

S310/S410 Series Stacking Solenoid Valves

Humphrey[®]





S310/S410 Stacking Solenoid Valves

This series of 1/8-inch ported 3-way and 4-way single solenoid stacking valves is based on the successful Humphrey 310/410 inline models (see Humphrey Inline brochure).

Any combination of 3-way and 4-way stacking valves can be used to form a single pneumatic control package with the threaded spacer assembly system.

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

Like the 310/410 inline models, the S310/S410 Stacking Series valves have the same direct-acting molded coil and Class B insulation system for resistance to ambient contamination. Their 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 plumbing costs of externally applied flow controls.

All S310/S410 valves feature a push button/spring return manual override as standard. Valves can also be specified without override.

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

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FEATURES

ADVANTAGES

BENEFITS

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

Versatility.

Design Flexibility.

Stacking permits centralized location of control valves

Simplified plumbing.

Reduced installation and maintenance costs.

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

Simplified installation.

Saves time and labor of installing valves individually.

SMP models (multiport) have individual IN and EXH portst

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

Design flexibility.

Designed for rigorous applications

Tolerant of many ambient/media conditions.

Reliability.

Small size/light weight

Reduced size and weight of control valves in finished product.

Lower material and finished product shipping cost.

Poppet design

Needs no lubrication. Tolerates impure media.

Performs in adverse conditions.

Humphrey solenoid design

Field-proven in thousands of applications.

Reliability.

Molded coil and override seal

Both internal and external resistance to solenoid contamination.

Proven performance.

Positive stop of solenoid armature

Prevents excessive impact and poppet overtravel.

Long product tcycle life.

Short stroke

Fast response.

Rapid cycling.

Integral dual flow controls on S410-70 valves

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

Eliminates need, cost and plumbing of external flow controls

Pressure balanced

Permits connection of pressure to any port.

Versatility.

End Plates provide two mounting option

Provides mounting flexibility without special brackets.

No mounting brackets required. Saves cost.

Attractive appearance

Complements appearance of your product.

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.

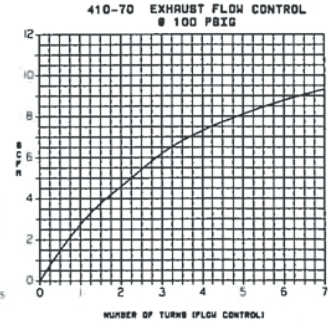
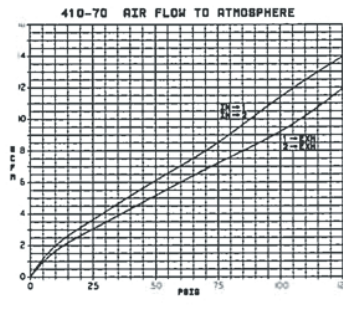
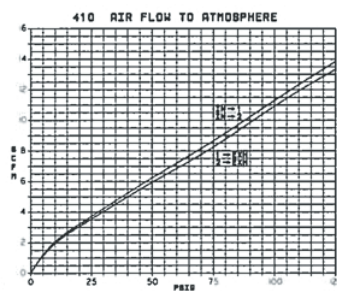
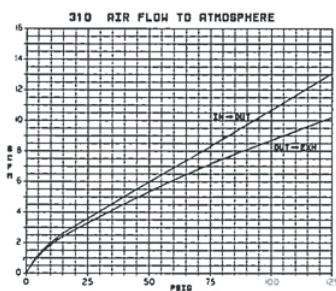
310/410 in-line valves are available for mounting to custom-made manifolds by specifying the Code 23 option (special mounting holes). Consult factory.

