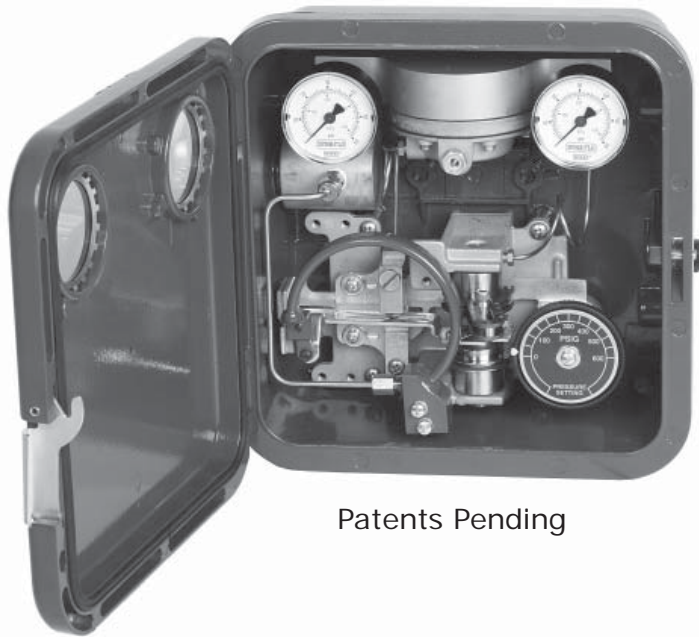


Model 4000LB Pressure Controllers

Technical Sales Bulletin



Patents Pending

Figure 1 Model 4000LB Pressure Controller
Direct Acting Configuration

The Dyna-Flo 4000 LB controller is specially designed to reduce supply air/gas consumption. Significant reductions in the steady state bleed rates reduce emissions on fuel gas supply applications as well as instrument air consumption on plant applications. The result is a lower operating cost and less environmental impact.

Pressure controllers are the “brains” of a self contained, local pneumatic control loop. The pressure controller (Figure 1) detects the process pressure using a Bourdon tube sensing element. The process pressure is then compared to an operator-adjusted set point, which in turn modulates the controller output. The controller’s pneumatic output is connected to a final control device, typically a control valve, that changes the process pressure.

The Dyna-Flo 4000LB Series pneumatic pressure controllers are manufactured to a high level of quality specifications to ensure superior performance and customer satisfaction.

FEATURES

Reduced Gas/Air Consumption

Steady state consumption can be reduced by 90% over standard controller designs.

Multiple Configurations

The 4000LB series pressure controller can be configured into either proportional only or proportional plus reset mode.

Rugged Design

Die cast aluminum case and cover can withstand impacts that would fracture plastic cases.

Corrosion Resistant Construction

The standard powder coated enclosure, stainless steel external fasteners, and standard stainless tubing ensure long and reliable operation.

Easily Field Reversible

Changing the action is accomplished in minutes without special tools or extensive disassembly.

Instrument Gas Tight Case

A standard feature for controlled venting when using natural gas as power gas.

Wide Range of Pressure Elements

Bourdon tube ranges from a minimum of 30 Psig (207 kPag) to a maximum 5,000 Psig (34,474 kPag). Contact factory for ranges below 30 Psi.

Bourdon Tube Materials

Bourdon tube materials are S31600 for standard application and N05500 for special applications.

Sour Instrument Gas Capability

Stainless steel gauges, relay, tubing and bellows are available for sour instrument gas supply.

Zero Bleed Relay

Soft seated relay guarantees zero leakage during steady state operation even when seats are slightly worn or dirty. Consistent low bleed rates can be assured over long term use.



Model 4000LB Pressure Controllers

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SPECIFICATIONS

Models

- Model 4000LB - Proportional Only Controller
- Model 4010LB - Proportional-Plus-Reset Controller
- Model 4020LB - Bellows Sensing
- Model 4030LB - Differential Gap Controller

Performance

- Repeatability: 0.5% of sensing element range
- Deadband: 0.1% of output span
- Differential Gap: 15-100% of sensing element range

Reset Adjustment

For Proportional-plus-reset controller:
Adjust from 0.01 to 74 minutes per repeat (100 to 0.01 repeats per minute).

