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**Title: H040 Indirect Acting In-Line Solenoid Valves**

**ISO Date: October 31, 1997**

**Don't Take Chances**

Compressed air is an extremely powerful medium. Always take maximum precautions when handling any component of a compressed air system. **Never** attempt to construct, replace, operate or service any component of a compressed air system unless you have been specifically and properly trained to do so. **Always** disconnect the supply air and exhaust the air system before attempting to remove or service a component of that system. Failure to heed these warnings could result in **SERIOUS, EVEN FATAL, PERSONAL INJURY.**

**Design And Specifications**

The design and specifications and other product information contained in this catalog is for general reference purposes based upon customary and usual manufacturing standards and product applications. However, it is difficult to predict or to anticipate the functioning or suitability of the product for any particular application or use. Therefore, nothing herein shall be deemed a representation or warranty of the product design or specifications and Buyer shall have the responsibility for investigating and testing the product in any particular application or use and all risks attendant in such use.

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# BASIC MODELS AND CONFIGURATIONS – H010, H040

## VALVES

### DIRECT ACTING, IN-LINE

H010 Series – 2- and 3-way

Normally Closed (N/C)



H010E1

### INDIRECT ACTING

H040 Series – 2- and 3-way

(N/C)

(N/O)



H041E1



H041E1-11

(N/C)

(N/O)



HA041E1



HA041E1-11

H040 Series – 4-way

Single solenoid

Double solenoid



H040-4E1



H040-4E2

2 position

Single solenoid

Double solenoid



HA040-4E1



HA040-4E2

### SUB-BASE TYPE

### MANIFOLDS

#### 2- AND 3-WAY MINIATURE MANIFOLD

H010 Series

H010M□F – F type manifolds have common inlet and common exhaust ports.

H010M□A – A type manifolds have all ports contained in the manifold.



H010E1

R (EXH)  
P (IN)



HA010E1

R (EXH)  
P (IN)  
A (OUT)

#### 2- AND 3-WAY SMALL MANIFOLD

H041 Series

H041M□F – F type manifolds have common inlet and common exhaust ports.

H041M□A – A type manifolds have inlet, exhaust, and cylinder ports in manifold.



H041E1

H041E1-11

R (EXH)  
P (IN)



HA041E1

HA041E1-11

R (EXH)  
P (IN)  
A (OUT)

H041M manifolds accommodate 2- and 3-way valves.

#### 2-, 3-, AND 4-WAY SMALL MANIFOLD

H040 Series

H040M□F – F type manifolds have common inlet and common exhaust ports.

H040M□A – A type manifolds have inlet, exhaust, and cylinder ports in manifold.

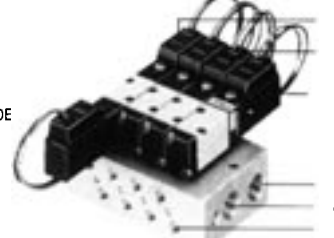


H040-4E2

H040-4E1

H040E1, H040E

R (EXH)  
P (IN)



HA040-4E2

HA040-4E1

HA040E1, HA040E1-11

R (EXH)  
P (IN)  
A (OUT), B (OUT)

H040M series manifolds accommodate 2-, 3- and 4-way valves in any combination.

# LIST OF SPECIFICATIONS MICRO SOLENOID VALVES SERIES H040

## BASIC MODELS AND VALVE FUNCTIONS

| Item                | Model                        |                                    |                 |                 |
|---------------------|------------------------------|------------------------------------|-----------------|-----------------|
|                     | In-line and F type manifold  | H041E1<br>H040E1                   | H040-4E1        | H040-4E2        |
|                     | Sub-base and A type manifold | HA041E1<br>HA040E1 <sup>NOTE</sup> | HA040-4E1       | HA040-4E2       |
| Number of positions | 2 positions                  |                                    |                 |                 |
| Number of ports     | 2- and 3-way                 |                                    | 4-way           |                 |
| Valve functions     | N/C standard<br>N/O optional |                                    | Single solenoid | Double solenoid |

NOTE: See pages 11 and 12 for option specifications and order code. H040E1 and HA040E1 are the 2- and 3-way valves to be mounted on the 2, 3 and 5 port combination manifolds only. They cannot be used in-line. If the 2- and 3-way valve is used, use H041E1 and HA041E1 with sub-base.

## SPECIFICATIONS

| Item  | Model                         |                      |           |           |
|---|-------------------------------|----------------------|-----------|-----------|
|   | In-line and F type manifold   | H041E1<br>(H040E1)   | H040-4E1  | H040-4E2  |
|   | Sub-base and A type manifold  | HA041E1<br>(HA040E1) | HA040-4E1 | HA040-4E2 |
| Media   | Air                           |                      |           |           |
| Type of operation   | Indirect acting               |                      |           |           |
| Effective area in. <sup>2</sup> (mm <sup>2</sup> ) [Cv] <sup>NOTE 1</sup> | .002 (1.5) [0.08]             |                      |           |           |
| Port threads <sup>NOTE 2</sup>  | M3x0.5                        |                      |           |           |
| Lubrication   | Not required                  |                      |           |           |
| Pressure range psi (kgf/cm <sup>2</sup> )                                 | 28.5 ~ 100 psi (2 ~ 7)        |                      |           |           |
| Proof pressure psi (kgf/cm <sup>2</sup> )                                 | 150 (10.5)                    |                      |           |           |
| Response time <sup>NOTE 3</sup><br>ON/OFF ms                              | DC5V, DC12V<br>DC6V, DC24V    | Below 12/15          |           | 12        |
| Maximum cycles/second   | 5                             |                      |           |           |
| Ambient range of operating temperature °F (°C)                            | 41 ~ 122 (5 ~ 50)             |                      |           |           |
| Shock resistance G  | 140 (60 in direction of stem) |                      |           |           |
| Mounting direction  | Unrestricted                  |                      |           |           |

NOTE 1: Please refer to Effective Area chart on page 15 for details.