FLOW RATES/C_v

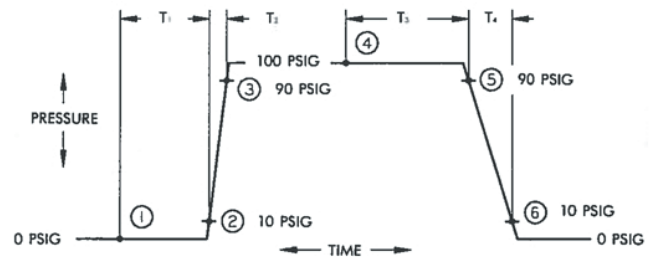
Humphrey recommends "fill/exhaust times," which are related to various chamber sizes, as the best method for calculating total valve and device (specifically, cylinder) response time. Humphrey recognizes the industry's use of flow coefficient C_v as a comparison standard.

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

Model	C _v	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

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 from outlet port).

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

AC/DC VOLTAGES

Coil voltage	T ₁	T ₂	T ₃	T ₄
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

T₁ 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.
 T₃ 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.*

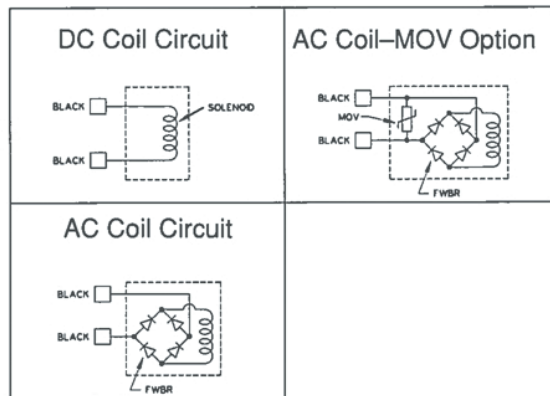
*Although this result is not exact, it is sufficient for most application needs and provides a simple, straightforward system.

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.

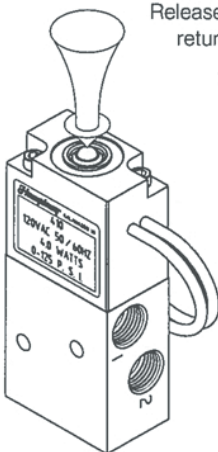
SOLENOID CIRCUIT SCHEMATICS



MANUAL OVERRIDE

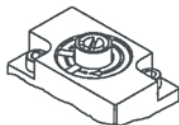
Push button/spring return manual override is standard. Manual override is located on top of coil.

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



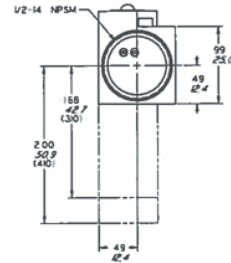
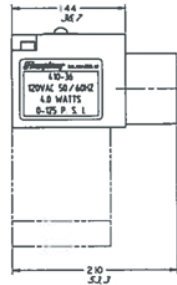
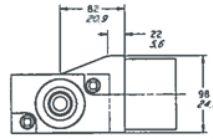
These valves are also available without manual override; specify Code 87 (example: 310-87 24VDC). On valves without manual override, a solid disk is installed on the coil. This replaces the punched disk which is used on valves with manual override.

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.



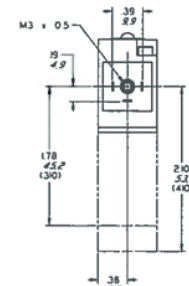
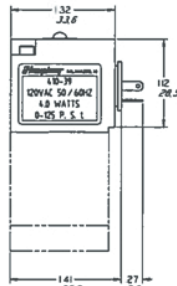
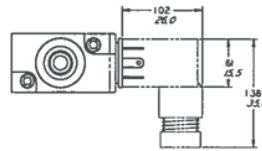
CONDUIT CONNECTOR

