Rp      | 1-7/8 (47)                 | 1 (25)     | 1-11/16 (43) | 3-11/16 (94)               | 4-1/8 (105)        |
| Inverted Flare  | See Figure-3 and Figure-4. |            |              | 4-3/16 (106)               | 4-7/16 (113)       |
| SAE Flare       |                            |            |              | See Figure-3 and Figure-4. |                    |

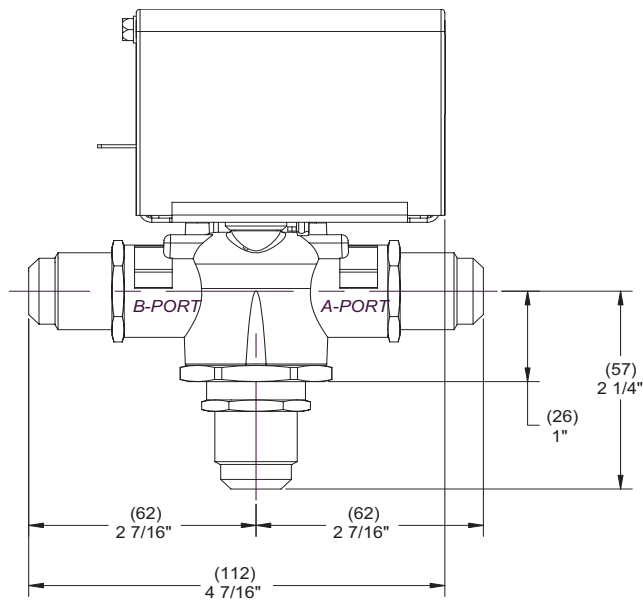


Figure-3 SAE - High Close-Off Style.

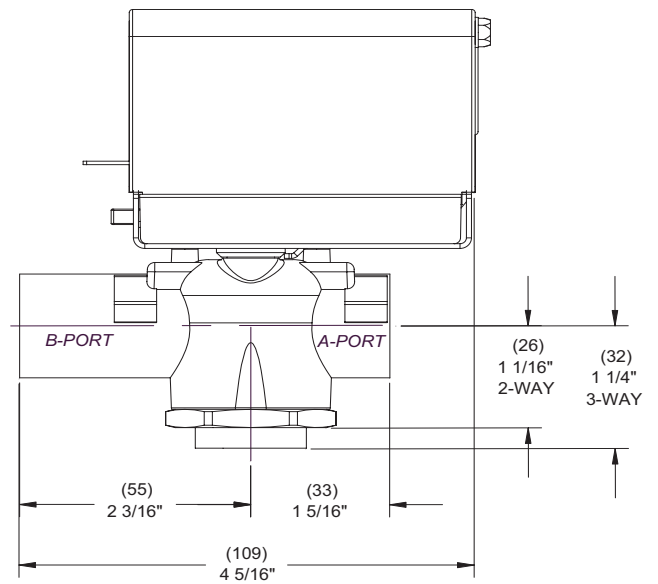


Figure-4 Inverted Flare - General Close-Off Style.

# Two Position Zone Valves with Actuators, Spring Return AG, AH Series



## Piping

- Three-way valves always require a normally closed actuator.
- Three-way valves are always closed at B port when no power is applied to motor.
- On power up the valve closes to A port on three-way valves.
- Orient three-way valve body as needed for normally open or normally closed flow through coil.

**CAUTION:** Use in systems which have substantial make-up water (open systems) is not recommended. Follow proper water treatment practices and system procedures. Refer to document F-26080 for Water and Steam EN205 Guidelines.

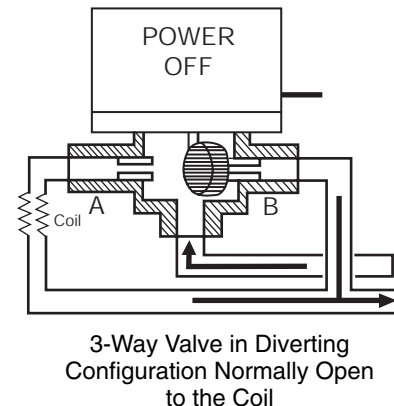
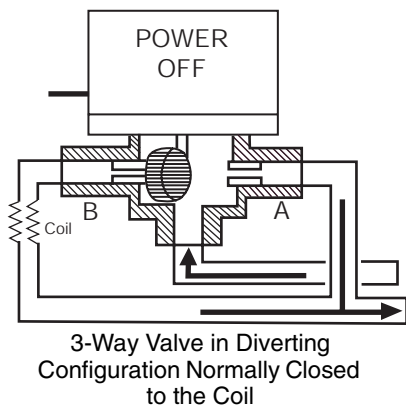
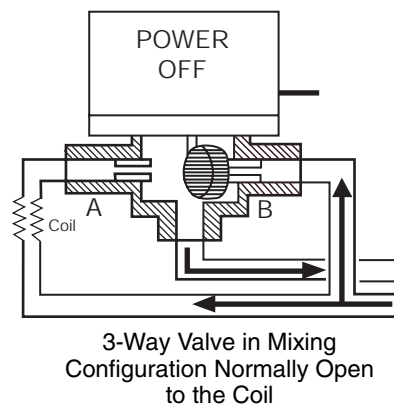
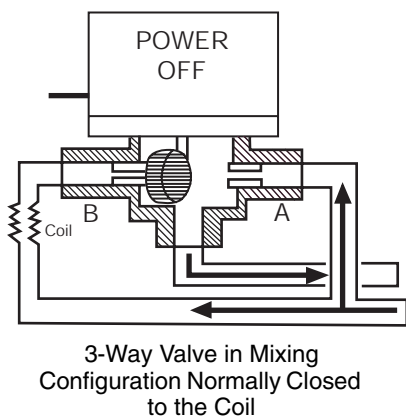
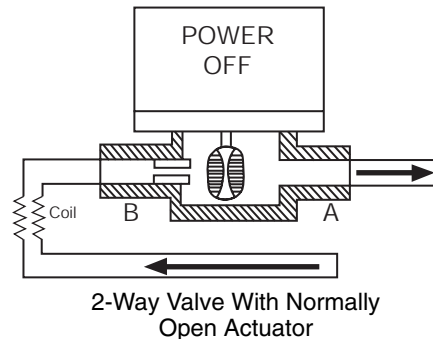
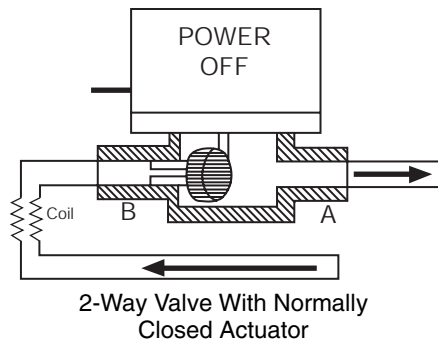


Figure 5 Piping Configurations.

**Note:** Three-way N.O. applications can be achieved when using a N.C. actuator, by piping the valves in reverse. The three-way examples show normally closed actuators.



## Application

The Modulating PopTop™ Series valve actuator assemblies are designed for closed hydronic heating and cooling systems. The Modulating PopTop actuators are used to control fluid flow in fan coil units, VAV reheat, unit ventilators, AHUs and radiant applications.

The Modulating PopTop Proportional (P) type is compatible with any 0 to 10Vdc or 4 to 20 mA signal with jumper selectable operating range and action resulting in precise positioning. The floating (T) type is compatible with any 24 Vac three-wire signal when three minute time-out logic resides in the valve actuator or system controller.

The Modulating PopTop valve assemblies allow the actuator to be snapped onto, or off from, the valve body. The actuator can be mounted after the valve body has been installed into the system without the need for linkages or calibration.

Available in non-spring return and spring return modulating actuators. The two-way spring return modulating actuators are provided in either normally open or normally closed operation. The three-way valves are available in normally closed operation only. Valve body reversal provides normally open flow for three-way valve bodies.



**Spring Return Actuator**



**Non-Spring Return Actuator**

## Features

- Magnetic clutch to maximize the life of the motor and gear train
- Manual operating lever/position indicator facilitates field setup
- Easy to use terminal blocks
- Actuator can be installed after the valve body
- Three wire floating and 0 to 10 Vdc or 4 to 20 mA proportional available
- Spring will return actuator to normal position when the power is lost

## Actuator Specifications

### Floating

|          |                          | Inputs               |           |                             |     |                            |     | Outputs             |        |                                 |                 |
|----------|--------------------------|----------------------|-----------|-----------------------------|-----|----------------------------|-----|---------------------|--------|---------------------------------|-----------------|
|          |                          |                      |           | Control Circuit,<br>Maximum |     | Total Actuator,<br>Maximum |     | Nominal Stroke Time |        | Elapsed Time<br>Before Time-Out |                 |
| Model    | Action                   | VAC                  | Frequency | mA                          | VA  | mA                         | VA  | 60 Hz               | 50 Hz  | 60 Hz                           | 50 Hz           |
| AT13A00T | Spring<br>Return         | 24 Vac +25%/-<br>15% | 50/60 Hz  | 24                          | 0.6 | 68                         | 1.6 | 2 min. 30<br>sec.   | 3 min. | 3 min                           | 3 min<br>36 sec |
| AT23A00T |                          |                      |           | 24                          | 0.6 | 68                         | 1.6 |                     |        |                                 |                 |
| AT33A000 | Non-<br>Spring<br>Return |                      |           | 60 Hz                       | —   | —                          | 40  |                     |        | 1.0                             | NA              |
| AT33A00T |                          |                      | —         |                             | —   | 50                         | 1.2 |                     | NA     | 3 min ±<br>30 sec               | NA              |

### Modulating

|          |                   | Inputs           |           |  |                         |     | Outputs             |        |                              |                |
|----------|-------------------|------------------|-----------|--|-------------------------|-----|---------------------|--------|------------------------------|----------------|
|          |                   |                  |           | Control Circuit  | Total Actuator, Maximum |     | Nominal Stroke Time |        | Elapsed Time Before Time-Out |                |
| Model    | Action            | VAC              | Frequency | Range/ Input Impedance   | mA                      | VA  | 60 Hz               | 50 Hz  | 60 Hz                        | 50 Hz          |
| AP13A000 | Spring Return     | 24 Vac +25%/-15% | 50/60 Hz  | 0-10 <sup>a</sup> VDC/200K<br>0-5 VDC/200K<br>5-10 VDC/200K<br>4-20 mA/300 | 65                      | 1.6 | 2 min. 30 sec.      | 3 min. | 2 min. 45 sec.               | 3 min. 18 sec. |
| AP23A000 |                   |                  |           |  |                         |     |                     |        |                              |                |
| AP33A000 | Non-Spring Return |                  |           |  |                         |     |                     |        |                              |                |
|          |                   |                  |           |  |                         |     |                     |        |                              |                |

<sup>a</sup> Factory supplied. Actual range is 1 to 9 Vdc.

# Modulating Zone Valve with Actuator, Spring and Non-Spring Return



## Specifications Continued

**Mechanical:** **Action, T series:** Direct acting. **P series:** Direct acting (valve opens port B with increase in signal.) Field selectable reverse acting.

**Manual Override:** Allows manual positioning.

**Operating Pressure Limits:** 300 psi (2068.4 kPa) static pressure.

**Material:** **Actuator:** High temperature plastic. **Valve:** body: forged brass; stem: nickel-plated/chrome-plated brass; seat: brass, plug/paddle: high temperature thermoplastic/rubber.

**Flow Characteristic:** 1.0 to 4.0 Cv: equal percentage. 7.0/8.0 Cv: linear.

### Ambient Temperature Limits:

**Shipping & Storage,** -40 to 158 °F (-40 to 70 °C).

**Operating,** 32 to 125 °F (0 to 52 °C).

**Fluid,** 32 to 200 °F (0 to 93 °C) (not steam rated).

**Humidity:** 5 to 95% RH, non-condensing.

**Seat Leakage:** ANSI class IV (0.01%).

**Agency Listings (Actuator Only):** UL873: Underwriters Laboratories (File #E9429 Category Temperature Indicating and Regulating Equipment), Class 2.

CUL: UL Listed for use in Canada by Underwriters Laboratory. Canadian Standards C22.2 No. 24.

European Community: EMC Directive (89/336/EEC)

Australia: This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radio Communications Act of 1992.

**Shipping Weight (Actuator/Valve Assy.):** 1.90 lbs (860 g).

## Modulating Zone Valve Spring and Non-Spring Return VM Series Flow Coefficients and Maximum Close-Off Differential Pressure.

| Valve Size in. | Connection Type      | Flow Coefficient Cv (kv) | Maximum Close-Off ΔP, PSI (kPa)           |                                       |  |
|----------------|----------------------|--------------------------|---|---------------------------------------|--|
|                |                      |                          | Non-Spring Operating Mode (Driven Closed) | Spring Operating Mode (Driven Closed) | Spring Power Failure Mode <sup>a</sup> (Spring Closed) |
| 1/2            | NPT, SW, SAE, and Rp | 1.0 (0.9)                | 50 (344)                                  | 50 (344)                              | 50 (344)   |
| 1/2            | NPT, SW, SAE, and Rp | 2.0 (1.8)                | 50 (344)                                  | 50 (344)                              | 20 (137)   |
| 3/4            | NPT, SW, and Rp      |                          |   |                                       |  |
| 1/2            | NPT, SW, SAE, and Rp | 4.0 (3.5)                | 35 (241)                                  | 35 (241)                              | 20 (137)   |
| 3/4            | NPT, SW, and Rp      |                          |   |                                       |  |
| 1              | SW                   |                          |   |                                       |  |
| 3/4            | NPT, SW, and Rp      | 7.5 (6.5)                | 35 (241)                                  | 35 (241)                              | 15 (103)   |
| 1              | SW                   |                          |   |                                       |  |
| 1              | NPT and Rp           | 8.0 (6.9)                | 35 (241)                                  | 35 (241)                              | 15 (103)   |
| 1-1/4          | SW                   |                          |   |                                       |  |

Valve Body Legend  
NPT — Threaded  
SW — Sweat

SAE — Society Automotive Engineers.  
Rp — "Metric" Threaded

<sup>a</sup> If the valve is driven closed before a power failure, the spring operating mode close-off pressures apply.

## Part Numbering System Modulating Spring and Non-Spring Return Zone Valves

△ 1 V M X X X X X X 3 A 00 X △ 2

**Body Type**  
M = Modulating

**Configuration**  
2 = 2-Way  
3 = 3-Way

**Valve Size**  
2 = 1/2  
3 = 3/4"  
4 = 1"  
5 = 1-1/4"

| Connection Type          | Availability           |
|--------------------------|------------------------|
| 1 = Sweat                | 1/2", 3/4", 1", 1-1/4" |
| 2 = Threaded NPT         | 1/2", 3/4", 1"         |
| 3 = Threaded Rp (Metric) | 1/2", 3/4", 1"         |
| 5 = SAE Flare            | 1/2"                   |

| CV Size |     |        |                 |
|---------|-----|--------|-----------------|
|         |     | Size   | Connection Type |
| 1 =     | 1.0 | 1/2"   | 1, 2, 3, 5      |
| 2 =     | 2.0 | 1/2"   | 1, 2, 3, 5      |
|         |     | 3/4"   | 1, 2, 3         |
| 3 =     | 4.0 | 1/2"   | 1, 2, 3, 5      |
|         |     | 3/4"   | 1, 2, 3         |
|         |     | 1"     | 1               |
| 7 =     | 7.5 | 3/4"   | 1, 2, 3         |
|         |     | 1"     | 1               |
|         | 8.0 | 1"     | 2, 3            |
|         |     | 1-1/4" | 1               |

**Actuator Type**  
T = Three-wire Floating  
P = Proportional, 0-10 Vdc, 0-5 Vdc,  
5-10 Vdc or 4-20 mA, Jumper Selectable

**Options**  
Non-Spring Return Actuators  
0 = No Options  
T = Three-Wire Signal Time-Out  
  
Spring Return Actuators  
T = Time-Out △ 3

**Electrical Leads**  
00 = No leads

**Voltage**  
A = 24 Vac Only

**Temperature Ratings**  
3 = General Temperature

**Action**  
1 = Spring Return Normally closed (2-way or 3-way)  
2 = Spring Return Normally opened (2-way only)  
3 = Non-Spring Return

△ 1 When ordering valve body only: use the first six positions to configure the valve.

△ 2 When ordering actuator only: use the last seven positions to configure the actuator. Prefix with the letter "A."

△ 3 This feature is standard for spring return three wire floating actuators. It must be included in the part number.

△ 4 Should not be used with thermostats/controllers unless they have a timeout feature.

| Available Actuators |                   |          |                     |               |
|---------------------|-------------------|----------|---------------------|---------------|
| Part Number         | Action            | Position | Actuator Type       | Option        |
| AT13A00T            | Spring Return     | N.C.     | Three Wire Floating | With Time-Out |
| AT23A00T            | Spring Return     | N.O.     | Three Wire Floating | With Time-Out |
| AT33A000            | Non-Spring Return |          | Three Wire Floating | None          |
| AT33A00T            | Non-Spring Return |          | Three Wire Floating | With Time-Out |
| AP13A000            | Spring Return     | N.C.     | Proportional        | None          |
| AP23A000            | Spring Return     | N.O.     | Proportional        | None          |
| AP33A000            | Non-Spring Return |          | Proportional        | None          |

△ 4

# Modulating, Spring and Non-Spring Return PopTop Two-Way and Three-Way VM Assemblies



**Two-Way Zone Valve**



**Three-Way Zone Valve**

**TABLE 1.** PopTop Modulating Valve Model Number Selection Guide.

| VM  | 2                      | 2   | 1   | 1   |
|---|------------------------|---|---|---|
| Type  | Configuration          | Size  | Connection  | Cv  |
| M = Modulating<br>General<br>Temperature Only | 2 = 2-Way<br>3 = 3-Way | 2 = 1/2"<br>3 = 3/4"<br>4 = 1"<br>5 = 1-1/4" (Sweat Only) | 1 = Sweat<br>2 = NPT (female)<br>3 = Rp (female)<br>5 = SAE (1/2" only) | 1 = 1.0<br>2 = 2.0<br>3 = 4.0<br>7 = 7.5/8.0 (linear) |

| Catalog Part Number                             | Fitting Size - in | Type  | Cv  |
|---|-------------------|-------|-----|
| <b>2-Way PopTop™ Modulating Valve Body Only</b> |                   |       |     |
| VM2211  | 1/2               | Sweat | 1.0 |
| VM2212  |                   |       | 2.0 |
| VM2213  |                   |       | 4.0 |
| VM2221  |                   | NPT   | 1.0 |
| VM2222  |                   |       | 2.0 |
| VM2223  |                   |       | 4.0 |
| VM2231  |                   | Rp    | 1.0 |
| VM2232  |                   |       | 2.0 |
| VM2233  |                   |       | 4.0 |
| VM2251  |                   | SAE   | 1.0 |
| VM2252  |                   |       | 2.0 |
| VM2253  |                   |       | 4.0 |
| VM2312  | 3/4               | Sweat | 2.0 |
| VM2313  |                   |       | 4.0 |
| VM2317  |                   |       | 7.5 |
| VM2322  |                   | NPT   | 2.0 |
| VM2323  |                   |       | 4.0 |
| VM2327  |                   |       | 7.5 |
| VM2332  |                   | Rp    | 2.0 |
| VM2333  |                   |       | 4.0 |
| VM2337  |                   |       | 7.5 |
| VM2413  | 1                 | Sweat | 4.0 |
| VM2417  |                   |       | 7.5 |
| VM2427  |                   | NPT   | 8.0 |
| VM2437  | 1-1/4             | Rp    |     |
| VM2517  |                   | Sweat |     |

| Catalog Part Number                             | Fitting Size - in | Type  | Cv  |
|---|-------------------|-------|-----|
| <b>3-Way PopTop™ Modulating Valve Body Only</b> |                   |       |     |
| VM3211  | 1/2               | Sweat | 1.0 |
| VM3212  |                   |       | 2.0 |
| VM3213  |                   |       | 4.0 |
| VM3221  |                   | NPT   | 1.0 |
| VM3222  |                   |       | 2.0 |
| VM3223  |                   |       | 4.0 |
| VM3231  |                   | Rp    | 1.0 |
| VM3232  |                   |       | 2.0 |
| VM3233  |                   |       | 4.0 |
| VM3251  |                   | SAE   | 1.0 |
| VM3252  |                   |       | 2.0 |
| VM3253  |                   |       | 4.0 |
| VM3312  | 3/4               | Sweat | 2.0 |
| VM3313  |                   |       | 4.0 |
| VM3317  |                   |       | 7.5 |
| VM3322  |                   | NPT   | 2.0 |
| VM3323  |                   |       | 4.0 |
| VM3327  |                   |       | 7.5 |
| VM3332  |                   | Rp    | 2.0 |
| VM3333  |                   |       | 4.0 |
| VM3337  |                   |       | 7.5 |
| VM3413  | 1                 | Sweat | 4.0 |
| VM3417  |                   |       | 7.5 |
| VM3427  |                   | NPT   | 8.0 |
| VM3437  | 1-1/4             | Rp    |     |
| VM3517  |                   | Sweat |     |

**TABLE 2.** Options Available: Modify model numbers as shown below.

| Options | Select   |
|---------|--|
| VMxxx_  | For desired Cv enter "1" = 1.0 Cv, "2" = 2.0 Cv, "3" = 4.0 Cv, and "7" = 7.5/8.0 Cv. |



**Non-Spring Return Actuator**



**Spring Return Actuator**

**TABLE 1.** PopTop Modulating Actuator Three Wire floating Model Number Selection Guide.

| AT                      | 1   | 3           | A        | 00            | 0  |
|-------------------------|---|-------------|----------|---------------|--|
| Type/Close-Off          | Action  | Temp        | Voltage  | Connection    | Options  |
| T = Three Wire Floating | 1 = Spring Return, Normally Closed<br>2 = Spring Return, Normally Opened<br>3 = Non-Spring Return | 3 = General | A = 24 V | 00 = No Leads | <b>Non-Spring Return Actuator</b><br>0 = No Options<br>T = Three Wire Signal Time Out<br><b>Spring Return Actuator</b><br>T = Three Wire Signal Time Out |

| Three Wire Floating, General Temperature, 24 Vac |                   |                 |                           |
|--|-------------------|-----------------|---------------------------|
| Model  | Action            |                 | Time Out                  |
| AT13A00T   | Spring Return     | Normally Closed | •                         |
| AT23A00T   |                   | Normally Open   | •                         |
| AT33A000   | Non-Spring Return | —               | Must reside in controller |
| AT33A00T   |                   |                 | •                         |

**TABLE 2.** Floating PopTop Valve and Actuator Assemblies.

| PopTop Valve Assembly, Two-Way Spring and Non-Spring Return |               |       |                   |               |       | PopTop Valve Assembly, Three-Way Spring and Non-Spring Return |               |       |                   |               |       |
|---|---------------|-------|-------------------|---------------|-------|---|---------------|-------|-------------------|---------------|-------|
| Spring Return, N.C.   |               |       | Non-Spring Return |               |       | Spring Return, N.C.   |               |       | Non-Spring Return |               |       |
| Model No.   | Size - inches | Type  | Model No.         | Size - inches | Type  | Model No.   | Size - inches | Type  | Model No.         | Size - inches | Type  |
| VM2211T13A00T   | 1/2           | Sweat | VM2211T33A000     | 1/2           | Sweat | VM3211T13A00T   | 1/2           | Sweat | VM3211T33A000     | 1/2           | Sweat |
| VM2221T13A00T   |               | NPT   | VM2221T33A000     |               | NPT   | VM3231T13A00T   |               | Rp    | VM3221T33A000     |               | NPT   |
| VM2231T13A00T   |               | Rp    | VM2231T33A000     |               | Rp    | VM3221T13A00T   |               | NPT   | VM3231T33A000     |               | Rp    |
| VM2251T13A00T   |               | SAE   | VM2251T33A000     |               | SAE   | VM3251T13A00T   |               | SAE   | VM3251T33A000     |               | SAE   |
| VM2312T13A00T   | 3/4           | Sweat | VM2312T33A000     | 3/4           | Sweat | VM3312T13A00T   | 3/4           | Sweat | VM3312T33A000     | 3/4           | Sweat |
| VM2323T13A00T   |               | NPT   | VM2322T33A000     |               | NPT   | VM3322T13A00T   |               | NPT   | VM3322T33A000     |               | NPT   |
| VM2332T13A00T   |               | Rp    | VM2332T33A000     |               | Rp    | VM3332T13A00T   |               | Rp    | VM3332T33A000     |               | Rp    |
| VM2413T13A00T   | 1             | Sweat | VM2413T33A000     | 1             | Sweat | VM3417T13A00T   | 1             | Sweat | VM3413T33A000     | 1             | Sweat |
| VM2427T13A00T   |               | NPT   | VM2427T33A000     |               | NPT   | VM3427T13A00T   |               | NPT   | VM3427T33A000     |               | NPT   |
| VM2437T13A00T   |               | Rp    | VM2437T33A000     |               | Rp    | VM3437T13A00T   |               | Rp    | VM3437T33A000     |               | Rp    |
| VM2517T13A00T   | 1-1/4         | Sweat | VM2517T33A000     | 1-1/4         | Sweat | VM3517T13A00T   | 1-1/4         | Sweat | VM3517T33A000     | 1-1/4         | Sweat |

**Note:** For complete part number configuration see the Part Numbering System on page 12.

**TABLE 3.** Options Available - Modify model numbers as shown below.

| Options       | Select   |
|---------------|--|
| VMxxx_Tx3A00x | For desired Cv enter "1" = 1.0 Cv, "2" = 2.0 Cv, "3" = 4.0 Cv, and "7" = 7.5/8.0 Cv.                                       |
| VMxxxxT_3A00x | For desired action enter: "1" = spring return normally closed, "2" = spring return normally open, "3" = non-spring return. |
| VMxxxxT33A00_ | To add the signal time out enter "T" (only an option on non-spring return).  |

# Modulating Spring and Non-Spring Return PopTop, Two-Way and Three-Way VM Assemblies



**Spring Return Actuator**



**Non-Spring Return Actuator**

**TABLE 1.** PopTop Modulating Actuator Proportional Model Number Selection Guide.

| AP                            | 1   | 3           | A        | 00            | 0              |
|-------------------------------|---|-------------|----------|---------------|----------------|
| Type/Close-Off                | Action  | Temp        | Voltage  | Connection    | Options        |
| P = Proportional <sup>a</sup> | 1 = Spring Return, Normally Closed<br>2 = Spring Return, Normally Opened<br>3 = Non-Spring Return | 3 = General | A = 24 V | 00 = No Leads | 0 = No Options |

<sup>a</sup> Factory shipped as 0 to 10 Vdc. Jumper selectable, 0 to 5 Vdc, 5 to 10 Vdc, or 4 to 20 mA.

| Modulating, General Temperature, 24 Vac |                   |                 |                |
|---|-------------------|-----------------|----------------|
| Model                                   | Action            |                 | Time Out       |
| AP13A000                                | Spring Return     | Normally Closed | Does not apply |
| AP23A000                                |                   | Normally Open   |                |
| AP33A000                                | Non-Spring Return | —               |                |

**TABLE 2.** Proportional PopTop Valve and Actuator Assemblies.

| PopTop Valve Assembly, Modulating Two-Way Spring and Non-Spring Return |               |       |                   |               |       |
|--|---------------|-------|-------------------|---------------|-------|
| Spring Return, N.C.  |               |       | Non-Spring Return |               |       |
| Model No.  | Size - inches | Type  | Model No.         | Size - inches | Type  |
| VM2211P13A000  | 1/2           | Sweat | VM2211P33A000     | 1/2           | Sweat |
| VM2221P13A000  |               | NPT   | VM2221P33A000     |               | NPT   |
| VM2231P13A000  |               | Rp    | VM2231P33A000     |               | Rp    |
| VM2251P13A000  |               | SAE   | VM2251P33A000     |               | SAE   |
| VM2312P13A000  | 3/4           | Sweat | VM2312P33A000     | 3/4           | Sweat |
| VM2322P13A000  |               | NPT   | VM2322P33A000     |               | NPT   |
| VM2332P13A000  |               | Rp    | VM2332P33A000     |               | Rp    |
| VM2413P13A000  | 1             | Sweat | VM2413P33A000     | 1             | Sweat |
| VM2427P13A000  |               | NPT   | VM2427P33A000     |               | NPT   |
| VM2437P13A000  |               | Rp    | VM2437P33A000     |               | Rp    |
| VM2517P13A000  | 1-1/4         | Sweat | VM2517P33A000     | 1-1/4         | Sweat |

| PopTop Valve Assembly, Modulating Three-Way Spring and Non-Spring Return |               |       |                   |               |       |
|--|---------------|-------|-------------------|---------------|-------|
| Spring Return, N.C.  |               |       | Non-Spring Return |               |       |
| Model No.  | Size - inches | Type  | Model No.         | Size - inches | Type  |
| VM3211P13A000  | 1/2           | Sweat | VM3211P33A000     | 1/2           | Sweat |
| VM3221P13A000  |               | NPT   | VM3221P33A000     |               | NPT   |
| VM3231P13A000  |               | Rp    | VM3231P33A000     |               | Rp    |
| VM3251P13A000  |               | SAE   | VM3251P33A000     |               | SAE   |
| VM3312P13A000  | 3/4           | Sweat | VM3312P33A000     | 3/4           | Sweat |
| VM3322P13A000  |               | NPT   | VM3322P33A000     |               | NPT   |
| VM3332P13A000  |               | Rp    | VM3332P33A000     |               | Rp    |
| VM3413P13A000  | 1             | Sweat | VM3413P33A000     | 1             | Sweat |
| VM3427P13A000  |               | NPT   | VM3427P33A000     |               | NPT   |
| VM3437P13A000  |               | Rp    | VM3437P33A000     |               | Rp    |
| VM3517P13A000  | 1-1/4         | Sweat | VM3517P33A000     | 1-1/4         | Sweat |

**TABLE 3.** Options Available – Modify model numbers as shown below.

| Options       | Select  |
|---------------|---|
| VMxxx_Px3A000 | For desired Cv enter “1” = 1.0 Cv, “2” = 2.0 Cv, “3” = 4.0 Cv, and “7” = 7.5/8.0 Cv.  |
| VMxxxxP_3A000 | For desired action enter:<br>“1” = spring return normally closed,<br>“2” = spring return normally open,<br>“3” = non-spring return. |

## DIMENSIONAL DATA

Dimensions shown in inches (mm).

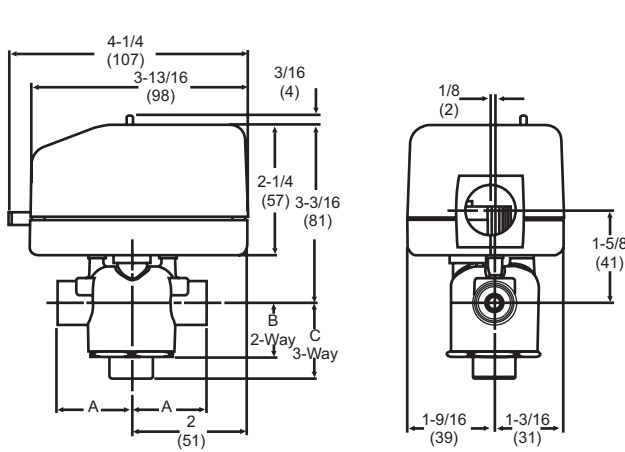


Figure 1 Modulating Non-Spring Return Valve.