Approximate Weight

12 pounds (5.5 kg)

Ambient Operating Temperature Limits

-40° to 160° F (-40° to 71° C)

Input Signal

Limits: See Table 1

Output Signal Range

- 3-15 Psig (21 to 103 kPag)
- 6-30 Psig (41 to 207 kPag)

Pressure Connections

All pressure connections on 4000LB Series controllers are 1/4-inch NPT female. Use 1/4-inch (6mm) or 3/8-inch (10mm) pipe or tubing for supply, and output. Vent lines should increase 1 pipe size every 10 feet, or, be kept as short as possible.

Steady-State Air Consumption

See Table 2.

Supply Pressure Requirements

See Table 2.

Controller Action

Control action is field reversible between direct acting (increasing sensed pressure produces increasing output signal), and reverse acting (increasing sensed pressure produces decreasing output signal) without additional parts.

Dimensions

See Figure 9.

Mounting Information

Mounting Kits are available for actuator yoke, actuator casing, panel mount, wall mount and 2" pipe stand mounting. See Figure 9 and 10.

For more information and other options contact your Dyna-Flo sales office.

Table 1

Bourdon Tube Pressure and Materials

Pressure Ranges		Maximum Allowable Static Pressure Limit		Materials
Psig	kPag	Psig	kPag	
0 - 30	0 - 207	30	207	S31600
0 - 60	0 - 414	60	414	S31600
0 - 100	0 - 689	100	689	S31600
0 - 200	0 - 1,379	200	1,379	S31600
0 - 300	0 - 2,068	300	2,068	S31600
0 - 600	0 - 4,137	600	4,137	S31600*
0 - 1,000	0 - 6,895	1,000	6,895	S31600*
0 - 1,500	0 - 10,342	1,500	10,342	S31600*
0 - 3,000	0 - 20,684	3,000	20,684	S31600
0 - 5,000	0 - 34,474	5,000	34,474	S31600

* - Available in N05500 (other materials and ranges special order).

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Table 2

Model 4000LB Supply Pressure Requirements

Output Signal Range Psig (kPag)	Normal Operating Supply Pressure ⁽¹⁾ Psig (kPag)	Maximum Allowable Supply Pressure (to prevent internal part damage) Psig (kPag)	Output Signal Psig (kPag)	Steady-State Air Consumption SCFH*
Throttling: 3 - 15 (21 - 103) On/Off: 0 - 20 (0 - 138)	20 (138)	40 (276)	0 (0)	1.6
			5 (34)	1.5
			10 (69)	1.4
			20 (138)	0.3
Throttling: 6 - 30 (41 - 207) On/Off: 0 - 35 (0 - 241)	35 (241)	40 (276)	0 (0)	2.6
			5 (34)	2.6
			10 (69)	2.6
			20 (138)	2.6
			30 (207)	2.5
			35 (241)	0.3

* **SCFH:** Standard Cubic Feet per Hour (ft³/hr. 60°F and 14.7 Psig). Air flow rate indicated, for natural gas flow rate multiply by 1.29.

1. Control may be degraded if this pressure is exceeded.

OPERATING PRINCIPLES

The Model 4000LB Series pressure controller operation is based on the pressure-balanced relay with its bridged double diaphragm assembly. In the relay, the supply pressure bleeds through the fixed orifice before passing through the nozzle, to register on the large relay diaphragm, and controller output pressure on the small relay diaphragm.

With steady state process pressure, the Bourdon tube is held steady in relation to the nozzle, allowing pressure to be released between the nozzle and beam-flapper assembly at the same rate released through the fixed orifice.

A process pressure change either expands or contracts the arc of the Bourdon tube, thereby moving the beam-flapper assembly with respect to the nozzle.

An increasing process pressure with direct action produces a nozzle to flapper restriction that increases the pressure on the large relay diaphragm, causing the relay valve to close at the exhaust end and to open at the supply end. The additional supply pressure passes through the relay housing to increase the output signal (loading pressure to the final control device).

In the opposite case of a falling process pressure with direct action creates a larger nozzle flapper gap that releases pressure from the large relay diaphragm, causing the relay valve inlet to close, thereby opening the exhaust, and reducing the output signal (loading pressure to the control device).

