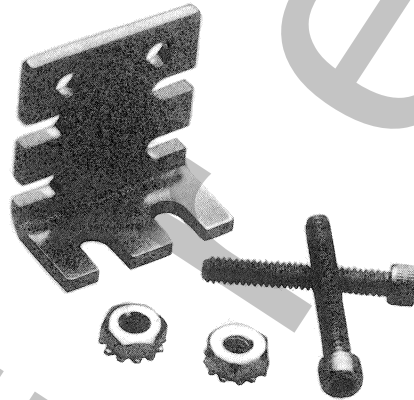


310 SOLENOID VALVES

310

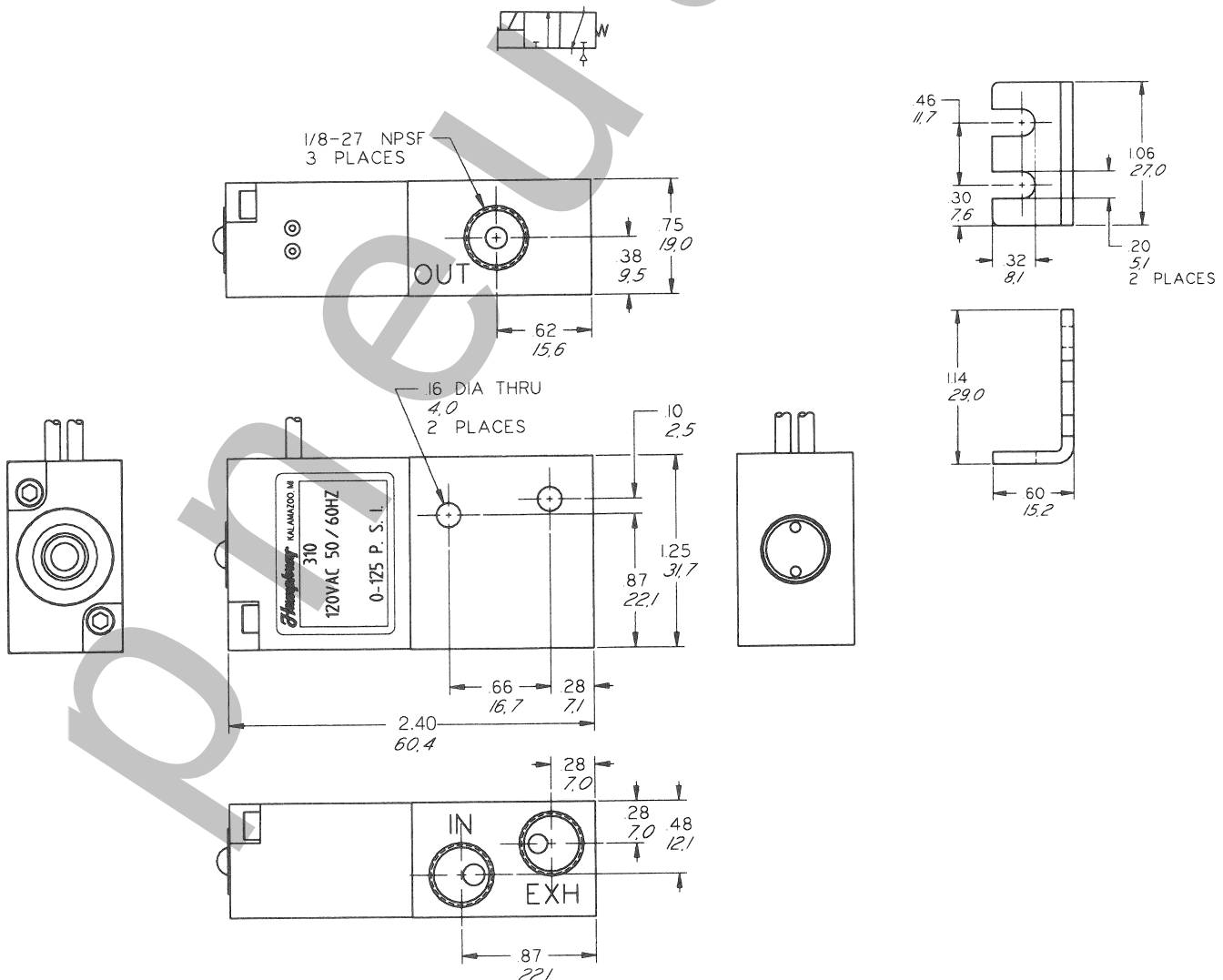


3-way
2-position, spring return
Direct acting, single solenoid
Continuous duty coil
Three 1/8-27 NPSF ports (IN, OUT, EXH)
Non-locking manual override
24-inch lead wires
Specify model V310 for vacuum from 0" to 28" Hg.

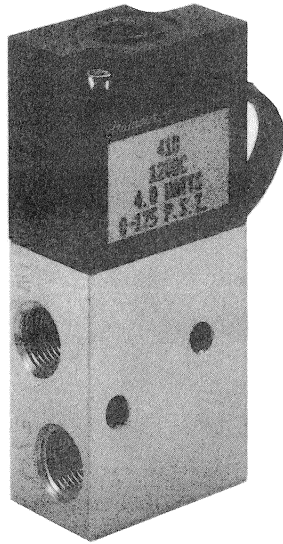


8-288A MOUNTING BRACKET

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 #6-32 screws, and two captive lockwasher nuts. Screws are plated steel, 1-inch (25.4mm) long.