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

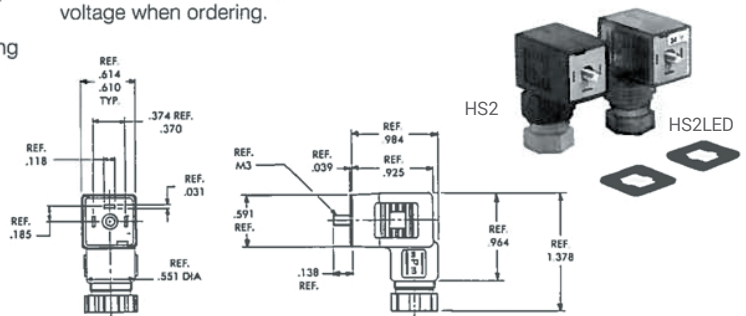
Humphrey Code 39 is an optional plug-in DIN-type connector that conforms to international standards. It provides simplicity, convenience, and fast, easy electrical installation. Available for all 310/410 series valves, this connector accepts screw-in sockets, which form a secure solderless electrical 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 S310/S410 SERIES STACKING SOLENOID VALVES

TECHNICAL SECTION

Refer to page 4 for additional general product information.

GENERAL INFORMATION

DESCRIPTION

S310

A 3-way, single solenoid, 2-position/spring return, Normally Open or Normally Closed, general purpose air valve, with one 1/8-inch external body outlet port, marked OUT.

VS310

Same as 310 but specifically for vacuum service. See Media/Pressure on page 4 for additional information.

S410

A 4-way Normally Open/Normally Closed, single solenoid, 2-position/spring return, general purpose air valve, with two 1/8-inch external body outlet ports marked 1 and 2.

SMP410

Like S410, but has Multi-Pressure capability. Valve has four 1/8-inch external body ports marked IN, EXH, 1 and 2. Model SMP410 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 stacking assembly of valves.

S410-70

Like S410, but offers the advantage of dual built-in flow controls.

PORT IDENTIFICATION

IN	Pressure Supply Port.
OUT	Delivery port for model S310.
1	Normally Open Delivery port for model S410/-70.
2	Normally Closed Delivery port for model S410/-70.
EXH	Exhaust port, vent to atmosphere.

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.**

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 stacking assembly is mounted using the 0.22 slotted mounting lugs in the End Plates and #10 screws. Four mounting lugs provided for mounting the assembly in two different planes.

When using hardened steel bolts to mount the stacking assembly, it is recommended that a flat washer be used between the screw head and the mounting lug.

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

USE AS A 3-WAY

S310

Model S310 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.

Normally Closed: Connect supply pressure to IN port of End Plate Assembly or valve.

Normally Open: Connect supply pressure to EXH port of End Plate Assembly or valve (IN becomes exhaust).

Selector: Connect pressure #1 to IN port of End Plate Assembly or valve. Connect pressure #2 to EXH port of End Plate Assembly or valve. OUT is common.

Diverter: Connect pressure to OUT port of valve. Diverter ports are IN and EXH ports in End Plate Assembly or valve.

S410

These 2-position 4-way valves can be used as a 3-way by plugging one of the two Delivery ports. Such use of a 4-way valve as a 3-way can simplify porting/pressurizing the stack of valves 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.

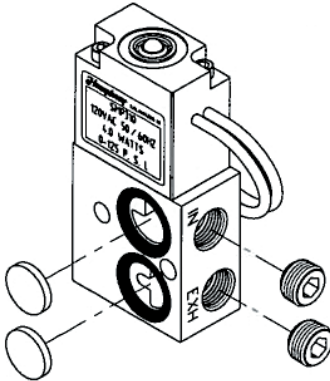
Normally Open 3-way: Plug Delivery port 2.

USE AS A 2-WAY

All of these valves can also be used as 2-way valves by isolating and/or plugging various ports.

S310

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: Isolate non-threaded port located furthest from the valve coil with one Port Isolator; connect supply pressure to IN in the End Plate Assembly.

Normally Open 2-way: Isolate non-threaded port located nearest the valve coil with one Port Isolator; connect supply pressure to EXH in the End Plate Assembly.

S410

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

Normally Closed 2-way: Isolate valve exhaust port (non-threaded port adjacent to Delivery port 2) with Port Isolator. Plug valve Delivery port 1.