Proportional-Only Controllers - Model 4000LB

As the controller output changes the feed back to the proportional bellows causes the flapper position to change which counters the movement of the bourdon tube. This essentially allows the user to adjust the sensitivity of the controller by changing the resistance of the Cantilever Assembly. The resistance of the Cantilever Assembly is adjusted using the Fulcrum Set Screw. With the Fulcrum Set Screw on the lowest setting, closest to the bellows, the sensitivity of the controller is optimum. Smaller process pressure changes will create an output change at this setting. As the Fulcrum Set Screw is adjusted to a higher setting, further from the bellows, the sensitivity of the controller is decreased and larger process pressure changes will be required to create an output change. The Cantilever Assembly effectively is an adjustable proportional band of 0-100 percent.

See Figures 2 and 8 for Proportional-only controller adjustment locations.

Proportional-Plus-Reset Controllers - Model 4010LB

The 4010LB Series controllers have a two-way reset restriction valve that controls (delays) the speed of the proportional pressure flow into the reset bellows (which oppose the proportional bellows action). The reset valve can be adjusted to vary the delay (reset) time.

See Figure 3 for Proportional-plus-reset controller adjustment locations.



Model 4000LB Pressure Controllers

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OPERATING PRINCIPLES (Continued)

Differential-Gap Controller - Model 4030LB

On/off action is obtained by connecting the proportional bellows so that feedback pressure forces the beam and flapper in the same direction as caused by the sensed pressure.

A decreasing process pressure with direct action (reverse action - increasing pressure) produces a nozzle to flapper restriction that reduces pressure on the large relay diaphragm. The relay valve inlet will then close and the exhaust port will open, therefore removing the output signal from the final control device.

The summing of feedback bellows movement, and the beam-flapper assembly movement, drives the relay valve either to available supply pressure or to complete exhaust, with no throttling action.

PRESSURE DEFINITIONS

Deadband

The amount which the measured input can change without causing a change in output signal.

Repeatability

The ability of an instrument to reproduce an output signal when a set input signal is applied repeatedly.