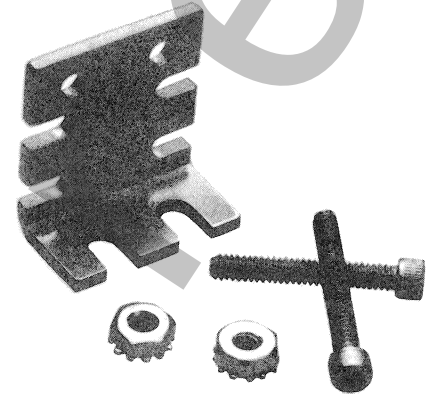


410 SOLENOID VALVES



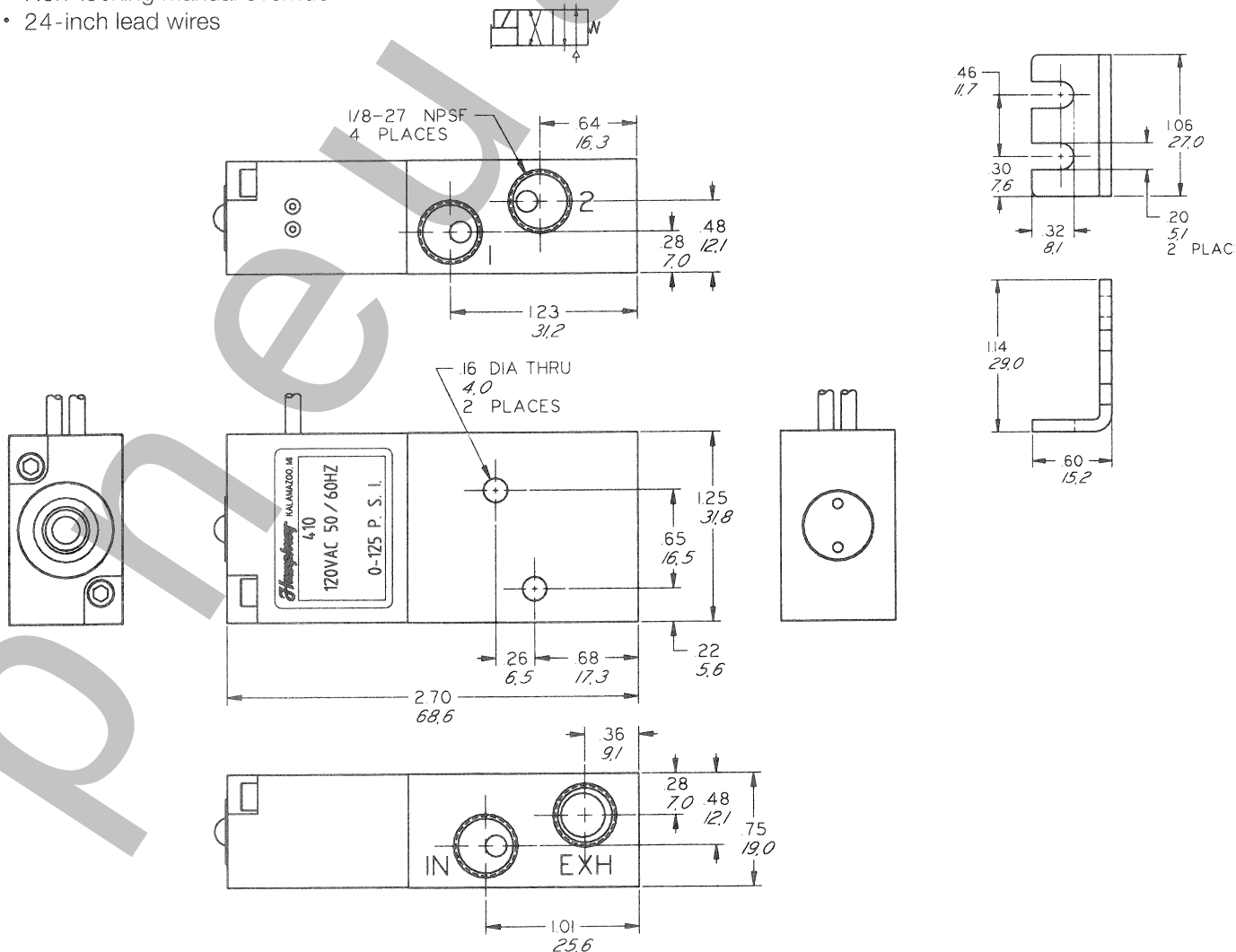
410

- 4-way, Normally Open/Normally Closed
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Four 1/8-27 NPSF ports: IN, Delivery ports 1 & 2, and single exhaust port (EXH)
- Non-locking manual override
- 24-inch lead wires

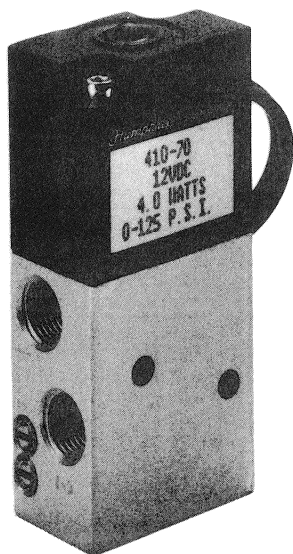


8-288A MOUNTING BRACKET

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 #8-32 screws, and two captive lockwasher nuts. Screws are plated steel, 1.25 inch (31.8mm) long.

