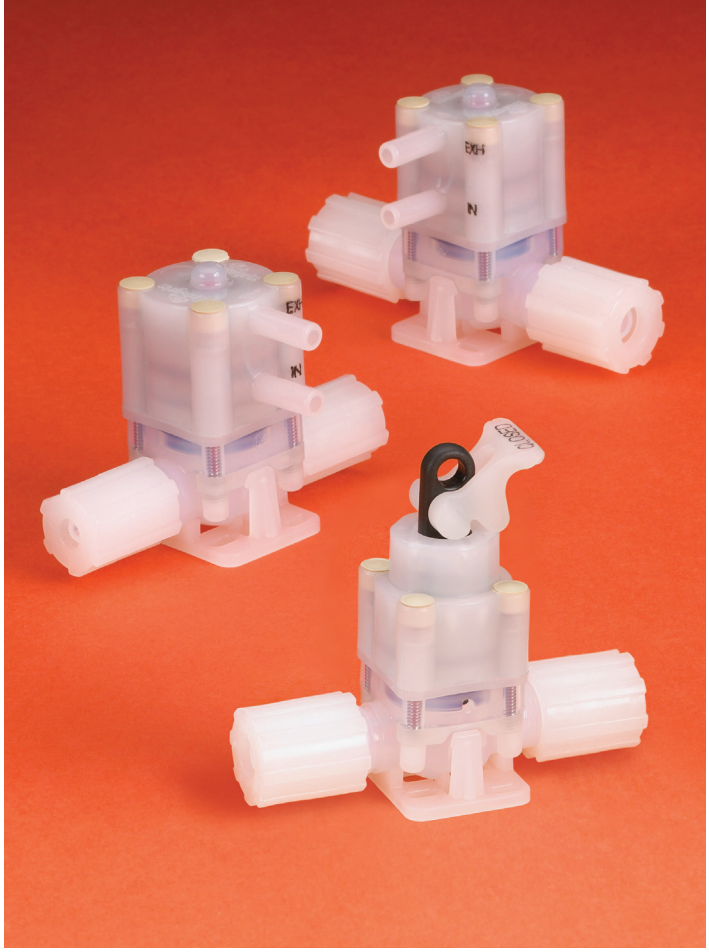
CR4 Series 2-way Manual and Pneumatic Valves

For corrosive environments in wet etch and clean applications



Smaller than most comparable valves, ¼" CR4 Series valves are ideal for handling wet etch and clean process chemicals. These durable valves can handle temperatures up to 160°C (320°F) at 276 kPa (40 psig).

With no exposed metal hardware, the valve is completely sealed and protected from harsh chemical environments. These all-PFA valves are available for high-purity chemical handling in line sizes ⅜" or smaller. A variety of connections including PrimeLock®, Flaretek®, FNPT, PureBond®, "SpaceSaver", and Super 300 Type Pillar® allow flexibility in your fluid design. And, the compact, module design enables manifold customization.

APPLICATION

- High-purity corrosive chemical handling
- All semiconductor wet clean process chemicals
- Chemical line sizes ⅜" or smaller

FEATURES & BENEFITS

- Smallest all-PFA wetted valve available for high-purity fluid handling applications
- High-temperature valves to withstand corrosive and harsh chemical environments
- Same footprint as the Galtek® SG series stand-alone valve and Dymension surface-mount manifold valves for easy replacement
- Valves offer a variety of connection options: PrimeLock, PrimeLock "SpaceSaver," Flaretek, Flaretek "SpaceSaver," Super 300 Type Pillar, PureBond, FNPT