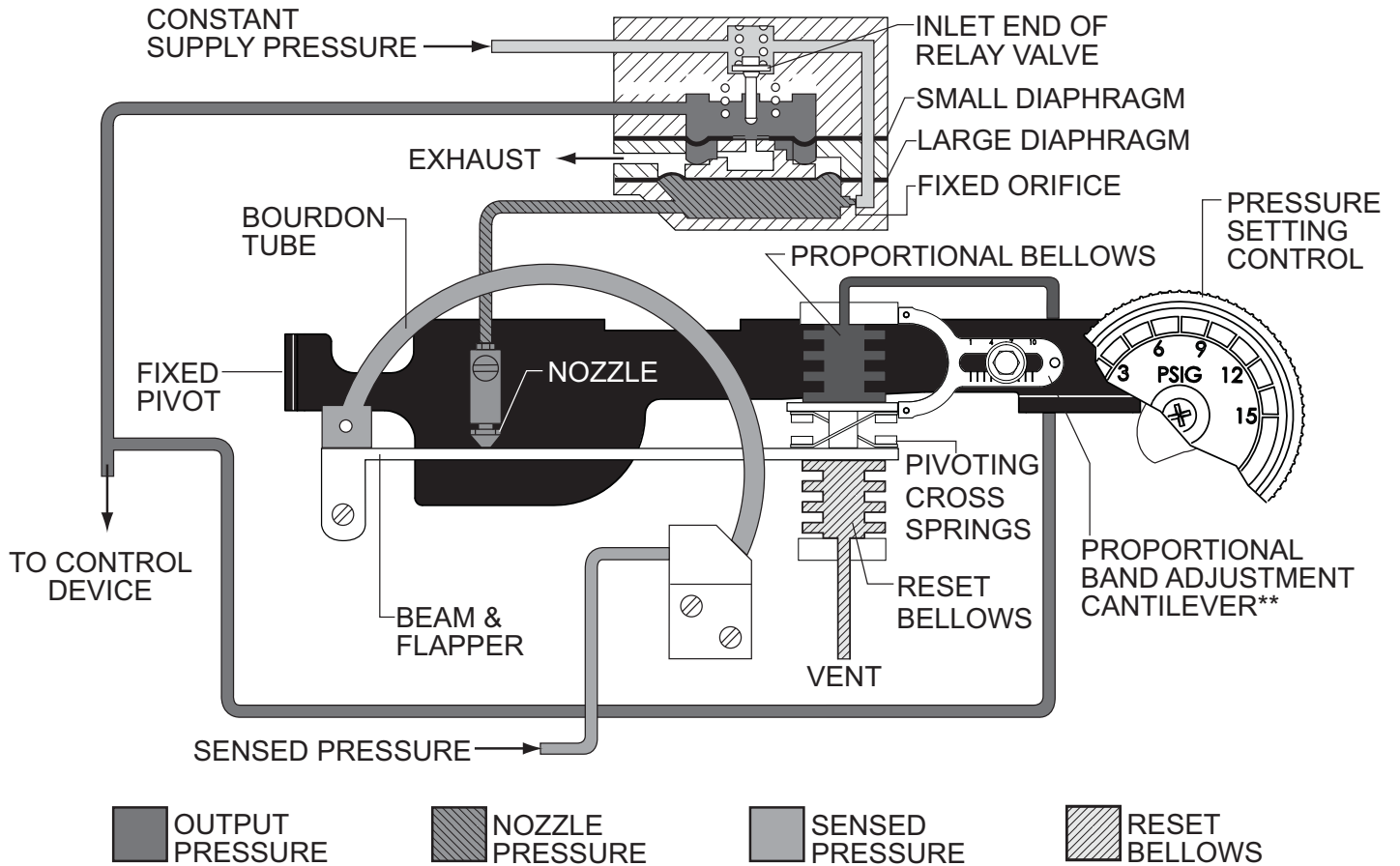
Differential Gap

A form of on/off control where the difference between the switch points is adjustable.

Table 3		
Model 4000LB Construction Materials		
Contact	Part	Standard Material
With Process	Bourdon tube	Stainless steel
	Pressure block	Forged steel
	Control tubing	Stainless steel
With Operating Medium (at pressure)	All other interior tubing	Stainless steel
	Nozzle and reversing block	Stainless steel/Aluminum
	Relay springs and spring plate	Steel
	Relay diaphragms	Neoprene / Nylon
	Other metal relay parts	Zinc / Aluminum / Stainless steel
	Proportional, reset bellows	Stainless steel
	O-rings	Nitrile
	Gaskets	Neoprene
Reset valve assembly	Aluminum/Stainless steel	
With Operating Medium (at atmospheric pressure)	Case and adjustment dial	Powder Coated Aluminum
	Cover	Powder Coated Aluminum
	Flapper	Stainless steel
	Control link	Stainless steel
	Flexure and pressure setting adjustment assemblies	Aluminum / Steel/Stainless steel / Plastic
	O-rings	Nitrile
	Calibration adjuster	Aluminum
	Proportional Band Adjustment Cantilever	S17400 PH