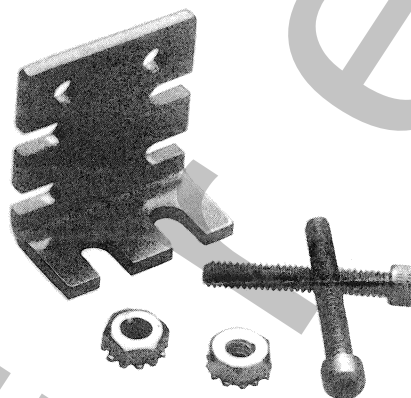
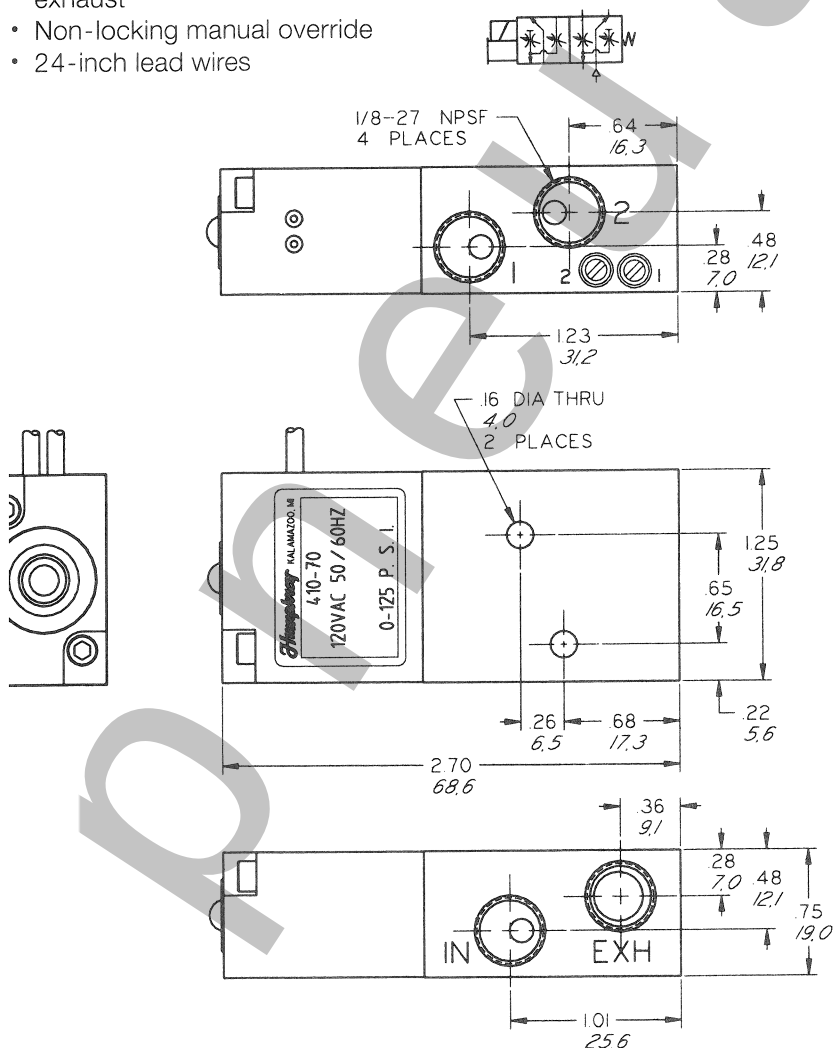


410-70 SOLENOID VALVES



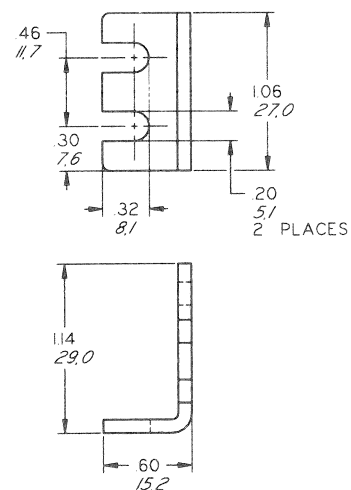
410-70

- 4-way, Normally Open/Normally Closed
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Four 1/8-27 NPSF ports: IN, Delivery ports 1 & 2, and single exhaust port (EXH)
- Individual flow controls for each Delivery port exhaust
- Non-locking manual override
- 24-inch lead wires



8-288A 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 #8-32 screws, and two captive lockwasher nuts. Screws are plated steel, 1.25 inch (31.8mm) long.



ORDER INFORMATION

310/410 Series In-line Body Ported Valves

1/8-inch ports, 2-way, 3-way, 4-way

VALVES

Model NOTE 2	Option description												Voltage
	Two-way NOTE 1	With mounting bracket NOTE 1	Conduit connector (24" ends)	DIN-type connector	DC surge suppression	Flow controls	Locking manual override	Thumbscrew Locking override	No manual override	72" lead wires	Metal oxide varistor	Rotated coil (180°)	
Option code	2	21	36	39	50	70	81	83	87	LL	MOV	RC	
310 3-way, in-line	SP	SP	SP	SP	SP	NA	SP	SP	SP	SP	SP	SP	12 VDC, 24 VDC 24 VAC 50/60 100 VAC 50/60 120 VAC 50/60 200 VAC 50/60 240 VAC 50/60
V310 vacuum 3-way, in-line													
410 4-way, in-line	NA					SP							

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

NOTE 1: 1/8" plug for 2-way and code 21 mounting bracket are furnished unattached to the valve.