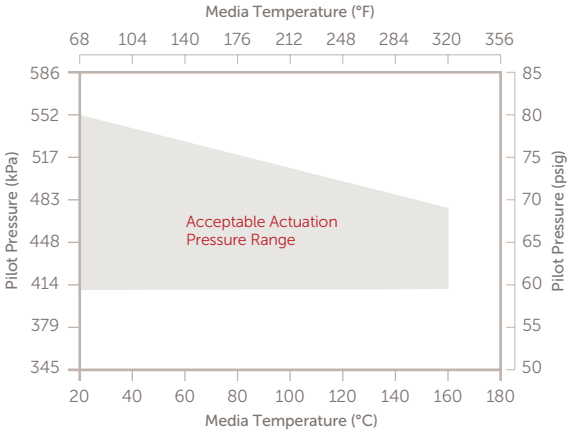
SPECIFICATIONS

Materials	All wetted parts	PFA
	Exterior actuator parts	PVDF, Viton®
	Interior actuator parts	PVDF, SST, Viton
	Mounting base	PVDF
Operating conditions	Media pressure at: 21°C (70°F): Inlet — 913 mbar (27" Hg) vacuum to 552 kPa (80 psig)[1] Outlet — 913 mbar (27" Hg) vacuum to 276 kPa (40 psig)*[2] 160°C (320°F): Inlet — 276 kPa (40 psig) Outlet — 138 kPa (20 psig)[1] Actuation pressure: 345–552 kPa (50–80 psig)[1] Temperature range: Ambient: 23°– 50°C (73°– 122°F) Fluid: 21°– 160°C (70°– 320°F)[1]	
Pneumatic supply port	¼" tube stub; accepts one-touch (push to connect) type fittings or molded female Luer lug style	
Compliant	RoHs, WEE	

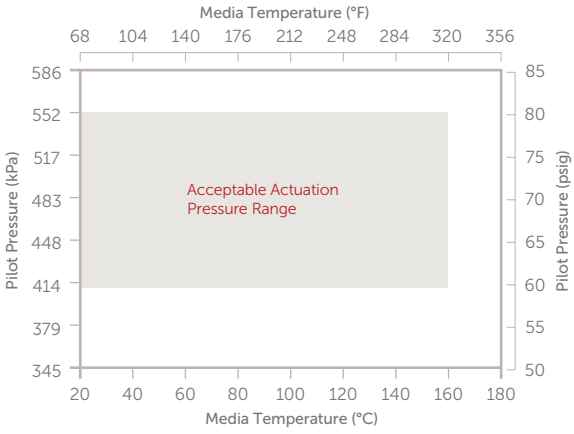
**Optional high pressure outlet versions for up to 552 kPa (80 psig) — Multi-turn only.*
[1]Actual valve performance varies with pressure and temperature; refer to actual ratings in performance data.
[2]Toggle only.

PERFORMANCE

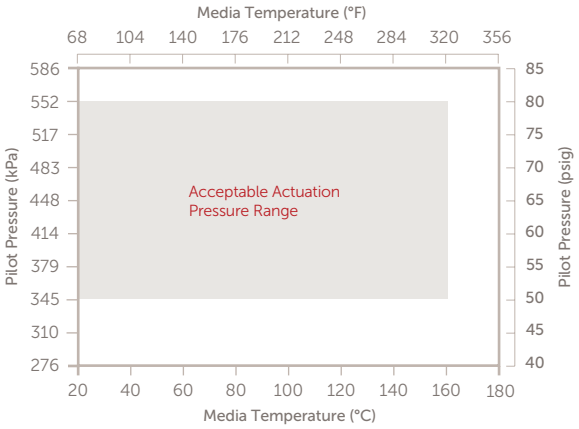
Normally Open Valve
Media Temperature vs. Actuator Pilot Pressure



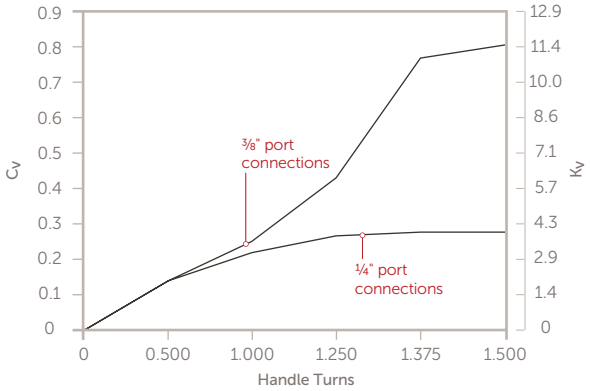
High Pressure Normally Closed Valve
Media Temperature vs. Actuator Pilot Pressure