Model 4000LB Pressure Controllers

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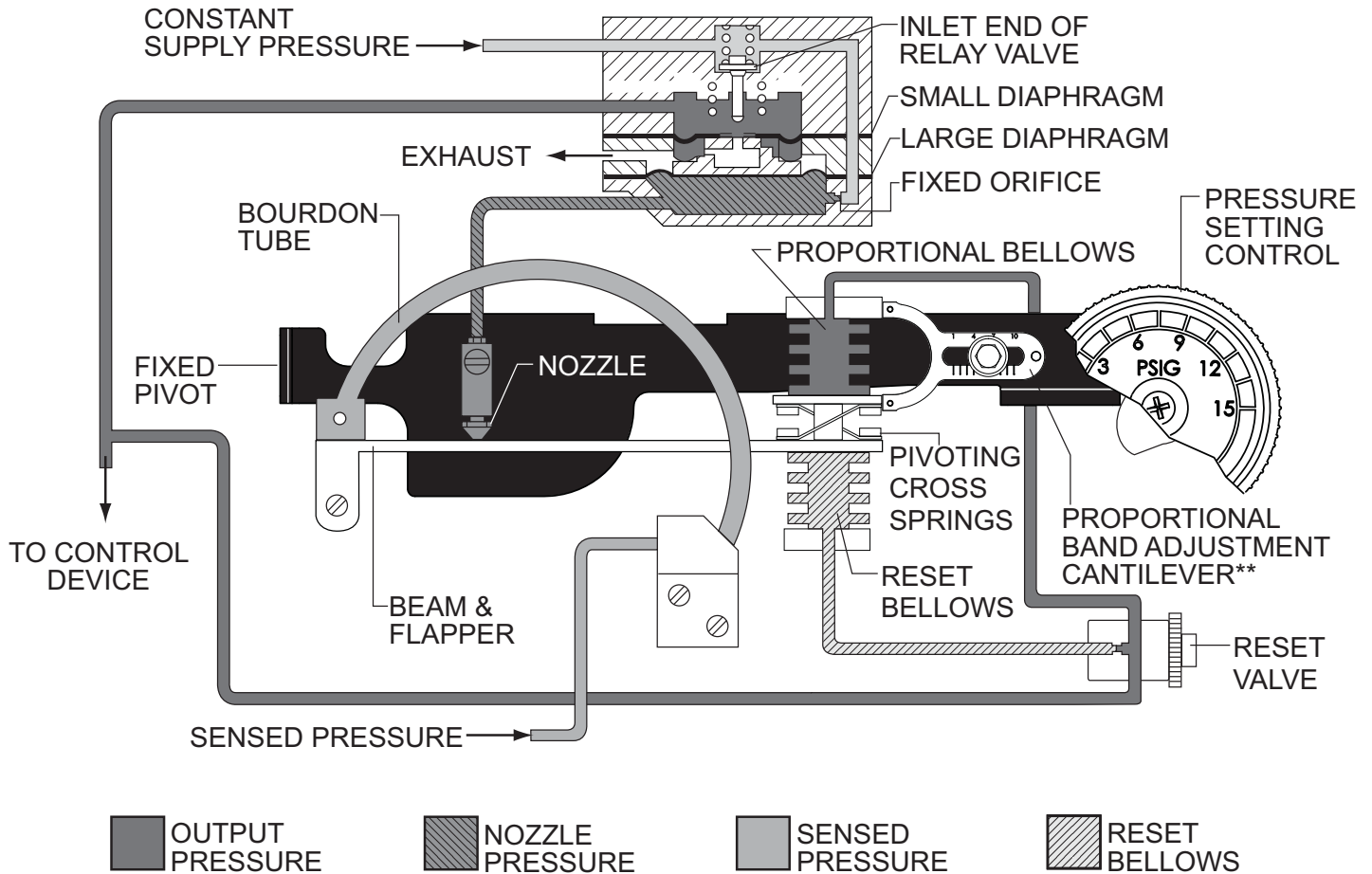


** NOTE: PROPORTIONAL BAND ADJUSTMENT CANTILEVER IS DISPLAYED FROM A TOP VIEW FOR PURPOSES OF SCHEMATIC. SEE FIGURES 4 & 6 FOR TRUE ORIENTATION.

Figure 2 Operational Schematic for Direct Acting Proportional-Only 4000LB Controller

Model 4000LB Pressure Controllers

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**** NOTE:** PROPORTIONAL BAND ADJUSTMENT CANTILEVER IS DISPLAYED FROM A TOP VIEW FOR PURPOSES OF SCHEMATIC. SEE FIGURES 5 & 7 FOR TRUE ORIENTATION.

Figure 3 Operational Schematic for Direct Acting Proportional-Plus-Reset 4000LB Controller