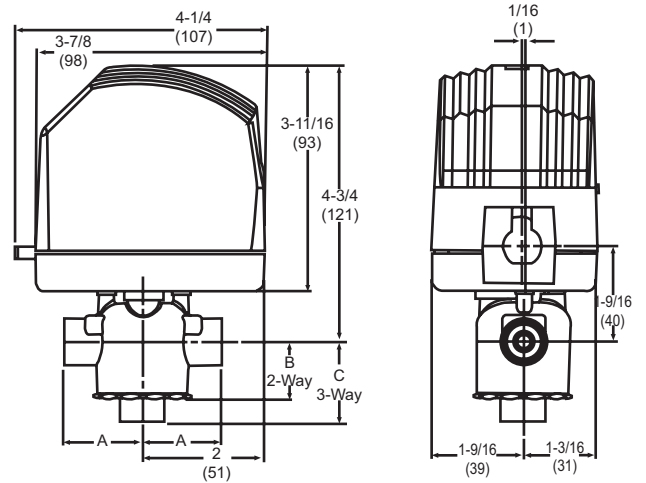


Figure 2 Modulating Spring Return Valve.

**TABLE 4.** Dimensions - inches (mm) .

| Valve Body Size | A             | B          | C            |
|-----------------|---------------|------------|--------------|
| 1/2" Sweat      | 1-5/16 (33)   | 15/16 (23) | 1-5/16 (33)  |
| 3/4" Sweat      | 1-3/8 (35)    | 15/16 (23) | 1-11/16 (43) |
| 1" Sweat        | 1-11/16 (43)  | 15/16 (23) | 1-11/16 (43) |
| 1-1/4" Sweat    | 1-7/8 (47)    | 1 (25)     | 1-13/16 (46) |
| 1/2" NPT, Rp    | 1-3/8 (35)    | 15/16 (23) | 1-5/16 (33)  |
| 3/4" NPT, Rp    | 1-11/16 (43)  | 15/16 (23) | 1-7/16 (37)  |
| 1" NPT, Rp      | 1-7/8 (47)    | 1 (25)     | 1-11/16 (43) |
| 1/2" SAE Flare  | See Figure-3. |            |              |

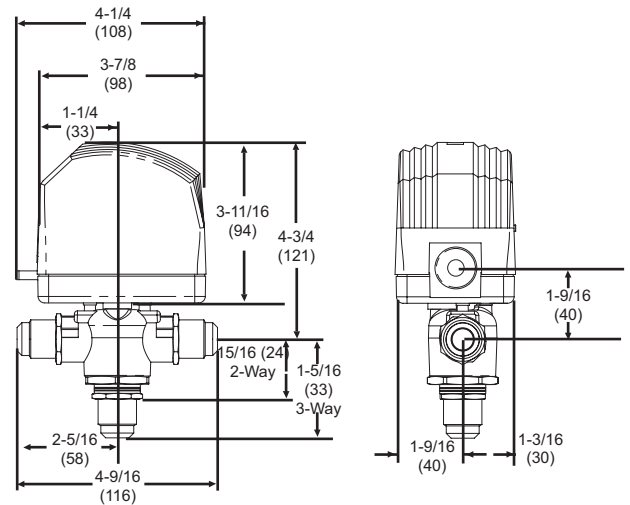


Figure 3 1/2" SAE.

# Modulating Spring and Non-Spring Return PopTop, Two-Way and Three-Way VM Assemblies



## Piping

- The 3-way is only configured as normally closed. For normally open configuration to the coil turn valve around. For proportional valves, set the control action (direct or reverse accordingly).
- The valve should be used in a closed loop system.
- All valves must be piped so that the plug closes against the direction of flow. For two-way valves, flow is from port B to port A. For normally closed three-way valves, B is the service port and A is the bypass port. For normally open three-way valves, A is the service port and B is the bypass port.
- Three-way VM valves must be piped in a mixing configuration, not diverting.

**CAUTION:** Do not use VM series valves in "open" systems. Excess make-up water may cause damage to the valve. Follow proper water treatment practices and system procedures. Refer to document F-26080; EN205, *Water and Steam System Guidelines*.

**Note:** Normally open actuators are not to be used on 3-way valves to achieve normally open configurations. Use a normally closed actuator and pipe as shown in Figure-5.

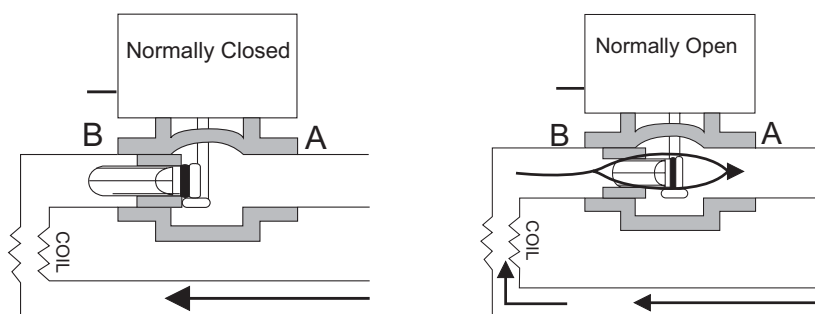


Figure 4 Two-Way Spring Return Valves.

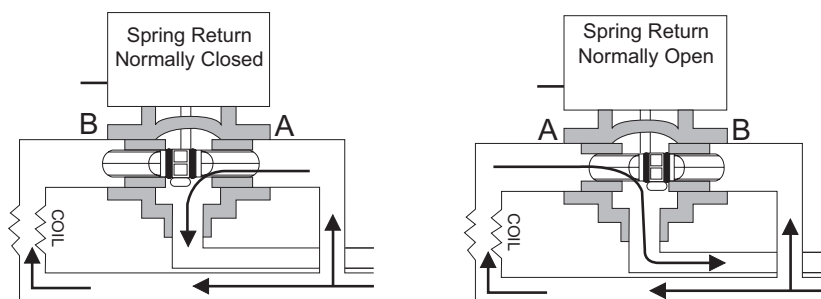


Figure 5 Three-Way Spring Return Valves.





## Two Position Damper Actuator Direct and Linkage Drive 453X Series

### Application

The 453L and 453H damper actuators are designed for a variety of two-position, spring return, damper applications. These actuators feature a hysteresis synchronous motor designed for long life with a unique "lost motion" mechanism to protect the gear train from closing shock.

The 453L and 453H use a simple 2-wire thermostat control, and are available with an optional end switch.

### Features

- Clockwise or counterclockwise rotation
- Linkage and direct drive models
- Auxiliary switch (optional)

### Actuator Specifications

**Voltage:** 24 Vac @ 50/60 Hz., 110 Vac @ 50 Hz. and 120 Vac @ 60 Hz., 220 Vac @ 50 Hz. and 230 Vac @ 60 Hz.

**Power Requirements:** See Table-1 Model Chart.

**Connections:** Internal junction box, 18 inch leads, cord sets.

**Optional End Switch:** 10 amps @ 125-250 Vac;  
1/3 hp @ 125-250 Vac.

**Direction of Rotation:** CW or CCW rotation is available.

**Direct Drive:** For 5/16" maximum damper output shaft with maximum engagement of 7/8".

**Ambient Temperature Limits:**

**Shipping & Storage,**

-40 °F to 160 °F (-40 to 71 °C).

**Operating,**

0 ° to 120 °F (-18 to 49 °C).

**Humidity:** Non-condensing.

**Agency Listings:** CE Mark compliant. UL and CUL recognized for 453L and 453H (File Number E9429).

**Shipping Weight:** 453L and 453H: 1.2 lbs (544 g).

**Location:** NEMA 1.

### Accessories

|          |  |
|----------|--|
| 453-52   | 6 to 12 in damper shaft kit  |
| 453-69   | 12 to 20 in damper shaft kit   |
| 453-239  | Damper shaft adapter converts direct coupled shafts from 5/16" to 1/2".  |
| 30-145-A | Damper Actuator Replacement Motor (H only) Class "A" Rated Temperature 120°F ambient, 24 Vac, 50/60 Hz.                      |
| 30-145-B | Damper Actuator Replacement Motor (H only) Class "A" Rated Temperature 120 °F ambient, 110 Vac @ 50 Hz. and 120 Vac @ 60 Hz. |
| 30-145-U | Damper Actuator Replacement Motor (H only) Class "A" Rated Temperature 120°F ambient, 220 Vac @ 50 Hz. and 230 Vac @ 60 Hz.  |



**Direct Drive  
453X Actuator**



**Linkage Drive  
453X Actuator**

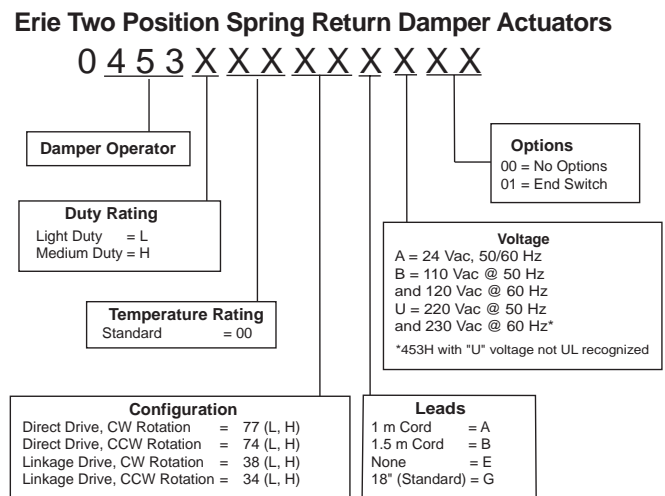


Figure 1 Selection Chart.

# Two Position Damper Actuator Direct and Linkage Drive 453X Series



**TABLE 1.** Model Chart

| Model Number | Torque Rating in-oz. |     |               |     | Power |     | Stroke Speed in Seconds  |               |
|--------------|----------------------|-----|---------------|-----|-------|-----|--------------------------|---------------|
|              | Motor Driven         |     | Spring Return |     |       |     |                          |               |
|              | 0°                   | 84° | 0°            | 84° | W     | VA  | Motor Driven             | Spring Return |
| 453L         | 45                   | 25  | 17            | 25  | 6.5   | 7.5 | 18 @ 60 HZ<br>22 @ 50 Hz | 6             |
| 453H         | 55                   | 35  | 35            | 55  | 6.5   | 10  | 27 @ 60 Hz<br>32 @ 50 Hz | 8             |



**Direct Drive  
453X Actuator**



**Linkage Drive  
453X Actuator**

**TABLE 1.** Light Duty, Two Position, Spring Return Model Number Selection Guide.

**NOTE:** For complete part number configuration, see Part Numbering System in Figure 1.

| Catalog Part Number | Voltage - Vac | Rotation | End Switch | Catalog Part Number | Voltage - Vac | Rotation | End Switch |
|---------------------|---------------|----------|------------|---------------------|---------------|----------|------------|
| Direct Drive        |               |          |            | Linkage Drive       |               |          |            |
| 0453L0074GA00       | 24            | CCW      |            | 0453L0034GA00       | 24            | CCW      |            |
| 0453L0074GB00       | 120           |          |            | 0453L0034GB00       | 120           |          |            |
| 0453L0074GU00       | 230           |          |            | 0453L0034GU00       | 230           |          |            |
| 0453L0077GA00       | 24            | CW       |            | 0453L0038GA00       | 24            | CW       |            |
| 0453L0077GA01       |               |          | •          | 0453L0038GA01       |               |          | •          |
| 0453L0077GB00       |               |          |            | 0453L0038GB00       |               |          |            |
| 0453L0077GB01       | 120           |          | •          | 0453L0038GB01       | 120           |          | •          |
| 0453L0077GU00       | 230           |          |            | 0453L0038GU00       | 230           |          |            |
| 0453L0077GU01       |               |          | •          | 0453L0038GU01       |               |          | •          |

**TABLE 2.** Medium Duty, Two Position, Spring Return Model Number Selection Guide.

| Catalog Part Number | Voltage - Vac | Rotation | End Switch |
|---------------------|---------------|----------|------------|
| Direct Drive        |               |          |            |
| 0453H0074GA00       | 24            | CCW      |            |
| 0453H0074GB00       | 120           |          |            |
| 0453H0074GU00       | 230           |          |            |
| 0453H0077GA00       | 24            | CW       |            |
| 0453H0077GA01       |               |          | •          |
| 0453H0077GB00       |               |          |            |
| 0453H0077GB01       | 120           |          | •          |
| 0453H0077GU00       | 230           |          |            |
| 0453H0077GU01       |               |          | •          |

| Catalog Part Number | Voltage - Vac | Rotation | End Switch |
|---------------------|---------------|----------|------------|
| Linkage Drive       |               |          |            |
| 0453H0034GA00       | 24            | CCW      |            |
| 0453H0034GB00       | 120           |          |            |
| 0453H0034GU00       | 230           |          |            |
| 0453H0038GA00       | 24            | CW       |            |
| 0453H0038GA01       |               |          | •          |
| 0453H0038GB00       |               |          |            |
| 0453H0038GB01       | 120           |          | •          |
| 0453H0038GU00       | 230           |          |            |
| 0453H0038GU01       |               |          | •          |

## Application

The 453R damper actuators are designed for two-position, motor open and motor closed, damper applications.

The 453R actuator features a reversible hysteresis synchronous motor which requires a maintained voltage to either the opening or closing side to hold position.

The 453R uses a simple 3-wire control. The 453R is suitable for up to 500 in<sup>2</sup> (3,225 cm<sup>2</sup>) of balanced damper.

## Features

- 24 Vac, 120 Vac, and 230 Vac models available
- Motor open/motor closed

## Actuator Specifications

**Voltage:** 24 Vac @ 60 Hz., 110 Vac @ 50 Hz. and 120 Vac @ 60 Hz., 220 Vac @ 50 Hz. and 230 Vac @ 60 Hz.

**Power Requirements:** See Table-1 Model Chart.

**Connections:** Internal junction box, 18 inch leads.

**Direct Drive:** For 5/16" maximum damper output shaft with maximum engagement of 7/8".

**Ambient Temperature Limits:**

**Shipping & Storage,**

-40 to 160 °F (-40 to 71 °C).

**Operating,**

0 to 120 °F (-18 to 49 °C).

**Humidity:** Non-condensing.

**Agency Listings:** None.

**Shipping Weight:** 453R: 1.7 lbs (71 g).

**Location:** NEMA 1.

## Accessories

|         |   |
|---------|---|
| 453-52  | 6 to 12 in damper shaft kit   |
| 453-69  | 12 to 20 in damper shaft kit  |
| 453-239 | Damper shaft adapter converts direct coupled shafts from 5/16" to 1/2". |



Direct Drive 453 Actuator

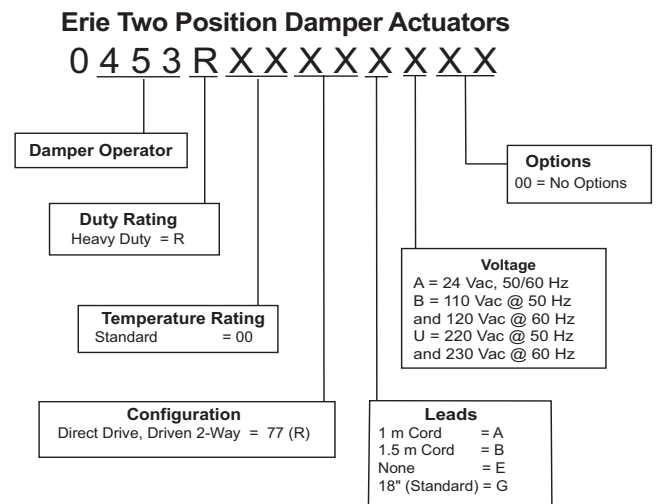


Figure 1 Selection Chart.

TABLE 1. Model Chart

| Model Number | Torque Rating in-oz. |     |               |     | Power |     | Stroke Speed in Seconds  |
|--------------|----------------------|-----|---------------|-----|-------|-----|--------------------------|
|              | Motor Driven         |     | Spring Return |     | W     | VA  | Motor Driven             |
|              | 0°                   | 84° | 0°            | 84° |       |     |                          |
| 453R         | 100                  | 100 | NA            | NA  | 6.5   | 7.5 | 37 @ 60 Hz<br>45 @ 50 Hz |

TABLE 2. Heavy Duty, Two Position, Motor Open/Motor Closed Model Number Selection Guide.

| Catalog Part Number | Voltage - Vac |
|---------------------|---------------|
| <b>Direct Drive</b> |               |
| 0453R0077GA00       | 24            |
| 0453R0077GB00       | 120           |
| 0453R0077GU00       | 230           |

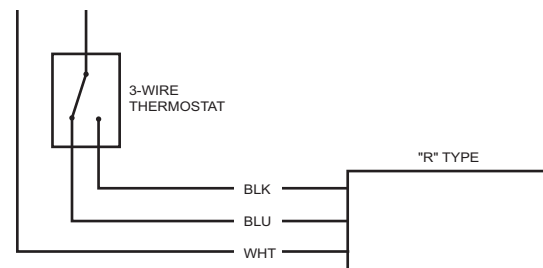


Figure 2 Wiring with 3-Wire Thermostat (18" Leads).

**Two Position Heavy Duty Damper  
Actuator**



**453R**

## Application

This valve actuator is an air-immersed, non-spring return actuator compatible with floating DDC controllers.

## Features

- Floating actuator controlled by SPDT floating controller (drive open-hold-drive closed) or a DDC controller with equivalent control action (contact or triac).
- Optional control module cards for proportional control (MF-63123 only): MFC-8000 for Vdc and MFC-420 for 4 to 20 mA<sub>dc</sub>.
- 210 lbs minimum output force with automatic load limit.
- Wide operating ambient range of 0 to 140 °F (-18 to 60 °C).
- Synchronous motor assures accurate stroke timing.
- MF-63123 series available with position feedback potentiometer.
- Self-adjusting travel and position feedback potentiometer mechanisms.
- Manual override operation with automatic release.
- Adjustable SPDT auxiliary switch on -500 models.
- Rugged construction: Die cast housing, double thread 1/2 in. dia. stainless steel jackscrew, roller thrust bearings, and all metal gear train.
- Integral linkage for 1/2 to 2 in. VB-7XXX valves. Optional linkage for 2-1/2 to 4 in. VB-9XXX valves.



## Model Chart

| Model No.                 | Actuator Power Input |       |      |       | Feedback 15K W Pot. | Aux. Switch |
|---------------------------|----------------------|-------|------|-------|---------------------|-------------|
|                           | Voltage (+10%/ -15%) | Hz    | Amps | Watts |                     |             |
| MF-63103                  | 24 Vac               | 50/60 | 0.25 | 7     | No                  | No          |
| MF-63103-500              |                      |       |      |       |                     | Yes         |
| MF-63123 <sup>a</sup>     |                      |       |      |       | Yes                 | No          |
| MF-63123-500 <sup>a</sup> |                      |       |      |       |                     | Yes         |

<sup>a</sup> Feedback potentiometer cannot be used when MFC control module card is installed

**Erle**

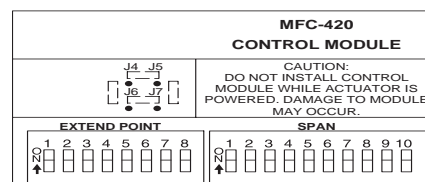
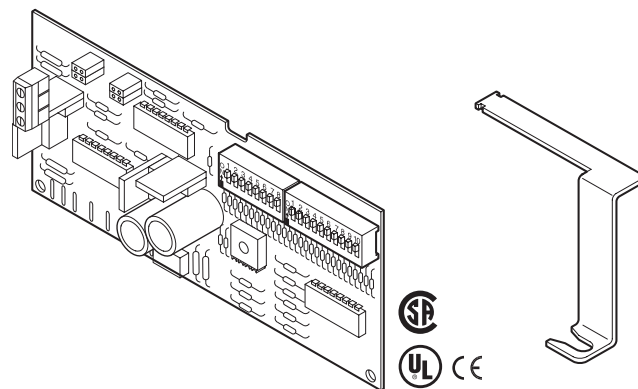
## Inputs

### Application

This Control Module Card is designed as a plug-in module for the MF-63123 Floating Valve Actuator. The MFC-420 card allows the actuator to accept proportional mAdc signals.

### Features

- Acceptance of all commonly used proportional mAdc input signals.
- Factory set for 4 to 20 mAdc applications.
- Switch selectable control input signal extend point and span for quick, accurate field setup.
- Control module plugs into MF-63123 actuator for quick, easy installation.
- Field selectable 100  $\Omega$  or 250  $\Omega$  impedance.



### Model Chart

| Model No. | Power Input               |     |     |       |       | Actuator Part Number |
|-----------|---------------------------|-----|-----|-------|-------|----------------------|
|           | Voltage<br>(+20%/-15%)    | Hz  |     | Amps  | Watts |                      |
| MFC-420   | 24 (Class 2 Power Supply) | 50  | N/A | 0.085 | 1.2   | MF-63123             |
|           |                           | N/A | 60  | 0.080 | 1.1   | MF-63123-500         |

### Specifications

#### Inputs

|                           |  |
|---------------------------|--|
| <b>Control signal</b>     | Factory setting: 4 to 20 mAdc.   |
|                           | Maximum input signal: 25 mAdc to maintain specified performance.   |
|                           | Operating span: 4 to 16 mAdc adjustable by DIP switch.   |
|                           | Start point: 2 to 16 mAdc adjustable by DIP switch.  |
|                           | Hysteresis: factory setting, 2.1% of span (16 mAdc control signal input span). Hysteresis is switch selectable using positions 9 and 10 of the 10 position DIP switch. |
| <b>Power requirements</b> | Impedance: Field selectable to either 100 $\Omega$ to 250 $\Omega$ (circuit performance is not affected by changing configuration).                                    |
| <b>Connections</b>        | Refer to Model Chart.  |
|                           | Control module to actuator: Uses the pin connections on the actuator circuit board to interface with control module.   |
|                           | Field wiring for control signal: Uses the screw terminals on the circuit board and accepts 14 to 20 gage wire.   |

#### Outputs

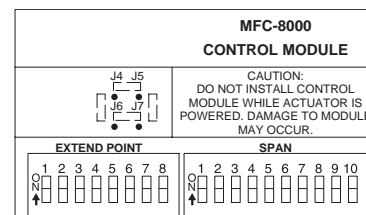
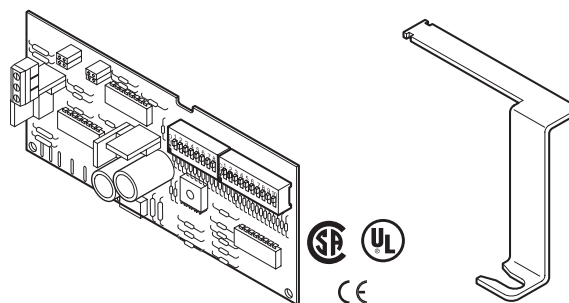
|                                   |  |
|-----------------------------------|--|
| <b>Electrical</b>                 | Control module plugs into MF-63123 Actuator.   |
| <b>Timing</b>                     | Refer to MF-63123 Actuator General Instructions, F-24732.  |
| <b>Ambient temperature limits</b> | Shipping and storage: -40 to 160 °F (-40 to 71 °C).<br>Operating: 0 to 140 °F (-17.78 to 60 °C). |
| <b>Humidity</b>                   | 5 to 95% RH, non-condensing.   |
| <b>Locations</b>                  | NEMA Type 1 (when mounted in MF-63123).  |
| <b>Dimensions</b>                 | 1-7/8 H x 4-9/16 W x 4/5 D in. (47.6 x 115.9 x 20.6 mm).   |

## Application

This card acts as a plug-in module for the MF-63123 Floating Valve Actuator. It allows the actuator to accept proportional voltage Vdc signals.

## Features

- Acceptance of all commonly used proportional Vdc input signals (0 to 10 Vdc and 6 to 9 Vdc).
- Factory set at 6 to 9 Vdc for System 8000 applications.
- Switch-selectable control input signal extend point and span for quick, accurate field setup.
- MF-63123 actuator plug-in for quick, easy installation.
- Field-selectable for direct or reverse action, for maximum application flexibility.



## Model Chart

| Model No. | Power Input               |    |       |       | Actuator Part Number |
|-----------|---------------------------|----|-------|-------|----------------------|
|           | Voltage<br>(+20%/-15%)    | Hz | Amps  | Watts |                      |
| MFC-8000  | 24 (Class 2 Power Supply) | 50 | 0.085 | 1.2   | MF-63123             |
|           |                           | 60 | 0.080 | 1.1   | MF-63123-500         |

## Specifications

| Inputs                     |   |
|----------------------------|---|
| Control signal             | Factory setting: 6 to 9 Vdc.  |
|                            | Maximum input signal: 22 Vdc to maintain specified performance. 30 Vdc to avoid component damage.   |
|                            | Operating span: 2 to 10 Vdc adjustable by DIP switch.   |
|                            | Start point: 0 to 12 Vdc adjustable by DIP switch.  |
|                            | Hysteresis: Hysteresis switch settings selectable using 9 and 10 of the 10-position DIP switch. Refer to General Instructions. Factory setting: 2.3% of span (3 Vdc control signal input span). Adjustable: hysteresis switch selection settings for control signal input spans. Refer to General Instructions. |
| Power required             | Impedance: Minimum of 10k $\Omega$ .  |
| Connections                | Refer to Model Chart.   |
|                            | Control module to actuator: Uses the pin connections on the actuator circuit board to interface with control module.  |
|                            | Field wiring for control signal: Uses the screw terminals on the circuit board and accepts 14 to 20 gage wire.  |
| Outputs                    |   |
| Electrical                 | Control module plugs into MF-63123 Actuator.  |
| Timing                     | Refer to MF-63123 Actuator General Instructions, F-24732.   |
| Ambient temperature limits | Shipping and storage: -40 to 160 °F (-40 to 71 °C).<br>Operating: 0 to 140 °F (-17.78 to 60 °C).  |
| Humidity                   | 5 to 95% RH, non-condensing.  |
| Locations                  | NEMA Type 1 (When mounted in MF-63123).   |
| Dimensions                 | 1-7/8 H x 4-9/16 L x 4-13/16 D in. (47.6 x 115.9 x 20.6 mm).  |



**Typical Applications**

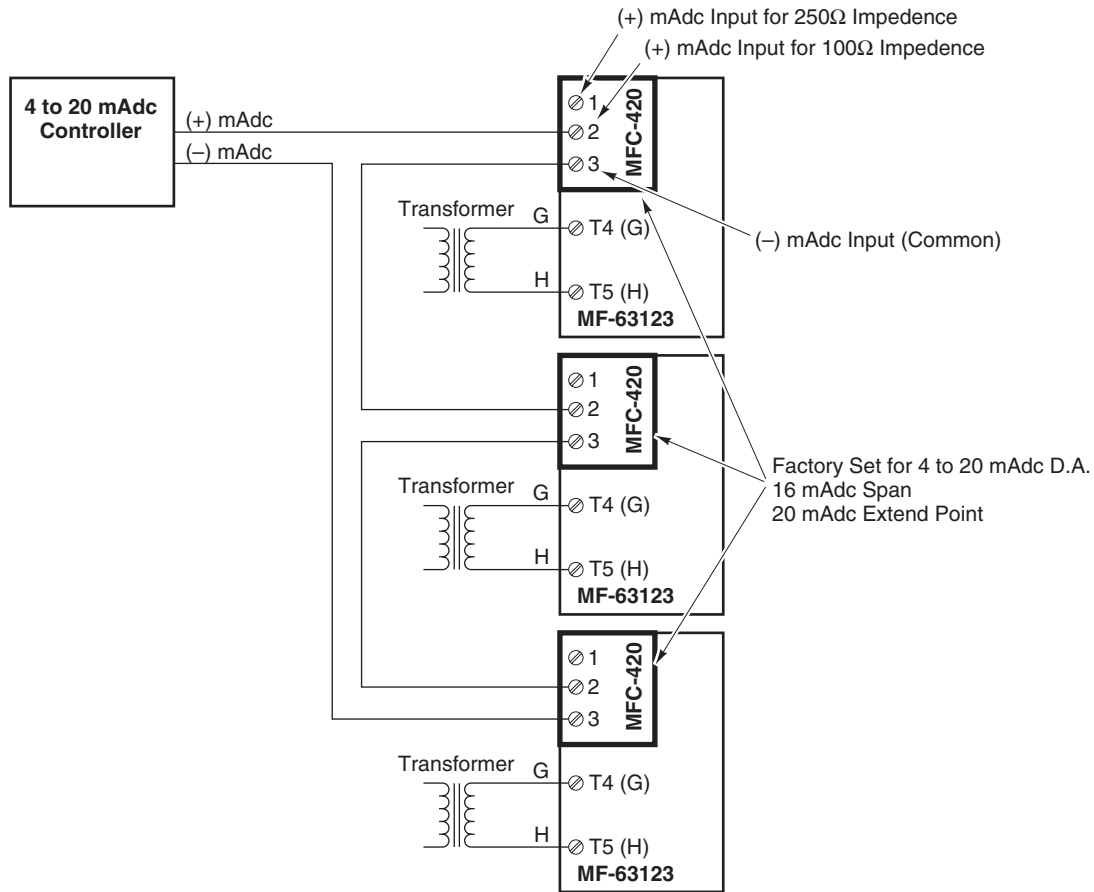


Figure 1 Switch and Adjustment Locations. Showing Wiring Designations, Typical Factory Switch and Shorting Block Settings.



Typical Applications

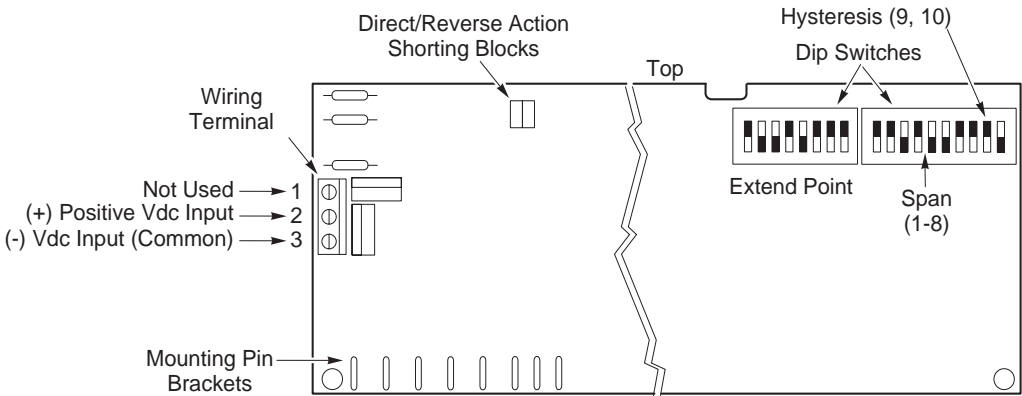


Figure 1 Switch and Adjustment Locations Showing Wiring Designations, Typical Factory Switch, and Shorting Block Settings.

## Application

The MP Series Actuators are used for two-position, floating, and proportional control of dampers, valves, and program switches in heating, ventilation, and air conditioning applications or similar applications.

## Features

- Proportional actuators with built-in feedback potentiometers.
- Spring return and non-spring return models available.
- 24 Vac models.
- Die cast housings with four 1/2 in. conduit openings.
- Oil-immersed motor and gear train.



