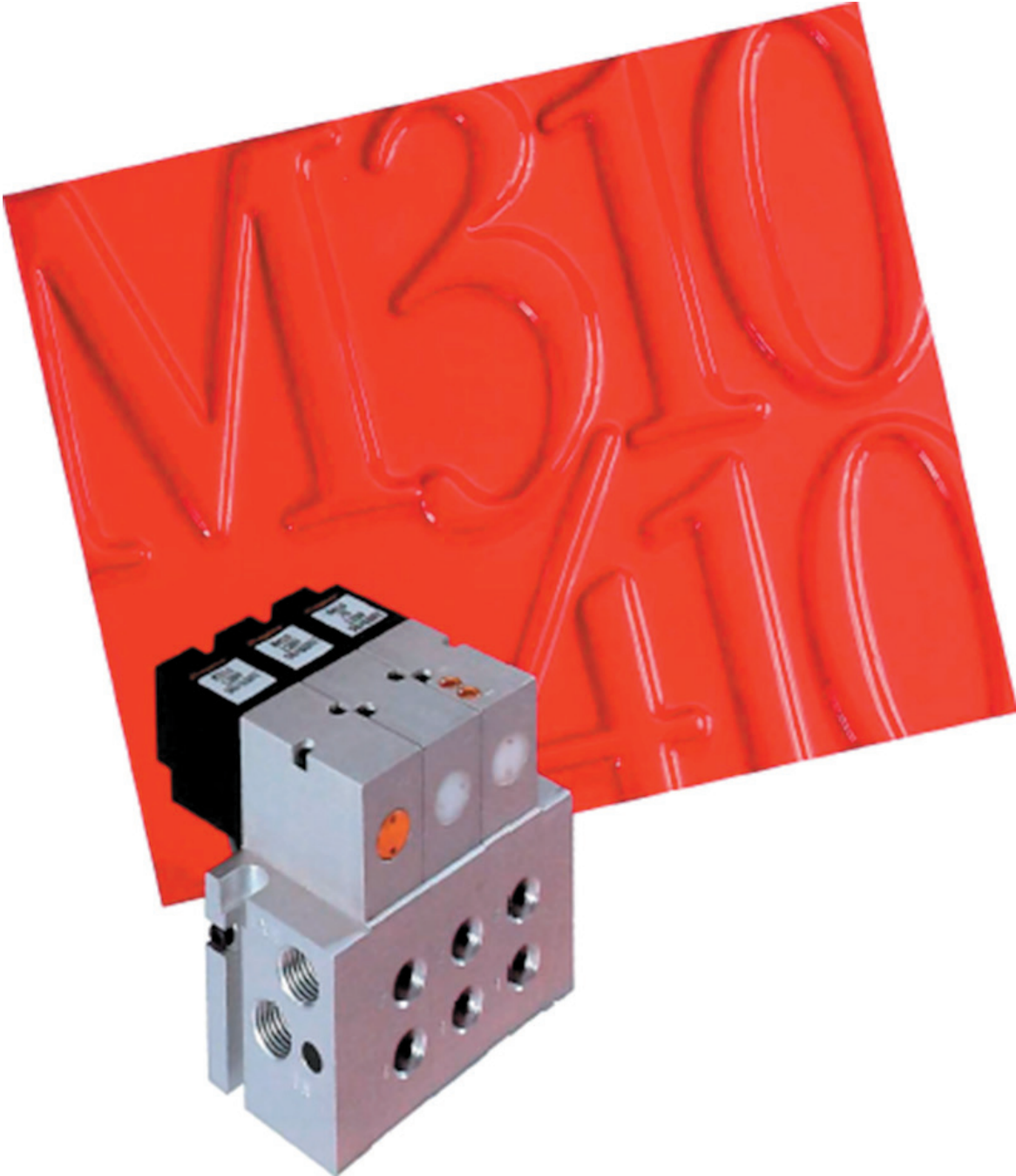


**M310/M410 Series  
Subbase Mounted  
Solenoid Valves**

*Humphrey*<sup>®</sup>





## M310/M410 Series Subbase Mounted Solenoid Valves

This series of 1/8-inch ported 3-way and 4-way single solenoid subbase mounted valves is the latest development of the successful Humphrey 310/410 inline and stacking models described in Humphrey 310/410 Inline and Stacking brochures.

Any combination of 3-way and 4-way subbase mounted valves can be used to form a single pneumatic control package.

Subbase mounting provides plumbing simplicity, easy maintenance, and minimum downtime. Valves can be changed on the spot in seconds, without disturbing the plumbing.

Small size, light weight, and low power make these valves ideal for today's precise, energy-efficient equipment

Like other valves of the 310/410 series, these subbase mounted models have the same direct-acting molded coil and Class B insulation system for ambient temperatures from 32°F to 125°F (0°C to 50°C).