Normally Open 2-way: Isolate valve exhaust port (non-threaded port adjacent to Delivery port 2) with Port Isolator. Plug valve Delivery port 2.

MULTI-PRESSURE

Valves with prefix letters SMP can be used to create multiple pressures on the same valve assembly.

SMP410

This 4-way valve can be used to introduce a separate pressure to a stack of valves. If the valve is not located adjacent to an End Plate Assembly, isolate the valve's non-threaded side ports with four Port Isolators. Connect the separate supply to valve IN port.

MULTI-PRESSURE, ALTERNATE METHOD

Locate valve(s) for separate pressure on one end of assembly, plugging the two side ports (those interfacing with the alternate pressure source) of the last valve to separate it from those operating at another pressure.

Connect separate pressure to End Plate Assembly. In this configuration, part of the assembly carries one pressure, the other part of the assembly carries another pressure.

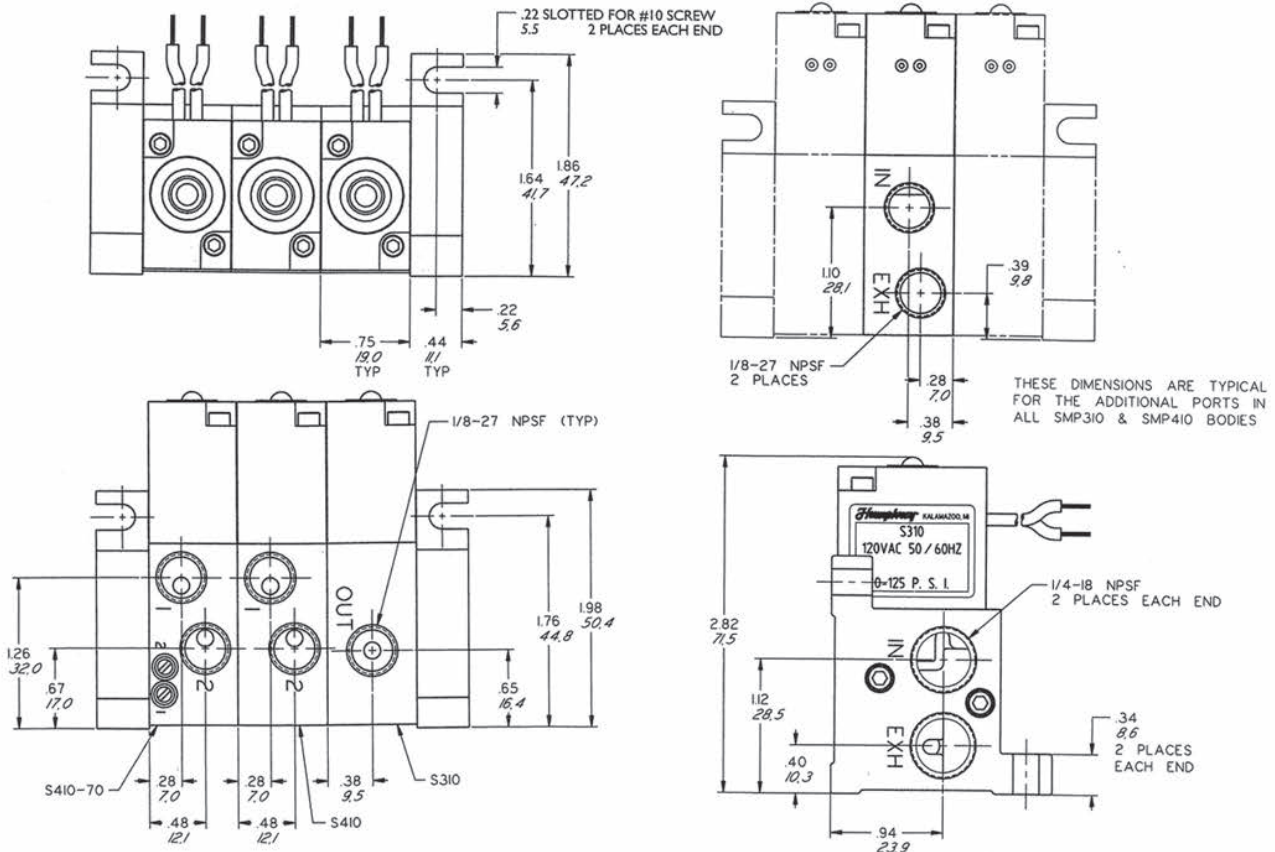
S310 SOLENOID VALVES

*U.L. recognized



S310

- 3-way
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Non-locking manual override
- 24-inch lead wires
- One 1/8-27 NPSF Delivery port (OUT)
- One 8-90A Mounting Kit, consisting of two threaded spacers and two o-rings, supplied per valve.
- Specify model VS310 for vacuum from 0" to 28" Hg.



S410/SMP410 SOLENOID VALVES

*U.L. recognized



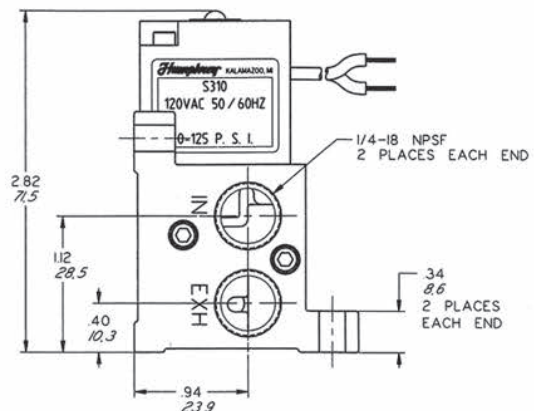
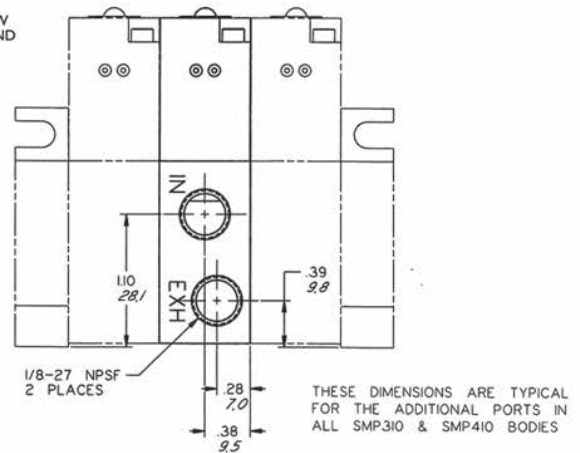
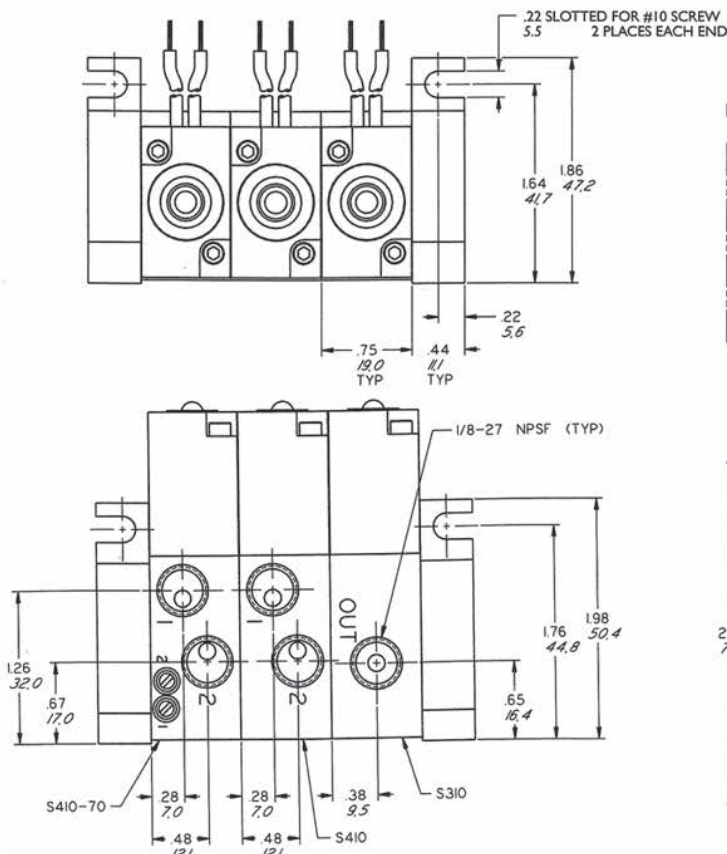
S410