**MP-361**



**MP-371**



**MP-381**

## Model Chart

### MP-3XX Series.

| Model No.               | Application  | Solid State Drive<br>CP-9301<br>CP-9302 | Power Requirements |    |      | Output Shaft               |                                |                             |                  | Aux.<br>Switch |
|-------------------------|--------------|---|--------------------|----|------|----------------------------|--------------------------------|-----------------------------|------------------|----------------|
|                         |              |   | Volts              | Hz | Amps | Torque<br>lb.-in.<br>(N-m) | Timing<br>Seconds<br>(No Load) | Degrees of<br>Rotation      | Spring<br>Return |                |
| MP-361                  | Proportional | Available                               | 24                 | 60 | 2.5  | 50 (5.6)                   | 90                             | 180<br>(Adj. <sup>a</sup> ) | CW               | SPDT           |
| MP-361-691 <sup>b</sup> |              | CP-9301 Included                        |                    |    |      |                            |                                |                             |                  |                |
| MP-361-692 <sup>c</sup> |              | CP-9302 Included                        |                    |    |      |                            |                                |                             |                  |                |
| MP-371                  |              | Available                               |                    |    |      |                            |                                | 180<br>(Non Adj.)           | CCW              |                |
| MP-371-691 <sup>b</sup> |              | CP-9301 Included                        |                    |    |      |                            |                                |                             |                  |                |
| MP-371-692 <sup>c</sup> |              | CP-9302 Included                        |                    |    |      |                            |                                |                             |                  |                |
| MP-381                  |              | Available                               |                    |    |      | 220<br>(24.9)              | 130                            | 180<br>(Adj. <sup>a</sup> ) | æ                | SPDT           |
| MP-381-691 <sup>b</sup> |              | CP-9301 Included                        |                    |    |      |                            |                                |                             |                  |                |
| MP-381-692 <sup>c</sup> |              | CP-9302 Included                        |                    |    |      |                            |                                |                             |                  |                |

<sup>a</sup> Rotation adjustable 45 to 320°. Caution: On actuators with proportional input signals changing the rotation will affect the control, since the internal feedback potentiometer's travel is fixed.

<sup>b</sup> Integral solid state drive CP-9301 accepts 6 to 9 Vdc voltage. May be field calibrated for other ranges, including 4 to 20 mAdc.

<sup>c</sup> Integral solid state drive CP-9302 accepts 4 to 20 mAdc voltage. May be field calibrated for other ranges, including 6 to 9 or 2 to 10 Vdc.

# Reversible and Proportional Electric Actuators



## MP-3XX Series

### Specifications

|                                   |  |
|-----------------------------------|--|
| <b>Input Control signals</b>      | Refer to the Model Charts for input control signal capability versus specific actuator models.   |
| <b>Floating</b>                   | Requires one Single Pole Double Throw (SPDT) switch with floating (center off) position rated at 0.9 amps at 24 Vac or two Single Pole Single Throw (SPST) switches rated at 0.9 amps at 24 Vac. |
| <b>Two-position</b>               | SPDT: Requires snap acting switch rated at 0.9 amps at 24 Vac.<br>SPST: Can be used with certain spring return actuators. Switch must be rated to handle actuator power requirements.            |
| <b>Proportional</b>               | Requires CP-930X-XXX Series solid state actuator drives. Refer to the Model Charts.  |
| <b>Solid State Drives</b>         | CP-9301: Vdc or mAdc factory set for 6 to 9 Vdc (System 8000).<br>CP-9302: Vdc or mAdc factory set for 4 to 20 mAdc (also has input signal override feature).                                    |
| <b>Connections</b>                |  |
| <b>MP-3XX</b>                     | Coded screw terminals.   |
| <b>Models -69X Suffix</b>         | Coded screw terminals except for input signal which are color coded pigtails.  |
| <b>Power Requirements</b>         | Refer to the Model Charts to determine power requirements.   |
| <b>Torque</b>                     | Refer to the Model Charts to determine the actuator torque rating.   |
| <b>Nominal damper area</b>        | Actuator sizing should be done in accordance with damper manufacturer's specifications.  |
| <b>Spring return</b>              | Refer to the Model Charts for models that are spring return.   |
| <b>Environment</b>                |  |
| <b>Ambient temperature limits</b> | Shipping and storage: -40 to 160 °F (-40 to 71 °C).<br>Operating: -40 to 136 °F (-40 to 58 °C).  |
| <b>Humidity</b>                   | 5 to 95% RH, non-condensing.   |
| <b>Locations</b>                  | NEMA 1.<br>NEMA 4 for non-spring return actuators with AM-363.   |
| <b>Dimensions</b>                 |  |
| <b>MP-3XX</b>                     | 7 H x 5-3/8 W x 6-5/16 D in. (178 x 136 x 160 mm).   |
| <b>Models -691 Suffix</b>         | 7 H x 5-3/8 W x 8-1/8 D in. (178 x 136 x 206 mm).  |

### Accessories

| Model No.  | Description   |
|--|---|
| <b>Valve linkage for 50 lb.-in. minimum, 180° actuator.</b>  |   |
| AV-391   | Valve linkage for 1/2 to 2 in. VB-7XXX and 1/2 to 1-1/4 in. obsolete VB-9XXX. |
| AV-395   | Valve linkage for 2-1/2 to 4 in. VB-9213 or VB-9313.                          |
| <b>Valve linkage for 130 lb.-in. minimum, 180° actuator.</b> |   |
| AV-352   | Valve linkage for 2-1/2 to 6 in. VB-9213 or VB-9313, 4 to 6 in. VB-9323.      |
| AV-393   | Valve linkage for 1/2 to 2 in. VB-7XXX and 1/2 to 1-1/4 in. obsolete VB-9XXX. |
| AV-396   | Valve linkage for 2-1/2 to 4 in. VB-9213 or VB-9313.                          |

### Typical Applications

- 1 Terminals 1,5, & 6 are used for built-in auxiliary switch.
- 2 Rotates CW or Closes Valve (Lowers Stem).
- 3 Rotates CCW or Opens Valve (Raises Stem).
- 4 These terminal are marked L1 & L2 on line voltage actuators.
- 5 Remove green wire to unground actuator.
- 6 SPDT Neutral Off Switch may be used on manual positioning applications.
- 7 Switch control circuit is 0.5 amp at approx. 24 Vac on either low or line voltage actuators.
- 8 Install under cover of actuator.

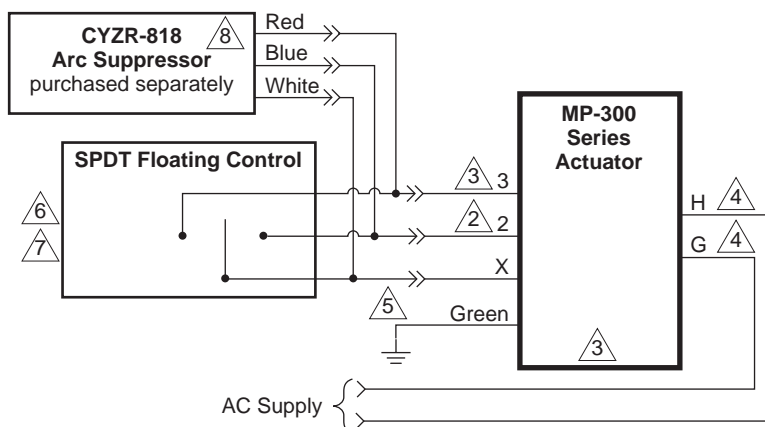


Figure 1 Reversible Floating Control.

| Maximum Amp Rating | 120V | 240V |
|--------------------|------|------|
| Running            | 5.8  | 2.9  |
| Locked Rotor       | 34.8 | 17.4 |
| Non-inductive      | 12   | 6    |

Terminal Identification

① — ⑥

• ⑤

Cam Action  
Factory Setting

Figure 2 Adjustable Auxiliary Switch SPDT.

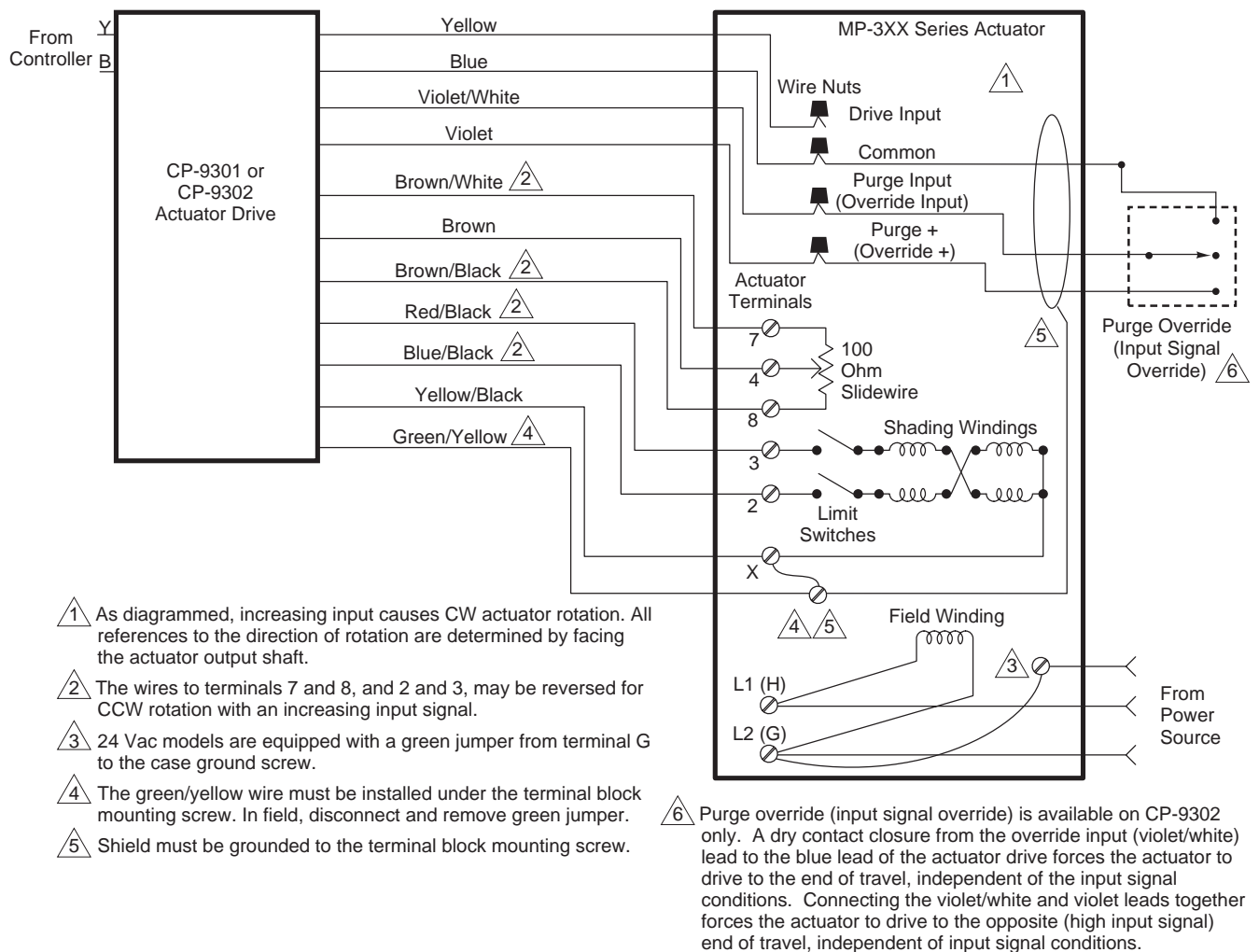


Figure 3 Proportional Electric Control, CP-930X.

**Reversible and Proportional  
Electric Actuators  
MP-3XX Series**





# Electronic Actuator Drive CP-9301-XXX Series, CP-9302 Series

## Application

The CP-9301 and CP-9302 electronic actuator drives process a variable input signal from a controller to provide proportional control of an electric gear train actuator. The CP-9301 is preset at the factory for voltage input. The CP-9302 is factory preset for current input and has additional wiring for connection to an override switch, for those applications requiring an external override of the input signal. These drives are equipped with built-in jumpers and adjustable potentiometers, so that the type of input signal, deadband, input span, and start point may be reset in the field when necessary.



## Features

- Mounts directly onto Invensys proportional, electric, gear train actuators.
- Power is supplied directly from the actuator.
- May be used with all gear train actuator voltages and frequencies.
- Jumpers for selecting either voltage or current input, as well as 3% or 5% deadband.
- Adjustable span and start point potentiometers.

## Model Chart

| Part Number | Input Signal Override       | Factory Jumper Settings |                  |             |            | Jumper Settings    |                        | Potentiometer Adjustment Ranges |                             |
|-------------|-----------------------------|-------------------------|------------------|-------------|------------|--------------------|------------------------|---------------------------------|-----------------------------|
|             |                             | Input Signal            | Deadband         | Start Point | Input Span | Input Signal       | Deadband               | Input Span                      | Start Point                 |
| CP-9301     | Not Available               | Voltage (6 to 9 Vdc)    | 3% of Input Span | 6 Vdc       | 3 Vdc      | Voltage or Current | 3% or 5% of Input Span | 3.0 to 16.5 Vdc or 8 to 16 mAdc | 0 to 10 Vdc or 2 to 16 mAdc |
| CP-9301-456 |                             | 0 to 10 Vdc             |                  | 0 Vdc       | 10 Vdc     |                    |                        |                                 |                             |
| CP-9302     | Available (Use is Optional) | Current (4 to 20 mAdc)  |                  | 4 mAdc      | 16 mAdc    |                    |                        |                                 |                             |

### Typical Actuators.

| Actuator Series | Power     |     | Torque |      | Stroke Degrees | Spring Return |
|-----------------|-----------|-----|--------|------|----------------|---------------|
|                 | Vac 60 Hz | Amp | Lb-in. | N-m  |                |               |
| MP-361          | 24        | 2.5 | 50     | 5.6  | 180            | CW            |
| MP-371          | 24        | 2.5 | 50     | 5.6  | 180            | CCW           |
| MP-381          | 24        | 2.5 | 220    | 24.9 | 180            | —             |

**Caution:** When using the CP-9301 or CP-9302 with actuators containing an *internal transformer*, disconnect and tape off the red and blue leads before installing and powering the device. *Failure to do so can result in damage to the actuator drive.*

**Note:** Models prior to “-2” suffix had transformer wired directly to potentiometer. To disconnect the transformer, remove the back plate of the actuator, then disconnect and tape the transformer leads.

# Electronic Actuator Drive

## CP-9301-XXX Series, CP-9302 Series



### Specifications

|                                     |  |
|-------------------------------------|--|
| <b>Mounting</b>                     | Directly to an actuator. The drive may be mounted on either the left or right side of the actuator, in a conduit opening adjacent to the low voltage wiring compartment. |
| <b>Case</b>                         | Injection molded plastic with stamped aluminum cover.  |
| <b>Inputs - Voltage and Current</b> |  |
| <b>Input</b>                        | Refer to Model Chart.  |
| <b>Input Span Adjustment</b>        | Refer to Model Chart.  |
| <b>Start Point Adjustment</b>       | Refer to Model Chart.  |
| <b>Input Impedance</b>              |  |
| <b>Voltage Input</b>                | Greater than 10,000 ohms.  |
| <b>Current Input</b>                | 250 ohms.  |
| <b>Power Supply</b>                 | Power is supplied directly from the shading coil windings provided on the shaded pole reversible motor of the gear train actuator (less than 30 Vac).                    |
| <b>Outputs</b>                      |  |
| <b>Connections</b>                  | Color-coded leads with crimped screw terminal connectors. Purge override (input signal override) leads are color-coded pigtails.   |
| <b>Triac Output</b>                 | 1.2 A RMS.   |
| <b>Deadband</b>                     | Refer to Model Chart.  |
| <b>Environment</b>                  |  |
| <b>Ambient temperature limits</b>   |  |
| <b>Shipping &amp; Storage</b>       | -40 to 160 °F (-40 to 71 °C).  |
| <b>Operating</b>                    | -40 to 136 °F (-40 to 58 °C).  |
| <b>Humidity</b>                     | 5 to 95% RH, non-condensing.   |
| <b>Locations</b>                    | NEMA Type 4; IEC IP56.   |
| <b>Agency Listings</b>              |  |
| <b>UL Listed</b>                    | UL 873 (File #E9429 Category Temperature Indicating and Regulating Equipment).<br>Certified for use in Canada by Underwriters Laboratories.                              |
| <b>European Community</b>           | EMC Directive 89/336/EEC.  |



## Typical Applications

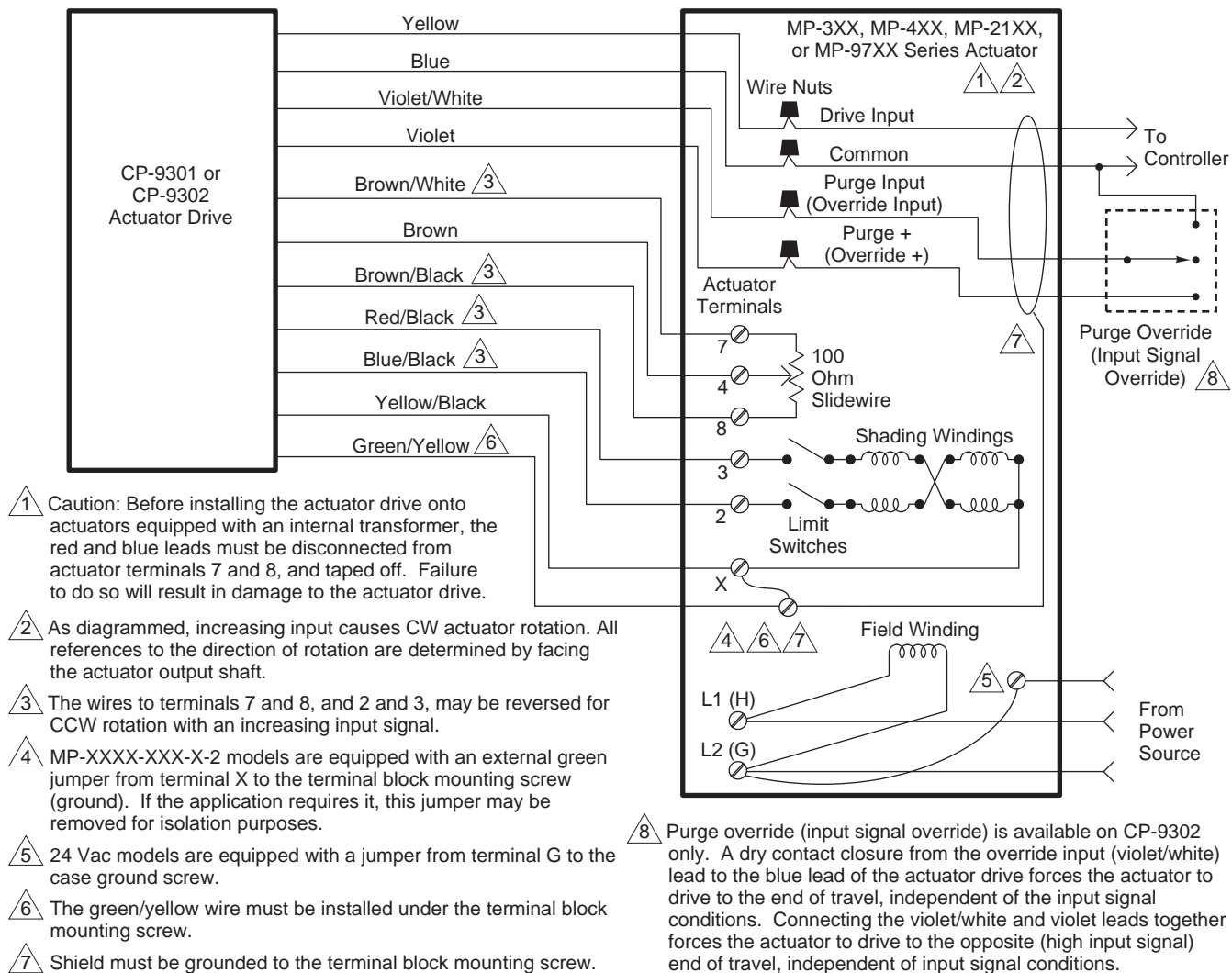


Figure 1 Service Application Wiring Diagram.

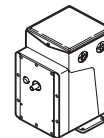
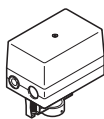
**Electronic Actuator Drive  
CP-9301-XXX Series, CP-9302  
Series**





## 2-Way Globe Valves with Electric Gear Train Actuators

Select Actuator Type with correct Input Signal having sufficient close-off for the application. A valve assembly will require a valve body, actuator and a valve linkage. If selecting Component Parts, select Valve Linkage.



|                        |                    |                 |   |              |                           |        |
|------------------------|--------------------|-----------------|---|--------------|---------------------------|--------|
| <b>Valve Linkage</b>   | 1-1/4 in. to 2 in. | Included        |   | AV-391       | AV-393                    | —      |
|                        | 2-1/2 to 4 in.     | AV-672          |   | AV-395       | AV-396                    | AV-352 |
|                        | 5 to 6 in.         | —               |   | —            | —                         | AV-352 |
| <b>Normal Position</b> |                    |                 | None  | N.O. or N.C. | None                      | None   |
| <b>Actuator Types</b>  |                    |                 | MF-63103  | MF-63123     | MP-361 (N.C.), 371 (N.O.) | MP-38X |
| <b>Valve Body</b>      | <b>P Code</b>      | <b>Size in.</b> | <b>ACTUATOR CLOSE-OFF PRESSURE RATING (psi)<sup>a b</sup></b> |              |                           |        |
| VB-7213-0-4-P          | -9                 | 1-1/4           | 150   | 90           | 200                       |        |
|                        | -10                | 1-1/2           | 100   | 60           | 140                       |        |
|                        | -11                | 2               | 50  | 35           | 80                        |        |
| VB-9213-0-4-P          | -12                | 2-1/2           | 35  | 22           | 50                        | 110    |
|                        | -13                | 3               | 25  | 14           | 35                        | 70     |
| VB-9213-0-5-P          | -12                | 2-1/2           | 35  | 22           | 50                        | 110    |
|                        | -13                | 3               | 25  | 14           | 35                        | 70     |
|                        | -14                | 4               | 13  | 7            | 19                        | 40     |
|                        | -15                | 5               | —   | —            | —                         | 18     |
|                        | -16                | 6               | —   | —            | —                         | 11     |

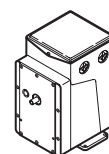
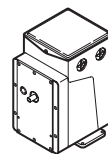
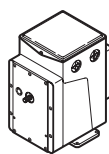
<sup>a</sup> Seat leakage rating is ANSI IV (0.01% of Cv).

<sup>b</sup> Close-off pressure ratings describe only the differential pressure which the actuator can close-off with adequate seating force. Consult valve body specifications for other limitations.

Consult Invensys Building Systems-Americas Catalog, F-25683 for further information.



Select Actuator Type with correct Input Signal having sufficient close-off for the application. A valve assembly will require a valve body, actuator and a valve linkage. If selecting Component Parts, select Valve Linkage.



|                       |                |          |   |    |                  |     |        |     |
|-----------------------|----------------|----------|---|----|------------------|-----|--------|-----|
| Valve Linkage VB-7313 | 1-1/4 to 2 in. |          | AV-391  |    | AV-393           |     | —      |     |
| Valve Linkage VB-9313 | 2-1/2 to 4 in. |          | AV-395  |    | AV-396           |     | AV-352 |     |
|                       | 5 to 6 in.     |          | —   |    | —                |     |        |     |
| Valve Linkage VB-9323 | 2-1/2 to 3 in. |          | AV-300 and AV-29  |    | AV-300 and AV-30 |     | —      |     |
|                       | 4 to 6 in.     |          | —   |    |                  |     | AV-352 |     |
| Actuator Types        |                |          | MP-36X <sup>a</sup><br>MP-37X <sup>a</sup>                  |    | MP-38X           |     |        |     |
| Valve Body            | P Code         | Size in. | ACTUATOR CLOSE-OFF PRESSURE RATING (psi) <sup>b c d e</sup> |    |                  |     |        |     |
|                       |                |          | SU  | SD | SU               | SD  | SU     | SD  |
| VB-7313-0-4-P         | -9             | 1-1/4    | 90  | 90 | 200              | 200 | —      | —   |
|                       | -10            | 1-1/2    | 60  | 60 | 140              | 140 | —      | —   |
|                       | -11            | 2        | 35  | 35 | 80               | 80  | —      | —   |
| VB-9313-0-4-P         | -12            | 2-1/2    | 20  | 20 | 50               | 50  | 110    | 110 |
|                       | -13            | 3        | 12  | 12 | 35               | 35  | 70     | 70  |
| VB-9313-0-5-P         | -12            | 2-1/2    | 20  | 20 | 50               | 50  | 110    | 110 |
|                       | -13            | 3        | 12  | 12 | 35               | 35  | 70     | 70  |
|                       | -14            | 4        | 6   | 6  | 17               | 17  | 40     | 40  |
|                       | -15            | 5        | —   | —  | —                | —   | 18     | 18  |
|                       | -16            | 6        | —   | —  | —                | —   | 11     | 11  |
| VB-9323-05-P          | -12            | 2-1/2    | —   | —  | 125              | 125 | —      | —   |
|                       | -13            | 3        | —   | —  | 125              | 125 | —      | —   |
|                       | -14            | 4        | —   | —  | —                | —   | 125    | 125 |
|                       | -15            | 5        | —   | —  | —                | —   | 125    | 125 |
|                       | - 16           | 6        | —   | —  | —                | —   | 125    | 125 |

<sup>a</sup> Use MP-361 for normally stem down, MP-371 for normally stem up.

<sup>b</sup> Close-off ratings for mixing: (SU = "A" port, SD = "B" port). "A" port (SU) ratings equal pressure at port "A" minus pressure at port "B". "B" port (SD) ratings equal pressure at port "B" minus pressure at port "A".

<sup>c</sup> SU = Stem Up; SD = Stem Down.

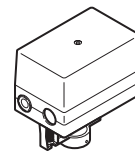
<sup>d</sup> Close-off pressure ratings describe only the differential pressure which the actuator can close-off to standards with adequate seating force. Consult valve body specifications for the limitations.

<sup>e</sup> Leakage ratings on 2 1/2 to 6 inch VB-9323 diverting valves are ANSI II (0.5% of Cv). Maximum differential pressure between opposite end ports is 50 psi. Leakage ratings on 2-1/2 to 6 inch VB-7313 and VB-9313 are ANSI III (0.1% of Cv).

## 3-Way Globe Valves with Electric Gear Train Actuators



Select Actuator Type with correct Input Signal having sufficient close-off for the application. A valve assembly will require a valve body, actuator and a valve linkage. If selecting Component Parts, select Valve Linkage.



| Input Signal                   |                |          | Floating SPDT and Multiple Input                            |          |
|--------------------------------|----------------|----------|---|----------|
| Valve Linkage for VB-7313      | 1-1/4 to 2 in. |          | Included  |          |
| Valve Linkage for VB-9313      | 2-1/2 to 4 in. |          | AV-672  |          |
| Actuator Types                 |                |          | MF-63103  | MF-63123 |
| Valve Body                     | P Code         | Size in. | ACTUATOR CLOSE-OFF PRESSURE RATING (psi) <sup>a b c d</sup> |          |
|                                |                |          | SD  | SU       |
| VB-7313-0-4-P<br>VB-7314-0-4-P | -9             | 1-1/4    | 140   | 140      |
|                                | -10            | 1-1/2    | 90  | 90       |
|                                | -11            | 2        | 50  | 50       |
| VB-9313-0-4-P<br>VB-9313-0-5-P | -12            | 2-1/2    | 35  | 35       |
|                                | -13            | 3        | 25  | 25       |
|                                | -14            | 4        | 13  | 13       |
|                                | -15            | 5        | —   | —        |
|                                | -16            | 6        | —   | —        |

<sup>a</sup> Close-off ratings for mixing or diverting valves: (SU = "A" port, SD = "B" port). "A" port (SU) ratings equal pressure at port "A" minus pressure at port "B". "B" port (SD) ratings equal pressure at port "B" minus pressure at port "A".

<sup>b</sup> SU = Stem Up; SD = Stem Down.

<sup>c</sup> Close-off pressure ratings describe only the differential pressure which the actuator can close-off to standards with adequate seating force. Consult valve body specifications for other limitations.

<sup>d</sup> Do not use mixing valves on diverting applications. Diverting valves may be used in mixing applications with minor affect on flow.

Consult Invensys Building Systems-Americas Catalog, F-25683 for further information.

## Application

VB-7213 series single seat, stem up open, two-way valves control water from 20 to 281°F (-7 to 138 °C) or steam to 281°F (138 °C) maximum in heating or air conditioning systems. They are used for two-position or proportional control applications. Valve assemblies require an actuator and a valve linkage. A large selection of factory assembled combinations is available. Consult the *Invensys Building Systems-Americas Environmental Controls Catalog*, F-25683.



**Danger:** Do not use for combustible gas applications. The VB-7213 series valve packings are not rated for combustible gas applications, and if used in these applications, gas leaks and explosions could result.



VB-7213

## Features

- Valve sizes 1-1/4" to 2"
- 250 psig pressure rating per ANSI Standards (B16.15–1985) for screwed cast bronze bodies
- Spring-loaded TFE packing
- American Standard Taper Pipe Thread (NPT) connections

## Specifications

|  |                  |                               | Valve Body Series VB-7213-0-4-P                |
|--|------------------|-------------------------------|--|
| <b>Service</b>   |                  |                               | Chilled or Hot Water and Steam                 |
| <b>Flow Characteristics</b>                                  |                  |                               | Equal Percentage                               |
| <b>Action</b>  |                  |                               | Stem Up Closed                                 |
| <b>Sizes</b>   |                  |                               | 1-1/4" to 2"                                   |
| <b>Type of End Fitting</b>                                   |                  |                               | NPT  |
| <b>Valve Materials</b>                                       | <b>Body</b>      |                               | Bronze   |
|  | <b>Seat</b>      |                               | Bronze   |
|  | <b>Stem</b>      |                               | Stainless Steel                                |
|  | <b>Plug</b>      |                               | Brass  |
|  | <b>Packing</b>   |                               | Spring-loaded TFE                              |
|  | <b>Disc</b>      |                               | EPDM   |
| <b>ANSI Pressure Class</b>                                   |                  |                               | 250 (up to 400 psig below 150 °F) <sup>a</sup> |
| <b>Maximum Inlet Pressure, Steam</b>                         |                  |                               | 35 psig (241 kPa)                              |
| <b>Allowable Control Media Temperature</b>                   |                  |                               | 20 to 281 °F (-7 to 138 °C)                    |
| <b>Allowable Differential Pressure for Water<sup>b</sup></b> |                  |                               | 35 psi (241 kPa) Maximum for Normal Life       |
| <b>Allowable Differential Pressure for Steam<sup>b</sup></b> |                  |                               | 20 psi (138 kPa)                               |
| <b>Valve Size<sup>c</sup></b>                                | <b>Cv Rating</b> | <b>kvs Rating<sup>d</sup></b> | <b>Complete Valve Body Part Number</b>         |
| 1-1/4"   | 20               | 17                            | VB-7213-0-4-9                                  |
| 1-1/2"   | 28               | 24                            | VB-7213-0-4-10                                 |
| 2"   | 40               | 35                            | VB-7213-0-4-11                                 |

<sup>a</sup> Pressure rating of valve only. Do not apply to system piping.

<sup>b</sup> Maximum recommended differential pressure. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

<sup>c</sup> Smaller valve sizes are available.

<sup>d</sup>  $kvs = m^3/h$  ( $\Delta P = 100$  kPa)     $Cv = kvs \times 1.156$

Consult *Invensys Building Systems-Americas Catalog*, F-25683 for further information.

**Two-Way Valve**  
**VB-7213**





## Application

VB-7313 series three-way mixing valves control hot or chilled water in heating or air conditioning systems. These valves must be piped with two inlets ("A" and "B" ports) and one outlet ("AB" port). They are used for two-position or proportional control applications. Valve assemblies require an actuator and a valve linkage that must be purchased separately.



**Danger:** Do not use for combustible gas applications. The VB-7313 series valve packings are not rated for combustible gas applications, and if used in these applications, gas leaks and explosions could result.