The poppet design is field-proven by years of reliable service in thousands of demanding applications worldwide.

Four-way models are available with integral dual flow controls which eliminate the need, expense, and installation costs of externally applied flow controls. All M310/M410 valves feature a non-locking, push button/spring return manual override. Valves can also be specified without manual override.

A DIN-type plug-in connector is another option that provides fast, easy and secure solderless electrical connections.



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## **FEATURES**

**Use any combination of 3-way and 4-way valves in the same subbase manifold**

**Subbase mounting permits centralized location of valves**

**Subbase manifold can be sub-assembled and placed in final product as complete, single control package**

**Multi-port Model SBMP-1 subbases have individual IN and EXH port**

**Designed for rigorous applications**

**Small size/light weight**

**Poppet design**

**Humphrey solenoid design**

**Molded coil and override seal**

**Positive stop of solenoid armature**

**Short stroke**

**Integral dual flow controls on model M410-70 valves**

**Pressure balanced**

**End Caps provide two mounting option**

**Attractive valve appearance**

## **ADVANTAGES**

Versatility.

Simplified plumbing.

Simplified installation.

Allows combination of NC/NO, or various pressures on same manifold.

Tolerant of many ambient/media conditions.

Reduced size and weight of control valves in finished product.

Needs no lubrication. Tolerates impure media.

Field-proven.

Both internal and external resistance to solenoid contamination.

Prevents excessive impact and poppet overtravel.

Fast response.

Permits individual control of each exhaust into a common exhaust port.

Permits connection of pressure to any port.

Provides mounting without special brackets.

Complements appearance of your product.

## **BENEFITS**

Design Flexibility.

Reduced installation and maintenance costs.

Saves time and labor of installing valves individually.

Design flexibility.

Reliability.

Lower material and finished product shipping cost.

Performs in adverse conditions.

Reliability.

Proven performance.

Long cycle life.

Rapid cycling.

Eliminates need, cost and plumbing of external flow controls

Versatility.

No mounting brackets required. Saves cost.

Contemporary, trim look.

# HUMPHREY 310/410 SERIES SOLENOID VALVES

## TECHNICAL SECTION

### MEDIA/PRESSURE

310/410 valves are designed for use with compressed air or inert gases from 0 to 125 psig (8.5 bar). 410 valves are also rated for vacuum service from 0 to 28" Hg. 310 models can be used with vacuum from 0 to 28" Hg. if ordered with the "V" prefix, i.e., V310, VS310, or VM310.

Media should be cleaned and uncontaminated. When in doubt, install a filter with filtering capacity of 40 microns. Periodically remove and clean or replace filter element. Consult factory if using any other media.

### LUBRICATION

310/410 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.

### PLUMBING

310/410 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 that sealant does not enter valves. This can potentially cause malfunction and/or leakage.

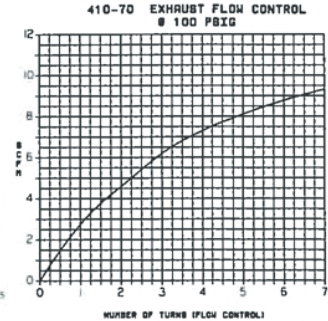
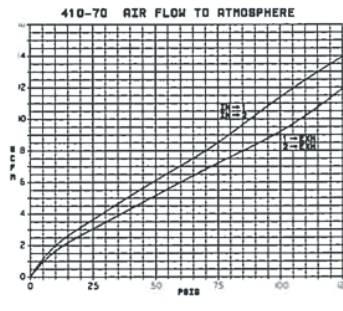
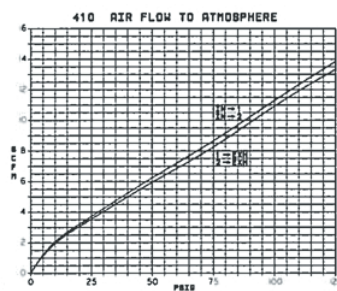
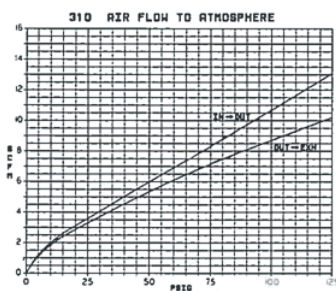
310/410 in-line valves are available for mounting to custom-made manifolds by specifying the Code 23 option (special mounting holes). Consult factory.

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

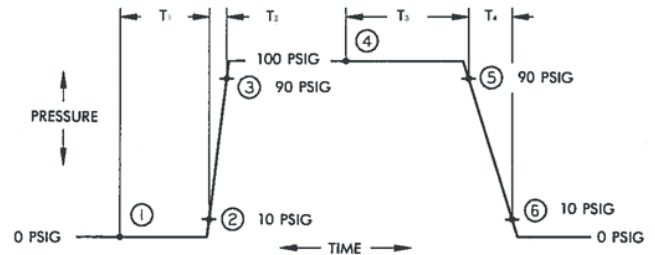
Humphrey recommends "fill/exhaust times," which are related to various chamber sizes, as the best method for calculating total valve and device (specifically, cylinder) response time. Humphrey recognizes the industry's use of flow coefficient C<sub>v</sub> as a comparison standard.