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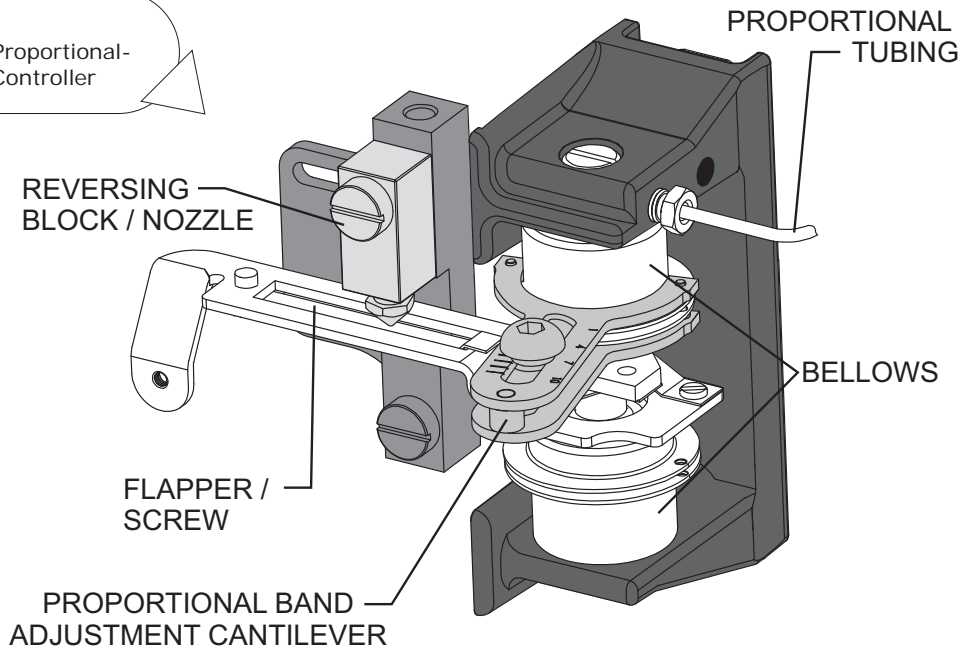
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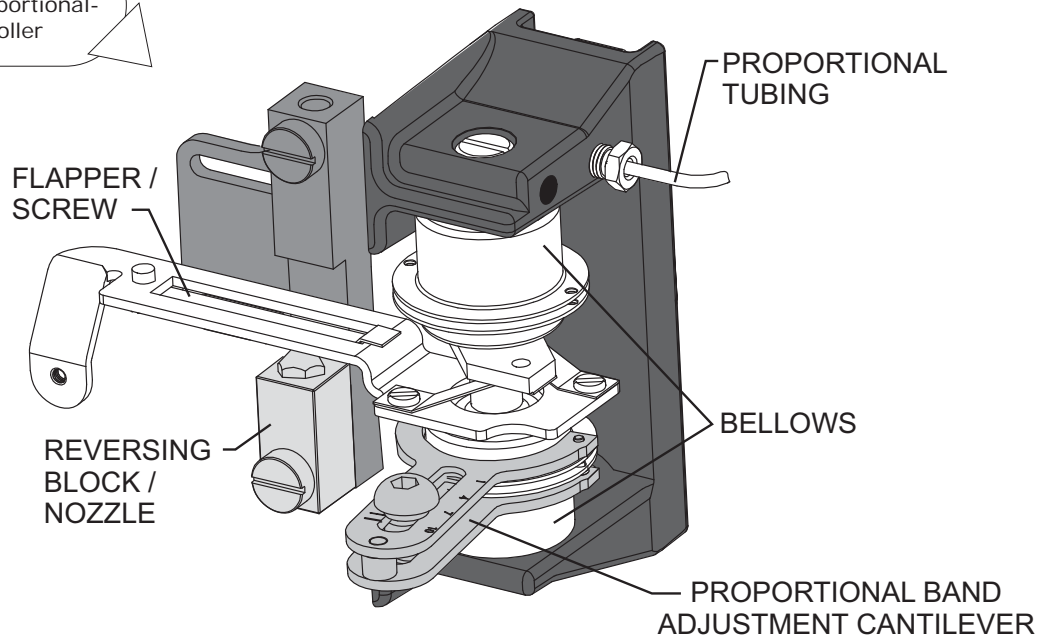