NOTE 2: To specify metric ports, add an "E" prefix (i.e., E310 or EV310).

ACCESSORIES

Model	Description
8-288A	Universal mounting bracket
130-31	1/8-inch pipe plug
HS-2	DIN receptacle for use with code 39 connector
HS-2L	Lighted DIN receptacle for use with code 39 connector. Specify voltage. DC only.
HS2-LED	LED DIN receptacle for use with code 39 connector.

HOW TO ORDER

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

Example: To order Model 310-2-21-LL 12VDC
 2-Way Operation (310-2)
 Mounting Bracket (310-2-21)
 72" Flying Leads (310-2-21-LL)
 Voltage 12VDC (310-2-21-LL 12VDC)
 To order Model 410-21-70-87 120VAC 50/60
 Mounting Bracket (410-21)
 Flow Controls (410-21-70)
 No Manual Override (410-21-70-87)
 Voltage 120VAC 50/60 (410-21-70-87 120VAC 50/60)

Remember: Option Codes marked STD and NA 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. SP indicates that Option must be specified when ordering. Specified Options become part of the Model Number.

N/C = No charge
 NA = Not available

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

HUMPHREY 310/410 SERIES SOLENOID VALVES

TECHNICAL SECTION

MEDIA/PRESSURE

10/410 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

10/410 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.

TUBING

10/410 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.

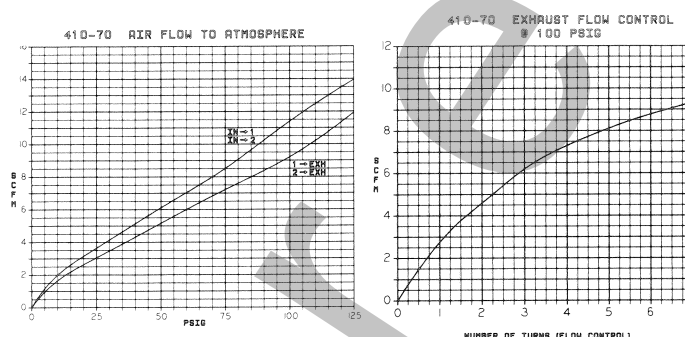
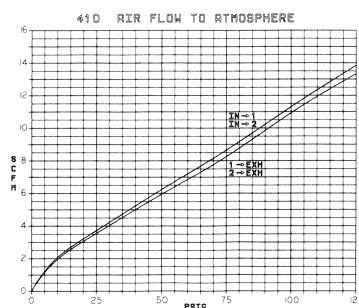
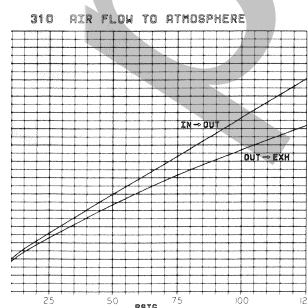
10/410 in-line valves are available for mounting to custom-made manifolds by specifying the Code 23 option (special mounting holes). Consult factory.

LOW RATES/C_V

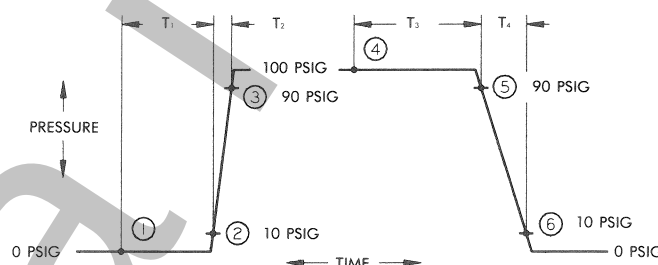
Humphrey recommends "fill/exhaust times," which are related to various chamber sizes, as the best method for calculating total valve and device (specifically, cylinder) response time. Humphrey recognizes the industry's use of flow coefficient C_v as a comparison standard.