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) (0 to 90 psig) chamber (cu. in.)			Exhaust time (sec) (100 to 10 psig) chamber (cu. in.)		
			1	10	100	1	10	100
310	.167	10.0	.020	.20	2.00	.032	.32	3.20
410	.167	10.0	.020	.20	2.00	.032	.32	3.20
410-70	.167	10.0	.020	.20	2.00	.032	.32	3.20



### RESPONSE TIMES



### IDENTIFICATION OF RESPONSE TIME AREAS

T<sub>1</sub> times are measured from point 1 (valve energization) to point 2 (10% of supply pressure detected at valve outlet port).

T<sub>2</sub> times are measured from point 2 (detection of outlet pressure) to point 3 (90% of supply pressure).

T<sub>3</sub> times are measured from point 4 (valve de-energization) to point 5 (10% of supply pressure exhausted from outlet port).

T<sub>4</sub> times are measured from point 5 (detection of pressure drop) to point 6 (90% of supply pressure exhausted).

### AC/DC VOLTAGES

Coil voltage	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
DC	0.010 sec.	0.001 sec.	0.005 sec.	0.002 sec.
AC	0.010 sec.	0.001 sec.	0.018 sec.	0.002 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 310, 24 VDC One Air Line (1/8-inch I.D. x 36-inch long)  
100 psig supply Air Cylinder (1.062-inch bore x 4-inch stroke)  
Volume = 0.785 x Diameter squared x stroke or length

Cylinder Volume = 3.54 cubic inches  
Air Line Volume = 0.44 cubic inches  
Total Circuit Volume = 3.98 or 4 cubic inches

T<sub>1</sub> Time to energize valve = 0.010 sec.  
Time to fill 4 cubic inches  
40% of 0.6 sec. for 10 cubic inches = 0.080 sec.  
T<sub>3</sub> Time to de-energize valve = 0.005 sec.  
Time to exhaust 4 cubic inches  
40% of 1 sec. for 10 cubic inches = 0.128 sec.  
Total Cycle Time = 0.223 sec.\*

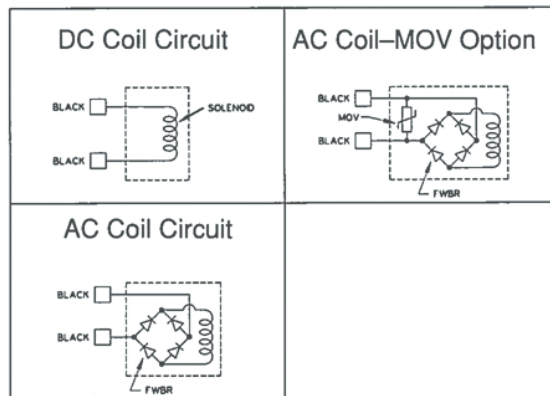
\*Although this result is not exact, it is sufficient for most application needs and provides a simple, straightforward system.

## ELECTRICAL SPECIFICATION CHART

Voltage	Resistance (Ohms)	Current (Milliamps)
12VDC	36	333
24VDC	144	167
24VAC	100	200
100VAC	2100	44
120VAC	3025	36
200VAC	8400	22
240VAC	12100	18

- 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 1750 VAC for one second.
- Ensure proper voltage supply per voltage label rating, +10%, -15% for AC or DC voltages.

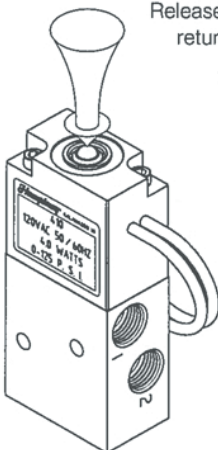
## SOLENOID CIRCUIT SCHEMATICS



## MANUAL OVERRIDE

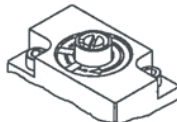
Push button/spring return manual override is standard. Manual override is located on top of coil.

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



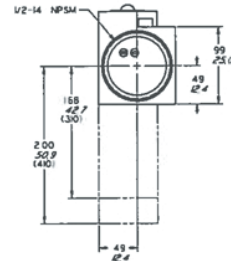
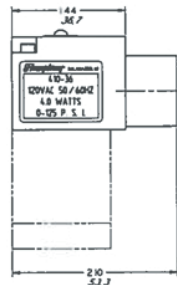
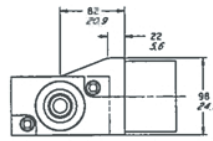
These valves are also available without manual override; specify Code 87 (example: 310-87 24VDC). On valves without manual override, a solid disk is installed on the coil. This replaces the punched disk which is used on valves with manual override.