NOTE 2: Please refer to Port Dimensions chart on page 15.

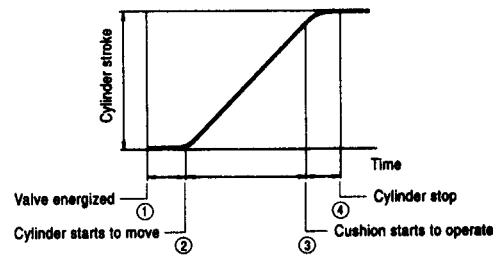
NOTE 3: Value with air pressure at 70 psi (5 kgf/cm<sup>2</sup>). Value of H040-4E2 is with pressure opposite the coil energized.

## ELECTRICAL SPECIFICATIONS CHART

| Item                                 | Voltage   |  |                           |                           |           |
|--------------------------------------|---|--|---------------------------|---------------------------|-----------|
|                                      | 5 VDC   | 6 VDC  | 12 VDC                    | 24 VDC                    |           |
| Type                                 | Flywheel diode incorporated for surge suppression |  |                           |                           |           |
| Voltage range VDC                    | 4.5 ~ 5.5<br>(5 ± 10%)                            | 5.4 ~ 6.6<br>(6 ± 10%)                               | 10.8 ~ 13.2<br>(12 ± 10%) | 21.6 ~ 26.4<br>(24 ± 10%) |           |
| Current mA                           | Standard  | 120 (0.6W)   | 105 (0.6W)                | 55 (0.7W)                 | 28 (0.7W) |
|                                      | With LED  | 130 (0.65W)  | 115 (0.7W)                | 65 (0.8W)                 | 40 (1.0W) |
| Maximum allowable current leakage mA | 10  | 7  | 5                         | 2                         |           |
| Heat rise °F (°C)                    | 68° (20°)   |  |                           |                           |           |
| Insulation resistance MΩ             | Over 100  |  |                           |                           |           |
| Connector and lead wire length       | Standard  | Grommet type 12 in. (300mm)                          |                           |                           |           |
|                                      | Option  | Plug connector type 12 in. (300mm) <sup>NOTE 4</sup> |                           |                           |           |
| Lead wire colors                     | Green (+) Black (-)                               | Blue (+) Black (-)                                   | Brown (+) Black (-)       | Red (+) Black (-)         |           |
| LED indicator                        | Red   |  |                           |                           |           |
| Surge suppression                    | Flywheel diode                                    |  |                           |                           |           |

NOTE 4: Please refer to page 12 for made-to-order information.

## HOW TO FIGURE STROKE TIME (CYLINDER SPEED)



- To obtain stroke speed, add t1 to t2. t1 is the lag time of coil energizing point 1 to when the cylinder begins to move point 2. t2 is the maximum speed zone of cylinder moving to its fullest position at point 3.
- If a cushion is incorporated, add t3 to the sum of t1 and t2. Point 3 now becomes the point where the cushion begins to take effect. Point 4 is the end of stroke when cushion is incorporated.

## MEASUREMENT CONDITIONS

### H040-4E1

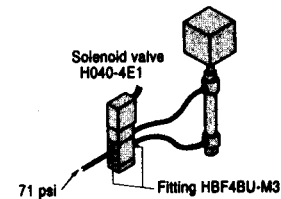
Air pressure: 71 psi (5 kgf/cm<sup>2</sup>)

Tubing I.D. and length: ø .098 in. (2.5mm) x 39.370 in. (1000mm)

Fitting: HB4BU-M3

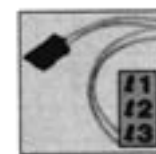
$$\text{Load ratio} = \frac{\text{Load}}{\text{Cylinder theoretical thrust}} (\%)$$

Examples for ø 3/8 in. nominal (ø 10mm actual) bore, ø 5/8 in. nominal (ø 16mm actual) bore, the stroke is 2.362 in. (60mm).  
For ø 3/4 in. nominal (ø 20mm actual), ø 1 1/4 in. nominal (ø 32mm actual) bore, the stroke is 3.397 in. (100mm).



## MADE TO ORDER

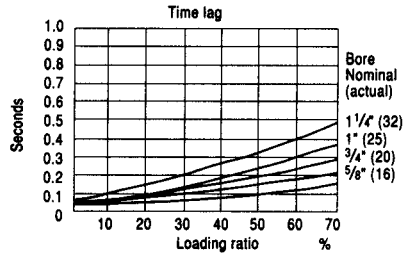
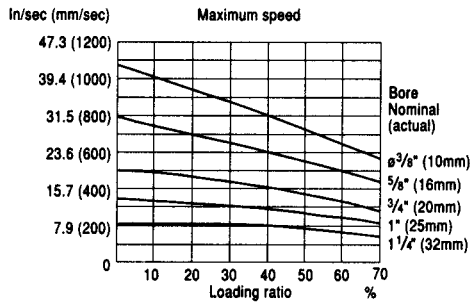
Plug model number



For plug connector only.  
Length in. (mm) ø1=36 (1000)  
ø2=72 (2000)  
ø3=108 (3000)

