

VARIABLE VOLUME PRESSURE CONTROLLER MODELS: V-1 R AND V-2R

The 3D Variable Volume Pressure Controller is available for requirements of 0 - 1,000 psi and 0 - 6,000 psi in absolute or gauge pressure. It is a highly sensitive vernier controller with adjustment sensitivity of .0005 psi (.005 with Model V-2R).

Utilizing the principle of expansion or compression of gas by the displacement of a piston the unit can generate up to 50 psi in a static system without requiring an outside pressure source.



SPECIFICATIONS MODEL: V-1R

PRESSURE RANGE: 0 - 1,000 psi
 ADJUSTMENT SENSITIVITY: 0.0005 psi
 LEAK RATE: Less than 1×10^{-5} atm cc/sec
 TOTAL MECHANICAL ROTATION: 33 1/2 turns. (nom.)
 TEMPERATURE RANGE: 32°F - 120°F
 PNEUMATIC PRESSURE GENERATION: 35 psia
 PROOF PRESSURE: 2,000 psi
 CONSTRUCTION: Aluminum body.
 Stainless steel screw and valve stem.
 (All stainless steel construction available for use with corrosive gases.)
 LIFE: 250,000 cycles
 WEIGHT: 4.5 lbs.
 TOTAL VOLUME: 12.756 cubic inches

