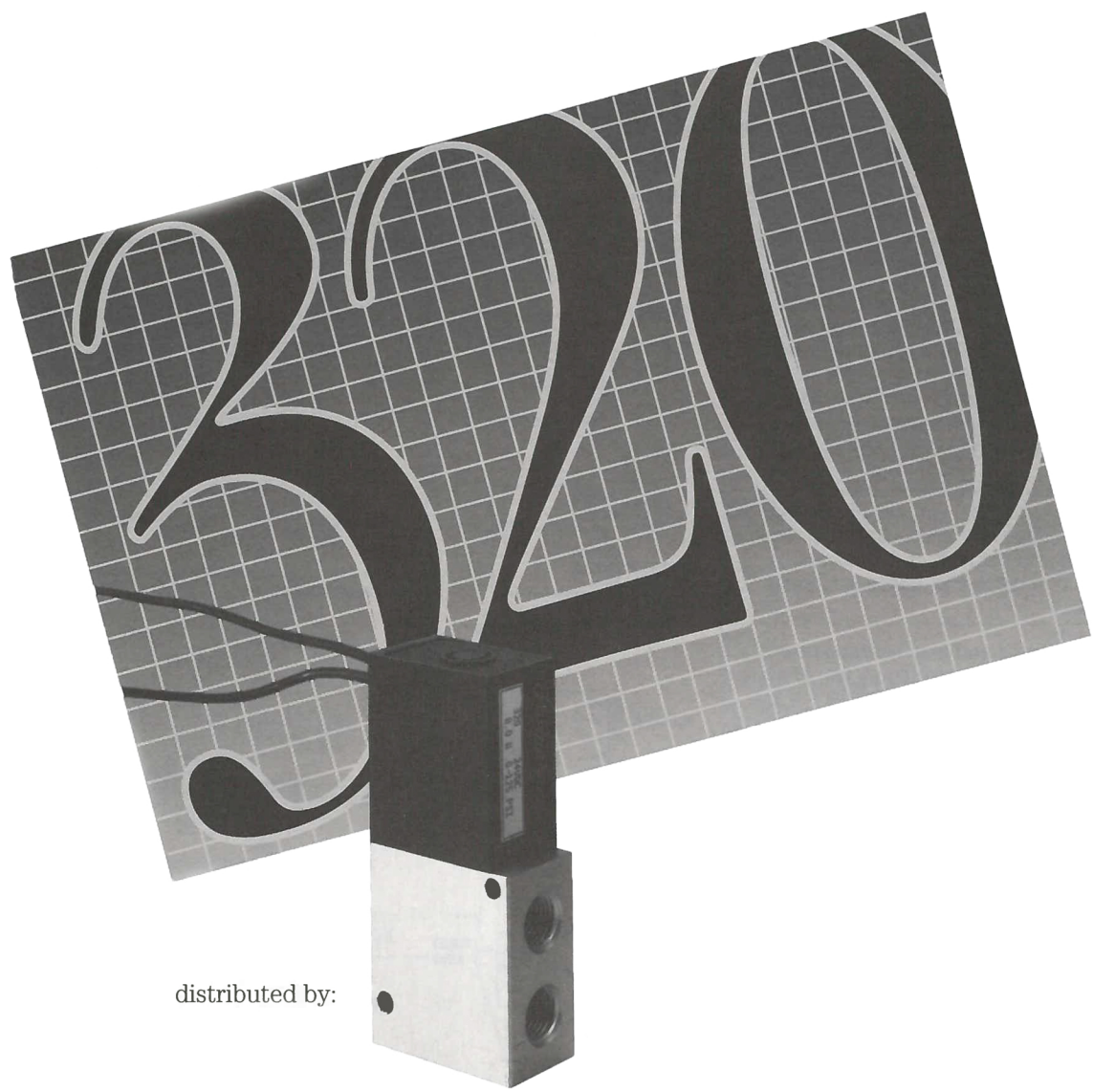


# 320/420 SERIES SOLENOID VALVES



distributed by:

*Humphrey*<sup>®</sup>

# HUMPHREY 320/420 SERIES SOLENOID VALVES

## TECHNICAL SECTION

### INSTALLATION

Valves should be mounted using the .185" (4.70mm) diameter side mounting holes and #8 or M4 mounting screws. The optional 8-388A mounting bracket kit consists of a bracket, two screws, and two captive lockwasher nuts. Mounting bracket adapts to any 320/420 valve on either side of valve.

**Plumbing** 320/420 valves are direct acting. When used with vacuum or low pressure, use largest possible tubing size and minimum tubing length for optimum performance.

Before connecting fittings and tubing, blow all foreign material from these components. If using a sealant, take extra care the sealant does not enter valve causing malfunction and/or leaks.

**Lubrication** 320/420 valves are pre-lubed and can be operated without air line lubrication to an estimated life of 20 million cycles, depending on application. If air pistons/cylinders or other devices require lubrication, ensure that lubricating oils are chemically compatible with Buna N elastomers and are of sufficient viscosity to assure adequate lubrication. Thin or low viscosity oils (spindle oil, machine oil, etc.) do not provide a good residual film of lubrication.