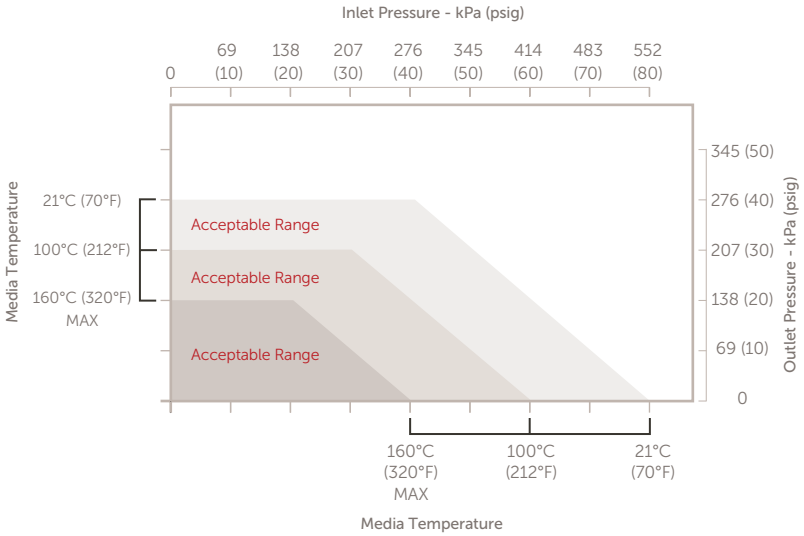


Normally Closed Valve
Media Temperature vs. Actuator Pilot Pressure



C_v/K_v vs. Number of Handle Turns





VALVE RELIABILITY TEST RESULTS

Valve qualification testing

Test type	Test conditions	Acceptance criteria	Test results
Pressure decay	40 psig CDA	<0.050 cc H_2O/hour equivalent leak rate	PASS <0.0077 cc H_2O/hour equivalent leak rate
Cracking pressure	Increase test pressure CDA until valve opens Maximum test pressure 140 psig	Cracking pressure must be >10% above rated pressures (88 psig inlet, 44 psig outlet). Cracking pressure defined as when downstream pressure increases by >2 psig, indicating valve has opened.	PASS Inlet cracking pressure >140 psig Outlet cracking pressure ~108 psig
Proof pressure	Hydraulic oil at valve proof pressure of 120 psig	Valve must maintain pressure decay and cracking pressure requirements after exposure to 120 psig	PASS <0.0077 cc H_2O/hour equivalent leak rate Inlet cracking pressure >140 psig Outlet cracking pressure ~108 psig
Burst pressure	Hydraulic oil pressure increased until leakage detected	Burst pressure must be >2X rated pressure	PASS Burst pressure average of 357 psig
Accelerated life testing	49% HF acid at 22°C @ 80 psig for 2.1 M cycles	Minimum acceptable B_{10} Weibull life* of 2 million cycles. Inspected every 300k cycles for cracking pressure (≥88 psig) and port-to-port leakage (<0.05 mL/min).	PASS No valve failures in 2.1 M cycles B_{10} life ≥2.0 M cycles Weibull MTTF ≥3.8 M cycles
	37% HCl acid at 80 psig @ 22°C for 2.1 M cycles	Minimum acceptable B_{10} Weibull life* of 2 million cycles. Inspected every 300k cycles for cracking pressure (≥88 psig) and port-to-port leakage (<0.05 mL/min).	PASS No valve failures in 2.1 M cycles B_{10} life ≥2.0 M cycles Weibull MTTF ≥3.8 M cycles
	Cabot Semi-Sperse® 12 slurry at 30 psig @ 22°C for 2.1 M cycles	Minimum acceptable B_{10} Weibull life* of 2 million cycles. Inspected every 300k cycles for cracking pressure (≥88 psig) and port-to-port leakage (<20 mL/hr).	PASS No valve failures in 2.1 M cycles B_{10} life ≥2.0 M cycles Weibull MTTF ≥3.8 M cycles
Pressure envelope	120 psig water @ 23°C (73°F)	No external leakage failures for 1 million cycles @ 1.5 rated pressure	PASS No external leakage
	60 psig hydraulic oil @ 160°C (320°F)	No external leakage failures for 1 million cycles @ 1.5 rated pressure	PASS No external leakage

**B_{10} Weibull life is defined as the statistical number of cycles where 10% of the valves are expected to fail.*

Valve test procedure in production

Test type	Test conditions	Acceptance criteria
External media leak	80 psig CDA	Zero bubbles per minute through 1/32" ID tube immersed in DI water
Port-to-port leak test	40 psig CDA to valve outlet	Less than 4 bubbles per minute through 1/32" ID tube immersed in DI water
Valve actuation	Pressure decay 70 psig CDA	Less than 5 psi pressure drop

SURFACE EXTRACTABLE SPECIFICATIONS

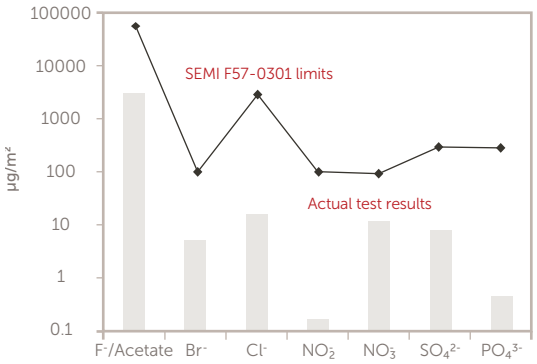
Entegris, Inc. certifies the corrosion-resistant CR4 series ¼" valves comply with the SEMI® F57-0301 specification for Extractable Ionic and Metallic Contamination, Total Organic Carbon Contamination and Surface Roughness. Per SEMI F40 (section 12.1), the following test parameters were used:

- The test fluid used was ultrapure water and the tests were carried out at 85°C.
- The parts were leached after the prescribed rinse pretreatment.
- The volumes of the test fluids used were 4.5 mL.
- The soak time was one week.
- The calculated wetted surface areas were 0.0032 m².

Testing has verified the corrosion-resistant CR4 series ¼" valves in stand-alone and PTFE manifolded configurations comply with the following specifications as outlined in SEMI F57-0301.

Surface Extractable Specifications

Extractable Ionic Contamination

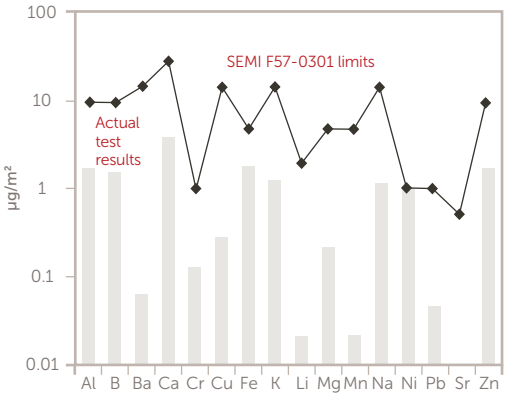


Surface extractable ionic contamination

Aqueous leachate anions (IC)	SEMI F57-0301 limits static value @ 85 ±5°C for 7 days	Actual test results molded PFA CR4 valves
Fluoride (F^-/Acetate)	≤60000 µg/m²	3904.0 µg/m²
Bromide (Br^-)	≤100 µg/m²	<6.8 µg/m²
Chloride (Cl^-)	≤3000 µg/m²	27.0 µg/m²
Nitrite (NO_2^-)	≤100 µg/m²	<0.3 µg/m²*
Nitrate (NO_3^-)	≤100 µg/m²	<14.0 µg/m²*
Sulfate (SO_4^{2-})	≤300 µg/m²	<9.0 µg/m²*
Phosphate (PO_4^{3-})	≤300 µg/m²	<0.7 µg/m²*

Below detection limit.

Extractable Metallic Contamination

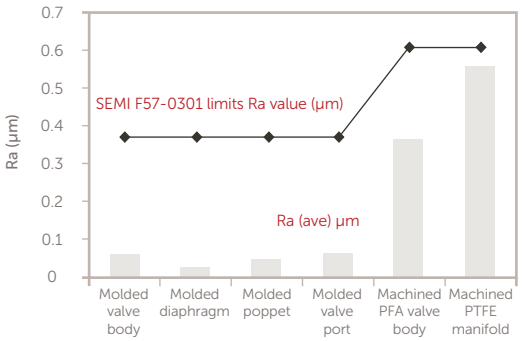


Surface extractable metallic contamination

Aqueous leachate anions (IC)	SEMI F57-0301 limits static value @ 85 ±5°C for 7 days	Actual test results molded PFA CR4 valves
Al	≤10.0 µg/m²	3.10 µg/m²
B	≤10.0 µg/m²	2.70 µg/m²
Ba	≤15.0 µg/m²	0.08 µg/m²
Ca	≤30.0 µg/m²	6.20 µg/m²
Cr	≤1.0 µg/m²	0.19 µg/m²
Cu	≤15.0 µg/m²	0.50 µg/m²
Fe	≤5.0 µg/m²	3.30 µg/m²
K	≤15.0 µg/m²	1.90 µg/m²
Li	≤2.0 µg/m²	<0.04 µg/m²
Mg	≤5.0 µg/m²	0.40 µg/m²
Mn	≤5.0 µg/m²	0.04 µg/m²
Na	≤15.0 µg/m²	1.60 µg/m²
Ni	≤1.0 µg/m²	1.00 µg/m²
Pb	≤1.0 µg/m²	<0.07 µg/m²
Sr	≤0.5 µg/m²	<0.01 µg/m²
Zn	≤10.0 µg/m²	3.12 µg/m²