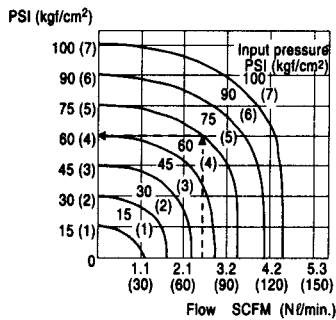
## CYLINDER SPEED

### H040 Series



## AIR FLOW

### H041 - H040 Series



## EFFECTIVE AREA [Cv] in.<sup>2</sup> (mm<sup>2</sup>)

| Model  | Standard            | Notes   |
|--|---------------------|---|
| H041E1<br>(H040E1)<br>H040-4E1<br>H040-4E2     | .002 (1.5)<br>[.08] | When HT53-M3M fittings are used in P, A and B ports, valves become .001 (.75) [.001 (.04)].<br>When HT53-M3M fittings are used in the A and B ports of "F" type manifold, valves become .001 (.80), [.001 (.05)]. |
| HA041E1<br>(HA040E1)<br>HA040-4E1<br>HA040-4E2 | .002 (1.5)<br>[.08] | When HT54-M5M fittings are in the P, A, and B ports of "A" type manifold, valves become .002 (1.30), [.001 (.07)].  |

## VALVE PORT DIMENSIONS

| Model                                      | Port       | Type          | Dimensions |
|--|------------|---------------|------------|
| H041E1<br>(H040E1) NOTE                    | P, A, R    | Female thread | M3x0.5     |
| H040-4E1<br>H040-4E2                       | P, A, B, R | Female thread | M3x0.5     |
| HA041E1-25<br>HA040-4E1-25<br>HA040-4E2-25 | P          | Female thread | 10-32 UNF  |
|  | A, B       |               |            |
|  | R          |               |            |
|  | PR         |               |            |

NOTE: H040-4E1 is to be used on manifolds only. Use H041E1 for in-line service.

## MANIFOLD CONNECTION PORT DIMENSIONS

| Manifold model         | Port | Component | Dimensions |
|------------------------|------|-----------|------------|
| H041M □ F<br>H040M □ F | P    | Manifold  | 10-32 UNF  |
|                        | A, B | Valve     | M3x0.5     |
|                        | R    | Manifold  | 1/8 NPT    |
| H041M □ A<br>H040M □ A | P    | Manifold  | 1/8 NPT    |
|                        | A, B |           |            |
|                        | R    |           |            |
|                        | PR   |           |            |

## VALVE WEIGHTS oz. (gf)

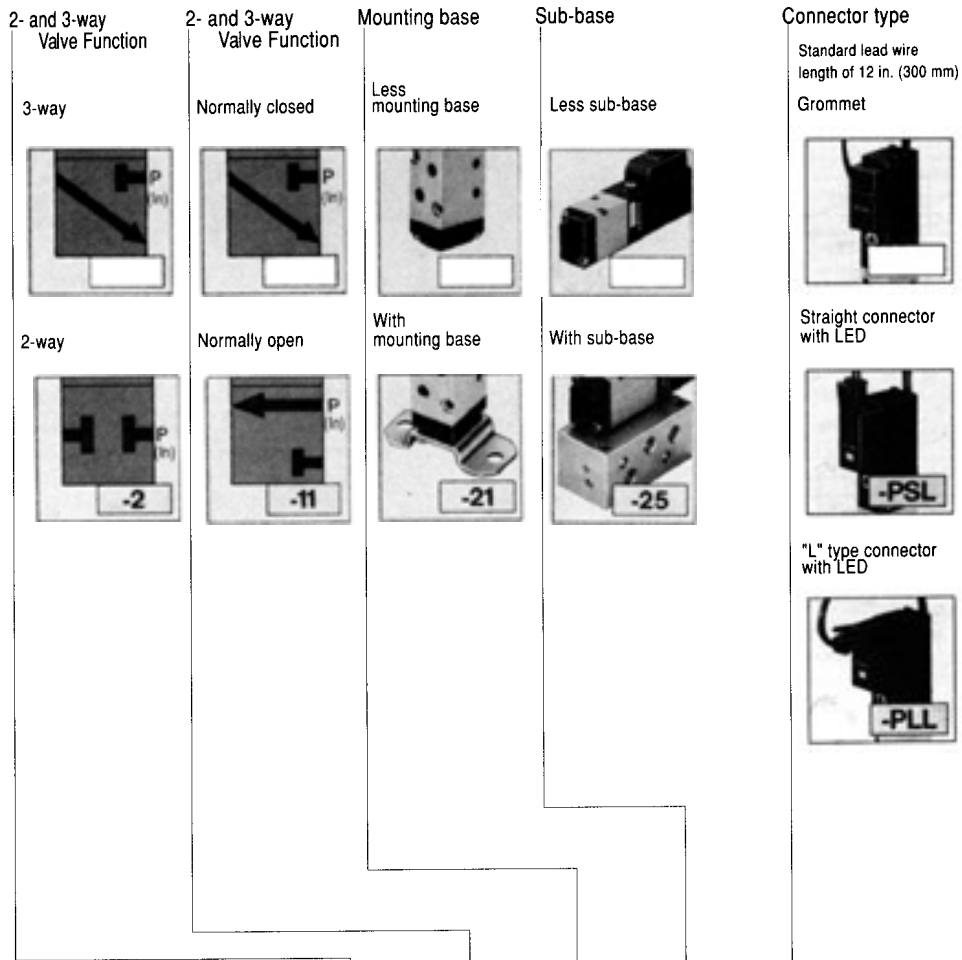
| Model     | Weight per unit |
|-----------|-----------------|
| H041E1    | 0.81 (23)       |
| H040E1    | 0.88 (25)       |
| H040-4E1  | 0.88 (25)       |
| H040-4E2  | 1.48 (42)       |
| HA041E1   | 0.85 (24)*      |
| HA040E1   | 0.88 (25)       |
| HA040-4E1 | 0.88 (25)**     |
| HA040-4E2 | 1.48 (42)**     |

\* Add .60 oz. (13 gf) for sub-base weight, code 25.  
\*\* Add .81 oz. (23 gf) for sub-base weight, code 25.