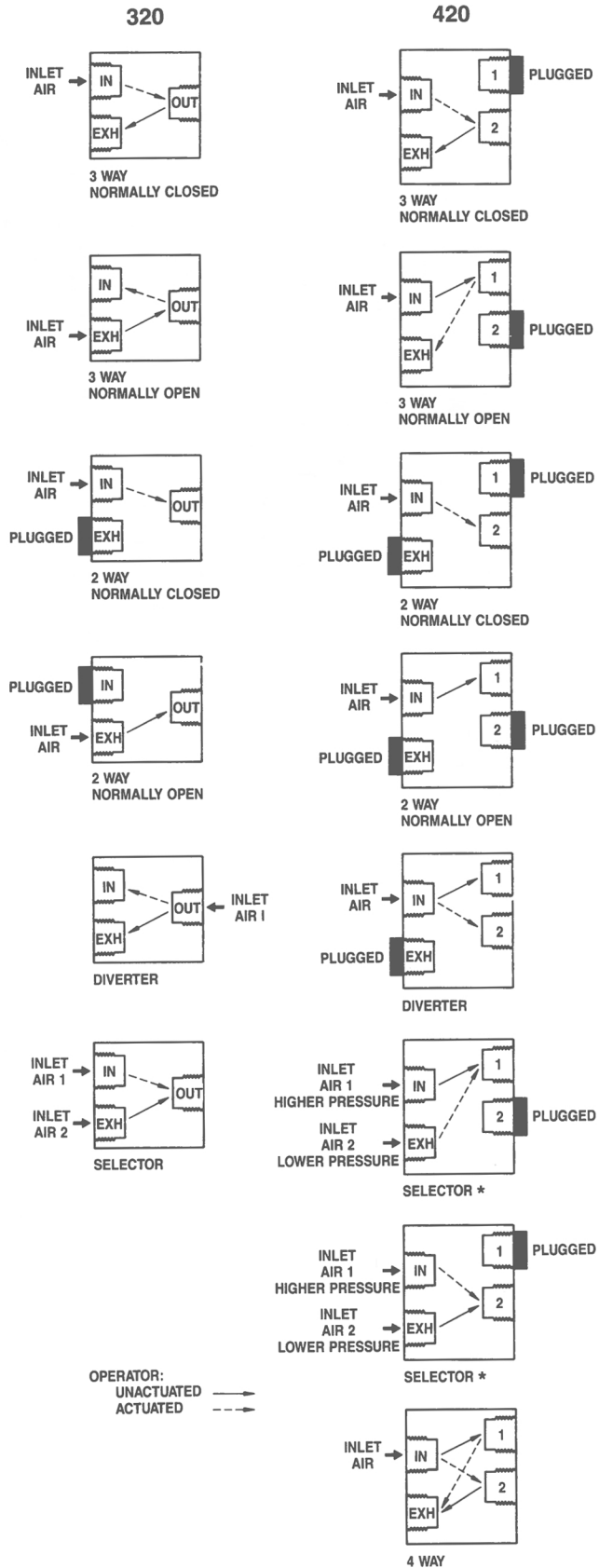
**Media/Pressure** 320/420 valves are designed for use with compressed air or inert gases from 28" Hg. vacuum to 125 psig (8.5 bar). Compressed air should be clean and uncontaminated. When in doubt, install an air filter with filtering capacity of 40 microns. Periodically, remove and clean or replace filter element. Consult factory if using any other media.

**CAUTION:** Compressed air is powerful and may be dangerous. Before attempting to remove a component from an air line or system, **always** disconnect the supply air and thoroughly exhaust the line or system. **Never** attempt to construct, operate, or service anything using compressed air unless you have been properly trained to do so. Failure to heed this warning could result in **SERIOUS, EVEN FATAL, PERSONAL INJURY.**

### Port Identification

- IN Pressure Supply Port.
- OUT Delivery port for model 320.
- 1 Normally Open Delivery port for model 420.
- 2 Normally Closed Delivery port for model 420.
- EXH Exhaust port, vent to atmosphere.

**Porting Diagrams** The 320/420 balanced poppet design allows the valve to function in a variety of pneumatic porting configurations. Typical porting diagrams are outlined below.



\*Always connect higher pressure to IN port.

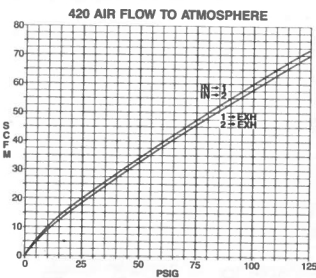
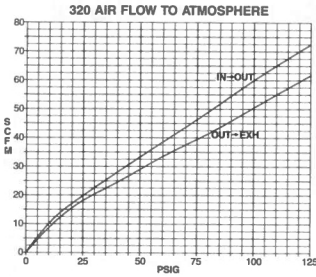
# FLOW AND ELECTRICAL DATA

## FLOW RATES/C<sub>v</sub>

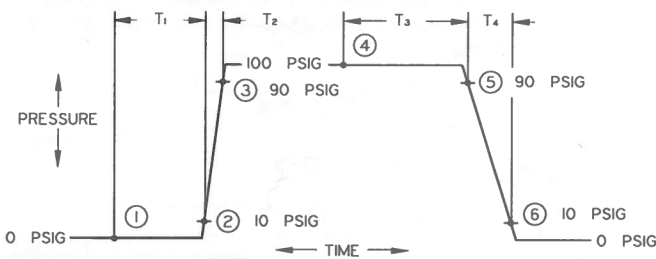
Humphrey recommends "fill/exhaust times," which are related to various chamber sizes, as the easiest method for calculating total valve and device (specifically, cylinder) response time. Humphrey recognizes the industry's use of flow coefficient C<sub>v</sub> as a comparison standard.