- 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
- Two 1/8-27 NPSF Delivery ports 1 and 2
- One 8-90A Mounting Kit, consisting of two threaded spacers and two o-rings, supplied per valve

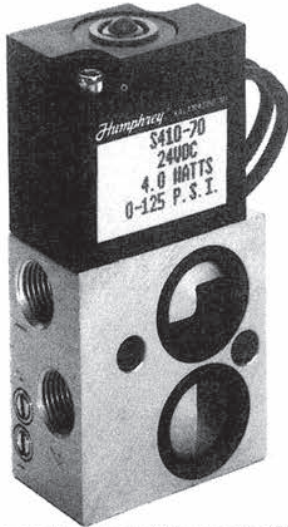


SMP410

- 4-way, Normally Open/Normally Closed
- Multi-Pressure capability (external body ports)
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Non-locking manual override
- 24-inch lead wires
- Four 1/8-27 NPSF ports (IN, Delivery ports 1 and 2, EXH)
- One 8-90A Mounting Kit, consisting of two threaded spacers and two o-rings, supplied per valve

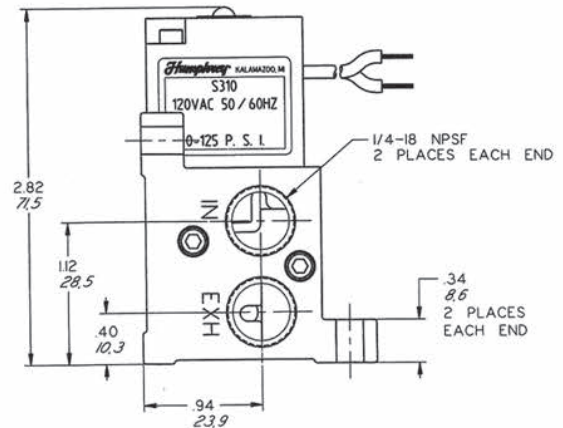
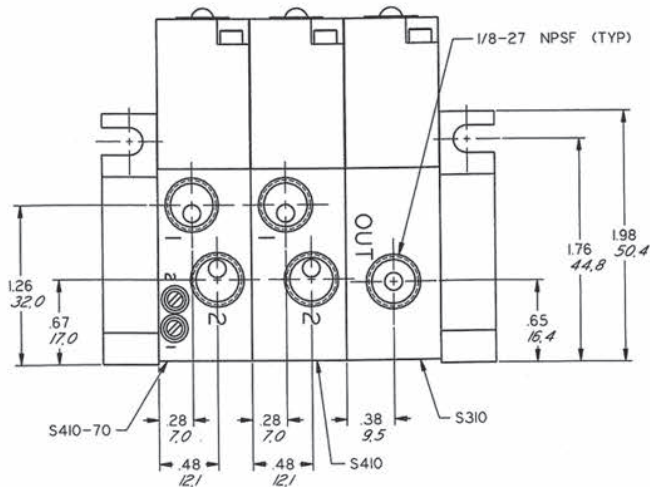
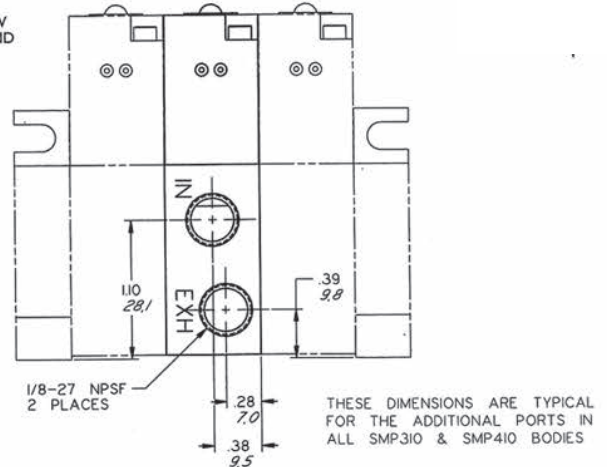
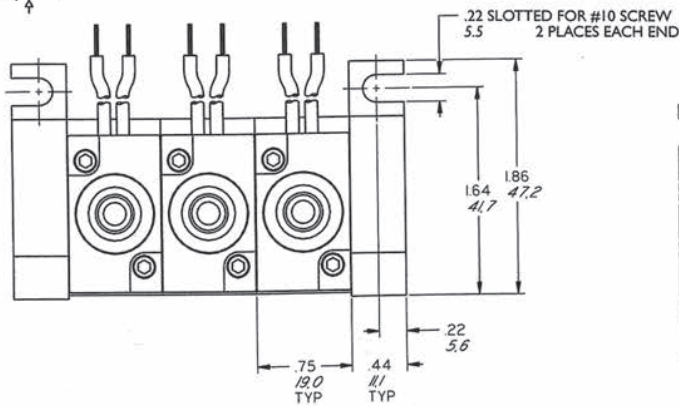