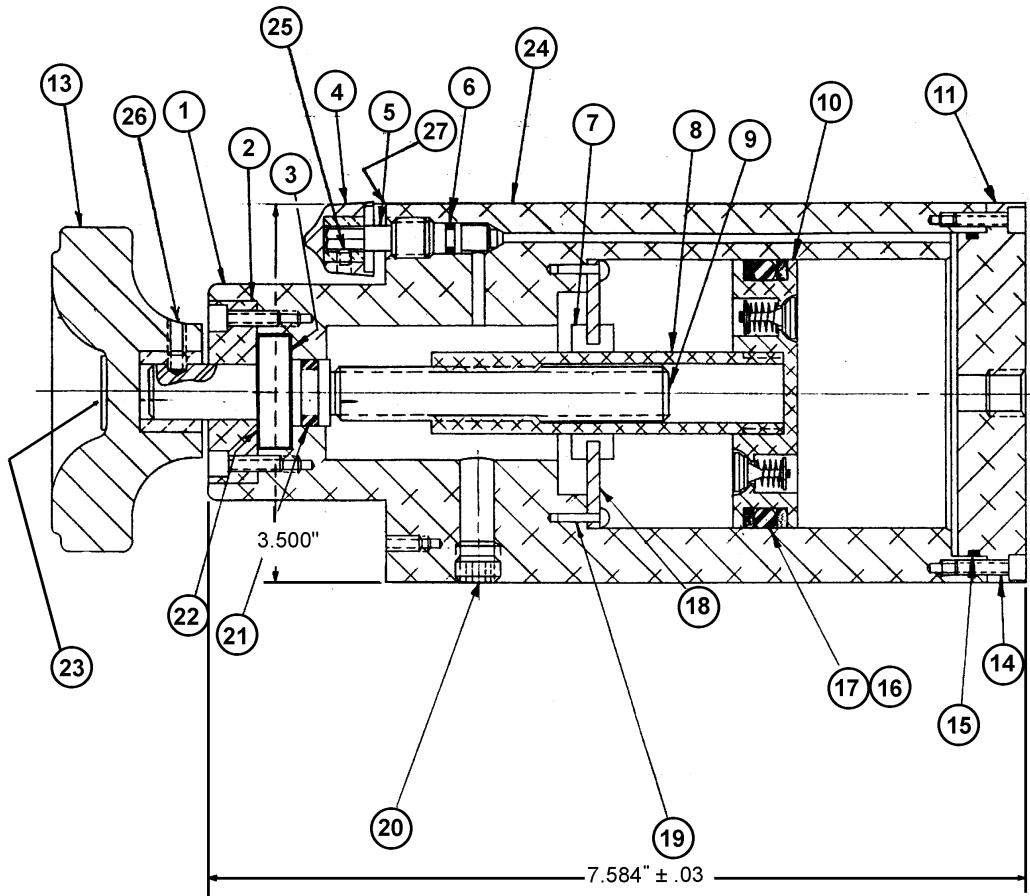
SPECIFICATION MODEL: V-2R

PRESSURE RANGE: 0 - 6,000 psi
 ADJUSTMENT SENSITIVITY: .005 psi
 LEAK RATE: 1×10^{-3} atm cc/sec
 TOTAL MECHANICAL ROTATION: 78 turns
 TEMPERATURE RANGE: 32°F - 120°F
 PROOF PRESSURE: 12,000 psi
 CONSTRUCTION: Aluminum body; stainless steel lead screw and valve, bronze nut, Viton and Teflon seals
 LIFE: 250,000 cycles
 WEIGHT: 6.5 lbs.
 TOTAL VOLUME: 1.53524 cubic inches

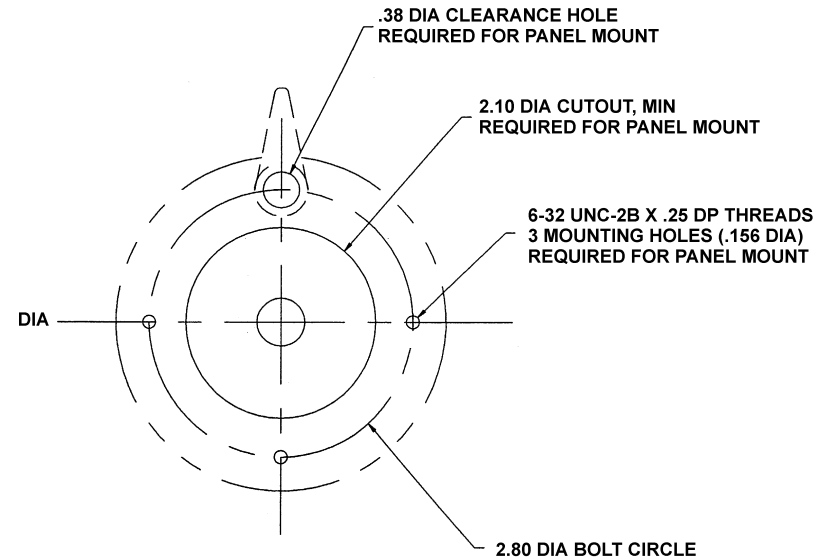


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V-1R Parts List



Item	Qty	Part Number	Description
1	1	2016-0007-1	BODY
2	1	2019-0030	BUSHING
3	1	2196-0093	WASHER, BACK
4	1	2105-0011-2	KNOB, VALVE
5	1	4190-0001	VALVE, EQUALIZE ASSY.
6	1	2128-0001-15	O-RING, VALVE
7	2	2078-0029	GUIDE, ANTI-ROTATION
8	1	2154-0004	SCREW, JACK
9	1	2154-0003	SCREW, LEAD
10	1	4136-0001	PISTON ASSEMBLY
11	1	2056-0003	CAP, END
12		DELETED	DELETED
13	1	2105-0011-1	KNOB, CONTROL
14	20	2154-0001-48	SCREW, CAP
15	1	2128-0001-16	O-RING, STATIC
16	1	2128-0001-17	O-RING, PISTON
17	2	2145-0072	RING, LEATHER BACKUP
18	1	2137-0110	PLATE, ANT-ROTATION
19	2	2154-0001-49	SCREW, DRIVE
20	2	2138-0051-2	PLUG, PIPE
21	1	2128-0001-18	O-RING, LEAD SCREW
22	1	2196-0090	WASHER, FRONT
23	1	2124-0089	LOGO LABEL
24	1	2124-0088	STICKER, CAUTION
25	1	2154-0001-50	SET SCREW
26	1	2154-0001-53	SET SCREW
27	1	2124-0091	LABEL