Consequently, Humphrey offers three types of flow data. The National Fluid Power Association's standards for C<sub>v</sub>, the scfm flow rate determined by flowing to atmosphere, and Humphrey's preferred "fill/exhaust times."

| Model | C <sub>v</sub> | SCFM @100 psig | Fill Time (Sec)<br>(0 to 80 psig)<br>Chamber (cu. in.) |     |      | Exhaust Time (Sec)<br>(100 to 20 psig)<br>Chamber (cu. in.) |     |      |
|-------|----------------|----------------|--|-----|------|---|-----|------|
|       |                |                | 10   | 100 | 1000 | 10  | 100 | 1000 |
| 320   | 1.0            | 60             | .032   | .32 | 3.2  | .049  | .47 | 4.7  |
| 420   | 1.0            | 60             | .032   | .32 | 3.2  | .049  | .47 | 4.7  |



## RESPONSE TIMES



### Identification of response time areas

T1 times are measured from point ① (valve energization) to point ② (10% of supply pressure detected at valve outlet port.)

T2 times are measured from point ② (detection of outlet pressure) to point ③ (90% of supply pressure).

T3 times are measured from point ④ (valve de-energization) to point ⑤ (10% of supply pressure exhausted at outlet port.)

T4 times are measured from point ⑤ (detection of pressure drop) to point ⑥ (90% of supply pressure exhausted).

### AC/DC Voltages (320)

| Coil Voltage | T <sub>1</sub> | T <sub>2</sub> | T <sub>3</sub> | T <sub>4</sub> |
|--------------|----------------|----------------|----------------|----------------|
| DC           | .016 sec.      | .002 sec.      | .007 sec.      | .002 sec.      |
| AC           | .016 sec.      | .002 sec.      | .035 sec.      | .002 sec.      |

### AC/DC Voltages (420)

| Coil Voltage | T <sub>1</sub> | T <sub>2</sub> | T <sub>3</sub> | T <sub>4</sub> |
|--------------|----------------|----------------|----------------|----------------|
| DC           | .020 sec.      | .002 sec.      | .005 sec.      | .002 sec.      |
| AC           | .020 sec.      | .002 sec.      | .035 sec.      | .002 sec.      |

Measured at 70°F (21°C) with 100% voltage and 100 PSIG supply. Times shown are nominal performance of valves tested.

## Example of how to calculate fill/exhaust times:

Model 320, 24VDC                      One Air Line (0.250 I.D. x 24-inch long)  
100 psig supply                      Air Cylinder (2.5-inch bore x 10-inch stroke)

Volume = 0.785 x Diameter squared x stroke or length

|                                      |                            |
|--------------------------------------|----------------------------|
| Cylinder Volume                      | = 49.06 cubic inches       |
| Air Line Volume                      | = 1.17 cubic inches        |
| Total Circuit Volume                 | = 50.23 or 50 cubic inches |
| T1 Time to Energize Valve            | = .018 sec.                |
| Time to fill 50 cubic inches         |                            |
| 50% of .32 sec. for 100 cubic inches | = .160 sec.                |
| T3 Time to De-energize Valve         | = .009 sec.                |
| Time to Exhaust 50 cubic inches      |                            |
| 50% of .47 sec. for 100 cubic inches | = .235 sec.                |
| Total Cycle Time                     | = .422 sec.*               |

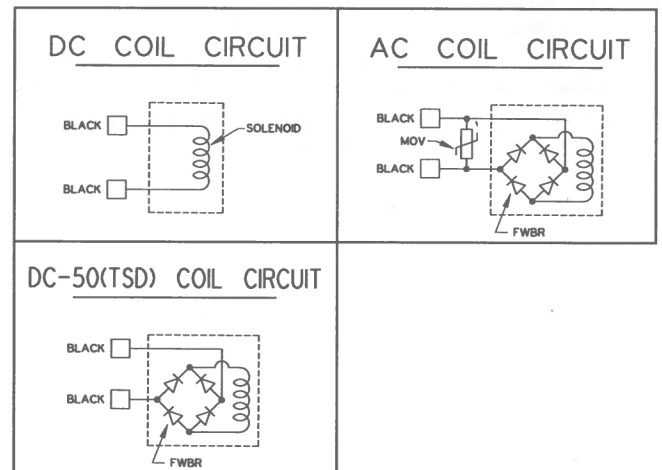
\*Although this result is not exact, it is sufficient for most application needs and provides a simple, straight-forward system.

## 320/420 SERIES VALVES ELECTRICAL SPECIFICATIONS

| Voltage  | Resistance (Ohms) | Current (Milliamps) |
|----------|-------------------|---------------------|
| 12VDC    | 18.0              | 667                 |
| 12VDC-50 | 13.8              | 760                 |
| 24VDC    | 72.0              | 333                 |
| 24VDC-50 | 58.0              | 370                 |
| 24VAC    | 50.0              | 400                 |
| 100VAC   | 1051.0            | 87                  |
| 120VAC   | 1512.0            | 73                  |
| 200VAC   | 4200.0            | 44                  |
| 240VAC   | 6050.0            | 36                  |

- All coils are standard with 24-inch black lead wires. Optional 72-inch lead wires are available.
- All AC coils are rated for 50/60 Hertz.
- All coils conform to Class B insulation systems.
- Resistance and current are nominal values.
- Valve assemblies are "hi-pot" tested at 1750VAC for one second.
- Voltage operating range is +10%, -15% of rated voltage for AC or DC voltages.