**Below detection limit.*

Surface Roughness



Surface roughness specification

Component description	SEMI F57-0301 limits Ra value	Actual test results Ra (average)
Injection molded CR4 valve body	≤0.38 µm (≤15 µin)	0.07 µm (2.6 µin)
Injection molded CR4 diaphragm	≤0.38 µm (≤15 µin)	0.03 µm (1.3 µin)
Injection molded CR4 poppet	≤0.38 µm (≤15 µin)	0.05 µm (2.2 µin)
Injection molded CR4 port	≤0.38 µm (≤15 µin)	0.07 µm (3.0 µin)
Machined PFA CR4 valve body	≤0.62 µm (≤25 µin)	0.37 µm (14.4 µin)
Machined PTFE manifold body	≤0.62 µm (≤25 µin)	0.57 µm (22.4 µin)

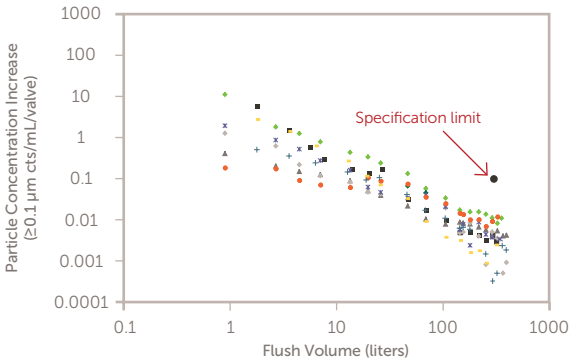
Total organic carbon contamination for molded CR4

	SEMI F57-0301 limits	Actual test results molded PFA CR4 valves
Total organic carbon contamination	60,000 µg/m²	623 µg/m²

PARTICLE CONTRIBUTION SPECIFICATIONS

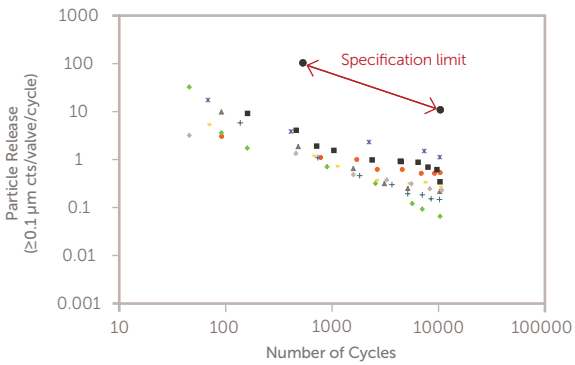
Because the SEMI F57-0301 Particle Contribution specification is still in development, Entegris has worked with several OEMs to establish a test method and particle contribution limits. Testing has verified the CR4 series ¼" valve in both standalone and manifolded configurations comply with the following particle contribution specification.

Flushing Particle Contribution



Note: During initial flushing, the device must contribute <0.1 particle/mL (particle size ≥0.1 µm) within 300 liters of flushing. During operation, the device must release <100 particles/actuation (particle size ≥0.1 µm) within 500 cycles and <10 particles/actuation (particle size ≥0.1 µm) within 10,000 cycles.

Post-cyclic Particle Contribution

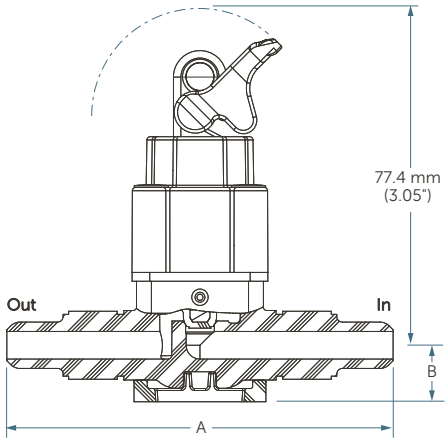


Note: After cycling the valves for 2.1 M cycles in 49 ±3% HF, the valves must also pass the particle contribution criteria.