**VB-7313**

## Features

- Valve sizes 1-1/4" to 2"
- 250 psig pressure rating per ANSI Standards (B16.15-1985) for screwed cast bronze bodies
- Spring-loaded TFE packing
- American Standard Taper Pipe Thread (NPT) connections

## Specifications

| Valve Body Series VB-7313-0-4-P                              |                  |  |  |
|--|------------------|--|--|
| <b>Service</b>   |                  | Chilled or Hot Water                           |  |
| <b>Flow Characteristics</b>                                  |                  | Mixing   |  |
| <b>Sizes</b>   |                  | 1-1/4" to 2"                                   |  |
| <b>Type of End Fitting</b>                                   |                  | NPT  |  |
| <b>Valve Materials</b>                                       | <b>Body</b>      | Bronze   |  |
|  | <b>Seat</b>      | Bronze   |  |
|  | <b>Stem</b>      | Stainless Steel                                |  |
|  | <b>Plug</b>      | Brass  |  |
|  | <b>Packing</b>   | Spring-loaded TFE                              |  |
|  | <b>Disc</b>      | None   |  |
| <b>ANSI Pressure Class</b>                                   |                  | 250 (up to 400 psig below 150 °F) <sup>a</sup> |  |
| <b>Allowable Control Media Temperature</b>                   |                  | 20 to 281 °F (-7 to 138 °C)                    |  |
| <b>Allowable Differential Pressure for Water<sup>b</sup></b> |                  | 35 psi (241 kPa) Maximum for Normal Life       |  |
| <b>Valve Size<sup>c</sup></b>                                | <b>Cv Rating</b> | <b>kvs Rating<sup>d</sup></b>                  | <b>Complete Valve Body Part Number</b> |
| 1-1/4"   | 20               | 17   | <b>VB-7313-0-4-9</b>                   |
| 1-1/2"   | 28               | 24   | <b>VB-7313-0-4-10</b>                  |
| 2"   | 41               | 35   | <b>VB-7313-0-4-11</b>                  |

<sup>a</sup> Pressure rating of valve only. Do not apply to system piping.

<sup>b</sup> Maximum recommended differential pressure. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

<sup>c</sup> Smaller valve sizes are available.

<sup>d</sup>  $kvs = m^3/h$  (DP = 100 kPa)       $Cv = kvs \times 1.156$

**Three-Way Mixing Valve  
VB-7313**



## Application

VB-9213 series single seat, stem down to close, two-way valves control water from 40 to 281 °F (4 to 138 °C) or steam to 281 °F (138 °C) maximum in heating or air conditioning systems. They are used for two-position or proportional control applications. Valve assemblies require an actuator and a valve linkage that must be purchased separately.



**Danger:** Do not use for combustible gas applications. The VB-9213 series valve packings are not rated for combustible gas applications, and if used in these applications, gas leaks and explosions will result.

## Features

- Valve sizes 2-1/2" to 6".
- 250 psig pressure rating per ANSI Standards (B16.15–1985) for screwed cast bronze bodies.
- 125 psig pressure rating per ANSI Standards (B16.1–1993) for flanged cast iron bodies.
- Spring-loaded TFE packing.



Typical of VB-9213-0-5-P  
2-1/2" to 6"

## Specifications

|  |           |                         | Valve Body Series                        |   |
|--|-----------|-------------------------|--|---|
|  |           |                         | VB-9213-0-4-P                            | VB-9213-0-5-P                                 |
| Service  |           |                         | Chilled or Hot Water and Steam           |   |
| Flow Characteristics                                   |           |                         | Equal Percentage                         |   |
| Sizes  |           |                         | 2-1/2" to 3"                             | 2-1/2" to 6"                                  |
| Type of End Fitting                                    |           |                         | Screwed NPT                              | 125 lb. Flanged                               |
| Valve Materials  | Body      |                         | Bronze                                   | Iron  |
|  | Seat      |                         | Bronze                                   |   |
|  | Stem      |                         | Stainless Steel                          |   |
|  | Plug      |                         | Brass                                    |   |
|  | Packing   |                         | Spring-loaded TFE                        |   |
|  | Disc      |                         | Composition                              |   |
| ANSI Pressure Class                                    |           |                         | 250 (up to 400 psig below 150 °F)        | 125 lb. Flanged (up to 200 psig below 150 °F) |
| Maximum Inlet Pressure, Steam                          |           |                         | 35 psig (241 kPa)                        |   |
| Allowable Control Media Temperature                    |           |                         | 40 to 281 °F (4 to 138 °C)               |   |
| Allowable Differential Pressure for Water <sup>a</sup> |           |                         | 35 psi (241 kPa) Maximum for Normal Life |   |
| Allowable Differential Pressure for Steam <sup>a</sup> |           |                         | 20 psi (138 kPa)                         |   |
| Valve Size   | Cv Rating | kvs Rating <sup>b</sup> | Complete Valve Body Part Number          |   |
| 2-1/2"   | 56        | 48                      | Not Available                            | VB-9213-0-5-12                                |
|  | 65        | 56                      | VB-9213-0-4-12                           | Not Available                                 |
| 3"   | 85        | 73                      | VB-9213-0-4-13                           | VB-9213-0-5-13                                |
| 4"   | 145       | 125                     | Not Available                            | VB-9213-0-5-14                                |
| 5"   | 235       | 203                     |  | VB-9213-0-5-15                                |
| 6"   | 350       | 302                     |  | VB-9213-0-5-16                                |

<sup>a</sup> Maximum recommended differential pressure in open position. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

<sup>b</sup> kvs = m<sup>3</sup>/h (ΔP = 100 kPa) Cv = kvs x 1.156

**Two-Way Valve**  
**VB-9213**



## Application

VB-9313 series three-way mixing valves control hot or chilled water in heating or air conditioning systems. These valves must be piped with two inlets ("A" and "B" ports) and one outlet ("AB" port). They are used for two-position or proportional control applications. Valve assemblies require an actuator and a valve linkage that must be purchased separately.



**Danger:** Do not use for combustible gas applications. The VB-9313 series valve packings are not rated for combustible gas applications, and if used in these applications, gas leaks and explosions will result.



**Typical of VB-9313-0-5-P**  
2-1/2" to 6"

## Features

- Valve sizes 2-1/2" to 6".
- 250 psig pressure rating per ANSI Standards (B16.15-1985) for screwed cast bronze bodies.
- 125 psig pressure rating per ANSI Standards (B16.1-1993) for flanged cast iron bodies.
- Spring-loaded TFE packing.

## Specifications

| Specifications   |           |                         | Valve Body Series<br>VB-9313-0-4-P       | Valve Body Series<br>VB-9313-0-5-P               |
|--|-----------|-------------------------|--|--|
| Service  |           |                         | Chilled or Hot Water                     |  |
| Flow Characteristics                                   |           |                         | Mixing                                   |  |
| Sizes  |           |                         | 2-1/2" and 3"                            | 2-1/2" to 6"                                     |
| Type of End Fitting                                    |           |                         | Screwed NPT                              | 125 lb. Flanged                                  |
| Valve<br>Materials                                     | Body      |                         | Bronze                                   | Iron   |
|  | Seat      |                         | Bronze                                   |  |
|  | Stem      |                         | Stainless Steel                          |  |
|  | Plug      |                         | Brass                                    |  |
|  | Packing   |                         | Spring-loaded TFE                        |  |
|  | Disc      |                         | None                                     |  |
| ANSI Pressure Class                                    |           |                         | 250 (up to 400 psig below 150 °F)        | 125 lb. Flanged<br>(up to 200 psig below 150 °F) |
| Allowable Control Media Temperature                    |           |                         | 40 to 300 °F (4 to 149 °C)               |  |
| Allowable Differential Pressure for Water <sup>a</sup> |           |                         | 35 psi (241 kPa) Maximum for Normal Life |  |
| Valve Size   | Cv Rating | kvs Rating <sup>b</sup> | Complete Valve Body Part Number          |  |
| 2-1/2"   | 67        | 58                      | VB-9313-0-4-12                           | Not Available                                    |
|  | 74        | 64                      | Not Available                            | VB-9313-0-5-12                                   |
| 3"   | 91        | 79                      | VB-9313-0-4-13                           | Not Available                                    |
|  | 101       | 87                      | Not Available                            | VB-9313-0-5-13                                   |
| 4"   | 170       | 147                     |  | VB-9313-0-5-14                                   |
| 5"   | 290       | 251                     |  | VB-9313-0-5-15                                   |
| 6"   | 390       | 337                     |  | VB-9313-0-5-16                                   |

<sup>a</sup> Maximum recommended differential pressure in open position. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected. Exceeding maximum recommended differential pressure voids product warranty.

<sup>b</sup> kvs = m<sup>3</sup>/h (ΔP = 100 kPa) Cv = kvs x 1.156

**Three-Way Mixing Valve  
VB-9313**



**Application**

AV-352 valve linkage is used to field-install gear train actuators on specified 2-1/2 to 6 in. valve bodies.

**Features**

- Compatible with Invensys (Barber-Colman) 2-1/2 to 6 in. valves.
- Provides increased close-off pressure on 2-1/2 to 4 in. valves.
- Required for rated close-off pressure on 5 and 6 in. valves.

**Specifications**

- Actuator mounting: In any upright position with actuator above the center line of the valve body.
- Minimum actuator torque required: 220 lb-in.
- Actuator travel required: 180°.

**AV-352**

**Valve Linkage for Gear Train  
Actuators  
AV-352**





### Application

The AV-390 through AV-396 linkages are used to field assemble gear train actuators to VB-7XXX series or VB-9XXX series valve bodies.

- AV-391 and AV-393 are used with current 1/2" to 2" VB-7X1X and obsolete 1/2" to 1-1/4" VB-9X1X valve bodies.
- AV-395 and AV-396 are used with current 2-1/2" to 4" VB-9X1X valve bodies.

### Features

- Die cast aluminum mounting bracket.
- Valve position indication provided as standard.

### Specifications

**Actuator Torque:** 50 in-lb minimum for AV-391 and AV-395. 130 in-lb minimum for AV-393 and AV-396.

**Temperature Restrictions:** Verify that the fluid temperature of the media in the valve versus the ambient temperature at the actuator does not exceed the ratings shown in Table-1

**TABLE 1.** Restrictions on Maximum Ambient Temperature for Actuators.

| Maximum Temperature of Media in the Valve (Check Rating of Valve)<br>°F (°C) | Maximum Ambient for Actuator<br>°F (°C) |
|--|---|
| 260 (126)  | 136 (57)                                |
| 281 (138)  | 125 (52)                                |
| 300 to 366 (149 to 185)  | 100 (37)                                |

**Close-off Pressure Ratings:** Refer to page 37 and page 39. Check the appropriate table to verify that the selected valve, valve linkage, and actuator provide adequate close-off pressure for your application.



**AV-390**

**Valve Linkage for Gear Train  
Actuators  
AV-390**



## Application

The VAT/VAP series valve actuators are designed for proportional voltage or current, or 3-wire floating of VBG series 2-way and 3-way globe valve.

The VAT/VAP series actuators feature a reversible synchronous motor with an integral magnetic clutch to eliminate the need for position switches and enhance the overall reliability of the actuator. Position feedback from a 0 to 1000 ohm potentiometer for the VAT, or from a 0 to 10 VCD potentiometer for the VAP, is a standard feature on all units. An auxiliary switch is available as an accessory on both models, field option kit D36PS1 (ordered separately).

For ease of installation, the VAT/VAP series actuators mount directly onto the VBG series valves in minutes, without the need for linkages or field calibration of the travel or span of the actuators.

For best control results, the VAT actuator can be controlled by virtually any 3-wire floating control signal. The thermostat or controller should be selected or adjusted to complement the stroke time of the VAT actuator.

The VAP actuator can be controlled by any proportional voltage or current output. The circuit board allows the user to select one of seven different operating ranges, as well as the direction of stroke. The thermostat or controller should be selected or adjusted to complement the stroke time of the VAP actuator.

The VAT/VAP valve actuator is furnished with a "time out" feature to extend the life of the drive motor. When an open or close signal has been sustained for more than 130 seconds, the circuit board turns off the motor until the control signal changes.

The VAP actuator is shipped as a direct acting actuator, which means that the valve opens upon an increase in control signal. To change the reverse action, reposition the jumper SW2 to the "A" position (Figure-4). The control operating range can also be changed by repositioning jumper SW1 to the desired operating range.



VAT Actuator on VBG Body

## Actuator Specifications

**Control Signal:** VAT100ANS—3-Wire floating.

VAP100ANS—0 to 10 Vdc; field selectable for 1 to 5, 2 to 10, 4 to 7, 6 to 9, 8 to 11 Vdc, or 4 to 20 mA.

**Feedback Signal:** VAT100ANS—0 to 1000  $\Omega$  (direct or reverse acting). VAP100ANS—1 to 10 Vdc (direct or reverse acting) or 0 to 20 mA (direct or reverse acting).

**Maximum Close-Off Pressure on Erie VBG Series**

**Valves:** 1-1/4 in. valve—58 psi (4 bar), 1-1/2 in. valve—36 psi (2.5 bar), 2 in. valve—30 psi (2 bar).

**Power Signal:** Nominal 24 Vac 3-wire, -15%, +10%, 50/60 Hz.

**Input Impedance:** 100K ohms.

**Power Consumption:** 5 VA.

**Stroke Time:** 65 seconds at 60 Hz.

**Maximum Stroke:** 7/8 in (21 mm).

**Close-Off Force:** 100 ft-lb (450 N).

**Maximum Fluid Temperature:** 250 °F (120 °C).

**Ambient Operating Limits:** 23 to 122 °F (-5 to 50 °C) at 80% RH maximum.

**Ambient Storage Temperature Limits:** -13 to 149 °F (-25 to 65 °C).

**Materials:** Thermoplastic and technopolimer enclosure.

**Wiring Connections:** Terminal strip.

**Approvals:** CE marked compliant.

**Shipping Weight:** 1.7 lb. (0.8 kg)

## Accessories

An auxiliary switch (p/n D36PS1) can be ordered separately to be installed in the actuator. The switch is single pole double throw (SPDT) and can be adjusted to actuate at any valve position. The switch is rated for 10 amps resistive, 3 amps inductive, at 250 Vac.

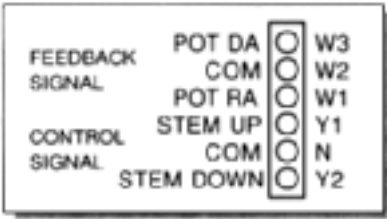


Figure 1 VAT100ANS Wiring.

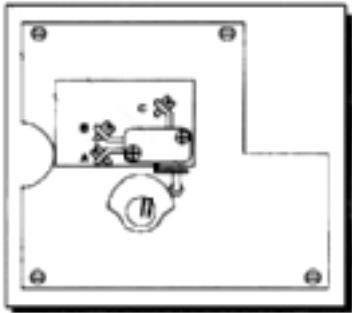


Figure 3 D26PSI Auxiliary Switch.

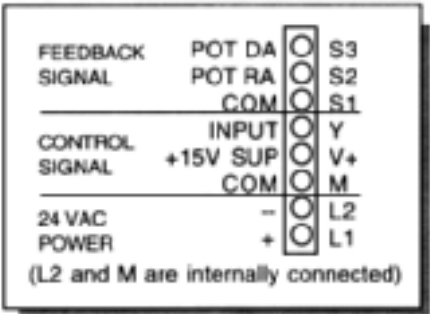


Figure 2 VAP100ANS Wiring.

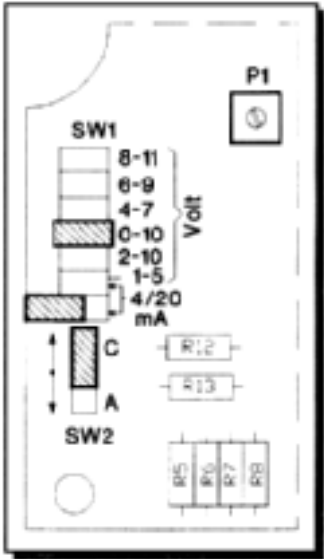


Figure 4 VAP100ANS Circuit Board Detail.

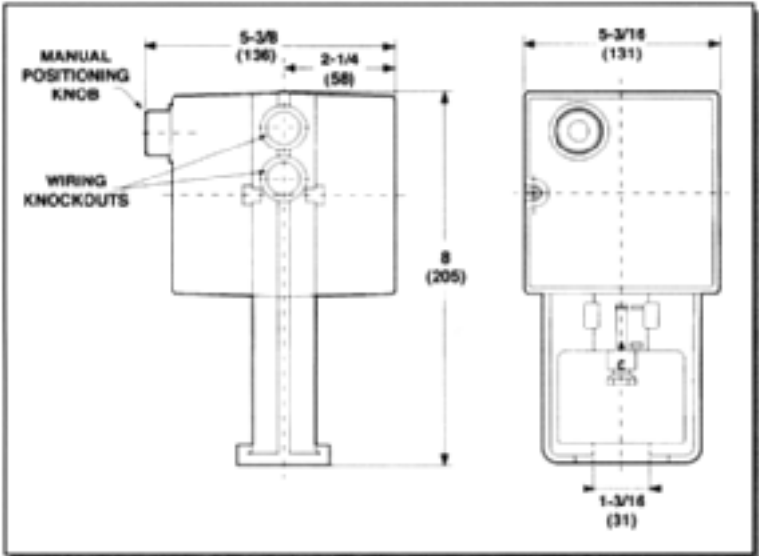


Figure 5 Dimensions, shown in inches (mm).

## Application

The VAT/VAP series valve actuators are designed for proportional voltage or current or 3-wire floating control of VBF series 2-way and 3-way globe valves. All units are equipped with usual position indications and a manual override.

The VAT/VAP series actuators feature a reversible synchronous motor. Position feedback signal of 0 to 10 Vdc or 0 to 200 mA is available on model VAP270ANS as a standard feature. An auxiliary switch is also available as an accessory, field option kit D270S1 (ordered separately).

For ease of installation, the VAT/VAP270 series actuators mount directly onto the VBF series valves in minutes, without the need for linkages or field calibration of the travel or span of the actuator.

For best control results, the VAT/VAP Series actuators can be controlled by virtually any proportional voltage or current or 3-wire floating input. The circuit board of the VAP270ANS actuator allows the user to select one of the seven different operating ranges, as well as the direction of stroke. The thermostat or controller should be selected or adjusted to complement the stroke time of the VAT/VAP270 series actuator.

## Actuator Specifications

**Control Signal: VAT270ANS**—3-Wire floating.

**VAP270ANS**—Factory set for 0 to 10 Vdc; field selectable for 1 to 5, 2 to 10, 4 to 7, 6 to 9, 8 to 11 Vdc, or 4 to 20 mA.

**Feedback Signal (Direct or Reverse Acting):**

**VAT270ANS**—None, **VAP270ANS**—0 to 10 Vdc or 0 to 200  $\mu$ A.

**Power Supply:** Nominal 24 Vac -15%, +10%, 50/60 Hz.

**Input Impedance:** 100K ohms.

**Power Consumption:** 9 VA.

**Stroke Time at 60 Hz (50 Hz):** 67 (80) seconds.

**Maximum Stroke:** 1-3/4" (45 mm).

**Close-Off Force:** 270 ft-lb (1200 N).

**Motor Transmission:** Crank-arm.

**Maximum Fluid Temperature:** 250 °F (120 °C)

**Ambient Operating Limits:** 32 to 122 oF (-0 to 50 °C)

**Ambient Storage Temperature Limits:** -13 to 149 °F (-25 to 65 °C).

**Enclosure:** Die-cast aluminum housing and plastic cover.

**Wiring Connections:** Terminal strip.

**Approvals:** CE marked compliant.

**Shipping Weight:** 4.4 lb. (2 kg).

## Model Chart

|           |  |
|-----------|--|
| VAT270ANS | 3-wire floating, 270 ft-lb, non-spring return.                     |
| VAP270ANS | Proportional 0-10 Vdc or 4 to 20 mA, 270 ft-lb, non-spring return. |



VAT/VAT-270 Series Actuator

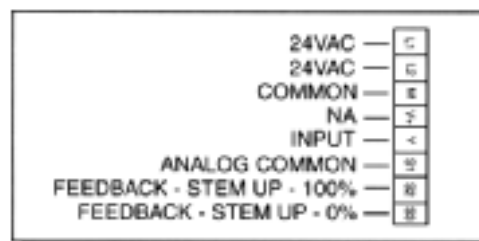


Figure 1 VAP270 Wiring Diagram.

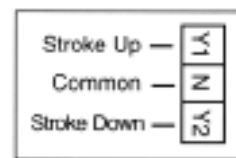


Figure 2 VAT270 Non-Spring Return.

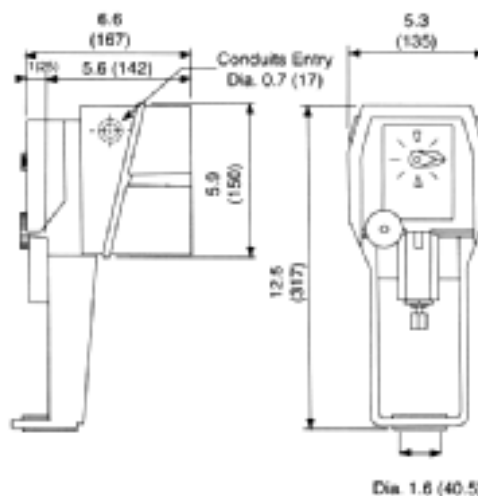


Figure 3 Dimensions, shown in inches (mm).



## Application

The VAT/VAP series valve actuators are designed for proportional voltage or current or 3-wire floating control of VBF series 2-way and 3-way globe valves. All units are equipped with usual position indication and a manual override device.

The VAT/VAP series actuators feature a reversible synchronous motor with a torque limited device to eliminate the need for position switches and enhance the overall reliability of the actuator. Position feedback signal of 0 to 10 Vdc or 0 to 200  $\mu$ A is available on VAP340AN\_ models as a standard feature. An auxiliary switch is also available as an accessory, field option kit D340S1 (ordered separately).

For ease of installation, the VAT/VAP340 series actuators mount directly onto the VBF series valves in minutes, without the need for linkages or field calibration of the travel or span of the actuator.

For best control results, the VAT/VAP340 series actuators can be controlled by virtually any proportional voltage or current or 3-wire floating input. The circuit board of the VAP340 actuator allows the user to select one of the seven different operating ranges, as well as the direction of stroke. The thermostat or controller should be selected or adjusted to complement the stroke time of the VAT/VAP340 series actuator.

## Actuator Specifications

### Control Signal:

**VAT340ANS, VAT340ANC, VAT340ANO**—3-Wire floating.  
**VAP340ANS, VAP340ANC, VAP340ANO**—Factory set for 0 to 10 Vdc; field selectable for 1 to 5, 2 to 10, 4 to 7, 6 to 9, 8 to 11 Vdc, or 4 to 20 mA.

**Power Supply:** Nominal 24 Vac, -15%, +10%, 50/60 Hz.

**Input Impedance:** 100K  $\Omega$ .

**Power Consumption:** 12 VA.

**Feedback Signal (Direct or Reverse Acting):** 0 to 10 Vcd or 0 to 200  $\mu$ A.

**Stroke Time at 60 Hz (50 Hz):** 28 (34) seconds/inch.

**Spring Return Time at 60 Hz (50 Hz):** 20 (25) seconds/inch.

**Maximum Stroke:** 1-3/4" (45 mm).

**Close-Off Force:** 333 ft-lb (1500 N), 155 ft-lb (700 N) for spring return models.

**Motor Transmission:** Rack and pinion.

**Ambient Operating Limits:** 5 to 122 °F (-15 to 50 °C).

**Ambient Storage Temperature Limits:** -13 to 149 °F (-25 to 65 °C).

**Enclosure:** Die-cast aluminum housing and plastic cover.

**Wiring Connections:** Terminal strip.

**Approvals:** CE marked compliant.

**Shipping Weight:** 6.6 lb. (3 kg), or 8.8 lb. (4 kg) for spring return model.



VAT/VAP340 Series Actuator

## Model Chart

| Table-1 Model Chart. |  |
|----------------------|--|
| VAT340ANS            | 3-wire floating, 340 ft-lb, non-spring return                |
| VAT340ANC            | 3-wire floating, 340 ft-lb, spring-close                     |
| VAT340ANO            | 3-wire floating, 340 ft-lb, spring-open                      |
| VAP340ANS            | Proportional 0-10Vdc or 4-20mA, 340 ft-lb, non-spring return |
| VAP340ANC            | Proportional 0-10 Vdc or 4-20mA, 270 ft-lb, spring-close     |
| VAP340ANO            | Proportional 0-10Vdc or 4-20mA, 270 ft-lb, spring-open       |

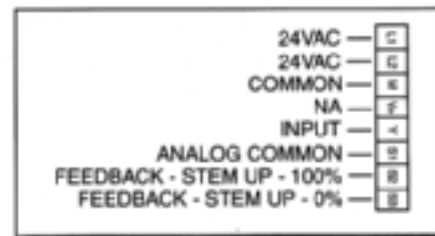


Figure 1 VAP340AN\_ Wiring.

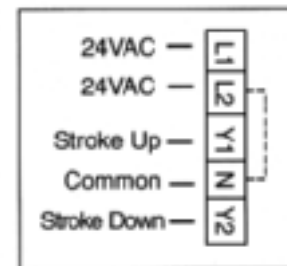


Figure 2 VAT340 Spring Return.

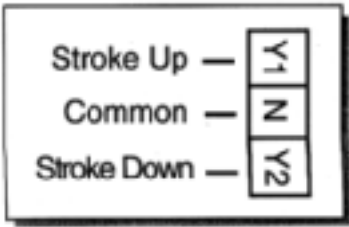


Figure 3 VAT340 Non-Spring Return.

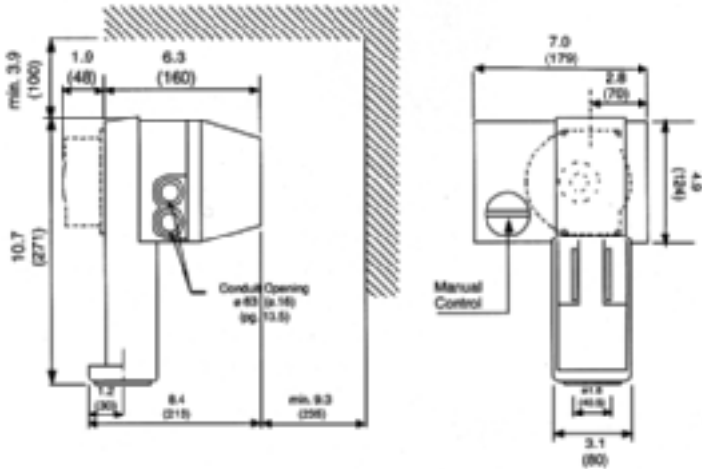


Figure 4 Dimensions, shown in inches (mm).



## Application

The VBF series globe valves are engineered specifically for temperature control applications requiring an equal percentage flow characteristic and a high degree of control precision. Common applications include hot water, chilled water, and low pressure steam coils and heat exchangers in air handling units, chillers, boilers, and cooling towers.

The VBF series valves are designed with ANSI flanged connections, in 2-way and 3-way configurations.

All VBF series valves are operated by VAT/VAP series electric actuators which are ordered separately. The actuators are designed specifically for mounting directly to the VBF series valves without the need of linkages or time-consuming field calibration.

## Pipe Connections

Install according to flow direction as indicated on valve body.

## Valve Mounting

Before mounting valve, be sure that pipes are clean and free from welding slag. It is essential that pipes be lined up squarely with the valve at each connection, free from vibrations. For installations on plants with higher temperature fluid (steam, superheated steam, water, or diathermic fluid), use expansion joints to avoid pipe bucking against valve body. With high fluid temperatures do not mount the actuator in a vertical position on the valve to avoid direct exposure to heat sources, see Figure-1.



Figure 1 Installation Positions.

Leave sufficient clearance for actuator removal.

Valve must not be installed in explosive atmosphere, nor at ambient temperature higher than 122 °F (50 °C) or lower than 23 °F (-5 °C): must not be subject to steam jets, water jets or dripping.

**Note:** Actuator may be rotated 180° with respect to valve body by loosening lock nut of valve body. After this operation, tighten lock nut.



VBF Flanged Globe Valve

## Valve Specifications

**Body Rating:** 250 PSI (1600 kPa, 16 bar).

**Maximum Recommended Differential:** 35 PSIG (24 kPa).

**Flow Characteristic:** **2-Way**—Equal percentage, **3-Way**—Service port A-equal percentage, bypass port B-linear.

**Service:** Hot and chilled water, up to 50% glycol, and low pressure steam.

**Seat Leakage:** **2-Way**—0.03% of Cv, **3-Way**—Service port A-0.03% of Cv, bypass port B-2% of Cv.

**Fluid Temperature & Pressure Limits:** 15 to 250 °F water (-10 to 120 °C), maximum 250 °F (120 °C) at 22 PSIA (150 kPa) steam.

**Materials:** **Body and Seat**—Cast iron, **Stem**—Stainless steel, **Plug**—Forged brass, **Stem Packing**—Buna N O-ring

**Body Connections:** ANSI flanges, 250 PSI (PN16)

**Dimensions & Shipping Weights:** See Figure-4, Figure-5, Table 1, and Table 2.

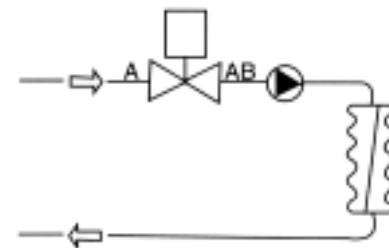


Figure 2 Two-Way Flow Direction.

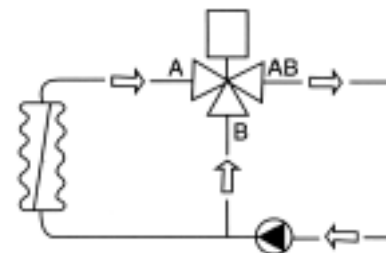


Figure 3 Three-Way Flow Direction.

# Flanged Globe Valve Bodies

## VBF Series

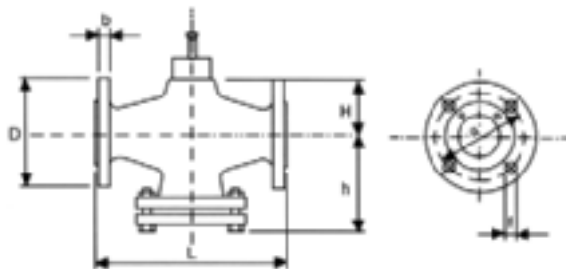


Figure 4 Two-Way Valve Body Dimensions, shown in inches (mm).