## SOLENOID CIRCUIT SCHEMATICS



Transient Suppression Diode (TSD), Order code -50, is available for DC voltages to protect drive circuits from DC voltage spikes generated by the valve.

If operating the valve with a reed switch, the TSD will enhance the life of switch contacts.

If operating the valve with a programmable controller, the TSD will eliminate voltage spikes which could cause erratic operation of the controller.

The TSD option will increase T<sub>3</sub> response times to that of the AC coils.

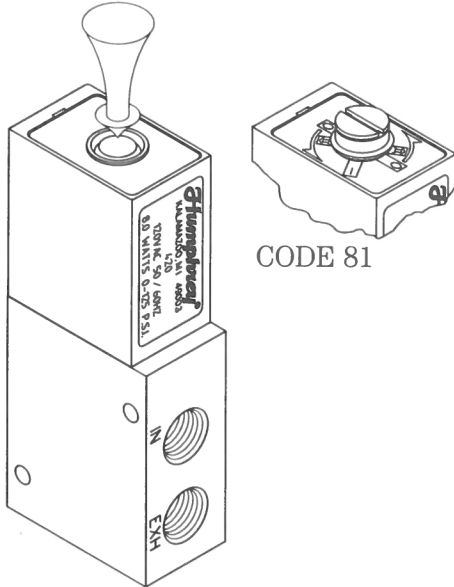
## MANUAL OVERRIDE

Push button/spring return manual override is standard. Manual override is located on top of coil.

Pushing red button shifts armature which actuates the main stem of valve. Release of manual force permits valve spring to return valve to normal position.

320/420 valves are available without manual override by specifying Code 87 (example is 320-87 24VDC). On valves without manual override, a solid cover is installed on the coil. This replaces the punched disk which is used on valves with manual override.

A locking manual override is optional; specify Code 81 (example: 320-81 24VDC). In the unactuated position the override is locked "Off" and will not operate the valve. Clockwise rotation of slotted screw approximately 30 degrees provides operation like the standard manual override: pushing center portion actuates the main stem of the valve; release of manual pressure permits spring to return valve to the normal position. Rotating an additional 90 degrees locks override and valve in the "On" position.



## METRIC PORTS/DIMENSIONS

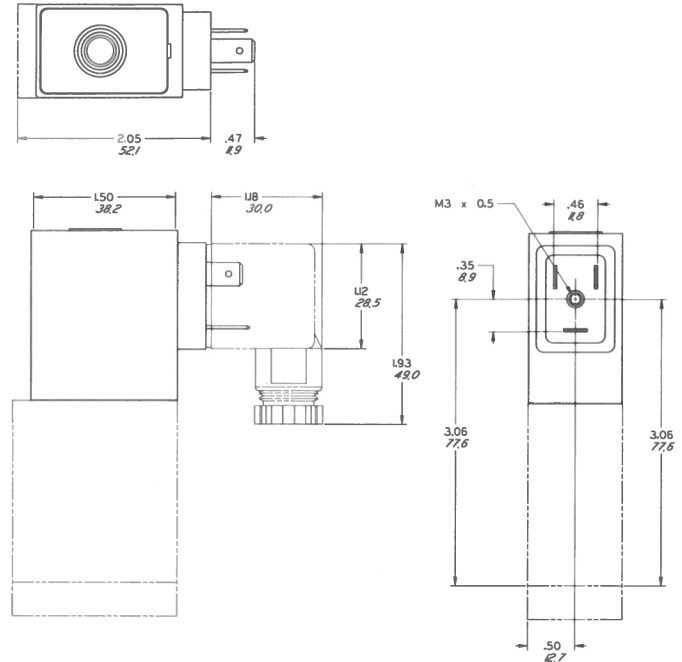
Although these valves are produced using the inch system, all drawings show the metric equivalent in millimeters (indicated by slanted numbers).

All port connections are available in metric sizes. The 1/4-18 NPSF pipe ports are available in ISO 7/1-Rp 1/4.

Specify metric port threads by using letter *E* as a model number prefix. Example: *E410* has metric size ports.

## CODE 39

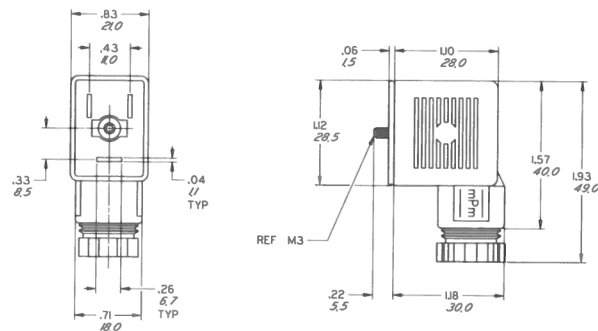
Humphrey Code 39 is an optional plug-in DIN-type connector base that conforms to international standards. It provides simplicity, convenience, and fast, easy electrical installation. Available for both 3-way and 4-way models, the connector base accepts DIN 43 650/ISO 4400 connectors which form a secure, solderless electrical connection.