## MANIFOLD WEIGHT oz. (gf)

| Type      | Weight calculation of each station<br>(n = number of stations) | Block-off plate |
|-----------|--|-----------------|
| H041M □ F | {0.36 (10.1) x n} + 0.53 (14.9)                                | 0.07 (2)        |
| H041M □ A | {0.43 (12.3) x n} + 0.67 (19)                                  | 0.11 (3)        |
| H040M □ F | {0.31 (8.8) x n} + 0.52 (14.8)                                 | 0.11 (3)        |
| H040M □ A | {0.63 (17.8) x n} + 1.35 (38.2)                                | 0.14 (4)        |

# H040 SERIES ORDERING NOMENCLATURE



|   |                       | Model                    |    |     |     | Voltage  |
|---|-----------------------|--------------------------|----|-----|-----|--|
| In-line Valve   | 2- and 3-way          | H041E1                   | -2 | -11 | -21 | -PSL<br>-PLL<br>5 VDC<br>6 VDC<br>12 VDC<br>24 VDC |
|   | 4-way Single solenoid | H040-4E1                 |    |     |     |  |
|   | 4-way Double solenoid | H040-4E2                 |    |     |     |  |
|   |                       | HA040-E1                 |    |     |     |  |
| Sub-base Mounted  | 2- and 3-way          | HA041E1                  | -2 | -11 | -25 | -PSL<br>-PLL<br>5 VDC<br>6 VDC<br>12 VDC<br>24 VDC |
|   | 4-way Single solenoid | HA040-4E1                |    |     |     |  |
|   | 4-way Double solenoid | HA040-4E2                | -2 | -11 |     |  |
| * 2-, 3-, and 4-way manifolds for using 3- and 4-way valves |                       | H040M□ F<br>2- and 3-way |    |     |     | -PSL<br>-PLL<br>5 VDC, 6 VDC,<br>12 VDC, 24 VDC    |
|   |                       | H040M□ A<br>2- and 3-way |    |     |     |  |

\* NOTE: This series cannot be used without manifold.

## OPTIONAL PARTS (AVAILABLE SEPARATELY)

### Mufflers



For in-line valves. For sub-base.

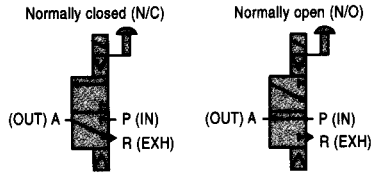
### Block-off plates



H040 M □ F -BP  
F- For "F" type manifold.  
A- For "A" type manifold.

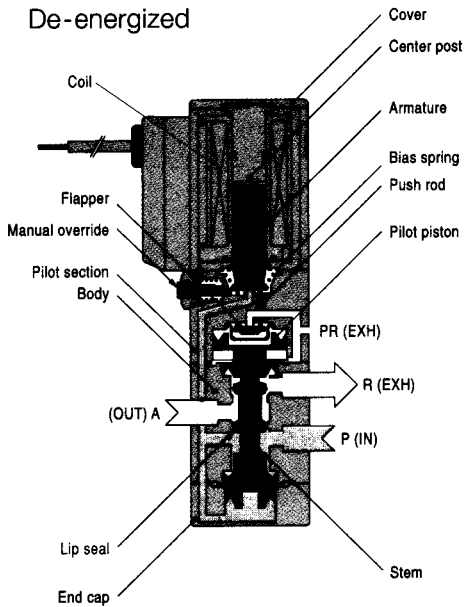
### 3 WAYS

#### H041E1



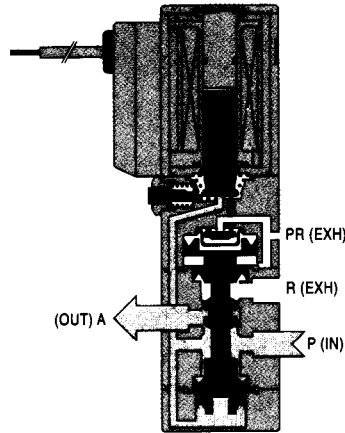
#### H041E1

De-energized



#### H041E1-11

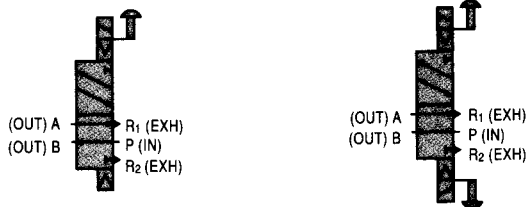
De-energized



### MATERIALS OF MAIN PARTS

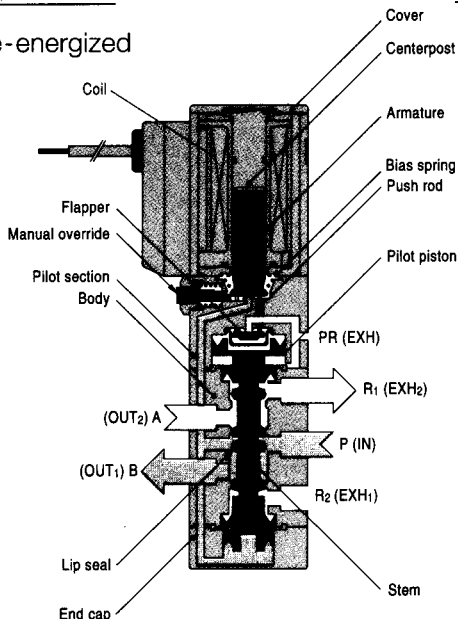
| Part        |                 | Material                            |
|-------------|-----------------|-------------------------------------|
| Valve       | Body            | Aluminum                            |
|             | Stem            |                                     |
|             | Lip seal        | Buna N                              |
|             | Flapper         |                                     |
|             | Mounting base   |                                     |
|             | Sub-base        | Zinc plated steel                   |
|             | Armature        | Electro magnetic<br>Stainless steel |
| Center post |                 |                                     |
| Manifold    | Body            | Aluminum                            |
|             | Block-off plate | Nickel plated steel                 |
|             | Seal            | Buna N                              |