A locking manual override is optional; specify Code 81 (example: 310-81 100VAC). To actuate valve, turn override screw clockwise to "On" position. Valve remains actuated until screw is returned to "Off" position by turning counterclockwise.



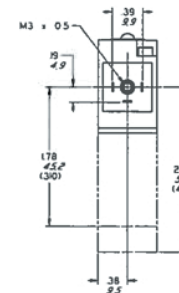
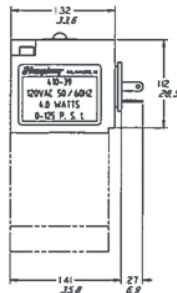
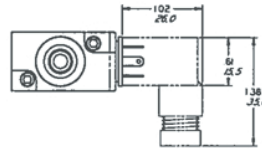
## CONDUIT CONNECTOR

Conduit connector for closed wiring systems. Available on all in-line models. The connector option (Code 36) features a steel conduit insert molded into the valve coil. Order example: 310-36 24VDC.



## CODE 39

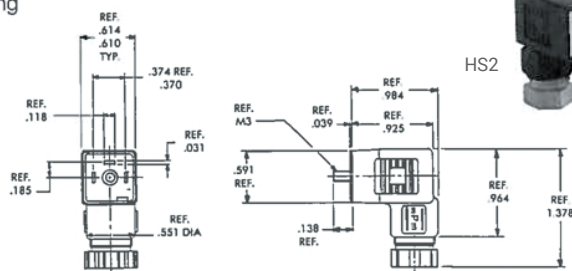
Humphrey Code 39 is an optional plug-in DIN-type connector that conforms to international standards. It provides simplicity, convenience, and fast, easy electrical installation. Available for all 310/410 series valves, this connector accepts screw-in sockets, which form a secure solderless electrical connection.



## SOCKETS (Order separately)

Model HS2. This socket is available for all 310/410 series valves. Color is black.

Model HS2LED. This socket is available for valves with 12VDC and 24VDC. Has indicator light and is housed in clear plastic. Specify voltage when ordering.



# HUMPHREY M310/M410 SERIES SUBBASE MOUNTED SOLENOID VALVES

## TECHNICAL SECTION

Refer to page 4 for additional general product information.

## GENERAL INFORMATION

### DESCRIPTION

#### M310

A 3-way, single solenoid, 2-position/spring return, Normally Open or Normally Closed, general purpose air valve.

#### VM310

Same as M310 but specifically for vacuum service. See Media/Pressure on page 4 for additional information.

#### M410

A 4-way Normally Open/Normally Closed, single solenoid, 2-position/spring return, general purpose air valve.

#### M410-70

Like M410, but offers the advantage of dual built-in flow controls.

#### SB-1

Subbase with two 1/8-inch outlet ports, marked 1 and 2.

#### SBMP-1

Subbase with Multi-Pressure capability. Model SBMP-1 has four 1/8-inch external body ports marked IN, EXH, 1 and 2. This subbase is used to introduce an alternate pressure into a given assembly of valves operating at a different pressure. It is also used to supply additional air and/or exhaust capability to a subbase mounted assembly of valves.

### PORT IDENTIFICATION

IN	Pressure Supply port
1	Normally Open Delivery port*
2	Normally Closed Delivery port**
EXH	Exhaust port, vent to atmosphere

\*Port #1 is not functional when using valve Model M310.

\*\*Port #2 is also the Delivery port when using Model 310.

### INSTALLATION

**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.**

Any combination of M310/410 subbase mounted valves can be assembled to form a completed manifold.

If manifold consists of a large number of valves or if several valves are to be actuated simultaneously, SBMP-1 subbases can be used to feed additional supply air to the manifold, and to provide additional exhaust capacity.

M310/410 Series valves and subbases (or subbases themselves) can be ordered completely factory-assembled, ready for installation in your equipment. Consult factory for details.

Valves can be mounted in any position in most environments, in keeping with the specifications. All models feature a Class B insulation system and molded coil for ambient temperatures from 32° to 125° F (0° to 50° C).

The subbase manifold assembly is mounted using the slotted mounting hole in each End Cap, and #10 socket head cap screws or fillister head screws. One mounting hole is provided in each End Cap for mounting the finished assembly.

For simplicity, when mixing valves with different functions on the same subbase manifold, consider locating valves of one common function on one end of the assembly. Use Port Isolators to separate the last valve of a common function from other valves in the assembly, then mix/match valves of other functions at the opposite end of the assembly.

### USE AS A 3-WAY

#### M310

Model M310 is a 2-position, 3-way valve and thus is ready for 3-way use. Use either Normally Open, Normally Closed, or as a Selector or Diverter.

The Humphrey 1/8-27 NPTF Port Plug #130-31 can be used to accomplish the following.