## CONNECTORS (Order separately)

**Model HS-3.** This connector is available for all 320/420 series valves and has an internal socket for screw-type wire termination contained within a black housing. The housing is capable of being rotated 180 degrees with respect to the socket for flexibility of cable placement.

**Model HS-3-LED.** This connector is available for all 320/420 series valves and has a built-in AC/DC LED that can be ordered for 12V, 24V, 120V, or 240V coils. It has an internal socket for screw-type wire termination. The transparent housing can be rotated 180 degrees with respect to the socket for flexibility of cable placement. Specify voltage when ordering.

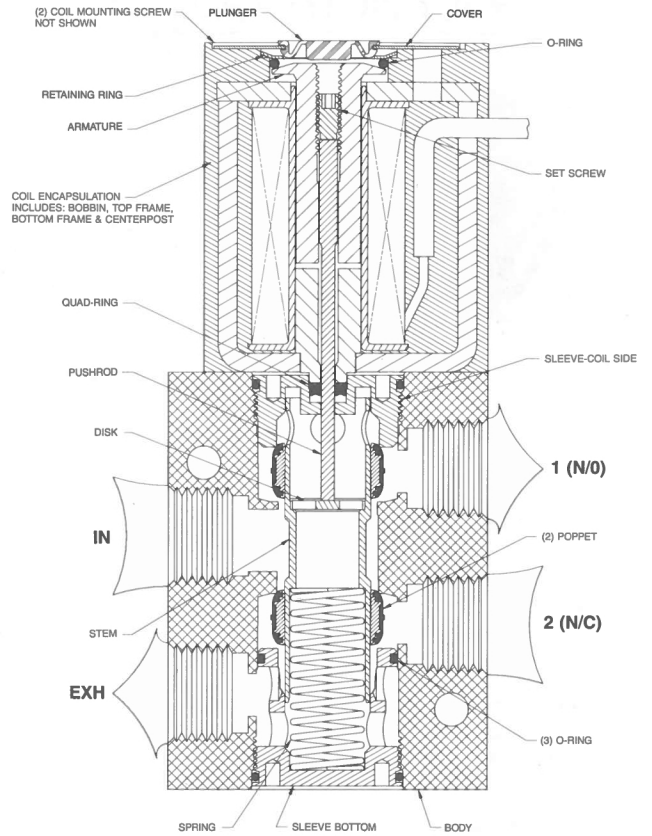


# SPECIFICATIONS

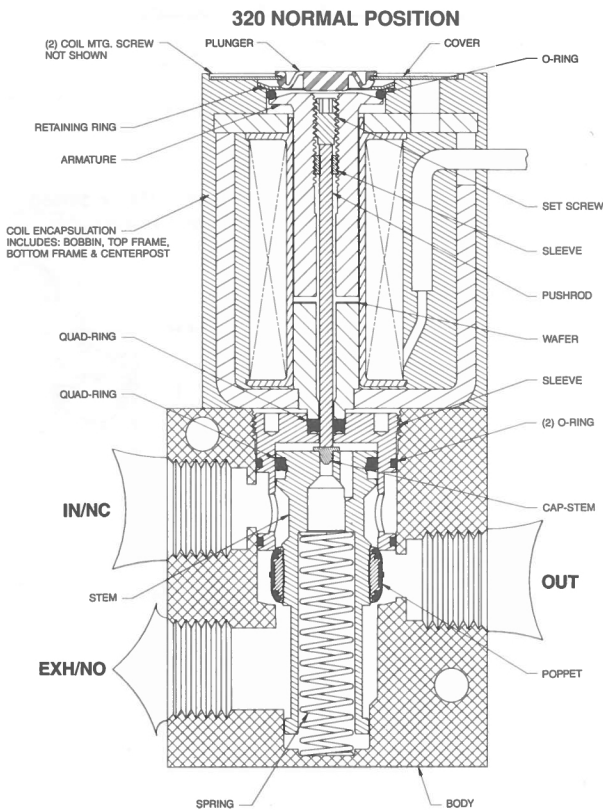
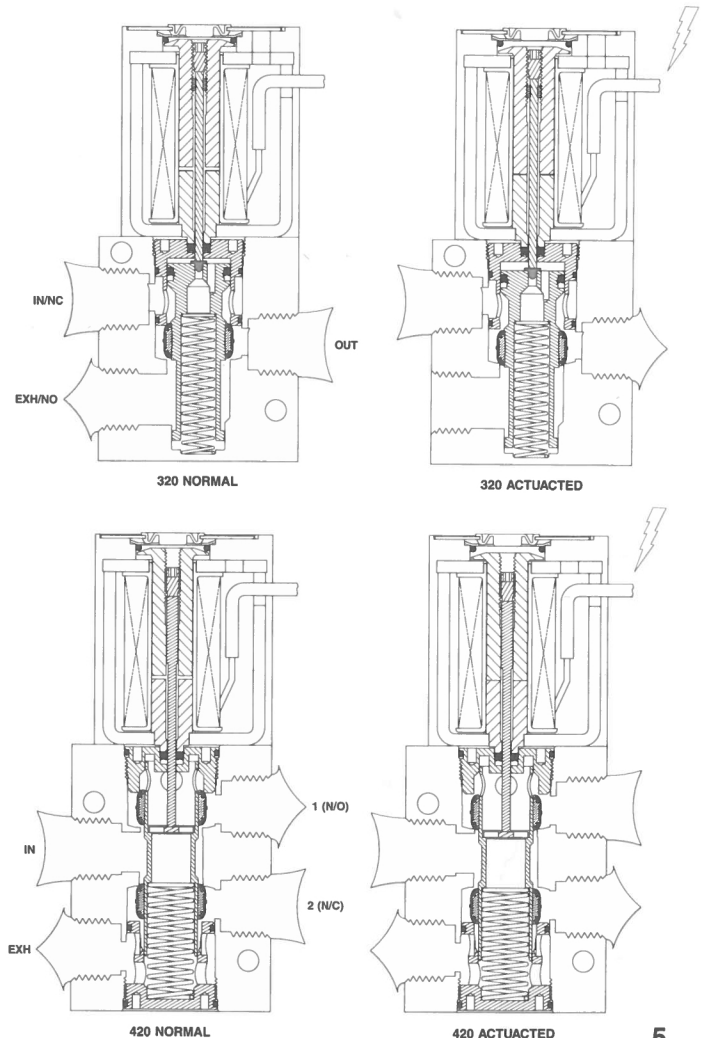
## 320/420 Models