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	.122	10.0	.020	.20	2.00	.032	.32	3.20
410	.144	10.0	.020	.20	2.00	.032	.32	3.20
410-70	.144	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 0.2 for 10 cubic inches = 0.080 sec.
T₃ Time to de-energize valve = 0.005 sec.
Time to exhaust 4 cubic inches
40% of .32 for 10 cubic inches = 0.128 sec.
Total Cycle Time = 0.223 sec.*

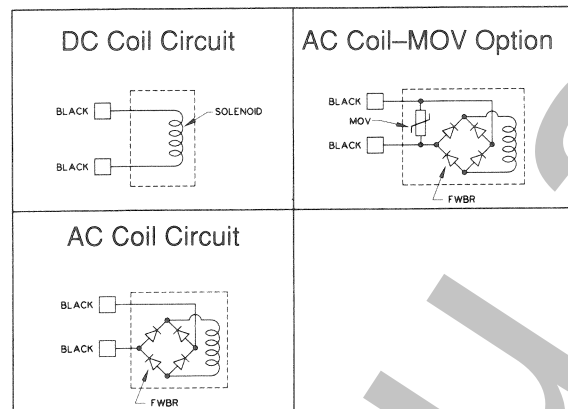
*Although this result is not exact, it is sufficient for most application needs and provides a simple, straightforward system.

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



METAL OXIDE VARISTOR, OPTION CODE MOV

All AC voltages can be ordered with Option Code MOV, a metal oxide varistor molded into the coil to protect against transient voltages of 300 volts or more. Option MOV protects the full wave bridge rectifier package from failure in the presence of voltage spikes.

MANUAL OVERRIDE

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

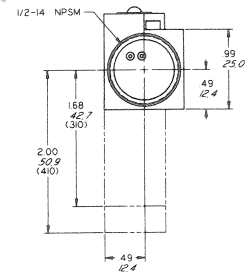
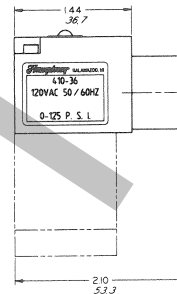
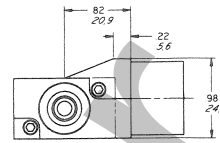
Push red button shifts armature which actuates valve's main stem. Release of manual force permits valve spring to return valve to normal position.

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, use screwdriver to turn override screw clockwise to "On" position. Valve remains actuated until screw is returned to "Off" position by turning counterclockwise.

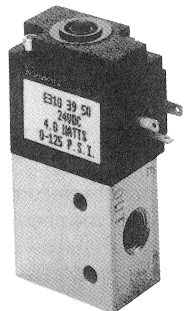
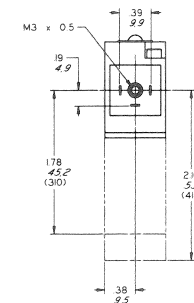
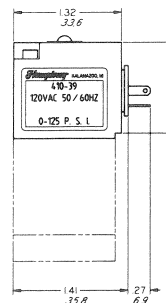
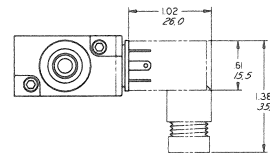
CONDUIT CONNECTOR

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

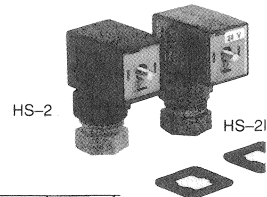
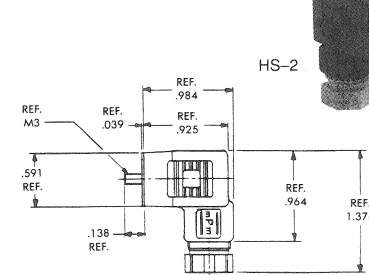
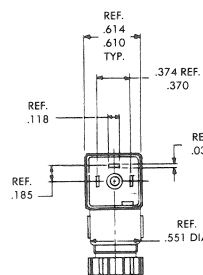
Humphrey Code 39 is an optional plug-in DIN-type connector that conforms to international standards. It provides simplicity, convenience, and fast, easy electrical installation. Available for all 310/410 series valves, this connector accepts screw-in sockets, which form a secure solderless electrical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



SOCKETS (Order separately)

Model HS-2. This socket is available for all 310/410 series valves. Color is black.

Model HS-2L. This socket is available for valves with 12VDC and 24VDC. Has indicator light and is housed in clear plastic. Specify voltage when ordering.