TABLE 1. Two-Way Valve Body Model Chart.

|             |                            | Body         |              |              | Flanges             |                      | Bolt Holes     |                     | Bolting         |                   |                 | Body            |
|-------------|----------------------------|--------------|--------------|--------------|---------------------|----------------------|----------------|---------------------|-----------------|-------------------|-----------------|-----------------|
| 2-Way Model | Nominal Pipe Size in. (mm) | L in. (mm)   | H in. (mm)   | h in. (mm)   | D Diameter in. (mm) | b Thickness in. (mm) | a BHC in. (mm) | f Diameter in. (mm) | Number of Bolts | Diameter in. (mm) | Length in. (mm) | Weight lb. (kg) |
| VBF250AA2   | 2-1/2 (65)                 | 11-1/2 (292) | 2-13/16 (71) | 6-7/8 (175)  | 7 (178)             | 11/16 (17)           | 5-1/2 (140)    | 3/4 (19)            | 4               | 5/8 (16)          | 2-1/2 (64)      | 50.7 (23)       |
| VBF300AA2   | 3 (80)                     | 12 (305)     | 3-3/16 (81)  | 7-5/16 (185) | 7-1/2 (191)         | 13/16 (21)           | 6 (152)        | 3/4 (19)            | 4               | 5/8 (16)          | 2-1/2 (64)      | 61.7 (28)       |
| VBF400AA2   | 4 (100)                    | 13-1/2 (343) | 3-11/16 (93) | 8-1/16 (205) | 9 (229)             | 13/16 (21)           | 7-1/2 (191)    | 3/4 (19)            | 8               | 5/8 (16)          | 3 (76)          | 77.2 (35)       |
| VBF500AA2   | 5 (125)                    | 15-1/2 (394) | 4-1/2 (115)  | 9-1/16 (230) | 10 (254)            | 7/8 (22)             | 8-1/2 (216)    | 7/8 (22)            | 8               | 3/4 (19)          | 3 (76)          | 108.0 (49)      |
| VBF600AA2   | 6 (150)                    | 18-3/4 (476) | 5-1/4 (133)  | 10-5/8 (270) | 11 (279)            | 15/16 (24)           | 9-1/2 (241)    | 7/8 (22)            | 8               | 3/4 (19)          | 3-1/4 (83)      | 143.3 (65)      |

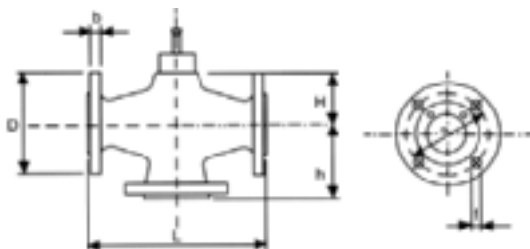


Figure 5 Three-Way Valve Body Dimensions, shown in inches (mm)

TABLE 2. Three-Way Valve Body Model Chart.

|             |                           | Body         |              |               | Flanges             |                      | Bolt Holes     |                     | Bolting         |                   |                 | Body            |
|-------------|---------------------------|--------------|--------------|---------------|---------------------|----------------------|----------------|---------------------|-----------------|-------------------|-----------------|-----------------|
| 3-Way Model | Nominal Pipe Size in (mm) | L in. (mm)   | H in. (mm)   | h in. (mm)    | D Diameter in. (mm) | b Thickness in. (mm) | a BHC in. (mm) | f Diameter in. (mm) | Number of Bolts | Diameter in. (mm) | Length in. (mm) | Weight lb. (kg) |
| VBF250AA3   | 2-1/2 (65)                | 11-1/2 (292) | 2-13/16 (71) | 5-11/16 (145) | 7 (178)             | 11/16 (17)           | 5-1/2 (140)    | 3/4 (19)            | 4               | 5/8 (16)          | 2-1/2 (64)      | 44.1 (20)       |
| VBF300AA3   | 3 (80)                    | 12 (305)     | 3-3/16 (81)  | 6-1/8 (155)   | 7-1/2 (191)         | 13/16 (21)           | 6 (152)        | 3/4 (19)            | 4               | 5/8 (16)          | 2-1/2 (64)      | 55.1 (25)       |
| VBF400AA3   | 4 (100)                   | 13-1/2 (343) | 3-11/16 (93) | 6-7/8 (175)   | 9 (229)             | 13/16 (21)           | 7-1/2 (191)    | 3/4 (19)            | 8               | 5/8 (16)          | 3 (76)          | 79.4 (36)       |
| VBF500AA3   | 5 (125)                   | 15-1/2 (394) | 4-1/2 (115)  | 7-7/8 (200)   | 10 (254)            | 7/8 (22)             | 8-1/2 (216)    | 7/8 (22)            | 8               | 3/4 (19)          | 3 (76)          | 99.2 (45)       |
| VBF600AA3   | 6 (150)                   | 18-3/4 (476) | 5-1/4 (133)  | 9-7/16 (240)  | 11 (279)            | 15/16 (24)           | 9-1/2 (241)    | 7/8 (22)            | 8               | 3/4 (19)          | 3-1/4 (83)      | 132.3 (60)      |

**TABLE 3.** Valve and Actuator Selection Guide.

| 2-Way VBF Bodies |                     |                    |     |     | Maximum $\Delta P$ PSI (kPa)<br>Operating Actuator |           |              | Maximum $\Delta P$ PSI (kPa)<br>Close-Off Actuator |           |              |
|------------------|---------------------|--------------------|-----|-----|--|-----------|--------------|--|-----------|--------------|
| 2-Way Model #    | Valve Size in. (mm) | Stem Lift in. (mm) | Cv  | Kv  | VA_270ANS  | VA_340ANS | VA_340ANC/NO | VA_270ANS  | VA_340ANS | VA_340ANC/NO |
| VBF250AA2        | 2-1/2 (65mm)        | 1 (25mm)           | 74  | 63  | 30 (200)   | 30 (200)  | 20 (140)     | 41 (280)   | 53 (360)  | 20 (140)     |
| VBF300AA2        | 3 (80mm)            | 1-3/4 (45mm)       | 117 | 100 | 25 (170)   | 30 (200)  | 11 (80)      | 25 (170)   | 34 (230)  | 11 (80)      |
| VBF400AA2        | 4 (100mm)           | 1-3/4 (45mm)       | 187 | 160 | 12 (80)  | 20 (140)  | 6 (40)       | 12 (80)  | 20 (140)  | 6 (40)       |
| VBF500AA2        | 5 (125mm)           | 1-3/4 (45mm)       | 292 | 250 | 7 (50)   | 12 (80)   | 4 (25)       | 7 (50)   | 12 (80)   | 4 (25)       |
| VBF600AA2        | 6 (150mm)           | 1-3/4 (45mm)       | 421 | 360 | 5 (30)   | 6 (40)    | 2 (15)       | 5 (30)   | 6 (40)    | 2 (15)       |

| 3-Way VBF Bodies |                     |                    |     |     | Maximum $\Delta P$ PSI (kPa)<br>Operating Actuator |           |              | Maximum $\Delta P$ PSI (kPa)<br>Close-Off Actuator |           |              |
|------------------|---------------------|--------------------|-----|-----|--|-----------|--------------|--|-----------|--------------|
| 3-Way Model #    | Valve Size in. (mm) | Stem Lift in. (mm) | Cv  | Kv  | VA_270ANS  | VA_340ANS | VA_340ANC/NO | VA_270ANS  | VA_340ANS | VA_340ANC/NO |
| VBF250AA3        | 2-1/2 (65mm)        | 1 (25mm)           | 74  | 63  | 30 (200)   | 30 (200)  | 22 (200)     | 44 (300)   | 58 (400)  | 22 (150)     |
| VBF300AA3        | 3 (80mm)            | 1-3/4 (45mm)       | 117 | 100 | 26 (180)   | 30 (200)  | 13 (170)     | 26 (180)   | 35 (240)  | 13 (90)      |
| VBF400AA3        | 4 (100mm)           | 1-3/4 (45mm)       | 187 | 160 | 15 (100)   | 22 (150)  | 7 (80)       | 15 (100)   | 22 (150)  | 7 (50)       |
| VBF500AA3        | 5 (125mm)           | 1-3/4 (45mm)       | 292 | 250 | 9 (60)   | 13 (90)   | 4 (50)       | 9 (60)   | 13 (90)   | 4 (25)       |
| VBF600AA3        | 6 (150mm)           | 1-3/4 (45mm)       | 421 | 360 | 6 (40)   | 7 (50)    | 2 (30)       | 6 (40)   | 7 (50)    | 2 (15)       |

**TABLE 4.** Port Configuration.

| Port Configuration |   |
|--------------------|---|
| 2-Way              | Fully closed with stem up and fully open with stem down (stem up closed)  |
| 3-Way              | Service Port A: Fully closed to port AB with stem up and fully open with stem down (stem up closed)<br>Bypass Port B: Fully open to port AB with stem up and fully closed with stem down (stem up open) |

**TABLE 5.** Valve Water Sizing Table, Water Capacity, gallons per minute (GPM).

| Flow Coefficient, Cv | Differential Pressure, $\Delta P$ (PSI) |     |     |     |      |      |      |      |      |      |
|----------------------|---|-----|-----|-----|------|------|------|------|------|------|
|                      | 2                                       | 3   | 4   | 5   | 10   | 15   | 20   | 25   | 30   | 35   |
| 74                   | 105                                     | 128 | 148 | 165 | 234  | 287  | 331  | 370  | 405  | 438  |
| 117                  | 165                                     | 203 | 234 | 262 | 370  | 453  | 523  | 585  | 641  | 692  |
| 187                  | 264                                     | 324 | 374 | 418 | 591  | 724  | 836  | 935  | 1024 | 1106 |
| 292                  | 412                                     | 506 | 584 | 653 | 923  | 1131 | 1306 | 1460 | 1599 | 1727 |
| 421                  | 595                                     | 729 | 842 | 941 | 1331 | 1631 | 1883 | 2105 | 2306 | 2491 |

**Flanged Globe Valve Bodies  
VBF Series**



## Application

The VBG series globe style valves are engineered specifically for temperature control applications requiring an equal percentage flow characteristic and a high degree of control precision. Common applications include hot water, chilled water and low pressure steam coils and heat exchangers in air handling units, chillers, boilers and cooling towers.

VBG series valves are available in 2-way and 3-way configurations, with American NPT threads. All VBG series valves are fully closed with the stem up and fully open with the stem down (stem up closed). See Figure-1 for model numbers.

All VBG series valves are operated by Erie VAP100 ANS (proportional) and VAT100ANS (3-wire floating) actuators which are ordered separately. The actuators are designed specifically for VBG series valves, and mount directly to the valves without the need for linkages or time-consuming field calibration.

## Piping

VB series valves can be installed on the supply side or the return side of coils and heat exchangers of all types. For 2-way valves, the direction of flow must be into the "A" port and out of the "AB" port. For 3-way valves, the valve must be piped as a mixing valve, with the coil flow into the "A" port, the bypass flow into the "B" port, and the common outlet out of the "AB" port.

## Actuator Specifications

**Body Rating:** 250 psi (16 bar).

**Flow Characteristic:** Service port equal percentage, bypass port linear.

**Body Styles and Sizes:** See Figure-1.

**Service:** Hot and chilled water, up to 50% glycol, and low pressure steam.

**Valve Stroke:** 0.65 in. (16.5 mm).

**Seat Leakage:** Service (A) port: 0.03% of Cv, bypass (B) port: 2% of Cv (3-way only).

**Fluid Temperature & Pressure Limits:** 14 to 274 °F (-10 to 120 °C) water, maximum. 274 °F at 21 PSIA (120 °C at 1.5 bar) steam.

**Materials: Body**—Cast iron, finished with corrosion resistant coating. **Stem**—Chromium nickel stainless steel.

**Plug**—Brass. **Stem Packing**—Double O-ring, Buna N, with Teflon wiper.

**Dimensions and Shipping Weights:** See Table-2.



VBG Series Valve

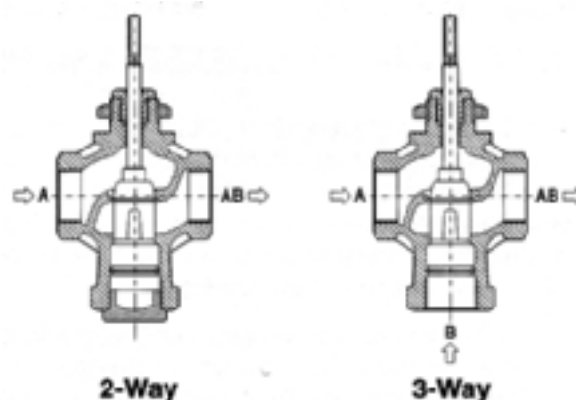


Figure 1 Valve Body Types.

| VBG    |             |               |   |                 |
|--------|-------------|---------------|---|-----------------|
| SIZE   | CONNECTIONS | CONFIGURATION |   |                 |
| 1 1/4" | 125         | NPT THREAD    | N | TWO WAY         |
| 1 1/2" | 150         |               |   | THREE WAY (MIX) |
| 2"     | 200         |               |   |                 |
|        |             |               |   | 2               |
|        |             |               |   | 3               |

Figure 2 Ordering Chart.

# Threaded Globe Valve Bodies VBG Series



**TABLE 1.** Flow Coefficients and Maximum Close-Off Pressure.

| Valve Size | Cv | Kv | Maximum $\Delta P$<br>Operating PSI (bar) | Maximum $\Delta P$<br>Close-Off PSI (bar) |
|------------|----|----|---|---|
| 1-1/4"     | 19 | 16 | 30 (2)                                    | 58 (4)                                    |
| 1-1/2"     | 26 | 22 | 30 (2)                                    | 36 (2.5)                                  |
| 2"         | 47 | 40 | 30 (2)                                    | 30 (2)                                    |

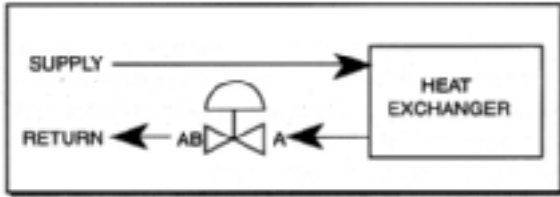


Figure 3 Two-Way Valve Piping.

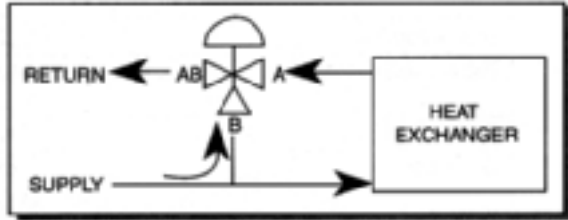


Figure 4 Three-Way Valve Piping.

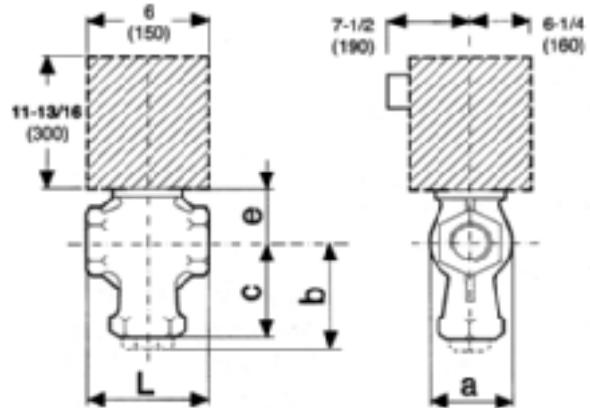


Figure 5 Dimensions.

**TABLE 2.** Dimensions.

| Two Way<br>Model | Three Way<br>Model | Body Size<br>in. (mm) | Dimensions, in. (mm) |                |                  |                 |                  | Weight<br>lb. (kg) |
|------------------|--------------------|-----------------------|----------------------|----------------|------------------|-----------------|------------------|--------------------|
|                  |                    |                       | L                    | A              | E                | B               | C                |                    |
| VBG125N2         | VBG125N3           | 1-1/4<br>(32)         | 4-1/4<br>(108)       | 2-3/4<br>(70)  | 1-3/4<br>(43.5)  | 3-3/8<br>(85.5) | 3-1/16<br>(78.5) | 4.4<br>(2.0)       |
| VBG150N2         | VBG150N3           | 1-1/2<br>(38.3)       | 4-3/4<br>(120)       | 3-3/16<br>(81) | 2<br>(51)        | 3-5/8<br>(92.5) | 3-3/8<br>(78.5)  | 5.9<br>(2.7)       |
| VBG200N2         | VBG200N3           | 2<br>(51)             | 5-5/8<br>(142)       | 3-7/8<br>(97)  | 2-3/16<br>(54.5) | 4-1/16<br>(104) | 3-7/8<br>(97)    | 8.8<br>(4.0)       |

## Application

The Boiler Boss® BB1200 series universal reset control is used to control water temperature boiler applications. The supply water is continuously adjusted up or down based on outside air temperature. As the outside air gets colder the BB1200 raises the hot water supply temperature through the dry contact output to a boiler controller. As the outside air gets warmer the BB1200 signals the boiler controller to supply cooler supply water to the heating system. This is not a boiler operating control.



**BB1200**

## Features

- Boiler water temperature reset.
- Warm weather shutdown.
- Domestic hot water priority.
- Boiler low limit.
- Boiler supply and outdoor air sensors (OAS-1).
- LED display for boiler temperature and system settings.
- Burner LED.
- Three reset ratios.
- Test mode.

## Specifications

### Inputs

|                            |   |
|----------------------------|---|
| <b>Power input</b>         | 24 Vac, class 2, 0.25 amps maximum (6 VA) @ 50/60 Hz. |
| <b>Thermostat input</b>    | 24 Vac, 60 mA dry contacts originates on BB1200.      |
| <b>Priority zone input</b> | 10 DC, 2 mA dry contacts originates on BB1200.        |
| <b>Temperature sensors</b> | 100kΩ @ 77 °F (25 °C) Thermistor.                     |

### Outputs

|                                |   |
|--------------------------------|---|
| <b>Electrical</b>              | Burner output (dry contacts): 24 Vac pilot duty class 2, 75 VA maximum. |
| <b>Mechanical</b>              | Boiler temperature range: 90 to 230 °F (32 to 110 °C).                  |
| <b>Operating differential:</b> | 15 or 25 F degrees (8 or 14 C degrees). Field selectable.               |

### Environment

|                                   |  |
|-----------------------------------|--|
| <b>Ambient temperature limits</b> | Operating: -20 to 120 °F (-29 to 49 °C).<br>Shipping and storage: -40 to 140°F (-40 to 60°C) |
| <b>Humidity</b>                   | 85% RH, non-condensing.  |
| <b>Locations</b>                  | NEMA Type 1.   |

### Control Ranges

|                               |                              |
|-------------------------------|------------------------------|
| <b>Outdoor temperature</b>    | -50 to 80 °F (-45 to 27 °C). |
| <b>Boiler temperature</b>     | 90 to 230 °F (32 to 110 °C). |
| <b>Operating differential</b> | 15 or 25 °F (-9 to -4 °C).   |





## Application

The Boiler Boss® BB2400 control is used for single stage boiler control and indirect domestic hot water.

## Features

- Boiler water temperature reset control.
- Boiler water supply and outdoor air sensor.
- Boiler low limit “stand-by” or “cold start” control.
- Domestic hot water Priority Plus® control.
- Warm weather shutdown in “cold start” applications.
- Optional low water cut-off.
- Safety high limit protection.
- Burner failure protection.
- Fused circuit board.



**BB2400**

## Model Chart

| Model No. | Burner Output (Vac) | Heating Circulator Output (Vac) | DHW Priority Zone Output |
|-----------|---------------------|---------------------------------|--------------------------|
| BB2400-2  | 120                 | 120                             | 120 Vac                  |
| BB2400-3  | 24                  | 120                             | 120 Vac                  |
| BB2400-4  | 120                 | 120                             | 24 Vac                   |

## Specifications

### Inputs

|                             |                                 |
|-----------------------------|---------------------------------|
| <b>Power input</b>          | 120 Vac @ 50/60 Hz 17 VA.       |
| <b>Internal transformer</b> | 24 Vac, 40 VA (75 VA optional). |
| <b>Fuse</b>                 | 250 V, 15 A slow blow.          |
| <b>Thermostat input</b>     | 60 mA @ 24 Vac.                 |

### Control Ranges

Boiler temperature range low: 90 to 200 °F (32 to 93 °C). Hi: 120 to 220 °F (49 to 104 °C).  
Operating differential: 15 F degrees standard, 30 °F degrees optional.

### Outputs

|                   |  |
|-------------------|--|
| <b>Electrical</b> | Line voltage burner: 120 Vac, 60 Hz, full load 7.4 amps, locked rotor, 44.4 amps resistive 10 amps.<br>Low voltage burner: 1 amp pilot duty @ 24 Vac 60 Hz.<br>Circulator: 120 Vac, Full load: 7.4 amps, Locked rotor: 44.4 amps, Resistive: 10 amps.<br>Priority circulator (BB2400-2, 3) or ZC/ZR.<br>1/4 hp @ 24 Vac, Full load: 3.6 amps, Locked rotor: 21.6 amps, Resistive: 5 amps.<br>Priority zone valve (BB2400) 1 amp pilot duty @ 24 Vac 60 Hz. |
|-------------------|--|

### Environment

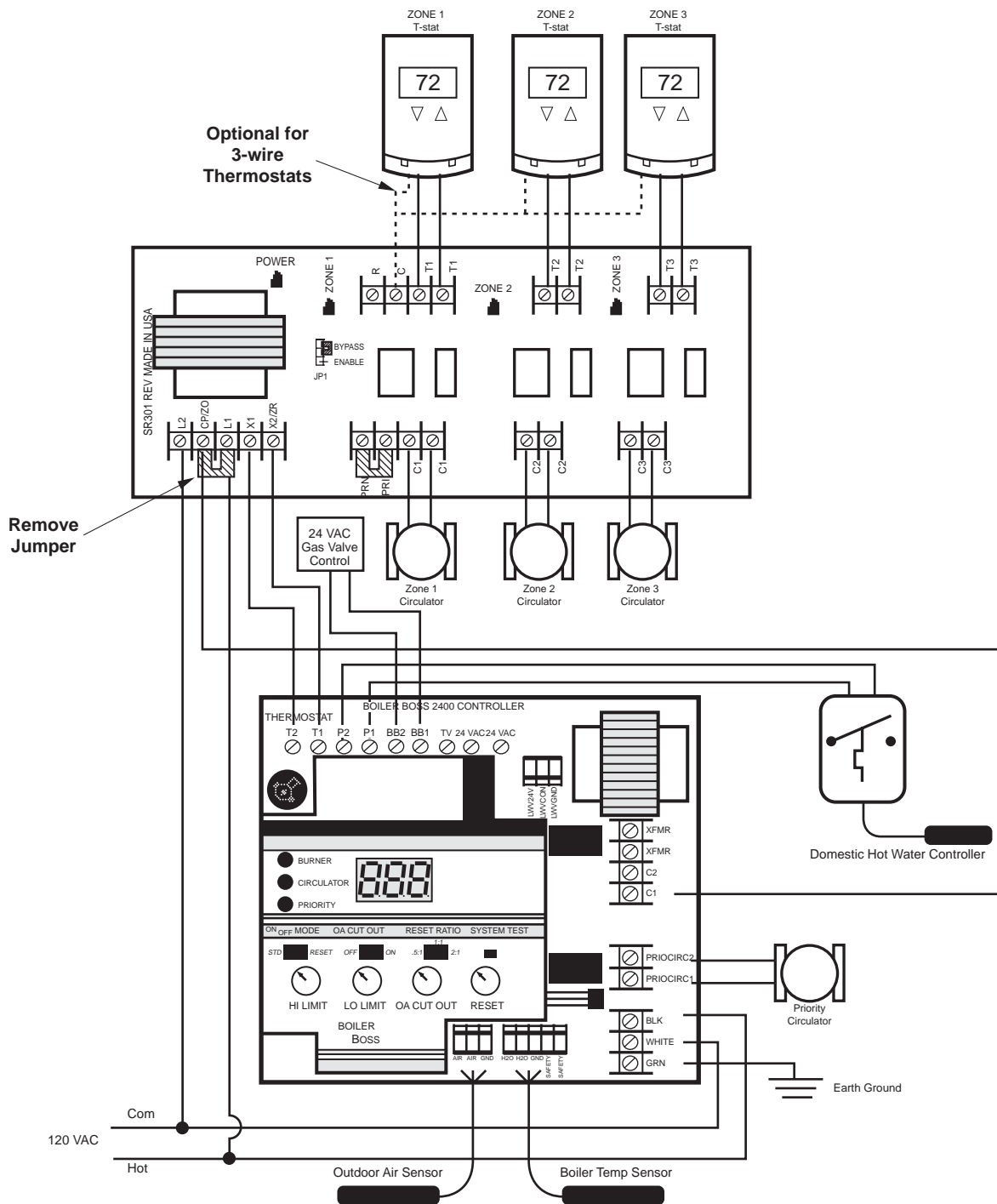
|                                   |   |
|-----------------------------------|---|
| <b>Ambient temperature limits</b> | Operating: Maximum of 100 °F (39 °C). 40 to 104 °F (4 to 40 °C)<br>Shipping and storage: -20 to 140 °F (-29 to 60 °C) |
| <b>Humidity</b>                   | 85% RH, non-condensing.   |
| <b>Locations</b>                  | NEMA Type 1. (IP 20)  |

## Accessories

| Model No. | Description.  |
|-----------|---|
| BTS-1     | Boiler Water/safety sensor (one included with BB2400).                    |
| OAS-1     | Outside air sensor with 25 ft. shielded cable (one included with BB2400). |
| OAS-2     | 50 ft. shielded cable for OAS-1 sensor.                                   |
| LWC-1     | Low water sensor with LED status indicators.                              |
| EXT-75    | 24 Vac, 75 VA transformer.  |

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## Application

The Boiler Boss® BB3000 injection pump mixing control with outdoor reset provides closed loop control of water temperature in the secondary (radiant) loop of a primary/secondary heating system.

The Boiler Boss BB3000 also protects against boiler condensation by monitoring and anticipating the boiler return water temperature.

The outdoor air and loop temperatures are displayed continuously, along with the secondary loop setpoint and pump speed.



**BB3000**

## Features

- Microprocessor control.
- Built-in transformer and relays.
- Real application data inputs.
- Large, bright display and indicators.
- Boiler short-cycle and low temperature protection.
- Sure start pump control.
- Proxy override.

## Specifications

### Inputs

|                                  |   |
|----------------------------------|---|
| <b>Power input</b>               | Switch selectable 115/230 Vac +10% -15% @ 50/60 Hz, 5 A.            |
| <b>Connections</b>               | See Figure 1 - Typical Wiring.                                      |
| <b>Priority zone input</b>       | Dry contact closure, 24 Vac @ 8 mA.                                 |
| <b>Heat demand</b>               | Dry contact closure, 24 Vac @ 8 mA.                                 |
| <b>Three temperature sensors</b> | 10 k $\Omega$ thermistors, -60 to 220 °F (-51 to 104 °C).           |
| <b>Internal transformer</b>      | 24 Vac, 5 VA. Not available for external loads except as specified. |
| <b>Fuse</b>                      | 250 V, 5 A slow blow.   |
| <b>Circulator fuse</b>           | 250 V, 10 A slow blow.  |

### Outputs

|                   |  |
|-------------------|--|
| <b>Electrical</b> | Boiler control signal, Normally open relay (dry contacts for class 2 circuit only) 24 Vac, 75 VA pilot duty. |
|                   | Injection pump, Phase controlled triac at line voltage, maximum of 1/6 hp @ 115/230 Vac.                     |
|                   | Secondary circulator, Normally open relay maximum 1/3 hp @ 115 Vac. Maximum 1/2 hp @ 230 Vac.                |

### Environment

|                                   |  |
|-----------------------------------|--|
| <b>Ambient temperature limits</b> | Shipping and storage: -20 to 140 °F (-29 to 60 °C) |
|                                   | Operating: 40 to 104 °F (4 to 40 °C).              |
| <b>Locations</b>                  | 95% RH, non-condensing.                            |
| <b>Locations</b>                  | NEMA Type 1.                                       |

### Agency Listings

|                    |             |
|--------------------|-------------|
| <b>U.S. Patent</b> | #6,062,485. |
|--------------------|-------------|

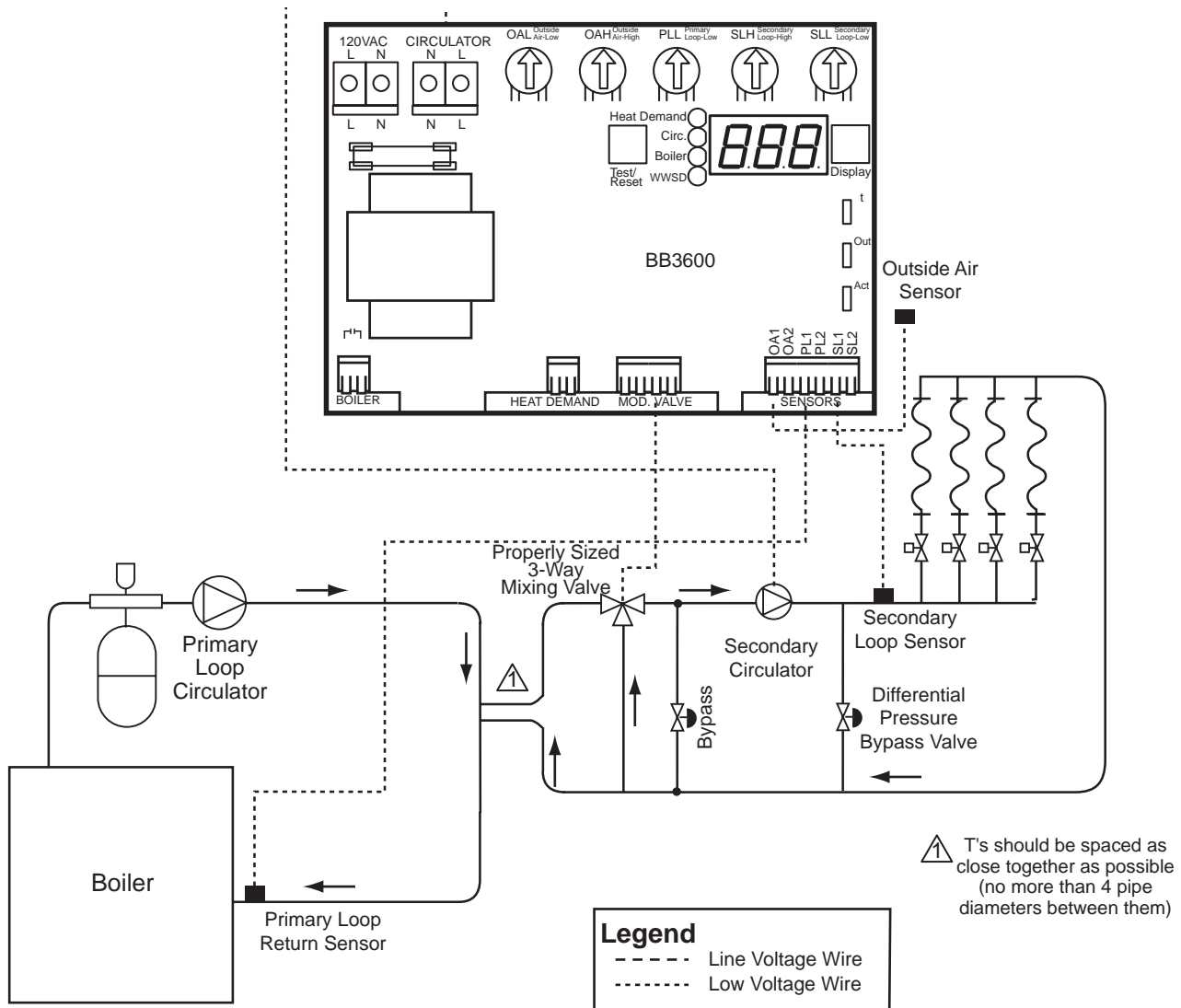


Figure-1 Typical Wiring Boiler Boss BB3000 Series.

## Application

The Boiler Boss® BB3600 mixing valve control with outdoor reset provides closed loop control of water temperature in the secondary (radiant) loop of a heating system using a proportional control three-way mixing valve.

The Boiler Boss BB3600 protects against boiler condensation by monitoring and anticipating the boiler return water temperature.

A continuously scrolling display shows the outdoor air, loop temperatures, secondary loop setpoint and valve signal value.



**BB3600**

## Features

- Microprocessor control.
- Built-in transformer and relays.
- Real application data inputs.
- Large, bright display and indicators.
- Boiler short-cycle and low temperature protection.
- Controls a modulating valve with either a 0 to 10 V or 4 to 20 mA signal.