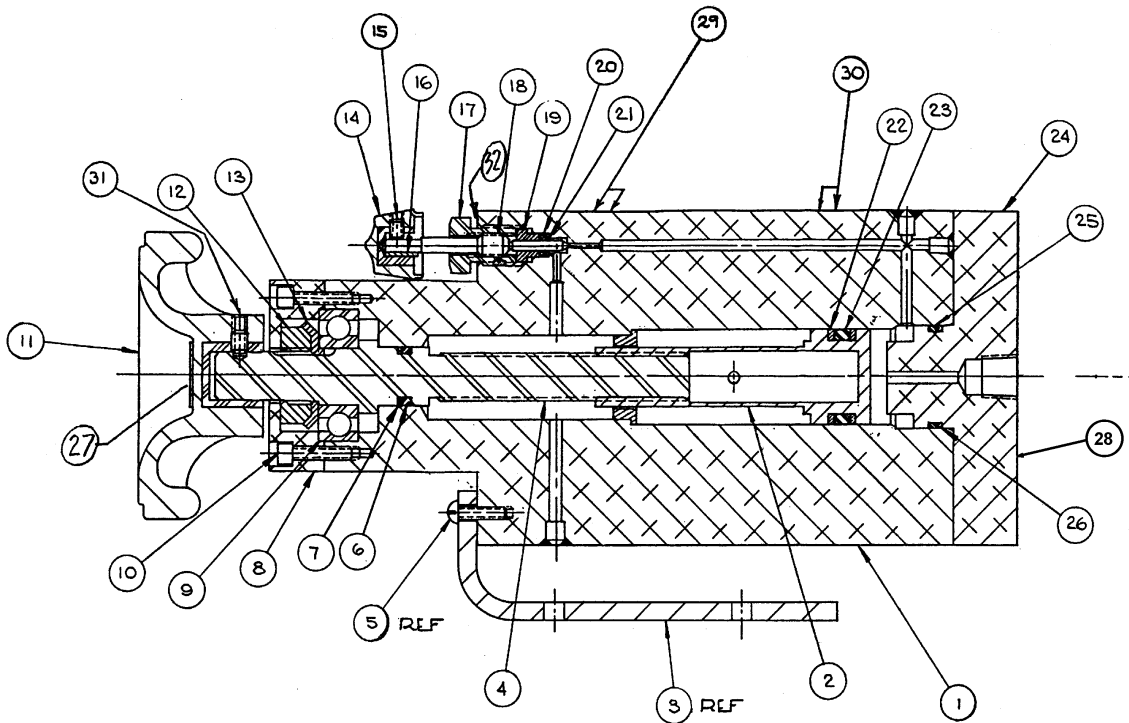


PANEL MOUNT DIMENSIONS

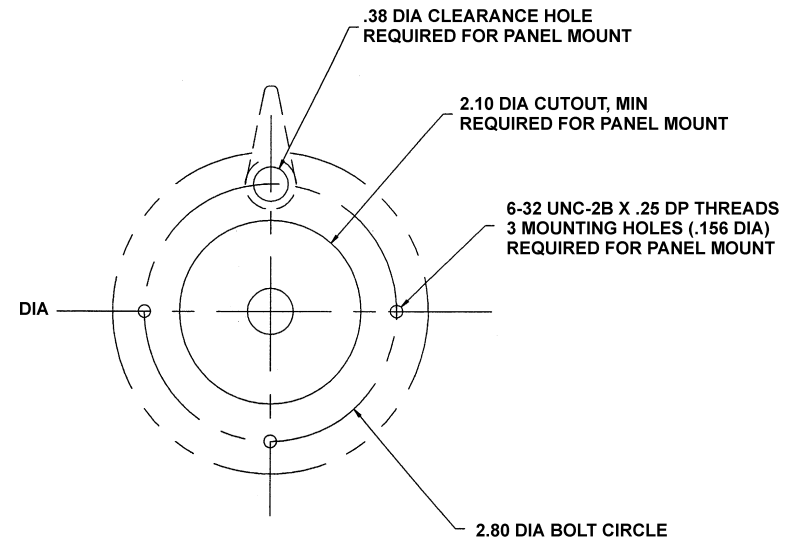


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V-2R Parts List



Item	Qty	Part Number	Description
1	1	4016-0064-1	BODY ASSEMBLY
2	1	2136-0011	PISTON
3	1	(2018-0052)	BRACKET (OPTIONAL)
4	1	2154-0005	SCREW, LEAD
5	3	(2154-0001-51)	SCREW (OPTIONAL)
6	1	2128-0001-18	O-RING
7	1	2145-0073-2	BACKUP RING
8	1	2056-0002	PLATE, FRONT
9	1	2012-0027	BEARING
10	12	2154-0001-48	SCREW
11	1	2105-0011-1	KNOB, CONTROL
12	1	2127-0035-4	NUT
13	1	2196-0087-14	WASHER
14	1	2105-0011-2	KNOB, VALVE
15	1	2154-0001-50	SCREW, SET
16	1	2019-0031	BUSHING, KNOB
17	1	2127-0038	NUT, GLAND
18	1	2190-0020	STEM, VALVE
19	1	2196-0091	WASHER, TOP PACK
20	1	2128-0001-12	O-RING
21	1	2196-0092	WASHER, BOT. PACK
22	2	2145-0073-1	BACKUP RING
23	1	2128-0001-14	O-RING
24	1	2056-0001	PLATE, BACK
25	1	2128-0001-21	O-RING
26	1	2145-0073-3	BACKUP RING
27	1	2124-0089	LOGO
28	12	2154-0001-52	SCREW
29	1	2124-0090	LABEL, CAUTION
30	1	2124-0087	NAMEPLATE
31	1	2154-0001-53	SCREW, SET
32	1	2124-0091	LABEL, EQUALIZE VALVE



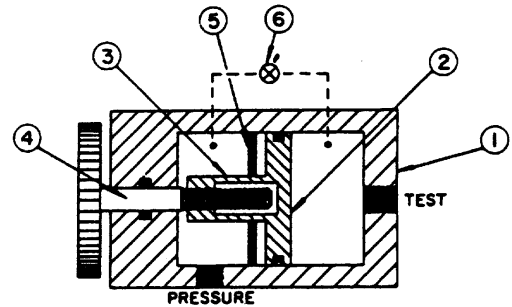
PANEL MOUNT DIMENSIONS

PRINCIPLE OF OPERATION