Figure 4
Direct Acting Proportional-
Only 4000LB Controller



DIRECT ACTING

Figure 5
Reverse Acting Proportional-
Only 4000LB Controller



REVERSE ACTING

Model 4000LB Pressure Controllers

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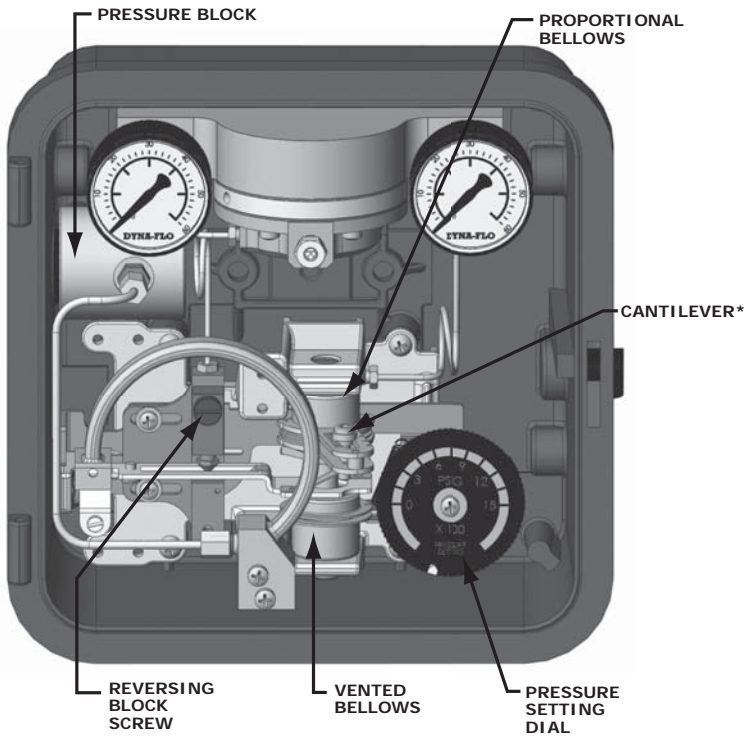
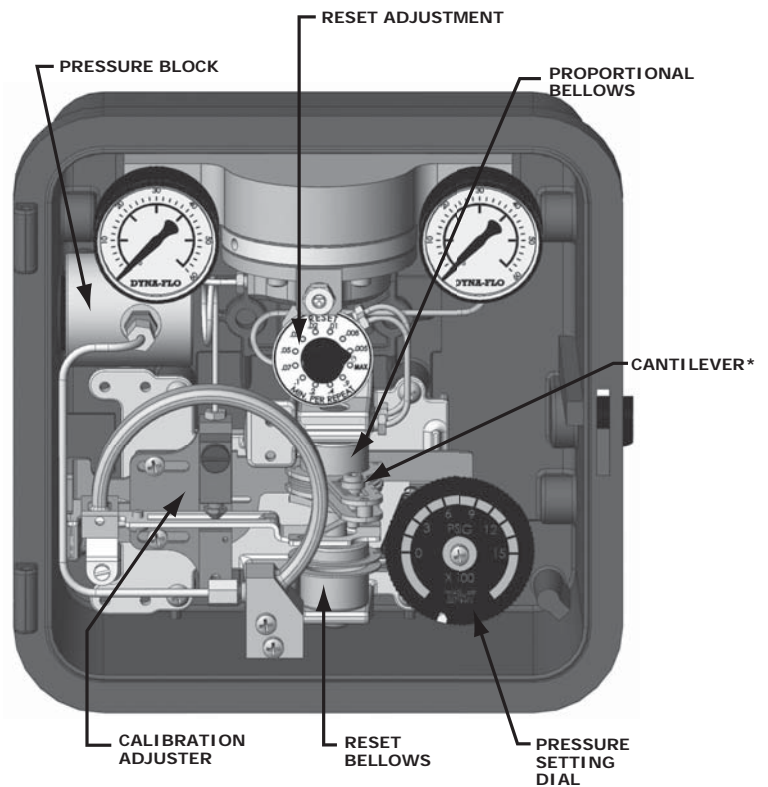


Figure 6
Direct Acting Proportional-
Only 4000LB Controller

Figure 7 Direct Acting
Proportional-Plus-Reset
4000LB Controller



*PROPORTIONAL BAND ADJUSTMENT CANTILEVER

Model 4000LB Pressure Controllers

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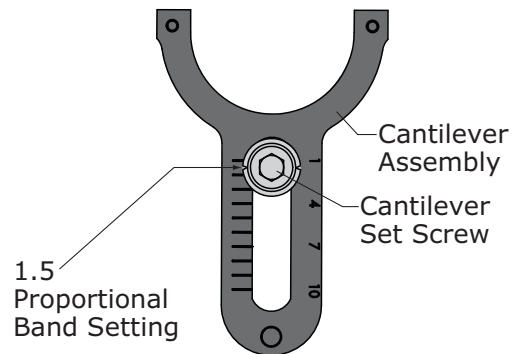