HUMPHREY 310/410 SERIES N-LINE SOLENOID VALVES

GENERAL INFORMATION

DESCRIPTION

Model 310 is a 2-position, 3-way valve and thus is ready for 3-way use. For Normally Closed use, connect supply to IN (OUT is the cylinder port). For Normally Open use, connect supply to EXH (OUT is the cylinder port; IN is the exhaust port).

Model 410 is a 2-position, 4-way valve, but can be used as a 3-way: Plug port 1 for use as a Normally Closed 3-way; plug port 2 for use as a Normally Open 3-way. Use 1/8 NPT plugs.

PORT IDENTIFICATION

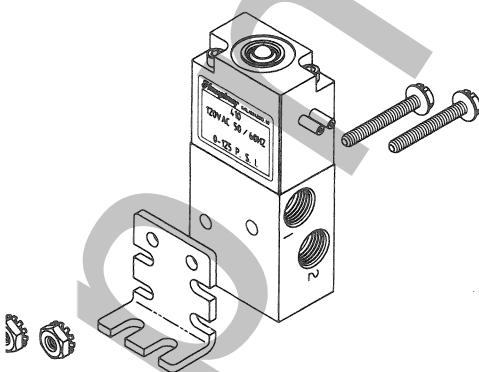
- IN Pressure Supply port.
- OUT Delivery port for model 310.
- EXH Normally Open Delivery port for model 410.
- EXH Normally Closed Delivery port for model 410.
- EXH Exhaust port, vent to atmosphere.

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. 310/410 valves feature a Class B insulation system and molded coil for ambient temperatures from 2° to 125° F (0° to 50° C).

Valves should be mounted using the .185" (4.70mm) diameter side mounting holes and #8 (M4) mounting screws. The optional 8-288A mounting bracket kit consists of a bracket, two #8-32 screws, and two captive lockwasher nuts. Mounting bracket adapts to any 310/410 valve on either side of valve.



USE AS A 3-WAY

310

Model 310 is a 2-position, 3-way valve and thus is ready for 3-way use. For Normally Closed use, connect supply to IN (OUT is the cylinder port). For Normally Open use, connect supply to EXH (OUT is the cylinder port; IN is the exhaust port).

410

Model 410 is a 2-position, 4-way valve, but can be used as a 3-way: Plug port 1 for use as a Normally Closed 3-way; plug port 2 for use as a Normally Open 3-way. Use 1/8 NPT plugs.

USE AS A 2-WAY

310

Model 310 can be used as a 2-way by plugging the EXH (exhaust) port.

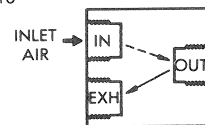
410

Model 410 can be used as a 2-way by plugging the EXH (exhaust) port and port 1 for Normally Closed, or port 2 for Normally Open.

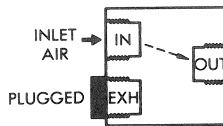
PORTING DIAGRAMS

The 310/410 balanced poppet design allows the valve to function in a variety of pneumatic porting configurations. Typical porting diagrams are outlined below.