### 4 WAYS

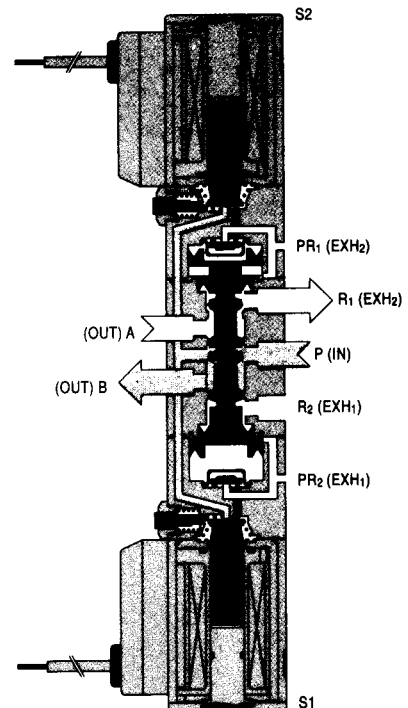


#### H040-4E1

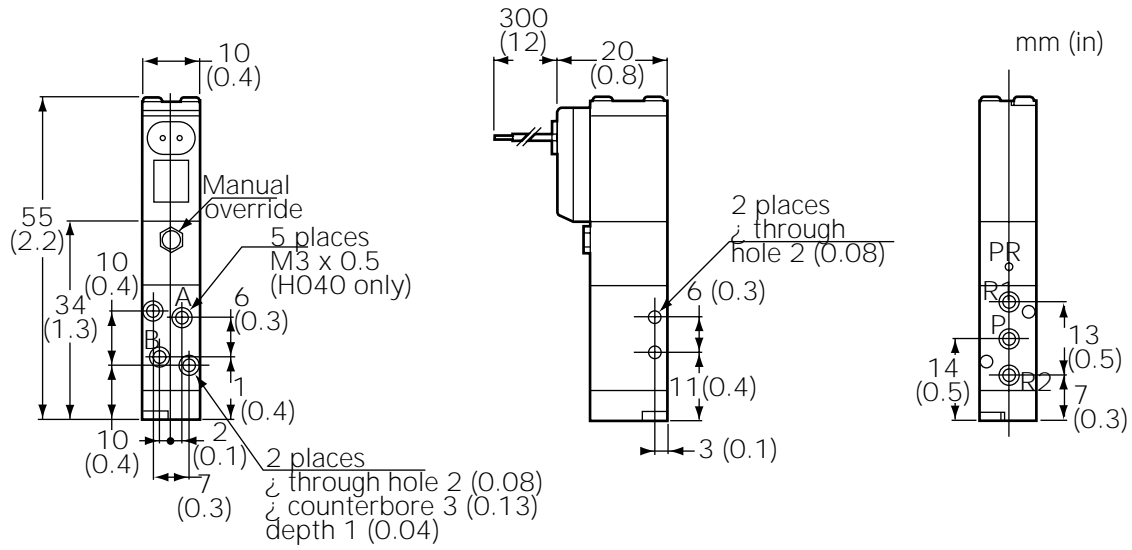
De-energized



#### H040-4E2



# H040-4E1



| C             | D               | E               | F            | G              |
|---------------|-----------------|-----------------|--------------|----------------|
| 0.398<br>(10) | 2.157<br>(54.8) | 1.330<br>(33.9) | 0.354<br>(9) | 0.378<br>(9.6) |

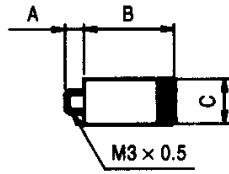
| A           | B               | C              | D               | E              |
|-------------|-----------------|----------------|-----------------|----------------|
| 12<br>(300) | 0.772<br>(19.6) | 0.251<br>(6.4) | 0.417<br>(10.6) | 0.114<br>(2.9) |

| A               | B              | C               |
|-----------------|----------------|-----------------|
| 0.504<br>(12.8) | 0.291<br>(7.4) | 0.543<br>(13.8) |

| H              | I               | J            | K              | L            |
|----------------|-----------------|--------------|----------------|--------------|
| 0.251<br>(6.4) | 0.417<br>(10.6) | 0.079<br>(2) | 0.291<br>(7.4) | 0.079<br>(2) |

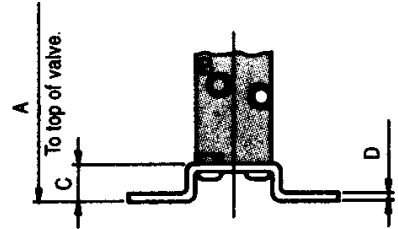
# OPTIONS

Muffler: Code 75. For use with in-line valve, use HKM-03.



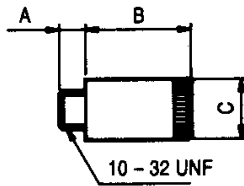
| A              | B             | C            |
|----------------|---------------|--------------|
| 0.098<br>(2.5) | 0.472<br>(12) | 0.236<br>(6) |

Mounting base: Code 21

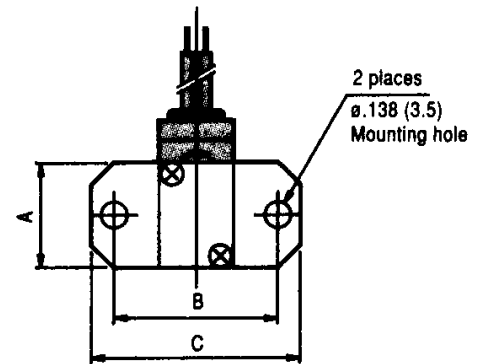


| A               | C            | D              |
|-----------------|--------------|----------------|
| 2.343<br>(59.5) | 0.197<br>(5) | 0.063<br>(1.6) |

For sub-base mounted valves, use HKM-05.