1. All 3D Instruments Pressure-Volume Controls operate on an identical functional principle. Their construction, therefore, varies only slightly from model to model. These instruments use a practical application of Boyle's Law wherein it is demonstrated that a gas pressure P trapped in a volume V will change in inverse proportion to any change in the volume of V . For instance: if V is doubled, P will be halved; or, if V is halved, P will be doubled. 3D Instruments P-V Controls apply this principle by providing (1) a means of trapping a test volume and (2) a method of varying the volume of this test system.

2. Figure No. 1 illustrates the major elements of a 3D Instruments P-V Control.

- These are:
- (1) A Housing
 - (2) Piston
 - (3) Jack Screw
 - (4) Lead Screw
 - (5) Anti-Rotation Mechanism and
 - (6) Isolation Valve



3. The housing has a honed bore with ports at both ends. A piston divides this bore into two chambers, front and rear. A jack screw is fixed to the piston and passes through an anti-rotation mechanism. This mechanism permits the piston and jack screw axial freedom but prevents them from rotating. The jack screw is engaged with a lead screw that is axially fixed in the housing but is free to rotate. The lead screw shaft extends out of the housing and is provided with a knob. This combination permits the piston to be axially positioned in the bore by rotation of the external control knob. An integral isolation valve permits the front and rear chambers to be either coupled, to or isolated from, one another.