|  |  |                                  |
|--|--|----------------------------------|
| Media                                  | Air, vacuum or inert gases   |                                  |
| Pressure Range                         | 28" Hg. (vacuum) to 125 psig (8.5 bar)   |                                  |
| Ambient Temperature Range              | 32° to 125°F (0° to 50°C)  |                                  |
| Coil Temperature Rise (any voltage)    | 108°F (60°C)   |                                  |
| Power Consumption (AC/DC)              | 8.0 watts  |                                  |
| Response Time (on/off)                 | Model 320 — .018/.009 (DC), .018/.037 (AC) sec.<br>Model 420 — .023/.007 (DC), .022/.037 (AC) sec. |                                  |
| Voltage Tolerance                      | Plus 10%, minus 15% of rated voltage   |                                  |
| Coil Voltages                          | 12VDC, 24VDC, 24VAC, 100VAC, 120VAC, 200VAC, 240VAC, 12VDC-50, 24VDC-50                            |                                  |
| SCFM @ 100 psig                        | 60   |                                  |
| C <sub>v</sub>                         | 1.0  |                                  |
| Fill/Exhaust Time @ 100 psig (7.0 bar) | 10 cu. in.   | .032/.049 sec.                   |
|  | 100 cu. in.  | .32/.47 sec.                     |
|  | 1000 cu. in.   | 3.2/4.7 sec.                     |
| Leak Rate (max. allowed)               | 4cc/minute @ 100 psig  |                                  |
| Type of Operation                      | Direct solenoid  |                                  |
| Effective Area                         | Model 320 .041 inch <sup>2</sup>   | Model 420 .045 inch <sup>2</sup> |
| Stroke                                 | .032 inch  |                                  |
| Typ. Cycle Rate (cycles/min.)          | 1500 (DC), 725 (AC)  |                                  |
| Lubrication                            | None required, factory pre-lubed   |                                  |
| Filtration                             | 40 Micron recommended  |                                  |
| Weight                                 | Model 320 .65 lbs. (295 gms)   | Model 420 .77 lbs. (350 gms)     |
| Materials                              | Brass, Buna N, Aluminum, Stainless Steel, Acetal   |                                  |

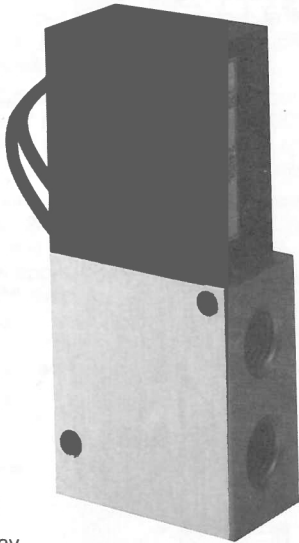
## 420 NORMAL POSITION



## FLOW PATH



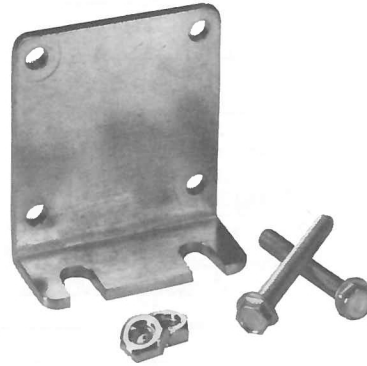
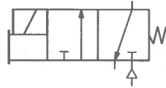
# 320 SOLENOID VALVES



## 320

- 3-way
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Three 1/4-18 NPSF ports (IN, OUT, EXH)
- Non-locking manual override
- 24-inch lead wires
- Optional conduit connector (order code -36)