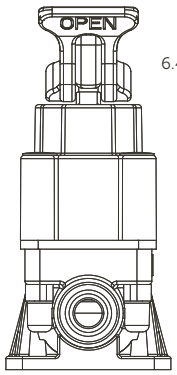
DIMENSIONS

Manual Toggle and Manual Toggle Panel Mount

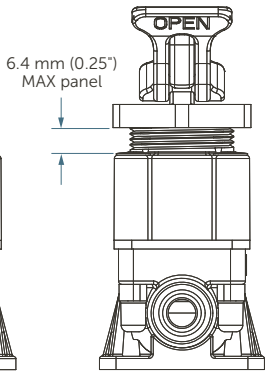
Front View



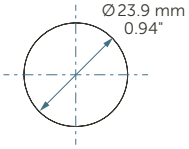
Side View – Manual Toggle



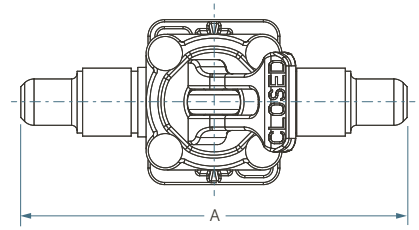
Side View – Manual Toggle Panel Mount



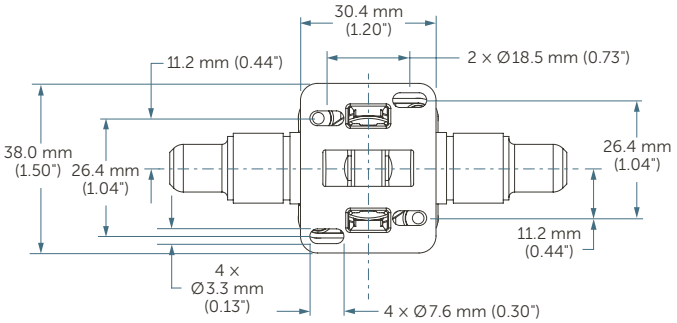
Panel Cutout



Top View – Manual Toggle



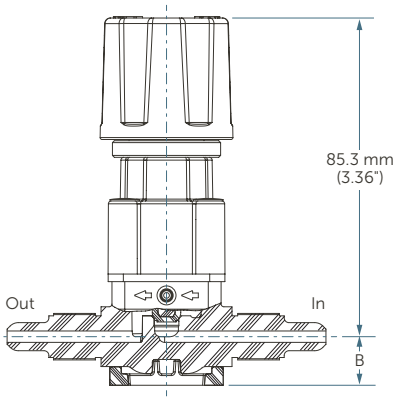
Bottom View



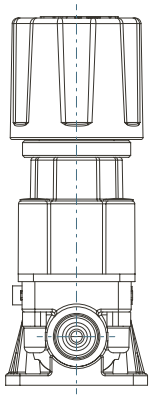
			DIMENSIONS	
Port connection	**Flow factor C_V**	**Flow factor K_V**	**A**	**B**
¼" Flaretek	0.29	4.2	85.3 mm (3.36")	13.0 mm (0.51")
⅜" Flaretek	0.84	12.0	88.9 mm (3.50")	13.0 mm (0.51")
¼" FNPT	0.84	12.0	69.9 mm (2.75")	13.0 mm (0.51")
¼" PrimeLock	0.34	4.9	80.8 mm (3.18")	13.0 mm (0.51")
⅜" PrimeLock	0.84	12.0	80.8 mm (3.18")	15.5 mm (0.61")
¼" PureBond	0.84	12.0	68.1 mm (2.68")	13.0 mm (0.51")
¼" Super 300 Type Pillar	0.29	4.2	65.3 mm (2.57")	13.0 mm (0.51")
⅜" Super 300 Type Pillar	0.84	12.0	73.2 mm (2.57")	13.0 mm (0.51")

Manual Multi-turn and Manual Multi-turn Panel Mount

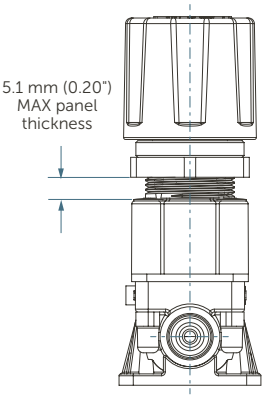
Front View



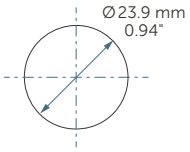
Side View – Manual Multi-turn



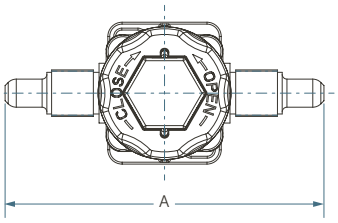
Side View – Manual Multi-turn Panel Mount