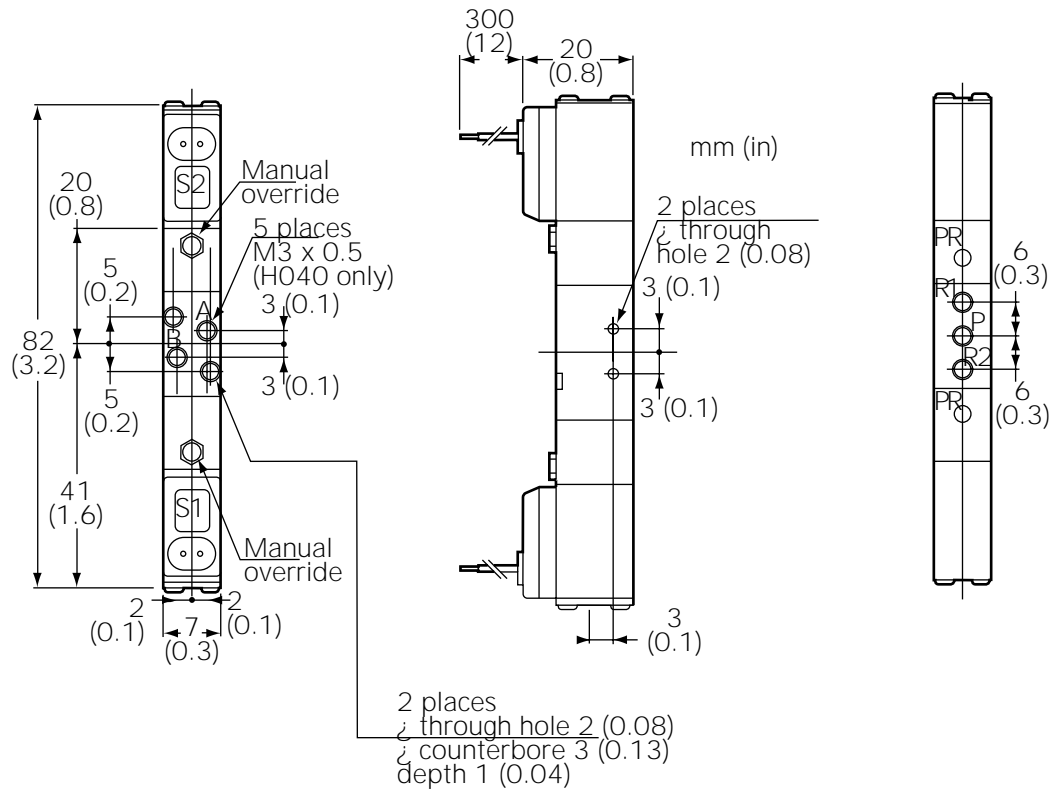


| A              | B             | C            |
|----------------|---------------|--------------|
| 0.138<br>(3.5) | 0.551<br>(14) | 0.315<br>(8) |



| A             | B             | C             |
|---------------|---------------|---------------|
| 0.551<br>(14) | 0.866<br>(22) | 1.102<br>(28) |

# H040-4E2



| C               | D               | E               | F              | G             |
|-----------------|-----------------|-----------------|----------------|---------------|
| 3.228<br>(82.0) | 1.614<br>(41.0) | 0.791<br>(20.1) | 0.189<br>(4.8) | 0.398<br>(10) |

| A           | B               | C              | D              |
|-------------|-----------------|----------------|----------------|
| 12<br>(300) | 0.772<br>(19.6) | 0.114<br>(2.9) | 0.126<br>(3.2) |

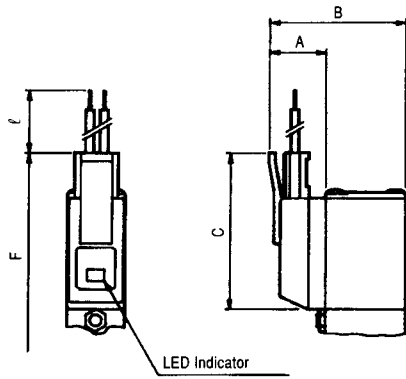
| A              | B              |
|----------------|----------------|
| 0.252<br>(6.4) | 0.252<br>(6.4) |

| H              | I            | J            | K              |
|----------------|--------------|--------------|----------------|
| 0.126<br>(3.2) | 0.079<br>(2) | 0.079<br>(2) | 0.291<br>(7.4) |

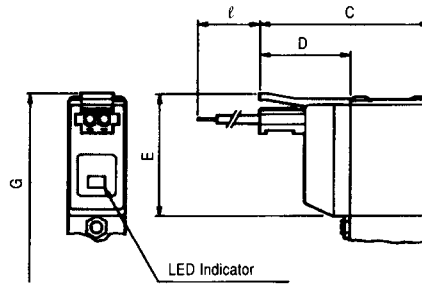
## OPTIONS

Solenoid with straight connector – PSL

Solenoid with “L” connector – PLL



| A             | B             | C               |
|---------------|---------------|-----------------|
| 0.394<br>(10) | 1.024<br>(26) | 1.083<br>(27.5) |