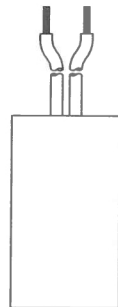
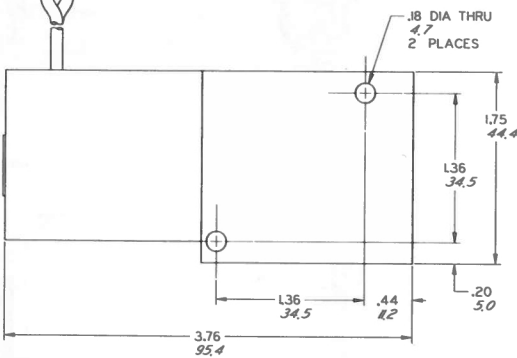
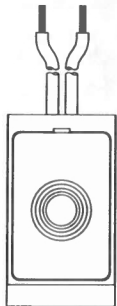
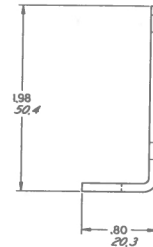
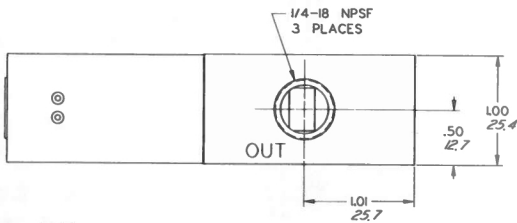
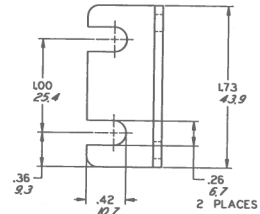
Order example: 320 24VDC



## 8-388A MOUNTING BRACKET

A convenient, optional plated steel mounting bracket kit is designed for use with both 3-way and 4-way valves. This kit consists of a bracket, two screws, and two captive lockwasher nuts.

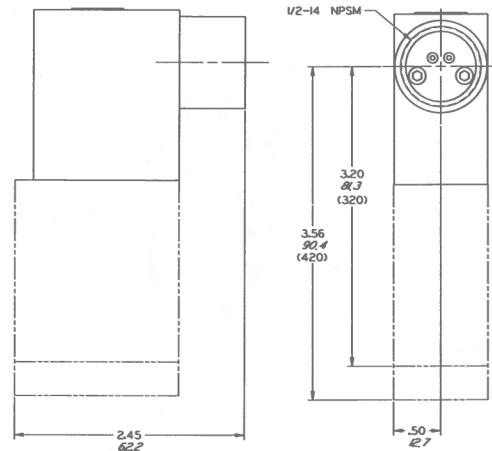
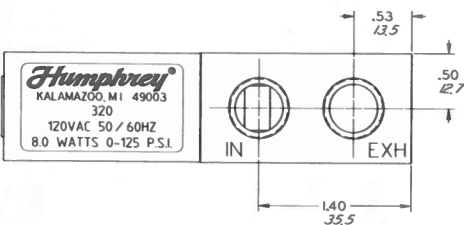
Order example: 8-388A



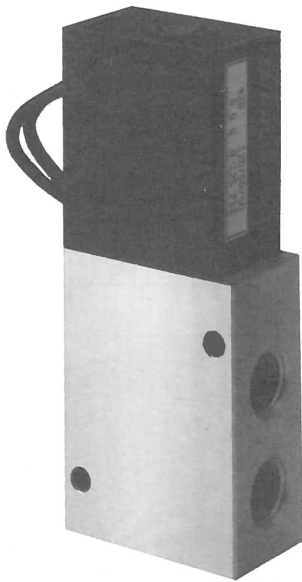
## MODEL 320-36

This conduit connector (Order code -36) for closed wiring systems features a steel conduit assembly attached to the valve coil.

Order example: 320-36 24VDC



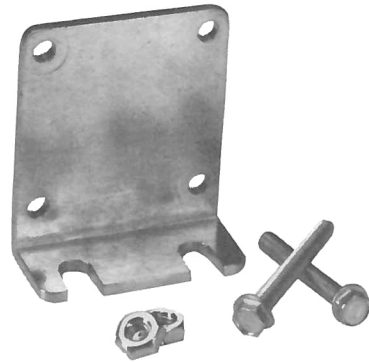
# 420 SOLENOID VALVES



## 420

- 4-way, Normally Open/Normally Closed
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Four 1/4-18 NPSF ports: IN, Delivery ports 1 & 2, and single exhaust port (EXH)
- Non-locking manual override
- 24-inch lead wires
- Optional conduit connector (order code -36)

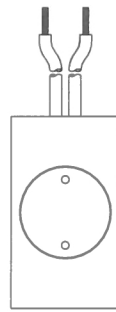
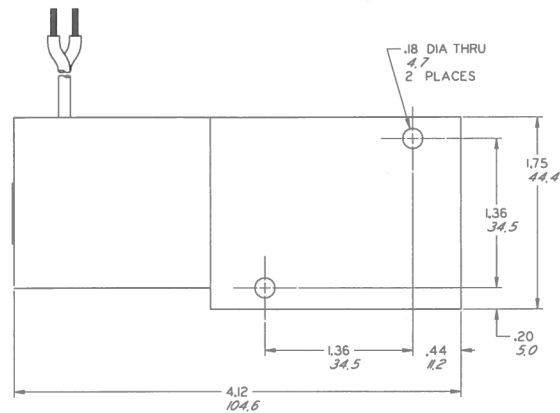
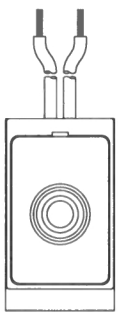
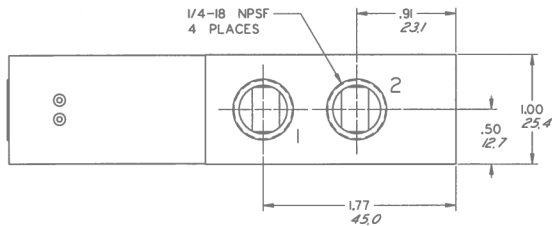
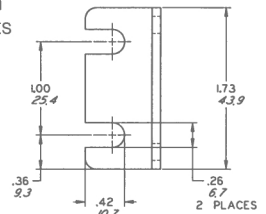
Order example: 420 120 50/60