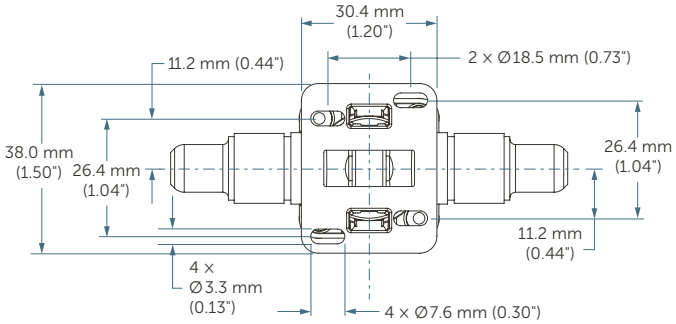
Panel Cutout



Top View – Manual Multi-turn



Bottom View



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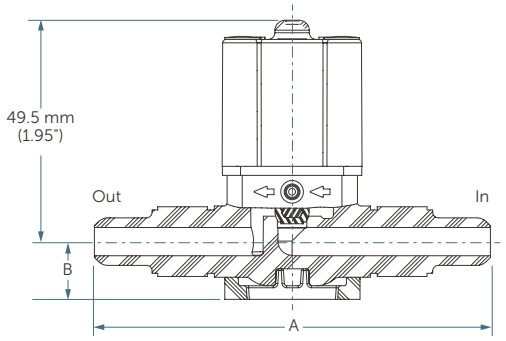
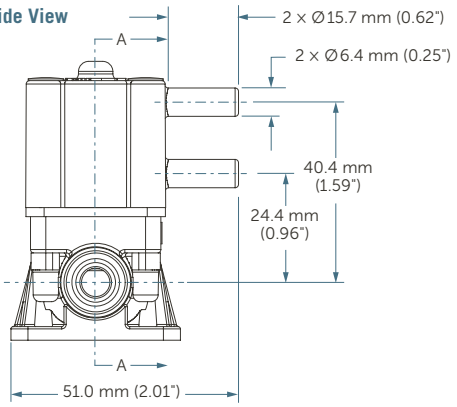
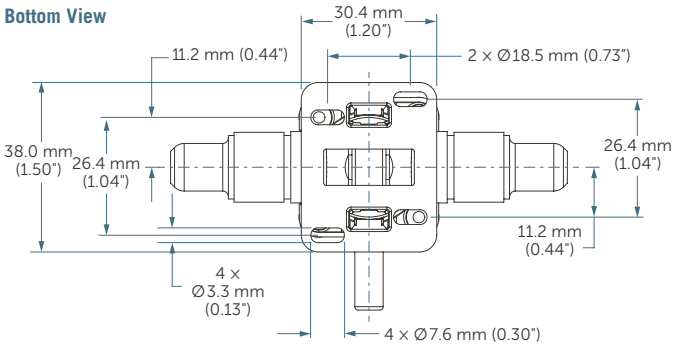


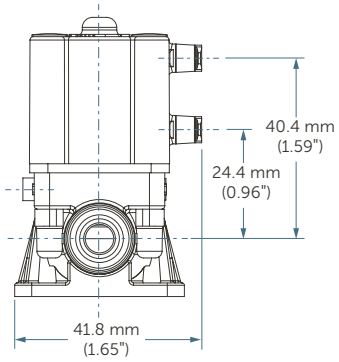
Side View



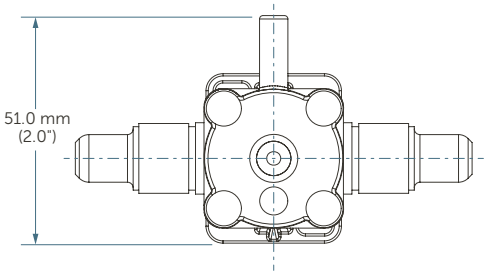
Bottom View



Side View-Luer



Top View



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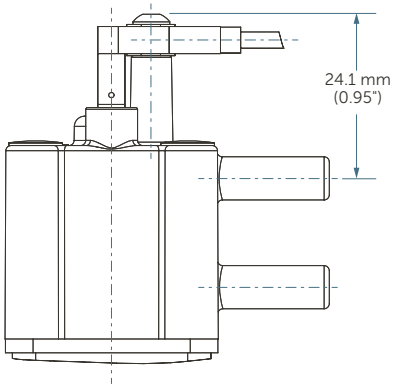
Sensing option dimensional information

Remote position indication option

Electronic valve position sensing for monitoring valve open and closed positions

Note: To enable the remote position indication option, you must special order the Omron® sensor (-OM) on the valve. In addition, order the Omron Position Sensor Indicator (EE-SX771R or EE-SX771A), which is sold separately.