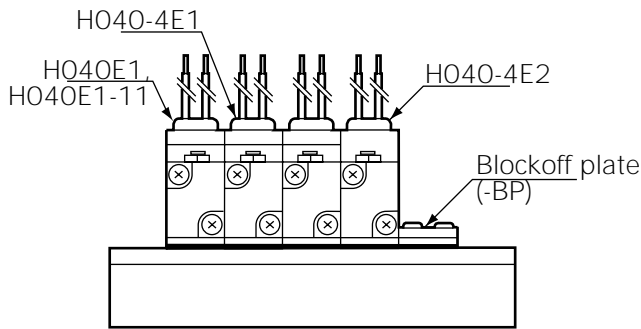
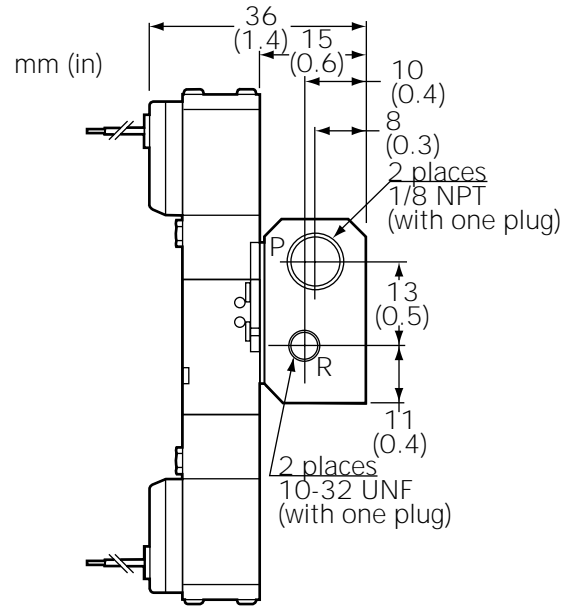
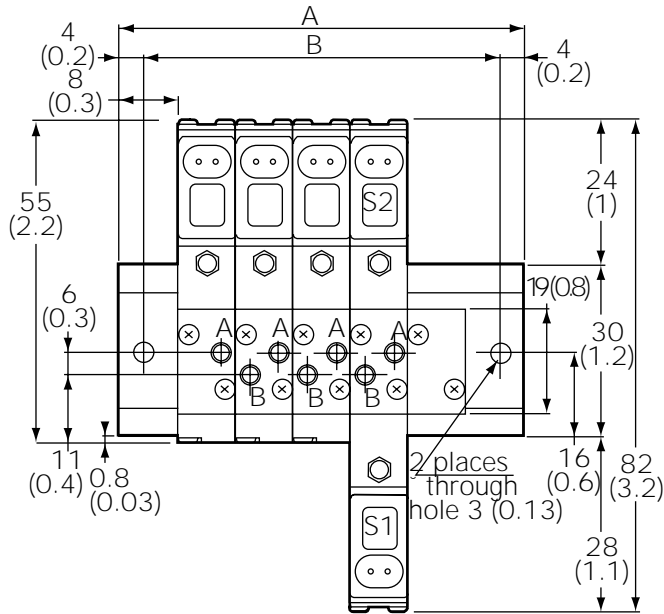
| C             | D             | E               |
|---------------|---------------|-----------------|
| 1.181<br>(30) | 0.630<br>(16) | 0.846<br>(21.5) |

## DIMENSIONS

| Valve                  | F            | G            | ℓ (Lead wire length)   | Notes   |
|------------------------|--------------|--------------|--|---|
| H041E1, HA041E1-25     | 2.271 (57.7) | 2.035 (51.7) | -PSL, -PLL: 12 (300) Made to order:<br>ℓ1 – 36 (1000)<br>ℓ2 – 72 (2000)<br>ℓ3 – 108 (3000) | Whole lengths to valve end or sub-base end                  |
| H040-4E1               | 2.417 (61.4) | 2.181 (55.4) |  |   |
| HA040-4E1-25           | 2.562 (65.1) | 2.326 (59.1) |  |   |
| H040-4E2, HA040-4E2-25 | 3.747 (95.2) | 3.275 (83.2) |  | Whole length from the solenoid end to opposite end of valve |

# MANIFOLD DIMENSIONS FOR 2, 3-, AND 4-WAY VALVE COMBINATIONS

## H040M□F



| C               | D               | E            | F              | G             | H               | I              | J               |
|-----------------|-----------------|--------------|----------------|---------------|-----------------|----------------|-----------------|
| 0.402<br>(10.2) | 0.516<br>(13.1) | 0.157<br>(4) | 0.318<br>(8.1) | 0.394<br>(10) | 2.157<br>(54.8) | 0.252<br>(6.4) | 0.417<br>(10.6) |

| A           | B               | C               | D             | E              | F            | G               | H             |
|-------------|-----------------|-----------------|---------------|----------------|--------------|-----------------|---------------|
| 12<br>(300) | 1.402<br>(35.6) | 0.772<br>(19.6) | 0.590<br>(15) | 0.382<br>(9.7) | 0.315<br>(8) | 0.492<br>(12.5) | 0.433<br>(11) |

| K              | L               | M             | N             | O             | P             | Q               | R            | S             |
|----------------|-----------------|---------------|---------------|---------------|---------------|-----------------|--------------|---------------|
| 0.031<br>(0.8) | 0.945<br>(24.0) | 0.748<br>(19) | 0.630<br>(16) | 1.181<br>(30) | 3.228<br>(82) | 1.102<br>(28.0) | 0.079<br>(2) | 0.945<br>(24) |