Normally Open: Connect supply pressure to EXH. Port 2 is delivery port. IN is exhaust port.

Normally Closed: Connect supply pressure to IN. Port 2 is delivery port. EXH is exhaust port.

NOTE: Port #1 is not functional when using valve Model M310.

Selector: Connect pressure #1 to IN port.  
Connect pressure #2 to EXH port.  
Delivery port 2 is common.

Diverter: Connect pressure to Delivery port 2.  
Diverting Delivery ports are IN and EXH.

#### M410/M410-70

These 2-position 4-way valves can be used as 3-ways by plugging one of the two Delivery ports. Such use of a 4-way as a 3-way can simplify porting/pressurizing the subbase manifold when combinations of 3-way NC, 3-way NO, and 4-way valves are used.

The Humphrey 1/8-27 NPTF Port Plug #130-31 can be used to accomplish the following:

Normally Closed 3-way: Plug Delivery port 1.

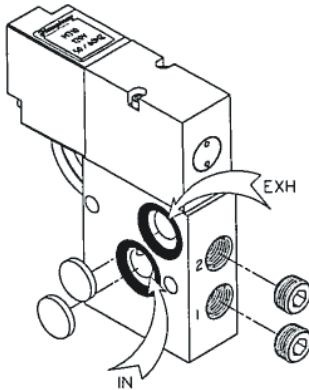
Normally Open 3-way: Plug Delivery port 2.

## USE AS A 2-WAY

All of these valves can also be used as 2-way valves by isolating and/or plugging various ports. Port 2 is always the delivery port.

### M310

This 2-position, 3-way valve can be used either as a Normally Closed or Normally Open 2-way valve.



The Humphrey Port Isolator Kit #40-900A and the 1/8-27 NPTF Port Plug #130-31 can be used to accomplish the following:

**Normally Closed 2-way:** When all valves on a subbase assembly are to be used as Normally Closed 2-ways: Use Port Isolators to isolate internal subbase EXH ports. (Internal EXH ports correspond with EXH ports in End Caps.) Also plug external EXH ports when using the Model SBMP-1 subbase, and the appropriate End Cap EXH port. Connect supply pressure to IN.

When one or more valves in a multi-valve assembly are to be used as Normally Closed 2-ways in a subbase assembly consisting of mixed valve functions, locate them on one end of the assembly. Use Port Isolators to isolate the internal subbase EXH ports. Also plug external EXH ports when using the Model SBMP-1 subbase, and the appropriate End Cap EXH port. Separate the subbase on the last Normally Closed 2-way valve from valves of another function by using Port Isolators. Connect supply pressure to IN.

**Normally Open 2-way:** When all valves on the subbase assembly are to be used as Normally Open 2-ways: Use Port Isolators to isolate internal subbase IN ports. (Internal IN ports correspond with IN ports in End Caps.) Also plug external IN ports when using the Model SBMP-1 subbase, and the appropriate End Cap IN port. Connect supply to EXH.

When one or more valves are to be used as Normally Open 2-ways in a subbase assembly consisting of mixed valve functions, locate them on one end of the assembly. Use Port Isolators to isolate the internal subbase IN ports. Also plug external IN ports when using the Model SBMP-1 subbase, and the appropriate End Cap IN port. Separate the subbase on the last Normally Open 2-way valve from valves of another function by using Port Isolators. Connect supply pressure to EXH for these valves.

### M410

This 2-position, 4-way valve can be used either as a Normally Closed or Normally Open 2-way valve.

**Normally Closed 2-way:** Plug #1 Delivery port. Use a Port Isolator to plug internal subbase EXH port. (Internal EXH port corresponds with EXH port in End Cap.) Also plug external EXH port when using the Model SBMP-1 subbase, and the appropriate End Cap EXH port. Connect supply pressure to IN.

**Normally Open 2-way:** Plug #2 Delivery port. Use a Port Isolator to plug internal subbase IN port. (Internal IN port corresponds with IN port in End Cap.) Also plug external IN port when using the Model SBMP-1 subbase, and the appropriate End Cap IN port. Connect supply pressure in EXH.

## MULTI-PRESSURE

Model SBMP-1 subbases can be used to create multiple pressures on a common subbase assembly. Use Port Isolators to isolate the subbase to be used with a separate pressure.

### M310

Connect supply pressure to the IN port of the individual subbase for a Normally Closed 3-way.

Connect supply pressure to the EXH port of the individual subbase for a Normally Open 3-way. IN port of the subbase becomes the exhaust port.

### M410

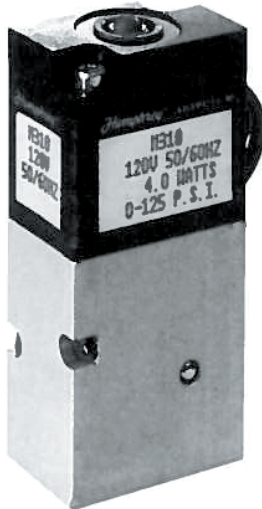
Isolate the subbase and connect supply pressure to the IN port of the subbase.