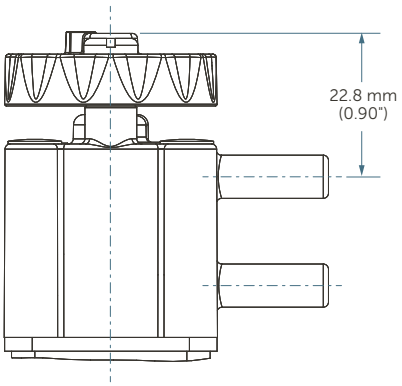
CR4 with Omron Sensor



Omron part number EE-SX771R or EE-SX771A

Restricted open/closed dimensional information

CR4 with Restricted Open or Restricted Closed



Note: Height dimension includes stem in open position

- Restricted open option allows for a manual variable limit control on the open travel of a pneumatically controlled valve
- Restricted closed option allows for a manual variable limit control on the closed travel of a pneumatically controlled valve
- Both options are offered in a normally closed and normally open pneumatic actuators

ORDERING INFORMATION

CR4 Series Valves: part number

CR4 – _____ – _____ – ___

Special order

3 = PFA Flaretek nut*
6 = CPFA Flaretek nut*
II = FlareLock® II nut*
N = Pillar nuts, inserts and gauge rings included**
P2 = Pilot rotated 90° clockwise
P3 = Pilot rotated 180° clockwise (over Port 2)
P4 = Pilot rotated 270° clockwise
HP = High-pressure option
C = Black piston
CF = Coated springs and fasteners***
RO = Restricted open
RC = Restricted closed
OM = Omron position sensor
= NA

Port configuration

4F = Port 1 (inlet), Port 2 (outlet) ¼" Flaretek
4P = Port 1 (inlet), Port 2 (outlet) ¼" PureBond
4SO = Port 1 (inlet) ¼" Flaretek, Port 2 (outlet) ¼" Flaretek "SpaceSaver"
4SI = Port 1 (inlet) ¼" Flaretek "SpaceSaver", Port 2 (outlet) ¼" Flaretek
4PS3 = Port 1 (inlet), Port 2 (outlet) ¼" Super 300 Type Pillar
4K = Port 1 (inlet), Port 2 (outlet) ¼" PrimeLock
4KV = Port 1 (inlet) ¼" PrimeLock, Port 2 (outlet) ¼" PrimeLock "SpaceSaver"
4VK = Port 1 (inlet) ¼" PrimeLock "SpaceSaver", Port 2 (outlet) ¼" PrimeLock
4VV = Port 1 (inlet), Port 2 (outlet) ¼" PrimeLock "SpaceSaver"
4N = Port 1 (inlet), Port 2 (outlet) ¼" FNPT
6F = Port 1 (inlet), Port 2 (outlet) ⅜" Flaretek
6SO = Port 1 (inlet) ⅜" Flaretek, Port 2 (outlet) ⅜" Flaretek "SpaceSaver"
6SI = Port 1 (inlet) ⅜" Flaretek "SpaceSaver", Port 2 (outlet) ⅜" Flaretek
6PS3 = Port 1 (inlet), Port 2 (outlet) ⅜" Super 300 Type Pillar
6K = Port 1 (inlet), Port 2 (outlet) ⅜" PrimeLock
6KV = Port 1 (inlet) ⅜" PrimeLock, Port 2 (outlet) ⅜" PrimeLock "SpaceSaver"
6VK = Port 1 (inlet) ⅜" PrimeLock "SpaceSaver", Port 2 (outlet) ⅜" PrimeLock
6VV = Port 1 (inlet), Port 2 (outlet) ⅜" PrimeLock "SpaceSaver"

Actuator

2C = 2-way normally closed tube
2U = 2-way normally open tube
2CL = 2-way normally closed Luer
2UL = 2-way normally open Luer
2MTL = 2-way manual toggle
2PMTL = 2-way manual toggle panel mount
2M = 2-way manual multi-turn
2PM = 2-way manual multi-turn panel mount

Notes: Not all configurations are permitted. Consult Entegris if multiple special order features are required. Contact factory if "SpaceSaver" port connections are to be used in media containing a fluorinated surfactant.

**Available for Flaretek port connections only.*

***Available for Super 300 Type Pillar port connections only.*

****Available for 2C, 2U, 2CL, 2UL actuators only.*

FOR MORE INFORMATION

Please call your Regional Customer Service Center today to learn what Entegris can do for you. Visit entegris.com and select the Contact Us link to find the customer service center nearest you.

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Entegris

Corporate Headquarters
129 Concord Road
Billerica, MA 01821
USA

Customer Service
Tel +1 952 556 4181
Fax +1 952 556 8022
Toll Free 800 394 4083