## 8-388A MOUNTING BRACKET

A convenient, optional plated steel mounting bracket kit is designed for use with both 3-way and 4-way valves. This kit consists of a bracket, two screws, and two captive lockwashers.

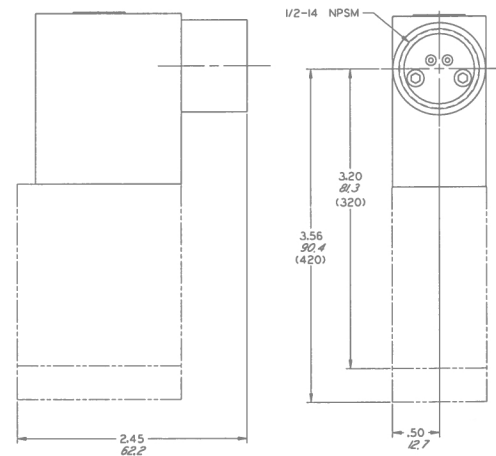
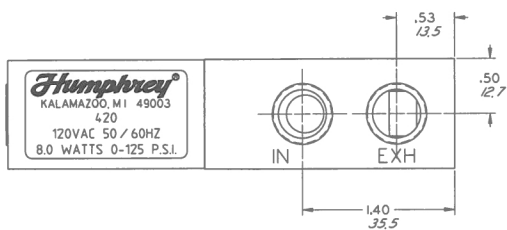
Order example: 8-388A



## MODEL 420-36

This conduit connector (Order code -36) for closed wiring systems features a steel conduit assembly attached to the valve coil.

Order example: 420-36 120VAC 50/60



# ORDER INFORMATION

**320/420 Series Valves**  
**1/4-Inch ports, 2-way, 3-way, 4-way**

## VALVES

| Option Code                              | 2 Way | Conduit Connector | DIN-type Connector | Transient Suppression Diode (TSD)* | Flying Leads |     | Spring Return Override | Locking Manual Override | No Manual Override | Specify Voltage | Rotated Coil 180° |
|--|-------|-------------------|--------------------|------------------------------------|--------------|-----|------------------------|-------------------------|--------------------|-----------------|-------------------|
|  |       |                   |                    |                                    | 24"          | 72" |                        |                         |                    |                 |                   |
| Option Code                              | 2     | 36                | 39                 | 50                                 |              | LL  |                        | 81                      | 87                 | See Below       | RC                |
| <b>Model 320</b><br><b>3-way In-line</b> | SP    | SP                | SP                 | SP                                 | STD          | SP  | STD                    | SP                      | SP                 | N/C             | SP                |
| <b>Model 420</b><br><b>4-way In-line</b> | SP    | SP                | SP                 | SP                                 | STD          | SP  | STD                    | SP                      | SP                 | N/C             | SP                |

\*DC voltages only.

\* To specify metric ports, add an "E" prefix (i.e. E320 or E420).

\* NOTE: Code 21 (Mounting Bracket with screws) furnished unattached to valve.

## Available Voltages

12V DC  
 24V DC  
 24V AC 50/60  
 100V AC 50/60  
 120V AC 50/60  
 200V AC 50/60  
 240V AC 50/60  
 12V DC-50  
 24V DC-50

## ACCESSORIES

| Model         | Description  |
|---------------|--|
| <b>8-388A</b> | Universal Mounting Bracket   |
| <b>130-15</b> | Port Plug  |
| <b>HS-3</b>   | DIN receptacle for use with code 39 connector  |
| <b>HS-3L</b>  | Lighted DIN receptacle for use with code 39 connector. Specify voltage. AC/DC 12V, 24V, 120V, or 240V. |

## HOW TO ORDER

Starting with Model Number, specify options in order from left to right.

Example: To order Model 320-2-50-LL 12VDC  
 2-way function (320-2)  
 TSD coil (320-2-50)  
 72" flying leads (320-2-50-LL)  
 Voltage 12VDC (320-2-50-LL 12VDC)

To order Model 420-87 120VAC 50/60  
 No manual override (420-87)  
 Voltage 120 50/60 (420-87 120VAC 50/60)

Remember: Option Codes marked STD, NA, N/C are not used as part of the Model Number when ordering. N/C indicates no charge but Option Code must be included in the Model Number.

N/C = No charge      STD = Standard  
 NA = Not available      SP = Specify; Additional charge for this option

HUMPHREY PRODUCTS COMPANY • P.O. Box 2008, Kalamazoo, MI 49003 • 616-381-5500 • FAX 616-381-4113