## MULTI-PRESSURE, ALTERNATE METHOD

Locate subbase(s) for separate pressure on one end of assembly. Use Port Isolators to plug the internal side ports (those interfacing with the alternate pressure source) of the last subbase to separate it from those operating at another pressure.

Connect separate pressure to End Cap. In this configuration, part of the assembly operates on one pressure, the other part operates on another pressure.

# M310/M410 VALVES AND SUBBASES



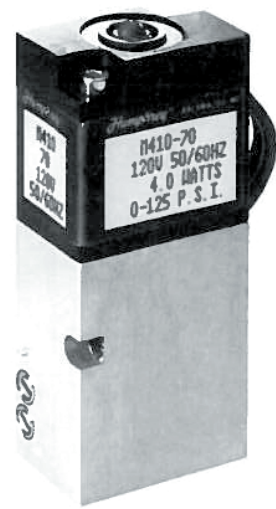
**M310**

- 3-way
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Non-locking manual override
- 24-inch lead wires
- Three 1/8-27 NPSF ports: In, Out, and Exhaust
- Two #3-48 x 1.25 socket head cap screws to mount valve to subbase, and four o-ring valve/subbase seals
- Specify Model VM310 for vacuum from 0" to 28" Hg.



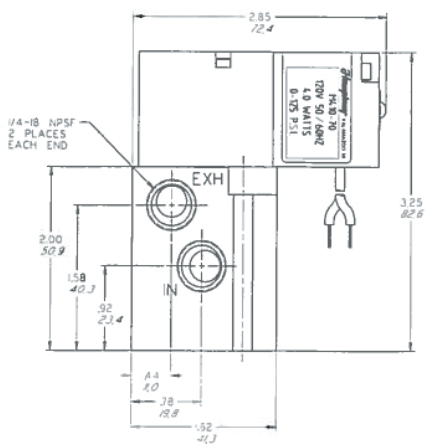
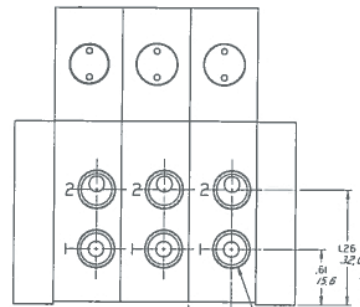
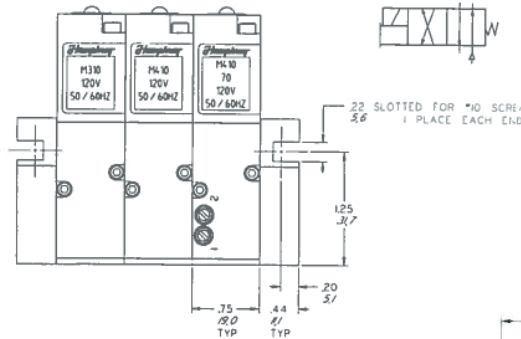
**M410**

- 4-way, Normally Open/Normally Closed
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Non-locking manual override
- 24-inch lead wires
- Four internal ports: In, Delivery ports 1 & 2, Exhaust
- Screws and o-rings are same as M310

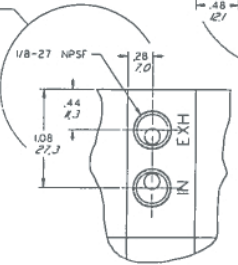


**M410-70**

- 4-way, Normally Open/Normally Closed
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Individual flow controls for each Delivery port exhaust
- Non-locking manual override
- 24-inch lead wires
- Four internal ports: In, Delivery ports 1 & 2, Exhaust
- Screws and o-rings are same as M310



THESE DIMENSIONS ARE FOR THE ADDITIONAL PORTS IN THE SBMP-1 SUBBASE ONLY



THESE DIMENSIONS ARE TYPICAL FOR THE SB-1 AND SBMP-1 SUBBASES



# MANIFOLD END PLATE ASSEMBLIES



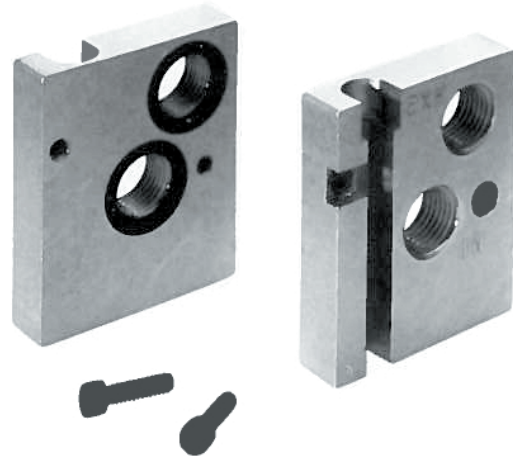
## SB-1

- Subbase accepts any M310/410 Series valve
- Two delivery ports, marked 1 & 2  
Port 1 is Normally Open, Port 2 is Normally Closed
- Two tie rod spacers, and two o-rings for inter-subbase seal