S410-70 SOLENOID VALVES



S410-70

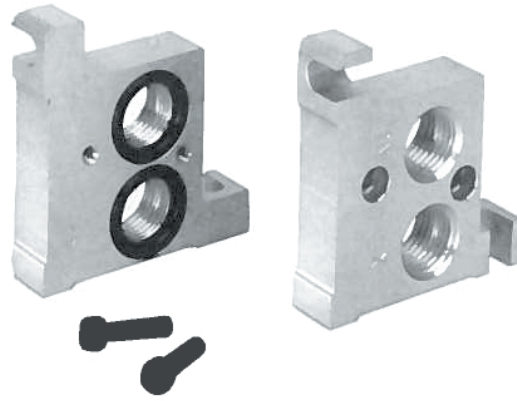
- 4-way, Normally Open/Normally Closed
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Individual flow controls for each Delivery port exhaust
- Non-locking manual override
- 24-inch lead wires
- Two 1/8-27 NPSF Delivery ports 1 and 2
- One 8-90A Mounting Kit, consisting of two threaded spacers and two o-rings, supplied per valve



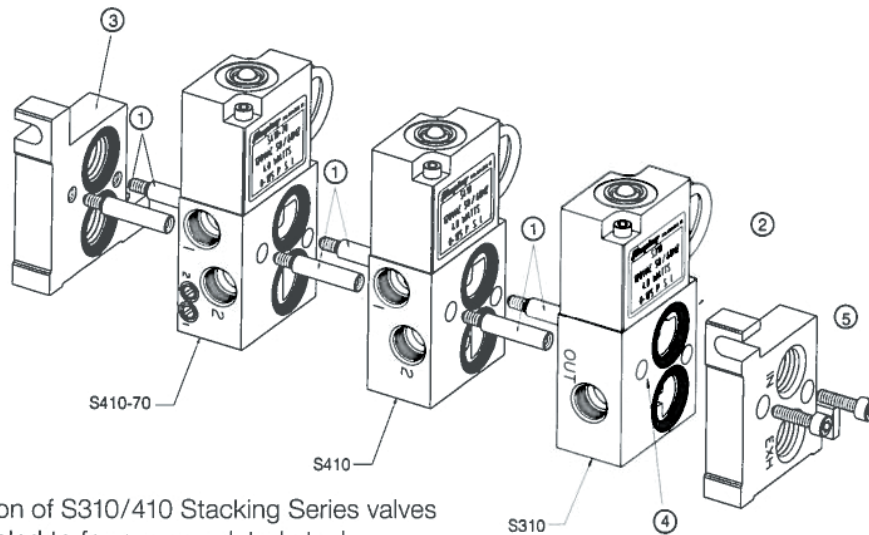
HUMPHREY VALVE AND END PLATE ASSEMBLIES

END PLATE ASSEMBLY PART NUMBER 7-900A

The End Plate Assembly, which consists of two end plates and fastening accessories, is mounted on each end of a completed assembly of valves. It also provides a method of mounting an assembled stack of valves.



STACKING ASSEMBLY INSTRUCTIONS



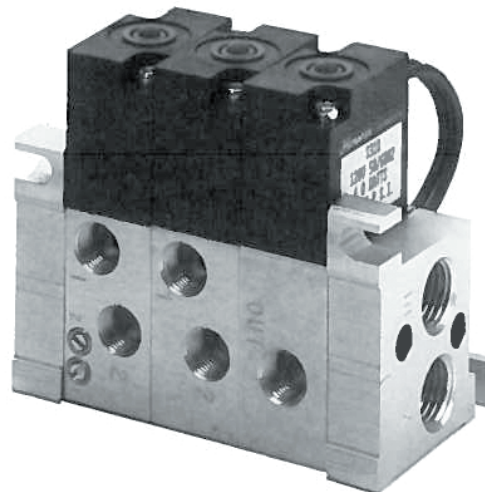
Any combination of S310/410 Stacking Series valves can be assembled to form a completed stack.

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

S310/410 Series valves can be ordered completely factory-assembled, ready for installation in your equipment. Consult factory for details.

TO ASSEMBLE A STACK OF VALVES

1. Hand tighten each set of threaded spacers (two supplied per valve) into units of equal length.
2. Ensure that o-ring seals (supplied) are placed in valve ports having o-ring grooves.
3. Place o-ring seals (two supplied) into End Plate possessing o-ring grooves, and thread spacers into this End Plate.