## Specifications

### Inputs

|                             |  |
|-----------------------------|--|
| <b>Power input</b>          | 120 Vac +10% -15% @ 50/60 Hz, 20 VA.                                 |
| <b>Connections</b>          | Power: 120 Vac.<br>Control: 24 Vac.                                  |
| <b>Heat demand</b>          | Dry contact closure, 24 Vac supplied.                                |
| <b>Temperature sensor</b>   | 10k thermistors, -60 to 220 °F (-51 to 104 °C).                      |
| <b>Internal transformer</b> | 24 Vac, 25 VA. Not available for external loads except as specified. |
| <b>Fuse</b>                 | 250 V, 15 A slow blow.   |

### Outputs

|                   |  |
|-------------------|--|
| <b>Electrical</b> | Boiler control signal: Normally open relay (dry contacts for class 2 circuit only) 24 Vac, 75 VA pilot duty.<br>Proportional valve supply: 24 Vac, 10 VA.<br>Proportional valve control signal: 0-10 Vdc into 500 $\Omega$ minimum, direct or reverse acting. 4-20 mA into 300 $\Omega$ maximum, direct or reverse acting.<br>Secondary circulator: Normally open relay, 1/3 hp @ 120 Vac. |
|-------------------|--|

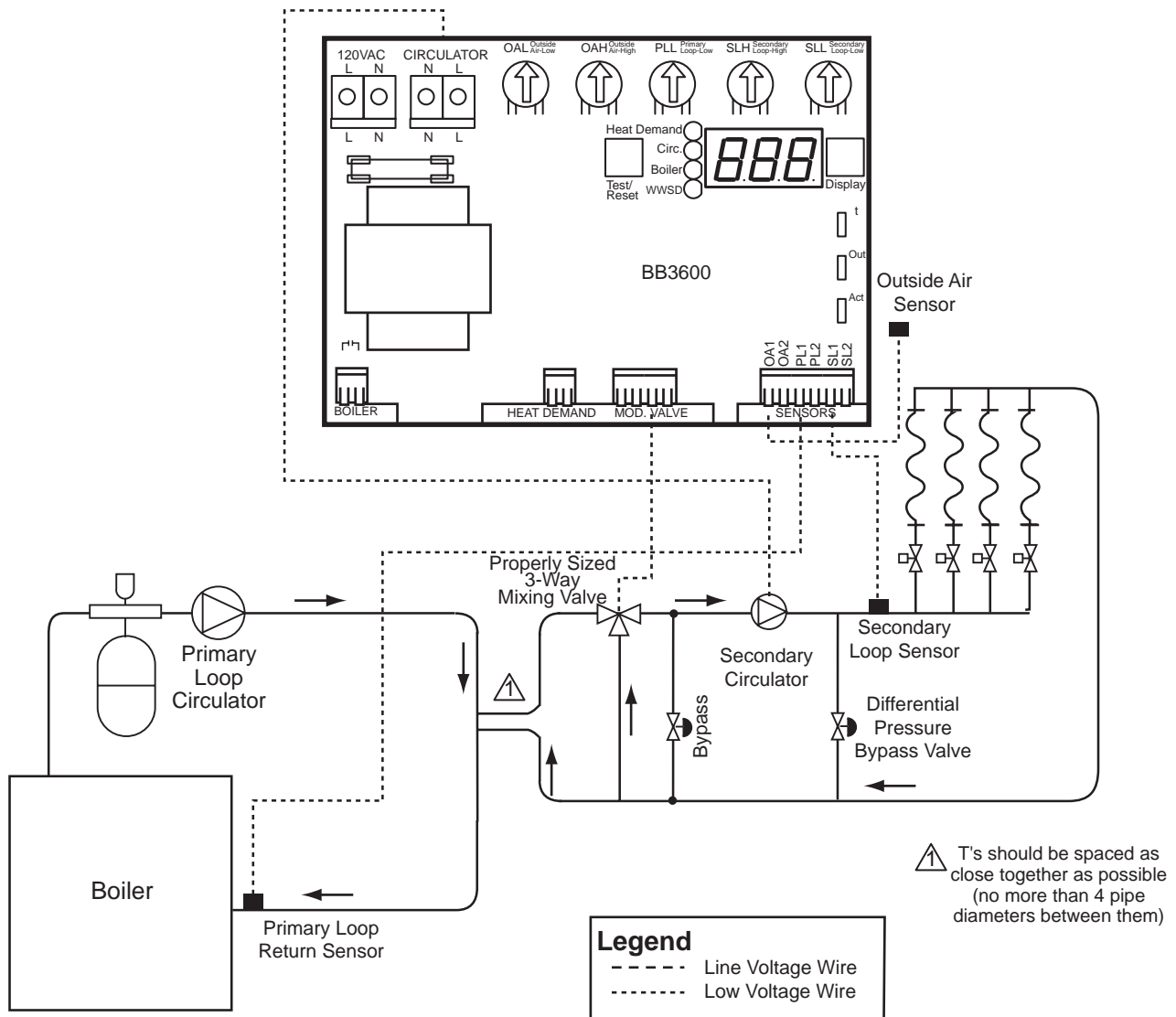
### Environment

|                                   |  |
|-----------------------------------|--|
| <b>Ambient temperature limits</b> | Shipping and storage: -20 to 140 °F (-29 to 60 °C).<br>Operating: 40 to 104 °F (4 to 40 °C). |
| <b>Humidity</b>                   | 95% RH, non-condensing.  |
| <b>Locations</b>                  | NEMA Type 1.   |

# Three-Way Mixing Valve Control BB3600



## Typical Applications





## Application

The SR100 series zone control relay incorporates a double pole/double throw relay to control a circulator and a boiler operating control in a single zone hydronic heating system.

## Features

- Field replaceable relay.
- High capacity 10 VA transformer.
- Large terminal connections.
- Common 24 Vac transformer terminal.
- Standard auto-test function to test system operation.
- Field configurable for two SPDT dry contacts (shipped from factory as one 120 V SPDT contact and one SPDT dry contact).



**SR100**

## Model Chart

| Model No | Description                       |
|----------|-----------------------------------|
| SR100    | Single zone relay.                |
| SR100AT  | Single zone relay with auto-test. |

## Specifications

### Inputs

|                    |  |
|--------------------|--|
| <b>Power input</b> | 120 Vac @ 50/60 Hz, 10 VA.                                     |
| <b>Thermostat</b>  | Thermostatic anticipator setting: 0.12 amps @ 24 Vac, Class 2. |

### Outputs

|                   |   |
|-------------------|---|
| <b>Electrical</b> | Thermostat supply (C-R/T): 24 Vac, 0.12 A, Class 2.             |
|                   | Low voltage dry contact (5-6NO or 5-6NC): 24 Vac, 8 A, Class 2. |
|                   | Line voltage dry contact (3-4NO or 3-4 NC):                     |
|                   | Motor: 1/3 hp @ 120 Vac,  |
|                   | Motor: 1/2 hp @ 240 Vac,  |
|                   | General purpose: 10 A @ 120/240 Vac,                            |
|                   | Resistive: 10 A @ 120 Vac                                       |

### Environment

|                                   |   |
|-----------------------------------|---|
| <b>Ambient temperature limits</b> | Shipping and storage: -20 to 140 °F (-29 to 60 °C)<br>Operating: maximum of 120 °F (49 °C). |
| <b>Humidity</b>                   | 85% non-condensing RH.  |
| <b>Locations</b>                  | NEMA Type 1.  |
| <b>Dimensions</b>                 | 4-1/8 x 2-7/8 x 5-1/8 inches (105 x 73 x 130 mm).   |

Zone Control Relay  
SR100 Series



Typical Applications

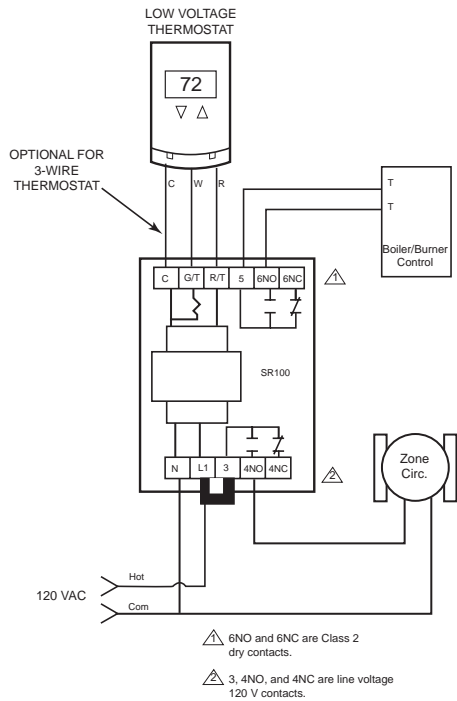


Figure 1 SR100 Relay Typical Wiring.

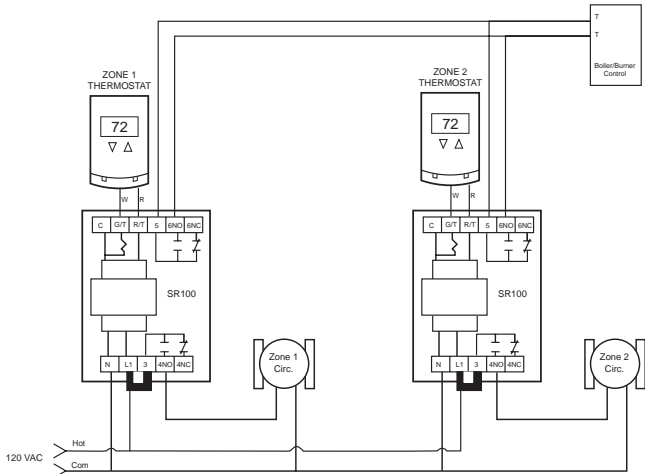


Figure 2 Multiple Zoning Using SR100 Relays.

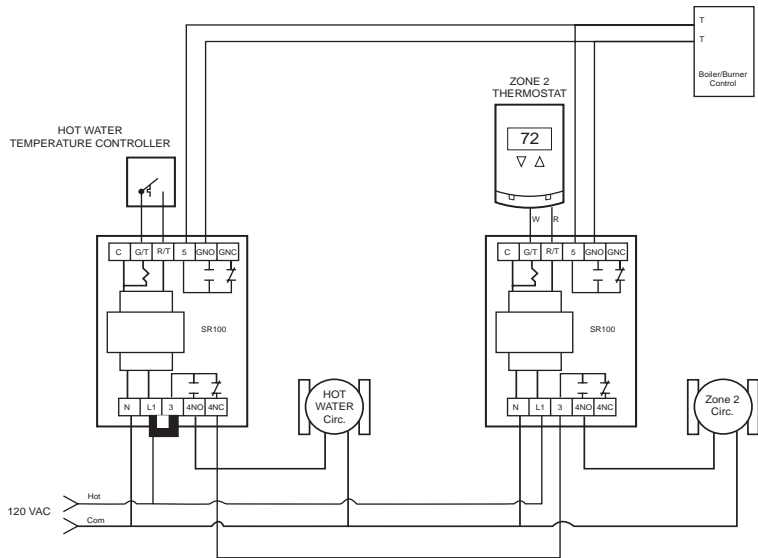


Figure 3 SR100 Series With Domestic Hot Water Priority.

### Application

The SR1 multiple-zone series control relays incorporate up to six double pole/single throw relays (SR601/601AT) providing control of up to six circulators and a boiler operating control in a multi-zone hydronic heating system. Field selectable priority for zone 1 eliminates the need for additional relays to provide domestic hot water priority.

### Features

- Field selectable priority zone.
- Sealed contact double pole/single throw relays.
- Field replaceable relays.
- High capacity transformer.
- LED status window.
- Zone expansion up to 10 amps of total switched line voltage.
- Common 24 Vac transformer terminal.



SR201

### Model Chart

| Model No | Description  | Priority Plus | Dimensions in. (mm)                       |
|----------|--|---------------|---|
| SR201    | 2 zone relay with Priority Plus. <sup>a</sup>                                    | Yes           | 5-18 x 2-15/16 x 12-5/16 (130 x 75 x 312) |
| SR201B   | 2 zone relay with Priority. <sup>b</sup>   | No            |   |
| SR201AT  | 2 zone relay with auto-test.   | Yes           |   |
| SR301    | 3 zone relay with Priority Plus. <sup>a</sup>                                    | Yes           |   |
| SR301B   | 3 zone relay with Priority. <sup>b</sup>   | No            |   |
| SR301AT  | 3 zone relay with auto-test and Priority Plus. <sup>a</sup>                      | Yes           | 8 x 2-7/8 x 12-3/8 (213 x 73 x 314)       |
| SR601    | 4 zone expandable to 6 zone relay with Priority Plus. <sup>a</sup>               | Yes           |   |
| SR601B   | 4 zone expandable to 6 zone relay with Priority. <sup>b</sup>                    | No            |   |
| SR601AT  | 4 zone expandable to 6 zone relay with auto-test and Priority Plus. <sup>a</sup> | Yes           |   |

<sup>a</sup> In addition to priority only logic, Priority Plus allows non-priority heating zones to be locked out for up to one hour on a call for priority domestic hot water heating.

<sup>b</sup> Priority only logic locks out non-priority heating zones indefinitely.

### Specifications

#### Inputs

|                    |  |
|--------------------|--|
| <b>Power input</b> | 120 Vac @ 50/60 Hz, 10 VA (SR201/301), 1 A (SR601).                              |
| <b>Thermostat</b>  | Thermostatic anticipator setting: Set to actual current draw of system @ 24 Vac. |

#### Outputs

|                   |  |
|-------------------|--|
| <b>Electrical</b> | SR201/301 Thermostat supply (R-C): 24 Vac, 5 VA, Class 2 (15 VA transformer secondary).<br>SR601 Thermostat supply (R-C): 24 Vac, 6 VA, Class 2 (25 VA transformer secondary)<br>Line voltage boiler output (dry contact X1-X2), and line voltage circulator outputs (C1 through C6):<br>Motor: 1/3 hp @ 120 Vac<br>Motor: 1/2 hp @ 240 Vac (SR201/301 only)<br>General purpose: 10A @ 120/240 Vac (SR201/301 only)<br>Resistive: 10 A @ 120 Vac (SR201/301), 7.4 A @ 120 Vac (SR601)<br><b>CAUTION:</b> Total load not to exceed 20 A (SR201/301) or 30 A/2hp (SR601) |
|-------------------|--|

#### Environment

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Ambient temperature limits</b> | Operating: maximum of 110 °F (43 °C). |
| <b>Humidity</b>                   | 85% non-condensing RH.                |
| <b>Locations</b>                  | NEMA Type 1.                          |
| <b>Dimensions</b>                 | Refer to Model Chart.                 |
| <b>Agency Listings</b>            | UL/CU                                 |

# Multi-Zone Circulation Control Relay



## SR201/301/601 Series

### Typical Applications

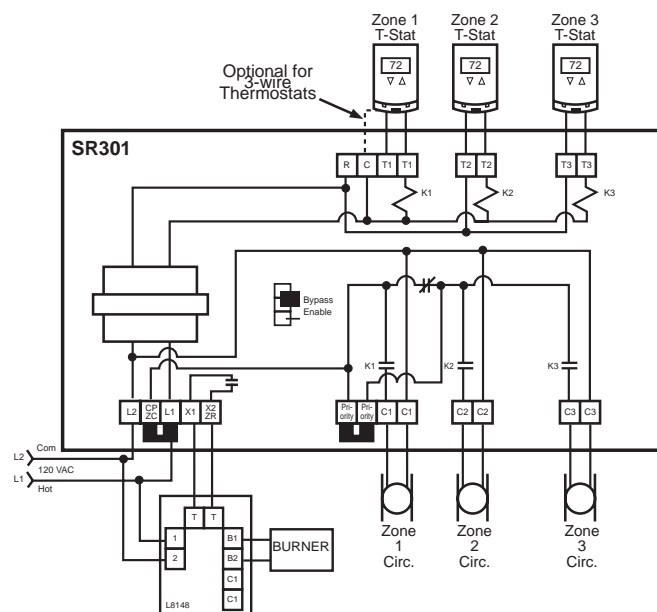


Figure 1 Typical Wiring SR301 – Boiler Controller.

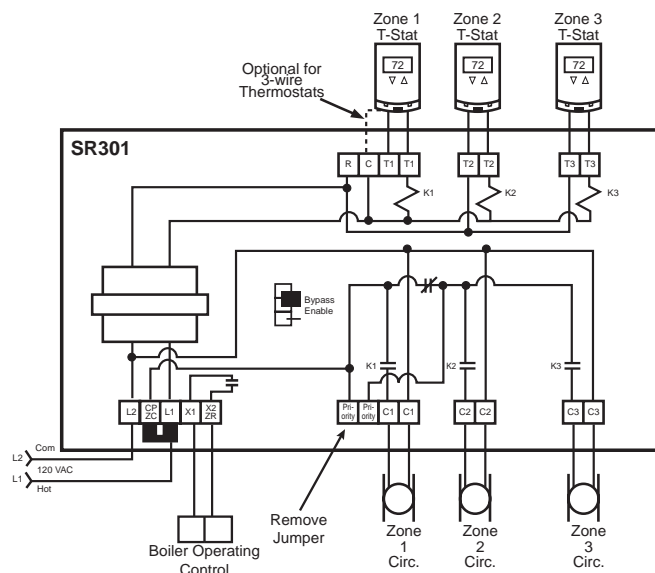


Figure 3 Typical Wiring SR301 – Domestic Hot Water Priority.

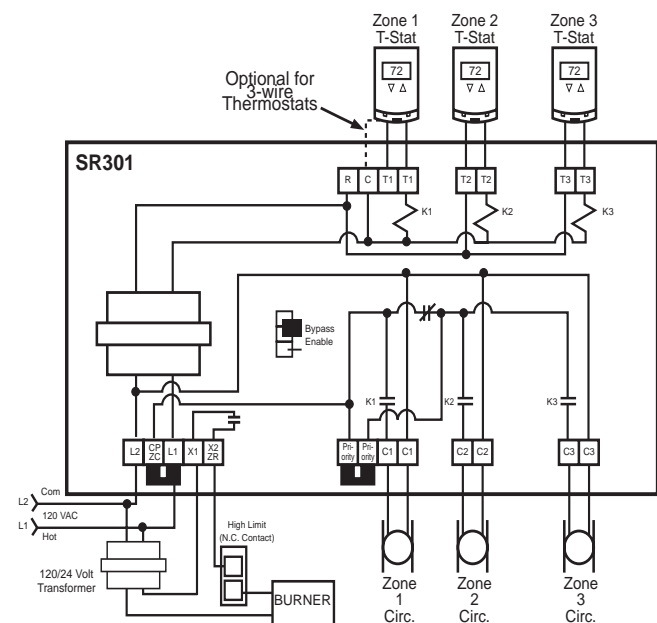


Figure 2 Typical Wiring SR301 – 24 Vac High Limit and Gas Valve.

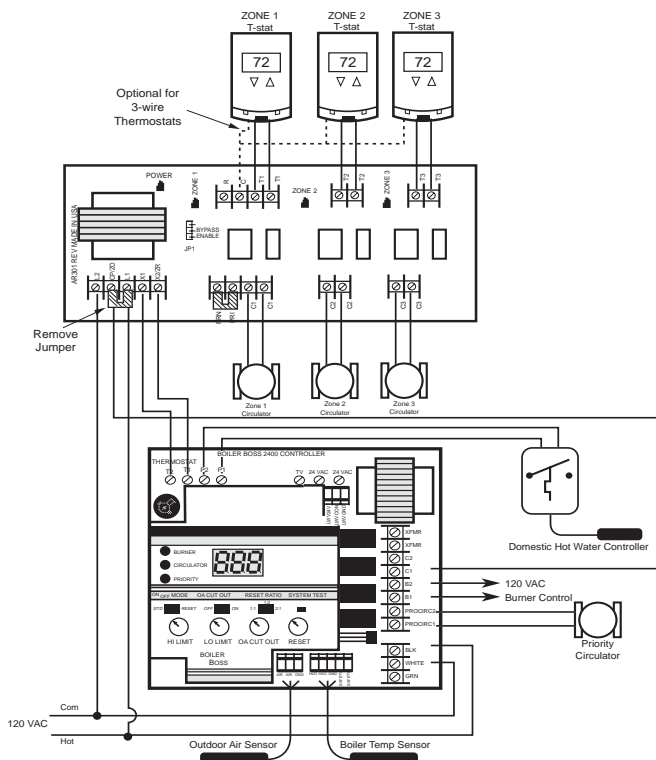


Figure 4 Typical Wiring SR301 – BB2400 Series With Domestic Hot Water Priority.

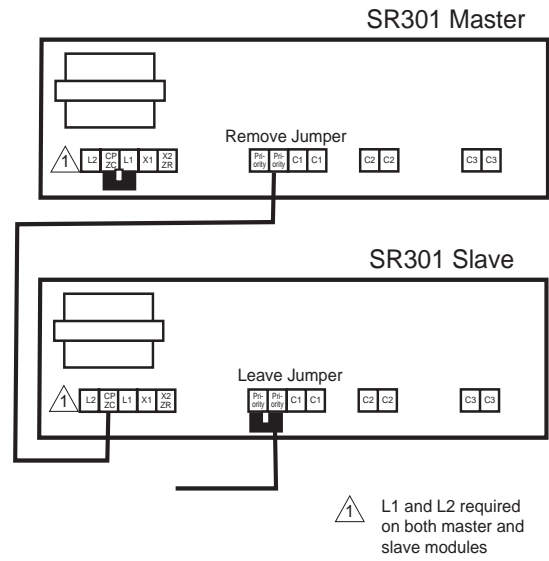


Figure 6 Typical Wiring SR301 – Zone Link Hot Water Priority.

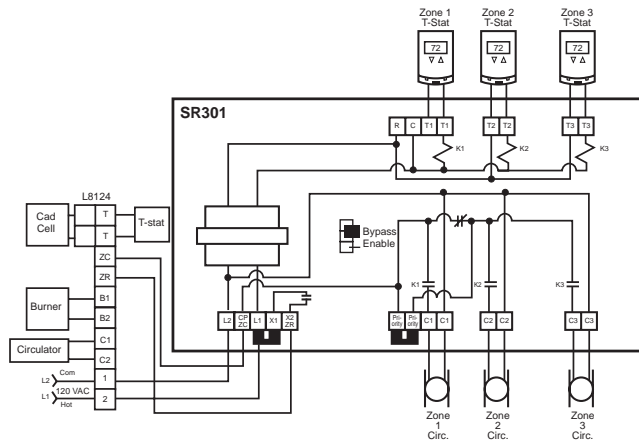


Figure 5 Typical Wiring SR301 – Tankless Coil Application.

**Multi-Zone Circulation Control  
Relay  
SR201/301/601 Series**



## Application

The VL500 zone control system provides control of up to five zone valves a circulator and boiler control in a multi-zone hydronic heating system.

Field selectable priority for zone 1 eliminates the need for additional relays to provide domestic hot water priority.

Additional zones can be added.

## Features

- Field selectable Priority Plus™ zone.
- Unlimited zone expansion. Maximum load on any serially linked VL500 slave module should not exceed 50 VA.
- Field replaceable relays.
- LED status window.
- Common 24 Vac transformer terminal.
- Field replaceable fuse.



**VL500**

## Specifications

|                                   |  |
|-----------------------------------|--|
| <b>Inputs</b>                     |  |
|                                   | Power (N-L1): 120 Vac 50/60 Hz, 100 VA.<br>Main fuse (F2): 10A, 125 Vac slow blow.   |
|                                   | Thermostat/heat demand dry contacts (T1-T1 through T5-T5): 24 Vac, Class 2<br>Switched load is 0.05 A plus load current at corresponding "1-2" terminals.<br>(Power supplied by this unit - do not connect external power source)<br>Set thermostat anticipator per thermostat instructions to measured current. |
|                                   | Zone in terminals: External dry contacts rated for 24 Vac, 2.2 A (58 VA), Class 2.   |
| <b>Outputs</b>                    |  |
| <b>Electrical</b>                 | Line voltage circulator output (C1-N):<br>Motor: 1/3 hp @ 120 Vac  |
|                                   | Boiler output (dry contact X1-X2):<br>General purpose: 3 A @ 24 Vac, Class 2   |
|                                   | Transformer: 24 Vac, 75 VA Class 2 (total external loads limited as specified below)<br>Secondary fuse (F1): 3.2 A, 125 Vac slow blow.   |
|                                   | Zone valve outputs (5 pair of terminals 1-2): 24 Vac, Class 2<br>Any single zone: 0.9 A (22 VA),<br>Maximum total for master zone valves and thermostats: 2.7 A (65 VA),<br>Maximum total for slave zone valves and thermostats: 2.1 A (50 VA),  |
|                                   | Zone out terminals: Switching capacity: 24 Vac, 2.2 A (58 VA), Class 2   |
|                                   |  |
| <b>Environment</b>                |  |
| <b>Ambient temperature limits</b> | Operating: 32 to 104 °F (0 to 40 °C).  |
| <b>Humidity</b>                   | Up to 85% non-condensing.  |
| <b>Locations</b>                  | NEMA Type 1.   |
| <b>Dimensions</b>                 | 8 H x 12-3/8 W x 2-7/8 D inches (203 x 314 x 73 mm).   |

**Typical Applications**

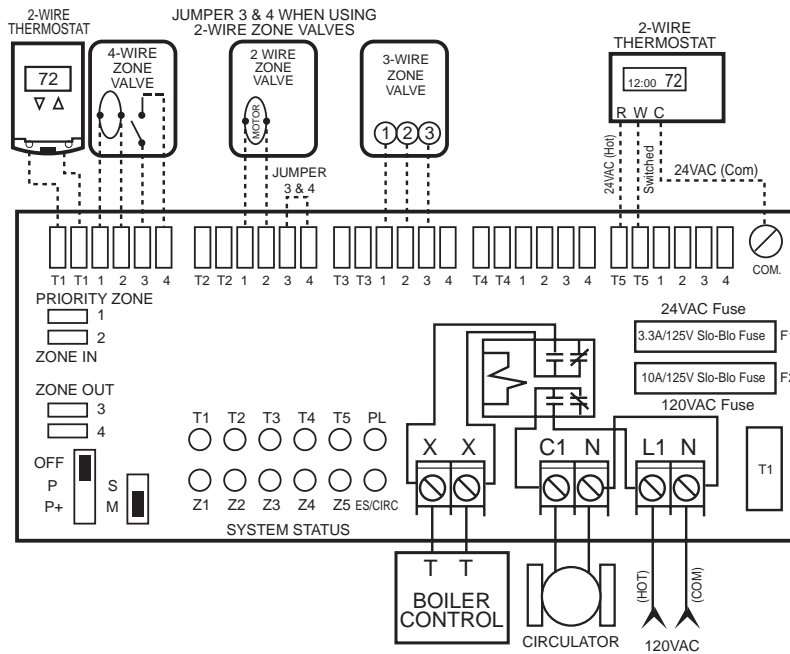


Figure 1 Typical Wiring.

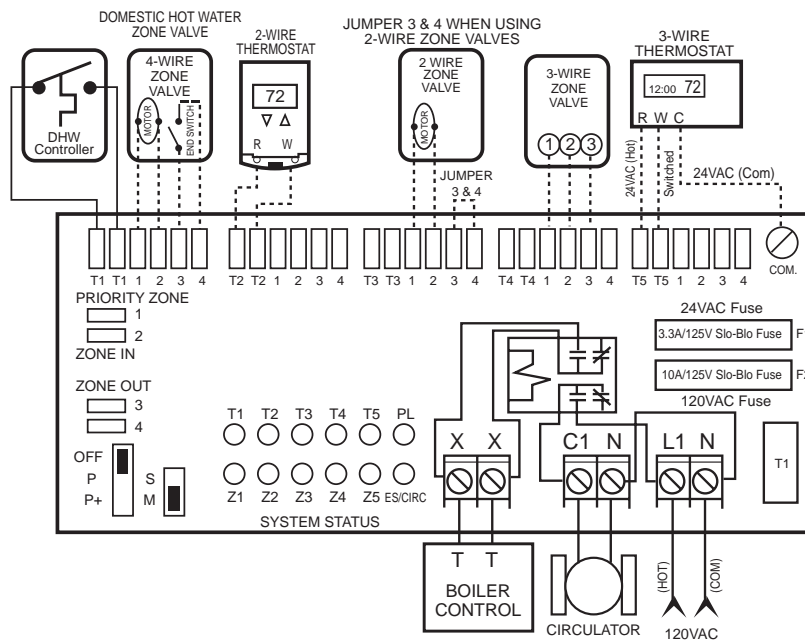


Figure 2 Typical Wiring VL500 Series with Domestic Hot Water Priority Zone, Boiler Controller and Circulator.



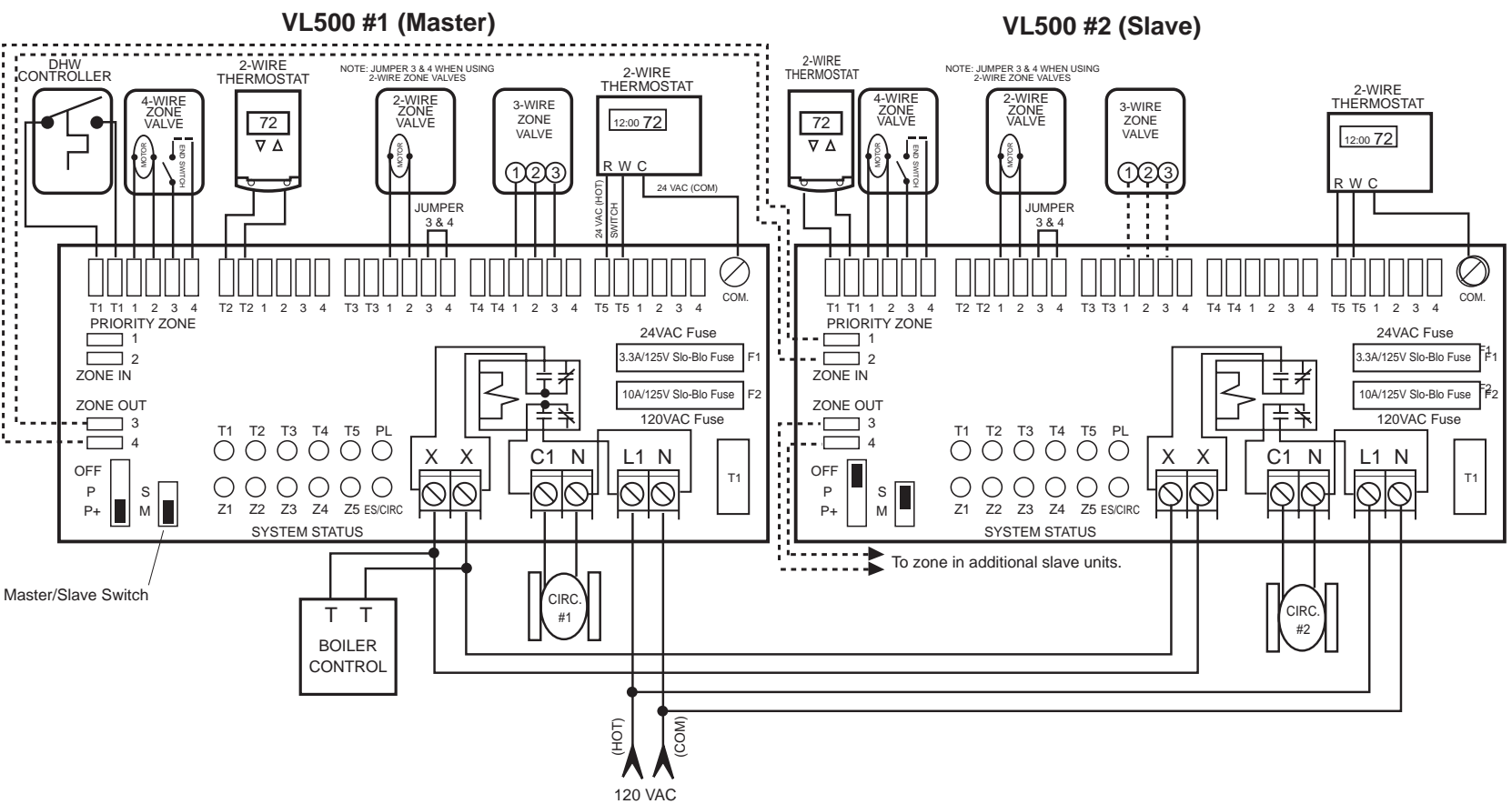


Figure 3 Two VL500 series with Domestic Hot Water Priority, Nine Heating Zones, Boiler and Circulator.