## SBMP-1

- Subbase accepts any M310/410 Series valve
- Four ports: Two delivery ports marked 1 & 2 (Port 1 is Normally Open, Port 2 is Normally Closed); plus one separate IN, and one separate EXH port
- Two tie rod spacers, and two o-rings for inter-subbase seal



## END PLATE ASSEMBLY PART NUMBER 7-900A

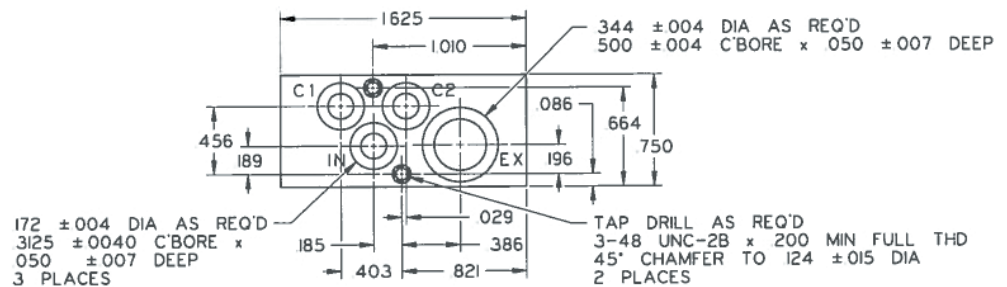
The End Plate Assembly, which consists of two subbase end caps and fastening accessories, is mounted on each end of a completed subbase valve assembly. Tighten screws to 8 lb.·in. of torque. Two slotted holes provide a method of mounting a subbase assembly. Includes two o-rings to seal subbase to end cap, and two #6-32 x .5 socket head cap screws to secure tie rod spacers.

## BLOCK-OFF PLATE

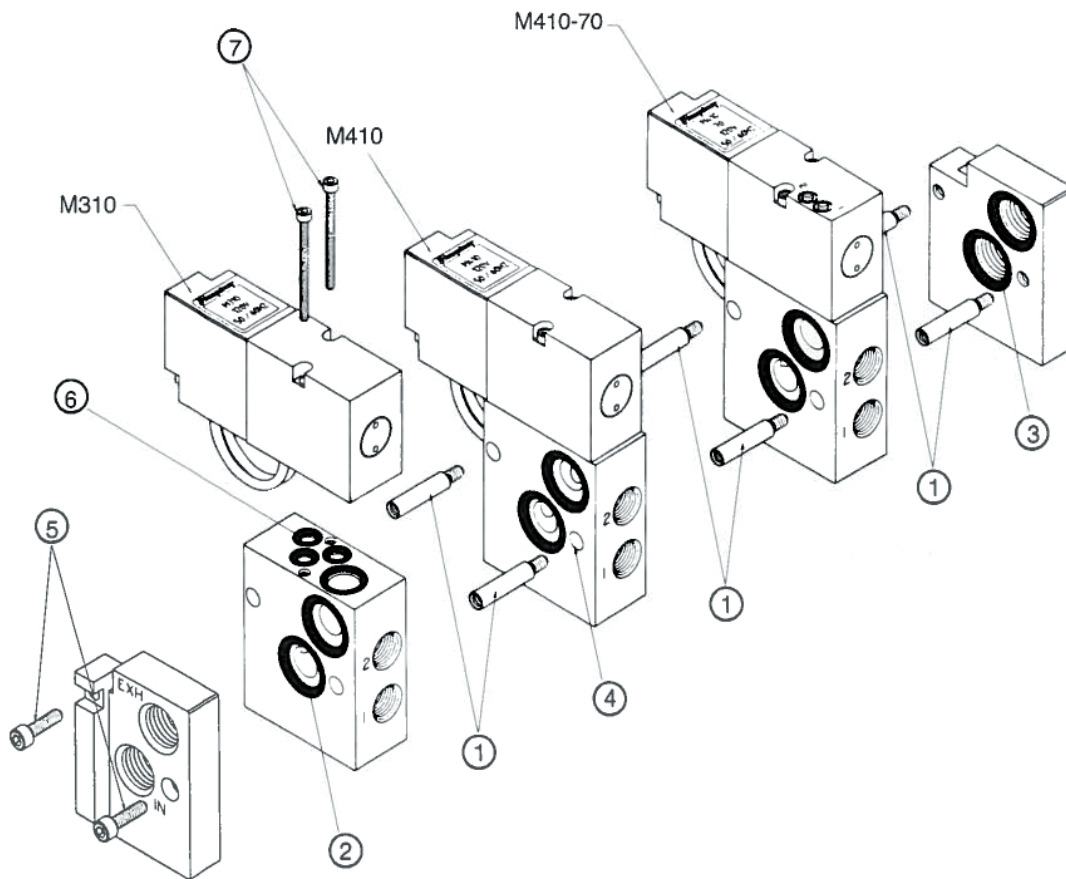
Model 8-310A anodized aluminum block-off plate is used to suspend the use of any SB-1 or SBMP-1 subbase. It can also be used to permit future valve additions related to machine options. Supplied with screws and o-rings to mate with subbase.