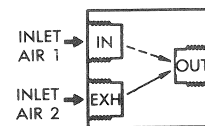
310



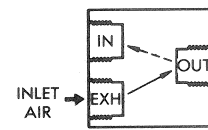
3 WAY
NORMALLY CLOSED



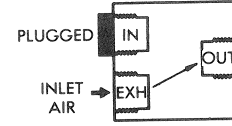
2 WAY
NORMALLY CLOSED



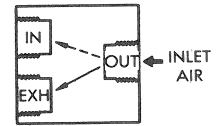
SELECTOR



3 WAY
NORMALLY OPEN

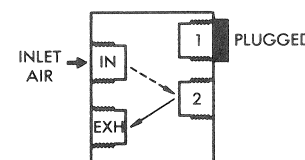


2 WAY
NORMALLY OPEN

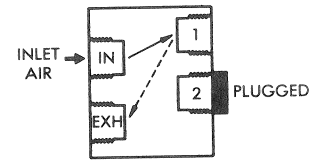


DIVERTER

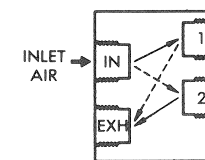
410



3 WAY
NORMALLY CLOSED



3 WAY
NORMALLY OPEN



4 WAY

OPERATOR:
UNACTUATED ———>
ACTUATED - - - - ->

METRIC PORTS/DIMENSIONS

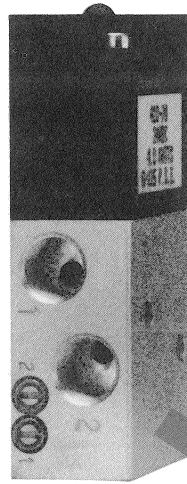
Although these valves are produced using the inch system, all drawings show the metric equivalent in millimeters (indicated by slanted numbers).

All port connectors are available in metric sizes. The pipe ports are available in ISO 7/1 – Rp 1/8.

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

FLOW CONTROL OPTION (CODE 70)

Model 410-70 is equipped with integral dual flow controls. Clockwise rotation of each flow control screw reduces exhaust flow from the respective port. Flow control screw number 1 controls exhaust flow from Delivery port 1. Flow control screw number 2 controls exhaust flow from Delivery port 2. Each flow control screw takes seven full turns from fully closed to fully open, providing an excellent flow control range.



PACKAGING

Individual valves are packaged for cleanliness in sealed plastic bags and shipped as individual units in corrugated cardboard boxes.

Customers purchasing large valve quantities may prefer to reduce unpackaging costs by ordering in bulk quantities.

TROUBLESHOOTING

If valve fails to function when electrical power is supplied:

1. Check valve function using manual override. If valve functions by manual actuation, proceed to steps 2 and 3. If valve does not function, proceed to step 4. For valves without manual override, proceed to steps 2 and 3.
2. Check line voltage to determine compliance with valve electrical rating.
3. Check valve for inoperable (open) coil, measuring milliamps per Electrical Specification Chart.
4. Check that air supply has been delivered in adequate volume and pressure for proper functioning of the device. Ensure that there are no blockages due to air line contamination or defective/blocked fittings.

WARRANTY

All valves have a one year warranty from date of manufacture. This warranty includes repair and/or replacement at no charge should the product be deemed defective due to workmanship and/or material. (See detailed Product Warranty in Humphrey's General Valve Catalog.)

SPECIFICATIONS

310/410 Models	
Media	Air or inert gas
Pressure range	0-125 psig (0-8.5 bar) 0.28" Hg vacuum (prefix "V" 3-way valves.)
Ambient temperature range	32 to 125° F (0 to 50° C)
Coil temperature rise (any voltage)	81° F (45° C)
Power consumption (AC/DC)	4.5 watts
Response time (on/off)	.012/.010 (DC), .012/.020 (AC) sec.
Voltage tolerance	Plus 10%, minus 15% of rated voltage
Coil voltages	12VDC, 24VDC, 24VAC, 100VAC, 120VAC, 200VAC, 240VAC
SCFM @ 100 psig	>10
Cv	.144
Fill/exhaust time @ 100 psig (7.0 bar)	1 cu. in. .020/.032 sec. 10 cu. in. .20/.32 sec. 100 cu. in. 2.00/3.20 sec.
Leak rate (max. allowed)	4cc/minute @ 100 psig
Type of operation	Direct solenoid
Effective area	Model 310 .0069-inch ² Model 410 .0064-inch ²
Stroke	.015-inch
Maximum cycle rate (cycles/min.)	2700 (DC), 1875 (AC)
Lubrication	None required, factory pre-lubed
Filtration	40 Micron recommended
Weight	Model 310 .26 lbs. (116 gms.) Model 410 .28 lbs. (128 gms.) Model 410-70 .28 lbs. (128 gms.)
Materials	Brass, Buna N, aluminum, stainless steel, acetal
Lead Wire	22AWG. Black Cross Linked Polyethylene insulated lead wire. 7 x 30 stranded/tinned copper conductor. 1258C/600V. UL Style 3173, 3271. CSA Type CL1251L