**Zone Valve Control Center  
VL500**



## Application

The WA300 hydro-air control relay incorporates several relays to provide control for up to two hydro-air systems including two air handlers/AC controller, two system heating circulators, one boiler/burner circulator, and one domestic hot water controller. Domestic hot water priority zone eliminates the need for additional relays to provide domestic hot water for indirect fired hot water tanks. The thermostats used with the WA300 must power the fan on when the heat output is powered.

**Note:** Thermostats used with the WA300 must switch on the heat and fan outputs when heat is called for.

## Features

- Capable of controlling two hydro-air systems in one relay package.
- Selectable fan delay of 90 or 180 seconds in heat mode.
- Common 24 Vac transformer terminal provides compatibility with electronic thermostats.
- Field replaceable circulator relays.
- Large terminal connections.
- Expandable up to 4 zones with the addition of a second WA300.



**WA300**

## Specifications

|                                   |   |
|-----------------------------------|---|
| <b>Inputs</b>                     |   |
| <b>Power input</b>                | Circulators: 120 Vac @ 50/60 Hz.<br>Fan centers: 24 Vac @ 50/60 Hz.                                       |
| <b>Connections</b>                | See Figure 1 - Typical Wiring.  |
| <b>Outputs</b>                    |   |
| <b>Electrical</b>                 | Thermostatic anticipator setting: Set to actual current draw of system @ 24 Vac.                          |
|                                   | Circulator relay rating: 1/4 hp @ 120 Vac, Full load: 6 amps; Locked rotor: 43.2 amps; Resistive: 6 amps. |
|                                   | Fan center switch rating: 1 amp @ 24 Vac.   |
| <b>Environment</b>                |   |
| <b>Ambient temperature limits</b> | Operating: 120 °F (49 °C) maximum.  |
| <b>Humidity</b>                   | 5 to 95% RH, non-condensing.  |
| <b>Locations</b>                  | NEMA Type 1.  |
| <b>Dimensions</b>                 | 5-1/8 H x 12-5/16 W x 2-15/16 D inches (130 x 312 x 75 mm).   |

# Two Zone Hydro-Air Relay WA300



## Typical Applications

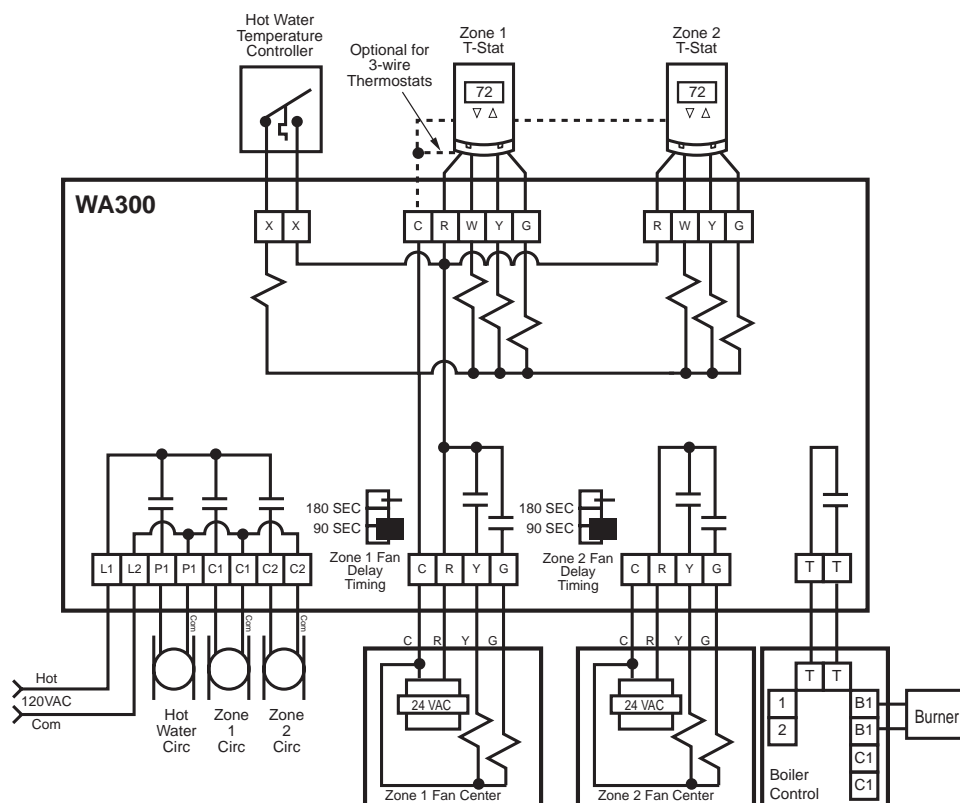


Figure 1 Typical Wiring WA300 – Boiler Controller and Two Fan Centers With Domestic Hot Water Priority.

## Application

The T155 series thermostat provides on/off control for low voltage and line voltage control of valves, relays and fan motors. Applications include two-pipe and four-pipe fan coil units, ventilators, and air quality operators.

## Features

- Manual or automatic changeover models.
- Line voltage 3-speed fan control.
- Continuous or cycling fan operation (cycling fan operation requires additional relay or relays).
- Remote sensor capability.
- Handles all supply voltages from 24 to 277 Vac at 50/60 Hz (fan and system voltage must be the same).



**T155**

## Model Chart.

| Model No. | Outputs | Changeover             | Fan Control | System Switches |
|-----------|---------|------------------------|-------------|-----------------|
| TA155-010 | Dual    | Manual                 | Hi-Med-Lo   | Heat-Off-Cool   |
| TA155-017 | Single  | N/A                    | Hi-Med-Lo   | On-Off          |
| TA155-018 | Single  | N/A                    | None        | None            |
| TB155-010 | Dual    | Automatic <sup>a</sup> | Hi-Med-Lo   | On-Off          |
| TB155-015 | Dual    | Automatic <sup>a</sup> | None        | None            |

<sup>a</sup> Auto changeover models have 4 F degree deadband between heating and cooling.

**TABLE 1.** Fan and System Switch Rating.

| Voltage <sup>a</sup> | Inductive |      | Resistive Amps | Pilot Duty |
|----------------------|-----------|------|----------------|------------|
|                      | FLA       | LRA  |                |            |
| 24                   | N/A       | N/A  | N/A            | 24 VA      |
| 120                  | 5.8       | 34.8 | 6.0            | 125 VA     |
| 240                  | 2.9       | 17.4 | 5.0            | 125 VA     |
| 277                  | 2.4       | 14.4 | 4.2            | 125 VA     |

<sup>a</sup> Fan and system must share same voltage.

Electronic On/Off  
Thermostat/Controller  
T155 Series



Specifications

|                            |   |
|----------------------------|---|
| Inputs                     |   |
| Power input                | 24 to 277 Vac @ 50/60 Hz.   |
| Power consumption          | 0.88 watts at maximum.  |
| Connections                | Power: Up to 14 AWG wire.   |
|                            | Control: Up to 14 AWG wire.   |
| Outputs                    |   |
| Electrical                 | Thermostatic switch ratings: 10 VA @ 24 Vac, Pilot duty 20 VA @ 120 - 277 Vac.              |
| Control ranges             | Operating differential: 1 F degree (0.6 C degree).  |
|                            | Changeover deadband (TB155 only): 4 F degrees (2.2 C degrees).                              |
|                            | Deadband (TA155-017 and TA155-018): 0 F degrees (0 C degrees).                              |
|                            | Setpoint adjustment range: 50 to 90 °F (10 to 32 °C).                                       |
| Mechanical                 | Material: Rigid vinyl.  |
|                            | Finish: Cool gray.  |
| Environment                |   |
| Ambient temperature limits | Shipping and storage:-30 to 130 °F (-34 to 55 °C).<br>Operating: 32 to 130 °F (0 to 55 °C). |
| Humidity                   | Non-condensing.   |
| Locations                  | NEMA Type 1.  |
| Dimensions                 | 4-1/2 H x 2-3/4 W x 1 D inches (114 x 79 x 25 mm).  |
| Agency Listings            | CE compliant.   |

Accessories

| Model No. | Description.                                    |
|-----------|---|
| 65345     | 4-3/4 x 4-3/4" adapter plate.                   |
| 65406     | Remote sensor, 60" leads 10k W @ 77 °F (25 °C). |
| 65409     | Fahrenheit set point dial, 50 to 90 °F          |
| 65410     | Celsius set point dial, 10 to 34 °C.            |
| 65170     | Warmer/cooler set point dial.                   |
| 65860     | Set point dial stop kit.                        |
| 680-243   | Auto seasonal changeover switch.                |
| 680-243-5 | 36" Changeover switch.                          |
| 680-243-6 | 36" Changeover switch with conduit connection.  |

Typical Applications

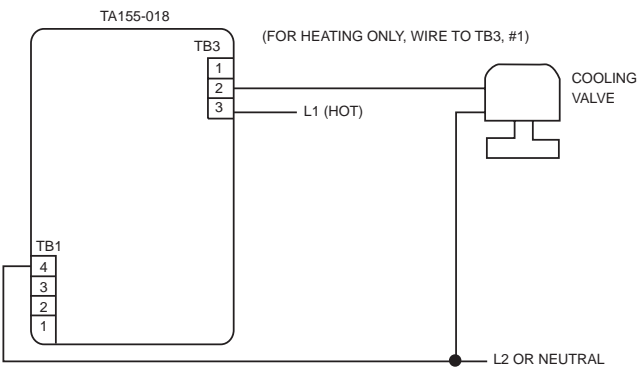


Figure 1 Typical 2-Pipe Cooling or Heating Only.  
No Fan Connections.

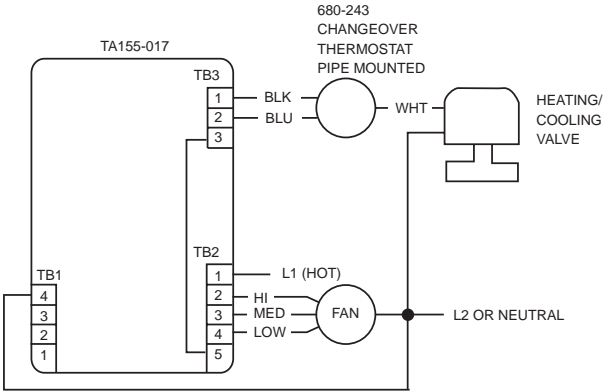
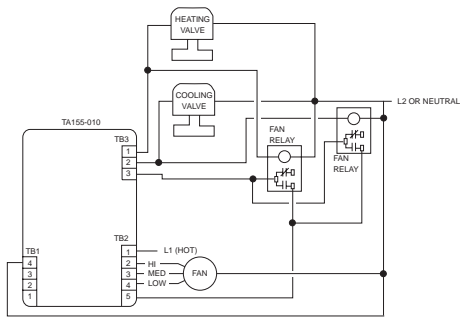
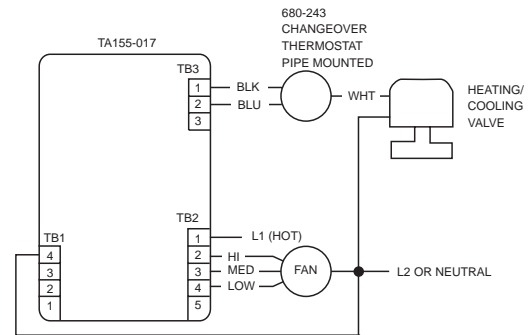


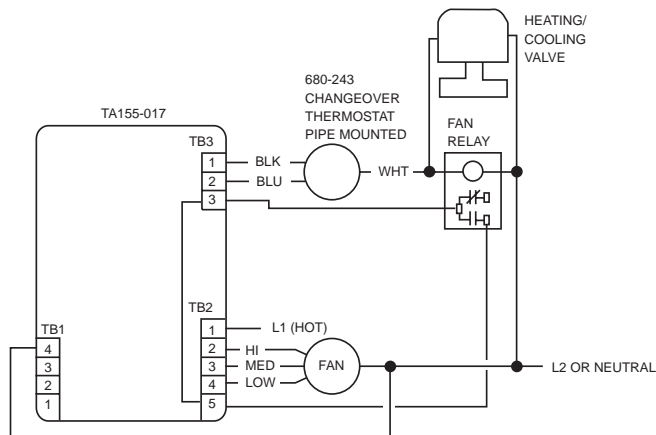
Figure 2 Typical 2-Pipe Heating/Cooling/Continuous Fan with  
System Switch off, Fan is Off.



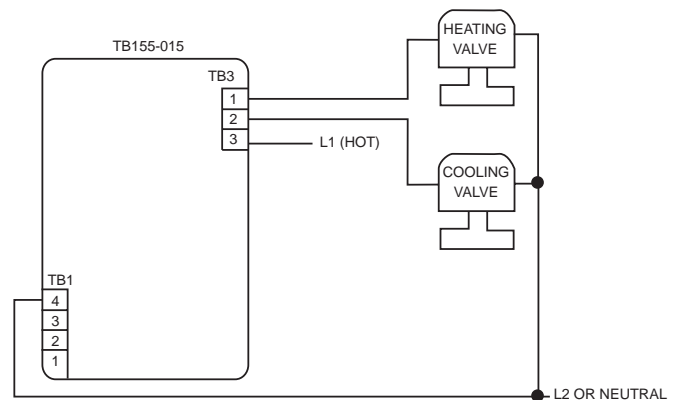
**Figure 3 Typical 4-Pipe Heating/Cooling Fan cycles with Demand for Heating or Cooling. With System Switch Off, Fan is Off.**



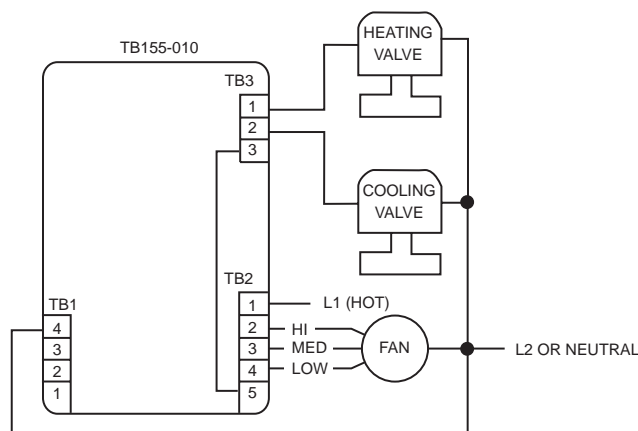
**Figure 4 Typical 2-Pipe Heating/Cooling Fan Runs with System Switch On or Off.**



**Figure 5 Typical 2-Pipe Heating/Cooling Fan Cycles with Demand for Heating or Cooling. With System Switch Off, Fan is Off.**



**Figure 6 Typical 4-Pipe Heating/Cooling. No Fan Connections.**



**Figure 7 Typical 4-Pipe Heating/Cooling Fan Runs Continuously with System Switch On. With System Switch Off, Fan is Off.**

**Electronic On/Off  
Thermostat/Controller  
T155 Series**





## Application

The T158 series microprocessor based thermostat/controller with digital display provides 3-wire floating, on/off control, or a combination of 3-wire floating and on/off control. This series controls a variety of two-pipe and four-pipe fan coil units, air handling units, and various heating and cooling applications. The microprocessor combines a proportional integral control algorithm with adaptive logic. This provides control without the need for tuning or calibrating the control algorithm in the field.

## Features

- Heating and cooling outputs are individually configurable for 3-wire floating or on/off control in the normally open or normally closed modes.
- Line voltage continuous 3-speed fan control.
- Manual or automatic changeover.
- Remote setback capability from a time clock or facility management system.
- Fahrenheit or Celsius display capability.
- Built-in purge cycle assists the controller to determine if the controlling agent is providing heating or cooling.
- Microprocessor eliminates the necessity for tuning or calibration.
- Setpoint can be calibrated to within  $\pm 5$  F degrees (2.5 C degrees).



**T158**

## Model Chart

| Model No. <sup>abc</sup> | Outputs | Control Signal Options | Fan Control   | Remote Sensor <sup>d</sup> | Setback | System Switches    |
|--------------------------|---------|------------------------|---------------|----------------------------|---------|--------------------|
| TA158-001                | Dual    | 6                      | None          | Yes                        | Yes     | Off-Auto-Heat-Cool |
| TA158-002                | Dual    | 6                      | Off-Hi-Med-Lo | Yes                        | Yes     | Off-Auto-Heat-Cool |
| TB158-001                | Dual    | 1, 2, 3, 4, 5, 6       | None          | Yes                        | Yes     | Off-Auto-Heat-Cool |
| TB158-002                | Dual    | 1, 2, 3, 4, 5, 6       | Off-Hi-Med-Lo | Yes                        | Yes     | Off-Auto-Heat-Cool |
| TB158-003                | Single  | 5, 7                   | Off-Hi-Med-Lo | Yes                        | Yes     | Off-Heat/Off-Cool  |
| TB158-007                | Single  | 5, 7                   | None          | Yes                        | Yes     | None               |
| TB158-015                | Single  | 5, 7                   | None          | Yes                        | Yes     | Off-Heat/Off-Cool  |
| TB158-017                | Dual    | 1, 2, 3, 4, 5, 6       | Off/On        | Yes                        | Yes     | Off-Auto-Heat-Cool |
| TB158-018                | Single  | 5, 7                   | Off/On        | Yes                        | Yes     | Off-Heat/Off-Cool  |

1. 3-wire floating single stage cooling and 3-wire floating single stage heating.
2. 3-wire floating cooling and two stage on/off heating.
3. Single stage on/off cooling, on/off fan control, and 3-wire floating single stage heating.
4. On/off single stage cooling, on/off single stage heating and fan control.
5. 3-wire floating single stage cooling or single stage heating.
6. On/off single stage cooling and on/off single stage heating.
7. On/off single stage cooling or on/off single stage heating.

- <sup>a</sup> Do not use with actuators in which the motor is driven by DC voltage.
- <sup>b</sup> Do not use with actuators which have position memory on power loss.
- <sup>c</sup> Actuator must full stroke open or closed in 1 to 3 minutes.
- <sup>d</sup> Remote sensor ordered separately.

**TABLE 1. Fan Switch Rating**

| Voltage | Inductive |      | Resistive Amps | Pilot Duty |
|---------|-----------|------|----------------|------------|
|         | FLA       | LRA  |                |            |
| 24      | N/A       | N/A  | N/A            | 24 VA      |
| 120     | 5.8       | 34.8 | 6.0            | 125 VA     |
| 240     | 2.9       | 17.4 | 5.0            | 125 VA     |
| 277     | 2.4       | 14.4 | 4.2            | 125 VA     |

# Digital, Three-Wire Floating Thermostat/Controller



## T158 Series

### Specifications

|                                   |  |
|-----------------------------------|--|
| <b>Inputs</b>                     |  |
| <b>Power input</b>                | 20 to 28 Vac, nominal 24 VA.                           |
| <b>Power consumption</b>          | 25 mA maximum at 24 Vac.                               |
| <b>Connections</b>                | Power: Up to 14 AWG wire.                              |
|                                   | Control: Up to 14 AWG wire.                            |
| <b>Outputs</b>                    |  |
| <b>Electrical</b>                 | Thermostatic switch ratings: 10 VA @ 24 Vac.           |
|                                   | System switch rating: 10 VA @ 24 Vac.                  |
| <b>Control ranges</b>             | Display range: 32 to 99 °F (0 to 37 °C).               |
|                                   | Proportional band: 2 °F (1.1°C).                       |
|                                   | Changeover deadband: 3 °F (1.6 °C).                    |
|                                   | Setpoint adjustment range: 50 to 90 °F (10 to 32 °C).  |
| <b>Mechanical</b>                 | Material: Rigid vinyl.                                 |
|                                   | Finish: Cool gray.                                     |
| <b>Environment</b>                |  |
| <b>Ambient temperature limits</b> | Shipping and storage: -30 °F to 130°F (-34 to 55 °C).  |
|                                   | Operating: 32 to 130 °F (0 to 55 °C).                  |
| <b>Humidity</b>                   | 95% Non-condensing.                                    |
| <b>Locations</b>                  | NEMA Type 1.   |
| <b>Dimensions</b>                 | 2-3/4 H x 4-1/2 W x 1-1/8 D inches (79 x 114 x 28 mm). |
| <b>Agency Listings</b>            | CE compliant.  |

### Accessories

| Model No. | Description.   |
|-----------|--|
| 65345     | 4-3/4" x 4-3/4" adapter plate.                         |
| 65406     | Remote sensor, 60" leads 10k $\Omega$ @ 7 7°F (25 °C). |

## Typical Applications

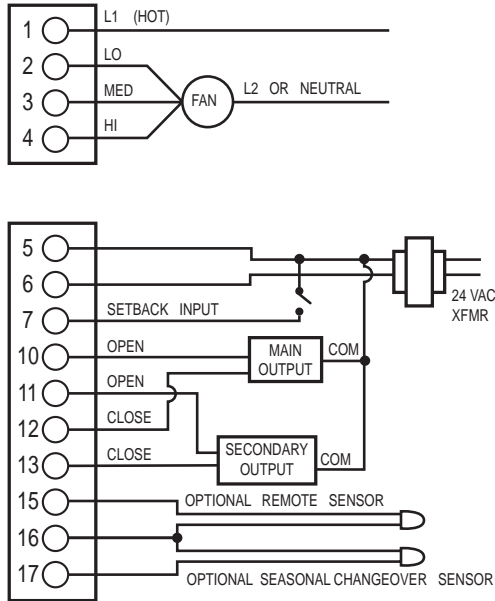


Figure 1 Typical Wiring for 3-Wire Floating Control

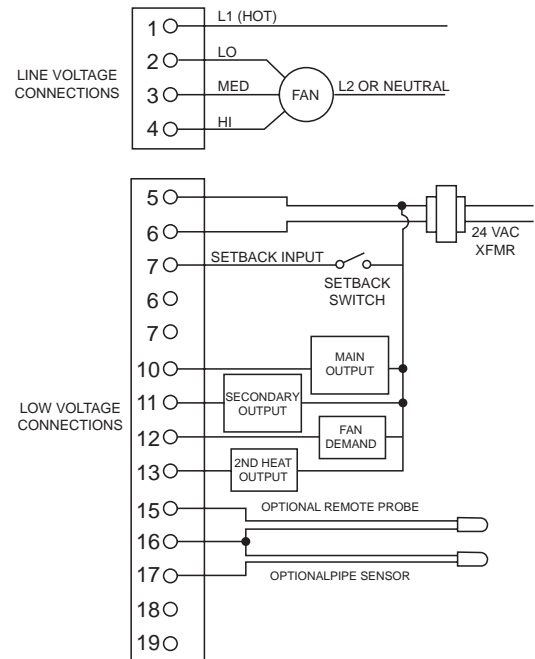
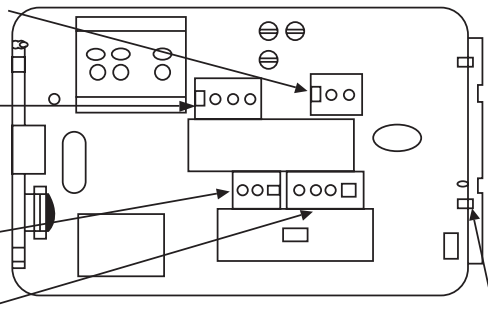


Figure 2 Typical Wiring for On/Off Control

### CONNECTIONS

- 15 REMOTE SENSOR
- 16 REMOTE SENSOR
- 17 CHANGE OVER SENSOR
- 10 MAIN OPEN
- 11 SECONDARY OPEN
- 12 MAIN CLOSE
- 13 SECONDARY CLOSE
- 5 24 VAC COMMON
- 6 24 VAC HOT
- 7 SETBACK INPUT
- 1 L1 (HOT)
- 2 FAN LOW/CONTINUOUS
- 3 FAN MED
- 4 FAN HIGH



JP1: REMOVE TO  
ALLOW USE OF  
REMOTE PROBE

Figure 3 Terminal Description

**Digital, Three-Wire Floating  
Thermostat/Controller  
T158 Series**



## Application

The T168 series microprocessor based thermostat/controller provides 0 to 10 Vdc or 4 to 20 mA control. This series controls a variety of two-pipe and four-pipe fan coil units, air handling units, and various heating and cooling applications. The microprocessor combines a proportional integral control algorithm with adaptive logic. This provides control without the need for tuning or calibrating the control algorithm in the field.

## Features

- 0 to 10 Vdc or 4 to 20 mA heat and cool outputs.
- Low voltage fan cycling operation with demand output.
- Remote setback capability from a time clock or facility management system.
- Auxiliary heat function.
- Remote and/or seasonal changeover sensor optional.
- Fahrenheit or Celsius display capability.
- In two pipe mode a built-in purge cycle assists the controller to determine if the controlling agent is providing heating or cooling.
- Line voltage continuous on/off or 3-speed fan control.



**T168-001**

## Model Chart

| Model No. | Outputs | Fan Control   | Demand Output | Auxiliary Heat | Setback | System Modes       |
|-----------|---------|---------------|---------------|----------------|---------|--------------------|
| TA168-001 | Dual    | None          | No            | Yes            | Yes     | Off-Auto-Heat-Cool |
| TA168-002 | Dual    | Off-Hi-Med-Lo | Yes           | Yes            | Yes     | Off-Auto-Heat-Cool |
| TA168-003 | Single  | Off-Hi-Med-Lo | Yes           | No             | Yes     | Off-Heat/Off-Cool  |
| TA168-004 | Single  | None          | No            | No             | Yes     | Off-Heat/Off-Cool  |
| TA168-005 | Single  | None          | Yes           | No             | Yes     | Off-Heat/Off-Cool  |
| TA168-006 | Dual    | None          | Yes           | Yes            | Yes     | Off-Auto-Heat-Cool |
| TA168-007 | Single  | Off/On        | Yes           | No             | Yes     | Off-Heat/Off-Cool  |
| TA168-008 | Dual    | Off/On        | Yes           | No             | Yes     | Off-Auto-Heat-Cool |

**TABLE 1.** Fan Switch Rating

| Voltage | Inductive |      | Resistive Amps | Pilot Duty |
|---------|-----------|------|----------------|------------|
|         | FLA       | LRA  |                |            |
| 24      | N/A       | N/A  | N/A            | 24 VA      |
| 120     | 5.8       | 34.8 | 6.0            | 125 VA     |
| 240     | 2.9       | 17.4 | 5.0            | 125 VA     |
| 277     | 2.4       | 14.4 | 4.2            | 125 VA     |

# Digital, Proportional Thermostat/Controller T168 Series



## Specifications

|                                   |  |
|-----------------------------------|--|
| <b>Inputs</b>                     |  |
| <b>Power input</b>                | 20 to 28 Vac, nominal 24 Vac.  |
| <b>Power Consumption</b>          | 25 mA maximum at 24 Vac.   |
| <b>Outputs</b>                    |  |
| <b>Electrical</b>                 | Thermostatic switch rating: 10 VA @ 24 Vac.  |
|                                   | Electrical connections: Terminal strip with screw-down terminals.                            |
| <b>Control signals</b>            | 0 to 10 Vdc 1000 $\Omega$ minimum.   |
|                                   | 4 to 20 mA 100 - 600 ohms.   |
| <b>Control ranges</b>             | Setpoint adjustment range: 50 to 90 °F (10 to 32 °C)   |
|                                   | Display range: 32 to 99 °F (0 to 37 °C).   |
|                                   | Proportional band: 2 F degrees (1.1 C degrees).  |
|                                   | Changeover deadband: 3 F degrees (1.6 C degrees)   |
| <b>Mechanical</b>                 | Material: Rigid vinyl.   |
|                                   | Finish: Cool gray.   |
| <b>Environment</b>                |  |
| <b>Ambient temperature limits</b> | Shipping and storage: -30 to 130 °F (-34 to 55 °C).<br>Operating: 32 to 130 °F (0 to 55 °C). |
| <b>Humidity</b>                   | Non-condensing.  |
| <b>Locations</b>                  | NEMA Type 1.   |
| <b>Dimensions</b>                 | 2-3/4 H x 4-1/2 W x 1-1/8 D inches (79 x 114 x 28 mm).                                       |
| <b>Agency Listings</b>            | CE compliant.  |

## Accessories

| Model No. | Description.                                   |
|-----------|--|
| 65345     | 4-3/4" x 4-3/4" adapter plate.                 |
| 65406     | Remote sensor, 60" leads 10k W @ 77 °F (25 °C) |

## Typical Applications

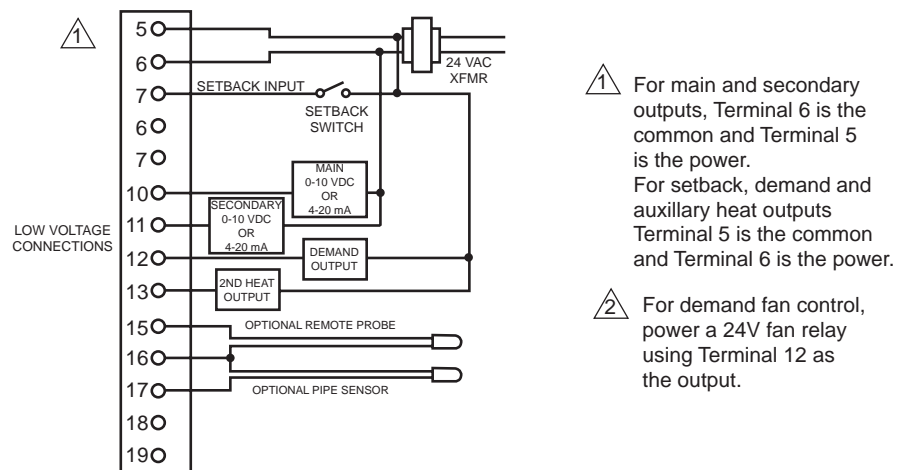
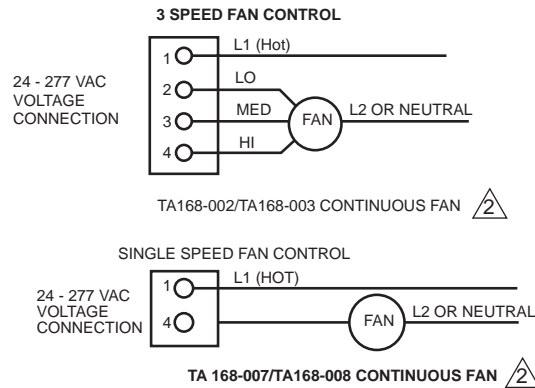


Figure 1 Typical Wiring for Proportional Control.

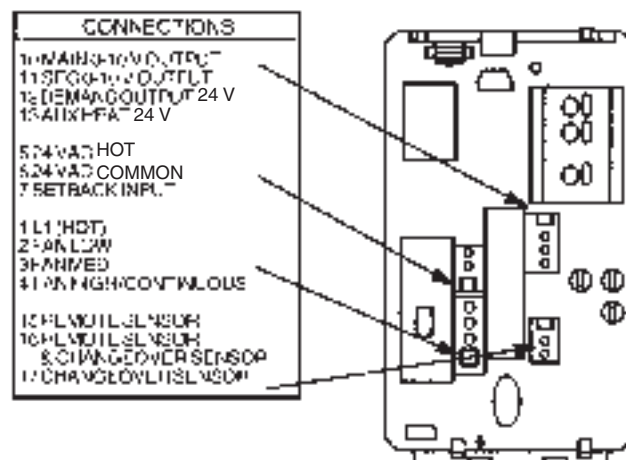


Figure 2 Terminal Description.