4. Assemble valves onto spacers using valve through-holes.
5. Secure entire assembly with 1/2-inch screws (supplied with End Plate) and tighten to 8 lb.·in. with 7/64-inch hex drive wrench (not supplied).



ORDER INFORMATION

S310/S410 Series Stackable 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	
S310 3-way, stackable	SP	NA	SP	SP	SP	SP	SP	12 VDC
SMP410 4-way, stackable								24 VDC
S410 4-way, stackable		SP						24/50/60
								100/50/60
								120/50/60
								200/50/60
								240/50/60

NOTE: Standard valves are furnished with 24" flying lead wires and a non-locking manual override.
To specify metric ports, add an "E" prefix (i.e. E310 or EV310).

N/C = No charge
NA = Not available

STD = Standard
SP = Specify; Additional charge for this option

ACCESSORIES

Model	Description
7-900A	Endplate assembly (two end plates, two screws, two o-rings).
8-90A	Mounting kit (two spacers, two o-rings).
40-900A	Port Isolator kit (two port isolators).
130-31	Port plug (one 1/8-27 NPTF port plug).
HS2	DIN receptacle for use with code 39 connector.
HS2LED	Lighted DIN receptacle for use with code 39 connector. Specify: 12V, 24V or 120V

HOW TO ORDER

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

Examples: **Model S310-LL 12VDC**
Long Leads 72" (S310-LL)
Voltage 12VDC (S310-LL 12VDC)

Model S410-70-87 120/50/60
Flow Controls (S410-70)
Without Manual Override (S410-70-87)
Voltage 120/50/60 (8410-70-87 120/50/60)

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