## “F” TYPE MANIFOLD DIMENSIONS BY UNIT in. (mm)

| Model    | L             | P             | Model    | L             | P             |
|----------|---------------|---------------|----------|---------------|---------------|
| H040M2F  | 1.433 (36.4)  | 1.118 (28.4)  | H040M12F | 5.449 (138.4) | 5.134 (130.4) |
| H040M3F  | 1.835 (46.6)  | 1.520 (38.6)  | H040M13F | 5.850 (148.6) | 5.535 (140.6) |
| H040M4F  | 2.236 (56.8)  | 1.921 (48.8)  | H040M14F | 6.252 (158.8) | 5.937 (150.8) |
| H040M5F  | 2.638 (67)    | 2.323 (59)    | H040M15F | 6.654 (169)   | 6.339 (161)   |
| H040M6F  | 3.039 (77.2)  | 2.724 (69.2)  | H040M16F | 7.055 (179.2) | 6.764 (171.8) |
| H040M7F  | 3.441 (87.4)  | 3.126 (79.4)  | H040M17F | 7.457 (189.4) | 7.142 (181.4) |
| H040M8F  | 3.843 (97.6)  | 3.528 (89.6)  | H040M18F | 7.858 (199.6) | 7.543 (191.6) |
| H040M9F  | 4.244 (107.8) | 3.929 (99.8)  | H040M19F | 8.230 (209.8) | 7.945 (201.8) |
| H040M10F | 4.646 (118)   | 4.331 (110)   | H040M20F | 8.661 (220)   | 8.346 (212)   |
| H040M11F | 5.047 (128.2) | 4.732 (120.2) | -        | -             | -             |

Valve mounting screws to manifolds and subbases: M2xL16

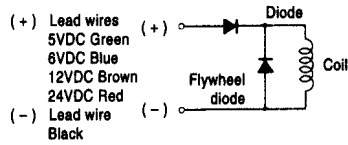
# PROPER HANDLING AND PRECAUTIONS

## SOLENOID

### INTERNAL CIRCUIT

#### STANDARD SOLENOID

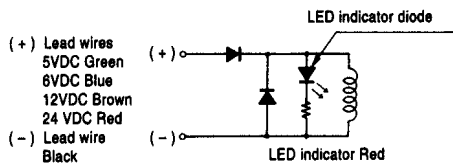
(Transient suppression incorporated)



#### SOLENOID WITH LED INDICATOR

(Transient suppression)

Order No. -PSL, -PLL

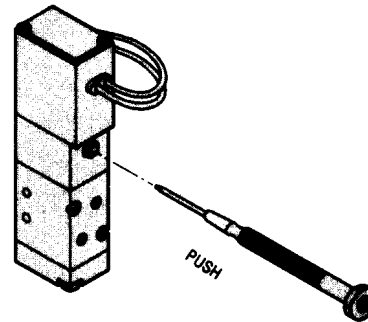


### CAUTIONS

1. Do not apply megger across lead wires.
2. Valve is polarity protected.
3. If current leakage within the circuit exceeds the recommended allowable quantity, the solenoid may not drop out. This malfunction is demonstrated by the valve not returning to the "home" position when de-energized (single solenoid).
4. Do not energize double solenoids simultaneously. The valve may midshift.

## MANUAL OVERRIDE OPERATION

Push the button all the way down, using a fine-tipped instrument. While pushing the button, the single solenoid valve will enter into the energized position. It will return to the "home" position when released. For the double solenoid, when the push button at the S<sub>1</sub> (S<sub>2</sub>) side is pushed, it will switch to the same condition as with the S<sub>1</sub> (S<sub>2</sub>) energized position. The valve will remain in that position even after the button is released. To return, operate the push button at the opposite end of the valve S<sub>2</sub> (S<sub>1</sub>).



### CAUTIONS

1. The H040 series is indirect acting type. Therefore, the body of the valve will not operate when pushing the manual override button unless minimum air pressure is supplied to the P-port.
2. Do not use a sharp tipped instrument to operate the manual override button. It may damage the button.

## MANIFOLD

### PIPING

Ports P and R are located at both ends of the manifold. Piping direction can be determined according to the mounting location. Ports at one end of the manifold are temporarily plugged during shipping. Remove plugs and reseal with sealing agent.

### BLOCK OFF PLATE

Use Block Off Plate to close stations when they are not in use. See charts on page 16 for proper model.

### CAUTIONS

1. For P port piping, make sure to select fitting sizes to fit the manifold connecting pipe dimensions. Actuators may not operate properly if there is insufficient flow and/or pressure due to improper piping.
2. When installing fittings or mufflers to R port, make sure that exhaust remains unrestricted. Restriction of exhaust may cause actuators to operate erratically. Consider using R ports at both ends of manifold to enhance exhaust.
3. When several manifold valves are to be operated simultaneously, connect supply air to both ends of manifold. Also exhaust through both ends of manifold. This ensures adequate supply and exhaust capacity.

## POINTS TO BE CONSIDERED

### INSTALLATION

1. Mount valves in any direction. However, mount valves perpendicular to significant shock or vibration.
2. Location near water, oil, or in excessively dusty conditions requires adequate solenoid housing protection to prevent solenoid actuator contamination. Also consider the installation of breather/muffler in exhaust ports to prevent foreign objects from entering valves.
3. Before installing fittings and tubing, blow all foreign material from them. If using a sealant, take extra care that sealant does not enter valve causing potential malfunction and/or leaks.
4. When valves are installed in tight enclosures, consider the possibility of heat build up. Ensure adequate ventilation.
5. Valves with A or B ports open to atmosphere will not operate properly.

### AIR SOURCE

1. Use compressed air or inert gas in accordance with the pressure rating in the specifications.
2. 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.
3. For optimum performance, use largest possible tubing size and minimum tubing length.

### LUBRICATION

No externally applied lubrication is required. However, when dry air is used (air that does not contain water or oil), use of a turbine SAE 20 oil (ISO VG32) or equivalent is recommended. Thin or low viscosity oils (spindle oil, machine oil, etc.) do not provide a good residual film of lubrication, thus should not be used.

### AIR QUALITY

These valves cannot be used when media or ambient conditions contain organic solvents, phosphoric acid, ester type machine oil, sulfuric acid gas, or other acids.