**Digital, Proportional  
Thermostat/Controller  
T168 Series**





### Application

T200 series thermostats provide temperature control on a variety of heating, cooling and single stage heat pump applications.

The large LCD window displays room temperature including 1/5th of a degree increments indicated by a series of up to 5 dashes. The system heat output cycles on a 1 or 2 F degree field selectable differential. The cool output differential is fixed at 2 F degrees. The setpoint is displayed and changed by pressing one of the setpoint buttons up or down. Installation is simplified by having all of the field wires mounted to the separate wall plate.

This is a powered thermostat, which must receive 75 mA of power at all times.



T201

### Features

- LCD window display.
- Jumper selectable 5 minute time delay for heating and cooling application.
- Mechanical contact for freeze protection (optional).

### Model Chart

| Model No.            | Control Outputs     | Fan Control <sup>a</sup> | System Switch <sup>a</sup> | Changeover | Mechanical Contact | B & O Terminals |
|----------------------|---------------------|--------------------------|----------------------------|------------|--------------------|-----------------|
| T201                 | Heating Only        | None                     | Heat/Off                   | None       | No                 | No              |
| T201-FP <sup>b</sup> | Heating Only        | None                     | Heat/Off                   | None       | Yes                | No              |
| T204                 | Cooling Only        | On/Auto                  | Cool/Off                   | None       | No                 | No              |
| T205                 | Cooling and Heating | On/Auto                  | Cool/Off/Heat              | Manual     | No                 | No              |
| T205-FP <sup>b</sup> | Cooling and Heating | On/Auto                  | Cool/Off/Heat              | Manual     | Yes                | No              |
| T207                 | Cooling and Heating | On/Auto                  | Cool/Off/Heat              | Manual     | No                 | Yes             |
| T207-FP <sup>b</sup> | Cooling and Heating | On/Auto                  | Cool/Off/Heat              | Manual     | Yes                | Yes             |

<sup>a</sup> Fan switch operates independent of system switch unless relays are added.

<sup>b</sup> Freeze protection, at 40 °F the thermostat mechanically latches heat with output.

### Specifications

|   |  |
|---|--|
| <b>Inputs</b>   |  |
| <b>Power input</b>  | 20 to 32 Vac, 75 mA to 1.2 amps (power-stealing thermostat, 75 mA required at all times. 250W, 5 watt resistor may be needed). |
| <b>Outputs</b>  |  |
| <b>Electrical</b>   | Battery: Setpoint backup Energizer 357 or similar (battery included).<br>Setpoint range: 50 to 86 °F (10 to 30 °C).            |
| <b>Control ranges</b>   | Operating differential: Heating 1 or 2 F degrees (0.6 or 1.1 C degrees), Cooling 2 F degrees (1.1 C degrees).                  |
| <b>Mechanical</b>   | Material: Rigid vinyl.<br>Finish: Off-white.   |
| <b>Environment</b>  |  |
| <b>Ambient temperature limits</b>   | Shipping and storage: -40 to 125 °F (-40 to 52 °C).<br>Operating: 40 to 125 °F (5 to 53 °C).                                   |
| <b>Humidity</b>   | 95% non-condensing.  |
| <b>Locations</b>  | NEMA Type 1.   |
| <b>Dimensions</b>   |  |
| Thermostat: 4 H x 2-1/2 W inches (102 x 64 mm).                             |  |
| Thermostat base and adaptor plate: 4-3/4 H x 4-1/4 W inches (121 x 108 mm). |  |

## Typical Applications

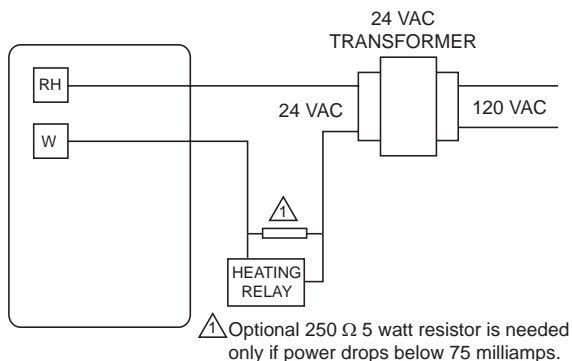


Figure 1 T201 Wiring to Heating System With Single Transformer.

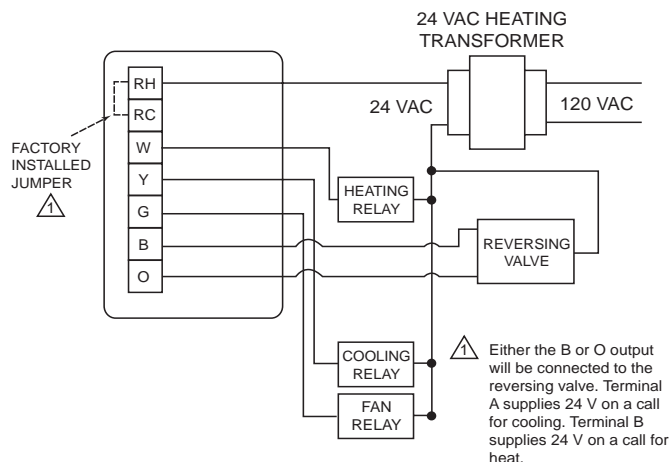


Figure 2 T207 Wiring to Heating/Cooling System With Single Transformer and Reversing Valve.

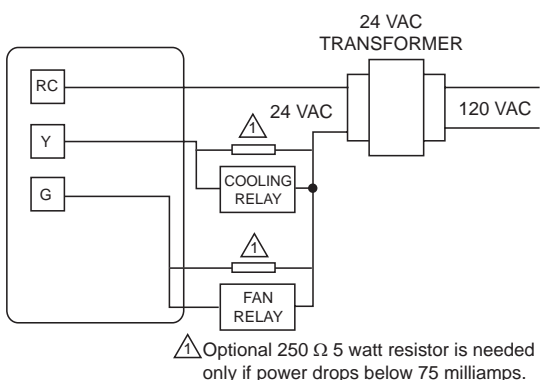


Figure 3 T204 Wiring to Heating/Cooling System With Single Transformer.

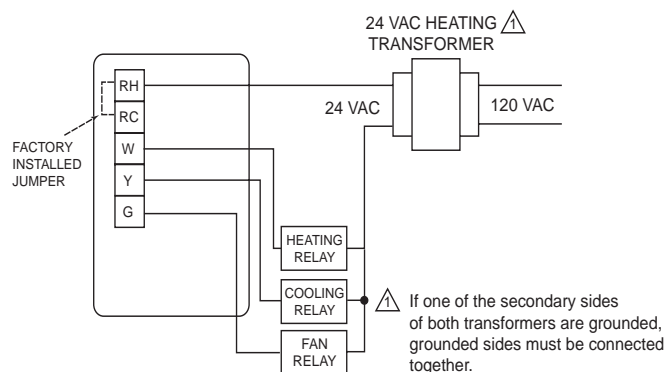


Figure 4 T205 Wiring To Heating/Cooling System With Single Transformer.

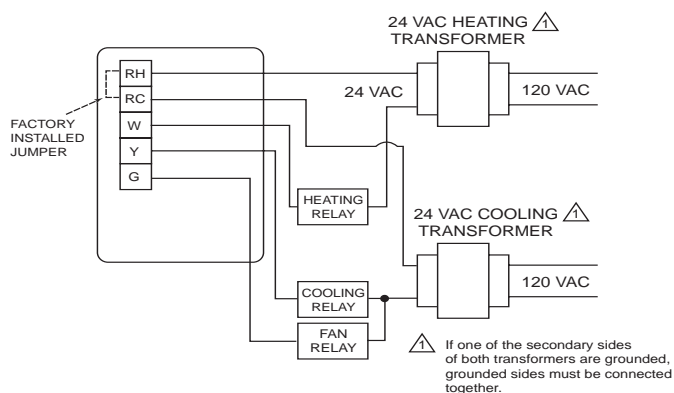


Figure 5 T205 Wiring To Heating/Cooling System With Dual Transformer.

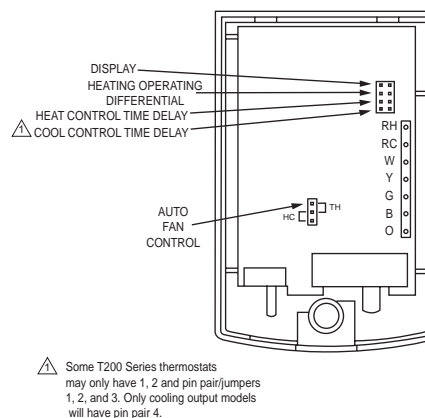


Figure 6 Terminal Identification.

## Application

The T500 series thermostats are available in four basic models for low and line voltage control of valves, relays, and fan motors in fan coil and packaged units for commercial, industrial, and residential installations. Special order option allows heating and/or cooling pilot light indication.

## Features

- Set point dial stop (optional).
- LED status indicators (optional).
- Bellows type sensor for constant and close temperature differential.
- System and fan switches



**T513**

## Model Chart

| Model No. | Outputs   | Dial       | Fan Control | System Switches |
|-----------|-----------|------------|-------------|-----------------|
| T511      | Two-pipe  | Celsius    | 3-Speed     | On/Off          |
| T511F     | Two-pipe  | Fahrenheit | 3-Speed     | On/Off          |
| T513      | Four-pipe | Celsius    | 3-Speed     | Heat/Off/Cool   |
| T513F     | Four-pipe | Fahrenheit | 3-Speed     | Heat/Off/Cool   |

## Specifications

### Inputs

|                    |  |
|--------------------|--|
| <b>Power req.</b>  | 24 to 250 Vac @ 50/60 Hz.                                |
| <b>Connections</b> | Power: Up to 18 AWG wire.<br>Control: Up to 18 AWG wire. |

### Outputs

|                       |  |
|-----------------------|--|
| <b>Electrical</b>     | Switch rating (heating): 6 amp resistive, 1.5 amp inductive.<br>Switch rating (cooling): 6 amp resistive, 1 amp inductive.<br>Fan switch rating: 6 amp resistive, 3 amp inductive. |
| <b>Control ranges</b> | Setpoint adjustment range: 50 to 85 °F (10 to 30 °C).<br>Operating differential: 2 F degrees (1.1 C degrees).  |
| <b>Mechanical</b>     | Material: Molded ABS.<br>Finish: Bone white.   |

### Environment

|                                   |  |
|-----------------------------------|--|
| <b>Ambient temperature limits</b> | Shipping and storage: -30 to 130 °F (-34 to 55 °C).<br>Operating: 32 to 130 °F (0 to 55 °C). |
| <b>Humidity</b>                   | Non-condensing.  |
| <b>Locations</b>                  | NEMA Type 1.   |
| <b>Dimensions</b>                 | 5-1/5 H x 3-1/4 W x 1-3/4 D in. (132 x 82 x 45 mm).  |
| <b>Agency Listing</b>             | CE compliant.  |

## Accessories

| Model No. | Description                                  |
|-----------|--|
| WP500     | 5-1/2 x 5-1/2" (140 x 140 mm) adapter plate. |
| PIN500    | Set point dial stop kit.                     |
| CAL500    | Set point calibration kit.                   |
| 680-243   | Auto seasonal changeover switch.             |

# On/Off Low/Line Voltage Thermostat/Controller



## T500 Series

### Typical Applications

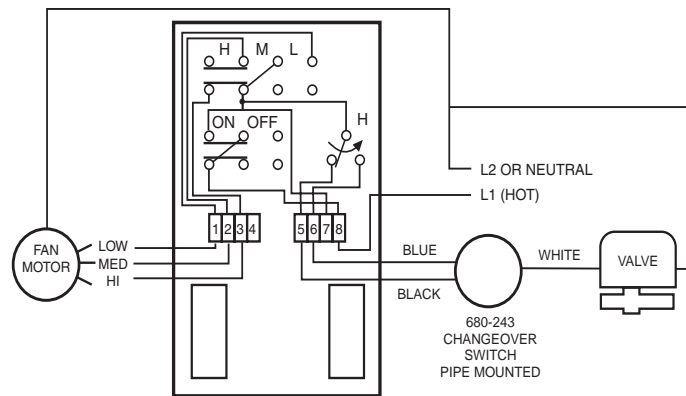


Figure 1 T511, 2-Pipe Heating & Cooling With Changeover Switch.

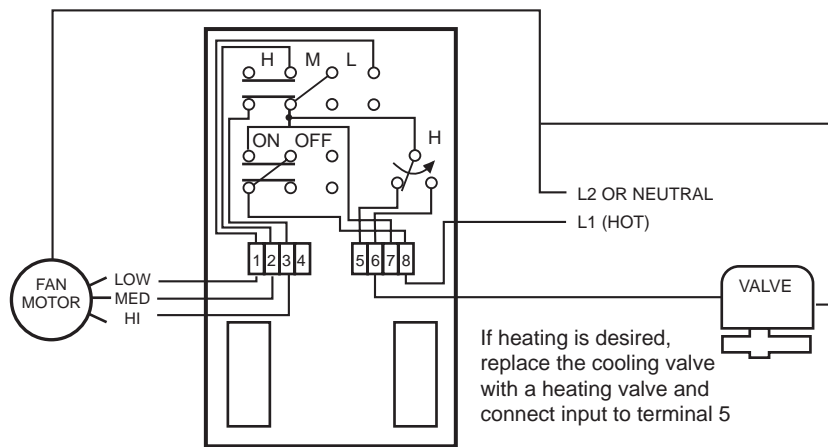


Figure 2 T511/T511F, 2-Pipe Cooling.

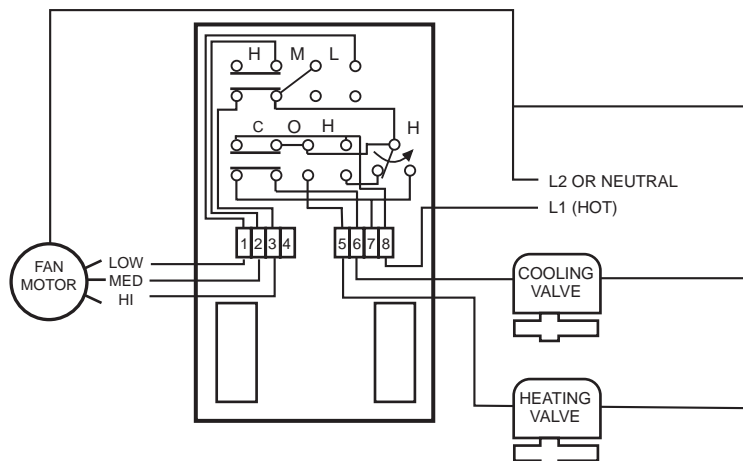


Figure 3 T513/T513F, 4-Pipe Heating/Cooling.

## Application

The 31-102 model thermostats control heating and cooling applications which require a single pole/double throw switch, adjustable heat anticipator and fixed cooling anticipator.

The 31-103 model thermostats control heating and cooling applications with adjustable heat anticipator and fixed cooling anticipator. Includes a "Heat-Off-Cool" system switch and "On-Auto" fan switch.

## Features

- Mounted directly on wall or standard outlet box with thermometer.
- Adjustable heat anticipator.
- Fahrenheit and Celsius models.
- Dust-proof operation.
- A bi-metal activated mercury bulb is used as the switching mechanism.



**31-102**



**31-103**

## Model Chart

| Model No. | Description   | Temperature Range |
|-----------|---|-------------------|
| 31-102    | Standard low voltage thermostat in Fahrenheit.                        | 50 to 90 °F       |
| 31-103    | "Heat-Off-Cool" system switch and "On-Auto" fan switch in Fahrenheit. |                   |
| 31-100    | Standard low voltage thermostat in Celsius.                           | 10 to 33 °C       |
| 31-101    | "Heat-Off-Cool" system switch and "On-Auto" fan switch in Celsius.    |                   |

## Specifications

### Inputs

|                         |  |
|-------------------------|--|
| <b>Power input</b>      | 24 to 30 Vac, 1.0 amp.                           |
| <b>Heat Anticipator</b> | 24 Vac, 0.3 to 1.2 amp.<br>Cool anticipator: 5 W |

### Environment

|                                   |   |
|-----------------------------------|---|
| <b>Ambient temperature limits</b> | Shipping and storage: 0 to 120 °F (18 to 49 °C).<br>Operating: 32 to 110 °F (0 to 43 °C). |
| <b>Humidity</b>                   | 95% RH, non-condensing.   |
| <b>Locations</b>                  | NEMA Type 1.  |

|                   |                                     |
|-------------------|-------------------------------------|
| <b>Dimensions</b> | 2-3/4 x 4-1/2 inches (70 x 114 mm). |
|-------------------|-------------------------------------|



Typical Applications

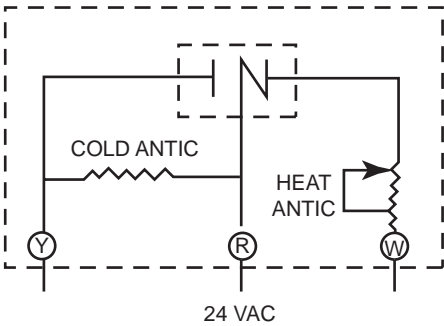


Figure 1 Heat/Cool Thermostats 31-100 and 31-102.

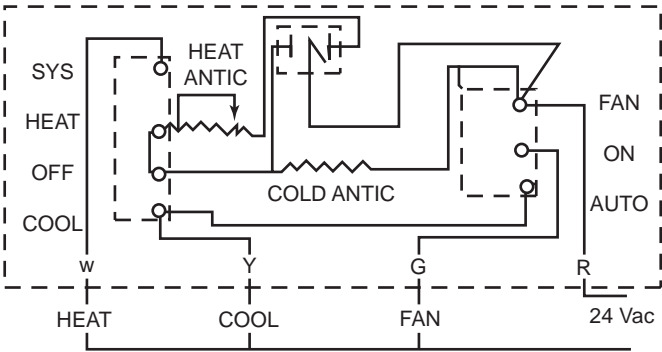


Figure 2 Heat/Cool Thermostat 31-101 and 31-103.

## Application

The 680 series low or line voltage changeover switches are designed to switch a thermostat from heating to cooling based on a change in supply water temperature. The 680 series switches can be mounted on 5/8" or 7/8" O.D. copper tube or iron pipe.

Both models are easily mounted to the supply piping with a simple spring clip included with the thermostat. Each thermostat also includes the necessary wire nuts and strain relief bushing.



**680-243**

## Features

- Add-on switch for seasonal change over.
- Includes all necessary parts for installation.
- Snap acting SPDT.

## Model Chart

| Model No. | Voltage | Inductive |      | Resistive Amps | Description                   |
|-----------|---------|-----------|------|----------------|-------------------------------|
|           |         | FLA       | LRA  |                |                               |
| 680-243-5 | 120     | 5.8       | 34.8 | 10             | Standard changeover switch    |
|           | 240     | 2.9       | 17.4 | 5              |                               |
| 680-243-6 | 120     | 10.0      | 60.0 | 25             | Includes a conduit connection |
|           | 240     | 5.0       | 30.0 | 25             |                               |

## Specifications

|                                   |   |
|-----------------------------------|---|
| <b>Inputs</b>                     |   |
| <b>Connections</b>                | Color coded leads, 36 in (914 mm).  |
| <b>Outputs</b>                    |   |
| <b>Mechanical</b>                 | Changeover temperature range: 65 ±5 to 83 ±5 °F (18 ±2 to 28 ±2 °C).  |
| <b>Environment</b>                |   |
| <b>Ambient temperature limits</b> | Shipping and storage: -20 to 176 °F (-29 to 80 °C).<br>Operating: 220 °F (104 °C) fluid at ambient temperature of 125 °F (52 °C). |
| <b>Locations</b>                  | NEMA Type 1.  |
| <b>Agency Listings</b>            |   |
| <b>CSA</b>                        | Approved.   |

## Typical Application

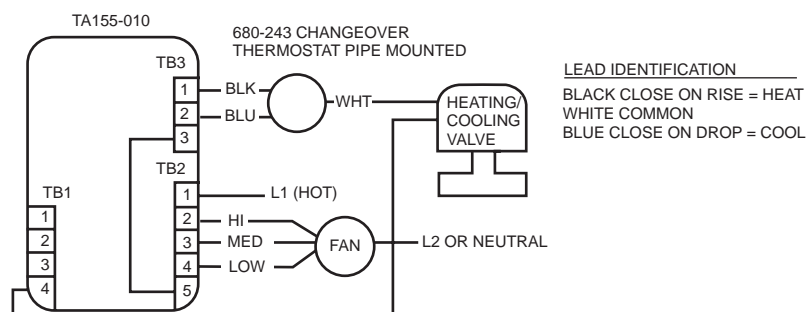


Figure 1 Typical Wiring.



**Seasonal Changeover Switch  
680 Series**






| Catalog Part Number | Description |
|---------------------|-------------|
|---------------------|-------------|

**PopTop™ Inverted Flare Sweat Fittings**  
**Fits all PopTop 3/4" Inverted Flare and Classic 0647 and 0767 Small Inverted Flare**

|   |           |                                   |
|---|-----------|-----------------------------------|
|  | 436-214-1 | 1/2" Sweat Female Elbow and Nut   |
|   | 436-214-4 | 1/2" Sweat Male Elbow 90° and Nut |
|   | 436-220   | 1/2" Sweat Female Tube and Nut    |
|   | 436-229-3 | 1/2" Sweat Male 3" Tube and Nut   |
|  | 436-252   | 3/4" Sweat Female Tube and Nut    |
|   | 436-256   | 1" Sweat Female Tube and Nut      |

**Replacement Motors for Erie Classic and G Dampers**  
**Class "F" Rated Temperature 250 °F Fluid/169 °F Ambient**

|   |          |                      |
|---|----------|----------------------|
|  | 30-118-A | 24 Vac 50/60 Hz      |
|   | 30-118-B | 110/120 Vac 50/60 Hz |
|   | 30-118-D | 208 Vac/60 Hz        |
|   | 30-118-T | 277 Vac, 50/60 Hz    |
|   | 30-118-U | 220/230 Vac 50/60 Hz |

**Replacement Motors R Classic Valve and Dampers**  
**Class "F" Rated Temperature 250 °F Fluid/169 °F Ambient**

|  |          |                      |
|--|----------|----------------------|
|  | 30-140-A | 24 Vac 50/60 Hz      |
|  | 30-140-B | 110/120 Vac 50/60 Hz |
|  | 30-140-U | 220/230 Vac 50/60 Hz |

**Classic Replacement End Switches**  
**Classic Valves and Dampers**

|  |           |   |
|--|-----------|---|
|  | 630-202   | Unsealed for Valves and Dampers         |
|  | 630-232-7 | Sealed for 2-Way Valves w/Bearing Plate |
|  | 630-232-8 | Sealed for 3-Way Valves w/Bearing Plate |
|  | 630-274   | Sealed for 2 & 3-Way 747 and 773 Valves |

**Classic Rebuilding Kits (Normally Closed Only)**  
**1/2" & 3/4" Rebuilding Kits for Body Styles 635, 654, 647, 672, 691 and 1" 751**

|  |           |  |
|--|-----------|--|
|  | 630-240-1 | 2 and 3-Way NC, w/o End Switch               |
|  | 630-240-2 | 2-Way, NC, w/Sealed End Switch Included      |
|  | 630-240-3 | 2 and 3-Way, NC, w/End Switch (Not Included) |
|  | 630-240-5 | 3-Way NC, w/Sealed End Switch Included       |

| Catalog Part Number | Description |
|---------------------|-------------|
|---------------------|-------------|

**Classic Rebuilding Kits (Normally Opened Only - Mfg. after 12/92)**  
**1/2" & 3/4" Rebuilding Kits for Body Styles 635, 654, 647, 672, 691 and 1" 751**

|  |           |   |
|--|-----------|---|
|  | 630-259-4 | 2 and 3-Way NO, w/o End Switch                |
|  | 630-259-5 | 2 and 3-Way, NO, w/Sealed End Switch Included |
|  | 630-259-6 | 2 and 3-Way, NO, w/End Switch (Not Included)  |

**Classic Rebuilding Kits (Normally Closed Only)**  
**1" Rebuilding Kits for Body Styles 747, 773**

|  |           |                                 |
|--|-----------|---------------------------------|
|  | 630-266-1 | 2 and 3-Way NC, w/o End Switch  |
|  | 630-266-2 | 2-Way NC, w/Unsealed End Switch |
|  | 630-266-3 | 3-Way NC, w/Unsealed End Switch |

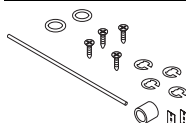
**Classic Rebuilding Kits (Normally Opened Only - Mfg. after 12/92) 1" Rebuilding Kits for Body Styles 747, 773**

|  |           |  |
|--|-----------|--|
|  | 630-267-3 | 2 & 3-Way NO, w/o End Switch               |
|  | 630-267-4 | 2 & 3-Way, NO, w/End Switch (Not Included) |

**Classic Modulating Motor Kits for "M", "T", "ST", "P", & "SP", Valves**  
**Actuator Motor and Gear Drive**

|  |         |   |
|--|---------|---|
|  | 645-213 | 24 Vac for "M" Valves                     |
|  | 646-253 | 24 Vac for "T" Valves                     |
|  | 646-277 | 24 Vac for "P" Valves with Circuit Board  |
|  | 646-279 | 24 Vac for "SP" Valves with Circuit Board |
|  | 646-280 | 24 Vac for "ST" Valves                    |

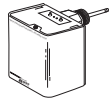
**Damper Actuator, Accessories**  
**Shaft Kits for Direct Drive "L", "H" & "R" Type**

|  |        |   |
|--|--------|---|
|  | 453-52 | 6" to 12" Shaft and Hardware, 5/16" Dia.  |
|  | 453-69 | 12" to 20" Shaft and Hardware, 5/16" Dia. |

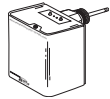
**Damper Actuator, Replacement Motor (H only)**  
**Class "A" Rated Temperature 120 °F Ambient**

|  |          |                      |
|--|----------|----------------------|
|  | 30-145-A | 24 Vac 50/60 Hz      |
|  | 30-145-B | 110/120 Vac 50/60 Hz |
|  | 30-145-U | 220/230 Vac 50/60 Hz |

| Catalog Part Number  | Description |
|--|-------------|
| <b>Boiler Boss® System Accessories</b>                       |             |
| <b>Water Level &amp; Temperature and Outdoor Air Sensors</b> |             |



BTS-1 Boiler Temperature Sensor (BB2400)



LWC-1 Low Water Cutoff w/10' Cable (BB2400)



OAS-1 Outdoor Air Sensor w/25' Cable (BB1200 and BB2400)



OAS-2 50' Shielded Cable for OAS-1 (BB1200 and BB2400)



SENS-10K 10K Enc. Thermometric 3 Sensors – OA, PRI, SEC (BB3000 and BB3600)

## Boiler Boss Accessories Expansion Relay and Replacement Transformers



EXP10 Expansion Relays for SR100 to SR600 Replacement for VL500 and WA300

EXT10 Foot Mounted, 10 VA, 120 V/24 V

EXT15 Foot Mounted, 15 VA, 120 V/24 V

EXT25 Foot Mounted, 25 VA, 120 V/ 24 V

EXT40 Foot Mounted, 40 VA, 120 V/ 24 V



EXT75 Foot Mounted, 75 VA, 120 V/ 24 V

SKT10 Relay Base with Terminals for EXP10

## Boiler Boss Accessories Fuses – BB3000

40-8-68 F1 Fuse (5A-250V) Slow Blow

40-8-69 F2 Fuse (10A-250V) Slow Blow

| Catalog Part Number                                     | Description |
|---|-------------|
| <b>T 155, 157, 167 &amp; 168 Thermostat Accessories</b> |             |
| <b>Sensors, Change-over Switches, Wall Plates</b>       |             |



65170 Warmer / Cooler Dial/T155/157/167



65345 4 3/4" x 4 3/4" Cool Gray Wall Plate



65406 60" Remote Sensor



65409 Fahrenheit Dial/T155/157/167



65410 Celsius Dial/T155/157/167



65860 Dial Stop Kit/T155/157/167



680-243-5 36" Changeover Switch

680-243-6 36" c/o Switch with Conduit Connection

## Room Thermostats Accessories Transformers, 120 Vac to 24 Vac, 240 Vac to 24 Vac

28-240 Hub Mount, 20 VA, 240 V to 24 Vac

28-260 Plate Mounted, 40 VA, 120 V/24 V

## Actuator Specification

Water hammer is symptomatic of a system problem, such as high differential pressure across a valve, a 2-way valve installed backward, or a pump dead heading against a valve attempting to close off. Variable high differential pressures can damage zone valve actuators. Differential pressure across a valve is not the same as pump head pressure, or static pressure in a system.

Differential pressure across a valve in a closed loop system affects the close-off capability of the actuator. It is the difference in pressure between pump supply and pump return. Do not exceed the valve Differential Pressure close-off ratings published in the **Erie installation valve data sheets and the Valve Selection pages in this publication.**

Subject to inspection, actuators with gears damaged by water hammer due to differential pressure excess, are not covered by Invensys warranty.

## Relationship to Specification

The smaller a valve's port, the greater the actuator's ability to close without noise or seat leakage. From Invensys data, select the actuator's pressure differential specification while maintaining adequate (Cv) flow to the load.

System solutions to valve noise from pump head pressures include: a pressure differential regulator by-pass across a pump's supply and return (loop) to eliminate pump head pressure spikes, selection of a pump with a flatter curve, and boiler Indoor/Outdoor reset control.

For valve seat by-pass leakage (inability to stop flow), use a lower Cv valve or a High close-off actuator. Cv means Capacity value (or Gallons Per Minute at a one lb. pressure drop across the valve). For most standard heating replacement applications, a 3.5 Cv valve will work with a General rated actuator. However, if you need to estimate a Cv: divide the GPM by the Square Root of the acceptable pressure drop.

$$Cv \text{ req'd} = \frac{\text{Estimate GPM req'd}}{\sqrt{\text{estimate allowable pressure drop across valve}}}$$

Example: One US gallon (4 L) heated from 160 °F to 180 °F will release 10,000 BTUs of heat. Therefore, a 3.5 Cv valve is capable of transferring 35,000 BTUs at a 1 lb drop across its port to the load (coil, baseboard, etc.).

## Oxygenated (potable) Water

Erie zone valves are designed for use in closed loop heating and cooling systems only. They are not meant to operate in systems where fresh (oxygenated) water is used for human or animal consumption. For pool or spa, space heating and cooling, where oxygenated water is used as the media, the zone valve must be placed on the closed loop side of a heat exchanger.

Subject to inspection, zone valves exhibiting premature failure from corrosion due to oxidation from excess fresh oxygen, or improperly treated boiler water will not be covered by Invensys warranty.

## Thermostats and Transformers

Troubleshooting a system by shorting across thermostat load connections will burn out heat anticipators in mechanical thermostats, and will destroy Triacs in electronic thermostats. Subject to inspection, thermostats with evidence of electrical short will not be covered by Invensys warranty.

Short circuiting a transformer secondary will burn out the transformer primary. Subject to inspection, transformers with evidence of electrical short, will not be covered by Invensys warranty.

All specifications are nominal and may change as design improvements are introduced. Invensys Building Systems shall not be liable for damages resulting from misapplication or misuse of its products.

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