## PORTING FOOTPRINT

Model 310, M410, and M410-70 valves can be mounted to your equipment or to special manifolds using the dimensional data shown below.



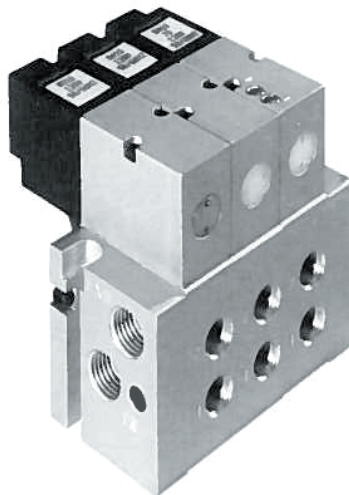
# MANIFOLD ASSEMBLY INSTRUCTIONS



## TO ASSEMBLE A VALVE MANIFOLD

1. Hand tighten each set of threaded spacers (two supplied per subbase) into units of equal length.
2. Ensure that o-ring seals (supplied) are placed in subbase side ports having o-ring grooves.
3. Place o-ring seals (two supplied) into End Cap possessing o-ring grooves, and thread spacers into this End Cap.
4. Assemble subbases onto spacers using subbase through-holes.
5. Secure entire assembly with #6-32 x .50-inch screws (supplied with End Caps) and tighten with  $\frac{7}{64}$ -inch hex drive wrench (not supplied).
6. Place o-rings (four per subbase, supplied with valve) onto the valve mounting surface on the subbases. (Light weight grease assists in maintaining o-ring position during assembly.)
7. Mount valves to subbase assembly with #3-48 x 1.25 socket head cap screws supplied with valve. Use 2 lb.·in. of torque.

NOTE: Coils face away from subbase Delivery ports.



# ORDER INFORMATION

M310/M410 Series Subbase Mounted Valves  
1/8-inch ports, 3-way, 4-way

## VALVES

Model	Option Description							Voltage
	DIN-Type Connector	Flow Controls	Locking Manual Override	No Manual Override	72" Lead Wires	Rotated Coil (180°)	Fluorocarbon Seals	
	Option Code							
	39	70	81	87	LL	RC	VAI	
<b>M310 3-way, subbase mounting</b>	SP	NA	SP	SP	SP	SP	SP	12 VDC 24 VDC 24/50/60 100/50//60 120/50/60 200/50/60 240/50/60
<b>M310 vacuum 3-way, subbase mounting</b>								
<b>M410 4-way, subbase mounting</b>		SP						

NOTE: Standard valves are furnished with 24" flying lead wires and a non-locking manual override.

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

## ACCESSORIES

Model	Description
<b>SB-1*</b>	Subbase with two delivery ports. 8-90A Mounting Kit supplied.
<b>SBMP-1*</b>	Subbase with two delivery ports, and one IN and one EXH port. 8-90A Mounting Kit supplied.
<b>7-100A*</b>	End Cap Kit (two subbase EndCaps, two o-rings, and two screws).
<b>8-90A</b>	Mounting Kit (two spacers, two o-rings).
<b>8-100A</b>	Valve Mounting Kit (two screws, four o-rings).
<b>28-650A</b>	Spade connector for use with terminals on Code 39 DIN-type coils.
<b>40-900A</b>	Port Isolator Kit (two port isolators).
<b>HS2</b>	DIN receptacle for use with Code 39 connector.
<b>HS2L</b>	Lighted DIN receptacle for use with code 39 connector. Specify: 12V, 24V or 120V

\* To specify metric ports, add an "E" prefix (i.e. ESB-I or E7-100A).

## HOW TO ORDER

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

Examples: **Model M310-LL 12VDC**  
Long Leads 72" (M310-LL)  
Voltage 12VDC (M310-LL 12VDC)

**Model M410-21-70-87 120/50/60**  
Flow Controls (M410-70)  
Without Manual Override (M410-70-87)  
Voltage 120/50/60 (M410-70-87 120/50/60)

M310 and M410 Subbase Mounted Valves are available with solid manifolds, Series SM. Manifold accept valves with standard lead wire or optional DIN type electrical entry.

Model	Number of Stations (2 thru 12)
<b>SM</b>	_____

Order Example: SM4

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