4. From the foregoing, it should be clear that:

- (A) The instrument can be used to generate moderate positive pressures by connecting the test system to the rear port, closing the isolation valve, and turning the control knob clockwise. To vent, open the isolation valve. The maximum positive pressure that can be generated is a function of (1) thread friction, (2) housing bore, (3) piston stroke and/or (4) test system volume.
- (B) Moderate vacuum levels can be generated by connecting the test system to the rear port, closing the isolation valve and turning the control knob counterclockwise. To vent, open the isolation valve. The maximum vacuum that can be generated is a function of (1) housing bore, (2) piston stroke and/or (3) test system volume.
- (C) The unit can be used as a precise vernier gas pressure control at any pressure (positive or negative) within its housing rating by connecting the test system to the rear port and a pressure source to the front port through a needle valve or regulator. With the isolation valve open, a coarse pressure is set with the needle valve or regulator. If a needle valve is used, the needle valve should then be closed. If a regulator is used, it should be left at the coarse pressure setting. Close the isolation valve and rotate the control clockwise to increase the test system pressure, or counterclockwise to decrease the test system pressure to the desired level. Pressure changes on either side of the piston without opening the isolation valve in excess of 100 PSID should not be made or damage can result.
- (D) The P-V Control can be used to generate moderate differential pressures at elevated line pressures by connecting one side of the differential test system to the front port and the other side to the rear port. A pressure source should be connected to the front port through a good regulator. With the isolation valve open, adjust the regulator to the line pressure desired and permit the regulator to "lock up." The regulator can be assumed to be "locked up" when the isolation valve can be closed and no differential pressure appears (without turning the control knob) for a period of 15 seconds. Close the isolation valve. Differential pressures of **either positive or negative level can now be generated by operation of the control knob**. The isolation valve should be opened before changing the regulator setting or the opening of any vent valve on either side of the system.

5. 3D Instruments P-V Controls provide these pressure control capabilities with infinite resolution and extreme control sensitivity. For these reasons, they have found their greatest use with air dead weight testers, manometers and secondary standard gauges in calibration activities.

INSTRUCTIONS FOR THE USE OF PRESSURE-VOLUME CONTROLLERS AS VERNIER PRESSURE CONTROLS

Pneumatic regulators and "feed" and "bleed" needle valves form the classical means for controlling pressure levels in static volumes. The coarseness of these techniques severely limits control sensitivity and, most often, results in overshooting the desired set point. While some systems are not sensitive to these inadequacies, precision calibration of pressure - sensitive instruments is made very difficult by such faulty controls.

The unique design of the 3D Instruments, pressure-volume controller utilizes Boyle's Law to provide static pressure control with heretofore unobtainable sensitivity, ultra-fine resolution and complete freedom from overshoot. At moderate vacuum and pressure levels, the P-V Controller can serve as the pressure source, independent of external supply and control. At pressure levels above and below the unit's generation capabilities, it serves as a "vernier" pressure control in conjunction with an external supply and "coarse" level controls. In this use, the P-V controller provides control sensitivity beyond the resolution of most existing pressure instruments.

PLUMBING

Figures 1 through 3 illustrate typical plumbing schematics for several "vernier" control applications. These diagrams are shown as "gauge" pressure systems; however, they are equally appropriate to "absolute use when exhaust outlets are plumbed to a vacuum source. Such control systems provide ideal accessories for such calibrating standards as manometers, barometers, air dead weight testers, precision pressure gauges and other air-operated primary and secondary standards.

OPERATING INSTRUCTIONS

Operation of these systems is as follows:

To increase pressure,

- Open the isolation valve of the P-V Control.
- Operate the coarse increase control to raise the pressure until near the desired level.
- Close the P-V Control's isolation valve.
- Rotate the control knob of the P-V Control clockwise to obtain the desired pressure.

To decrease pressure:

- Open the isolation valve of the P-V Control.
- Operate the coarse decrease control to lower the pressure until near the desired level.
- Close the P-V Control's isolation valve.
- Rotate the control knob of the P-V control counterclockwise to obtain the desired pressure.