Figure 8 Proportional Band Design Setting Comparison

Model 4000 Proportional Band Adjustment Knob Set at 1.5



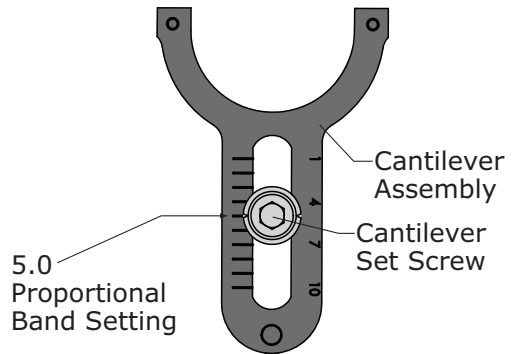
Model 4000LB Proportional Band Adjustment Cantilever Set Screw Set at 1.5



Model 4000 Proportional Band Adjustment Knob Set at 5



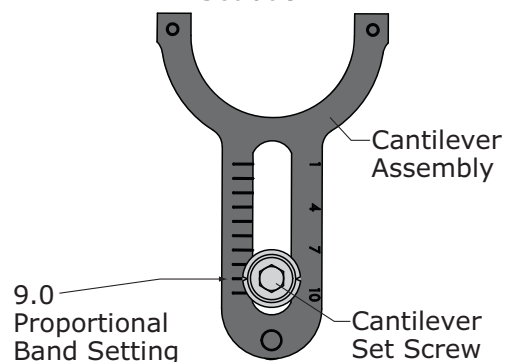
Model 4000LB Proportional Band Adjustment Cantilever Set Screw Set at 5



Model 4000 Proportional Band Adjustment Knob Set at 9



Model 4000LB Proportional Band Adjustment Cantilever Set Screw Set at 9

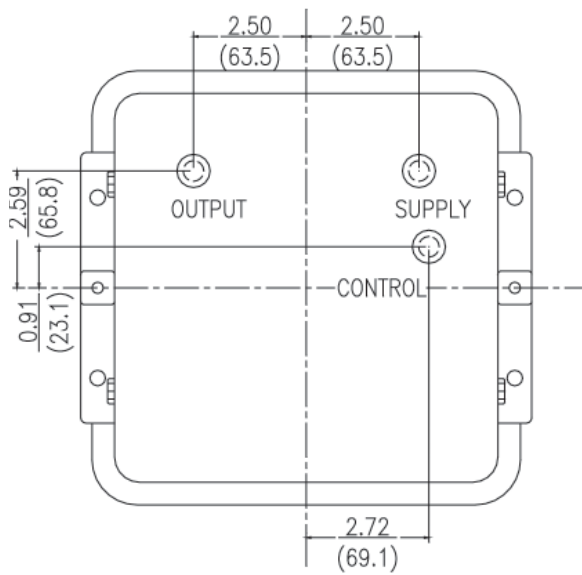


Model 4000LB Pressure Controllers

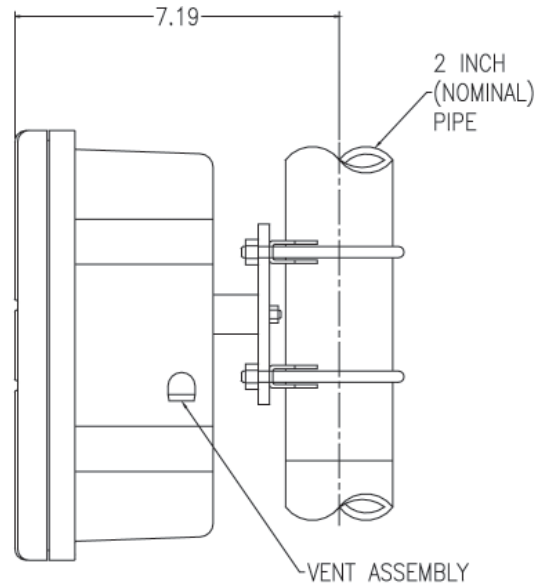
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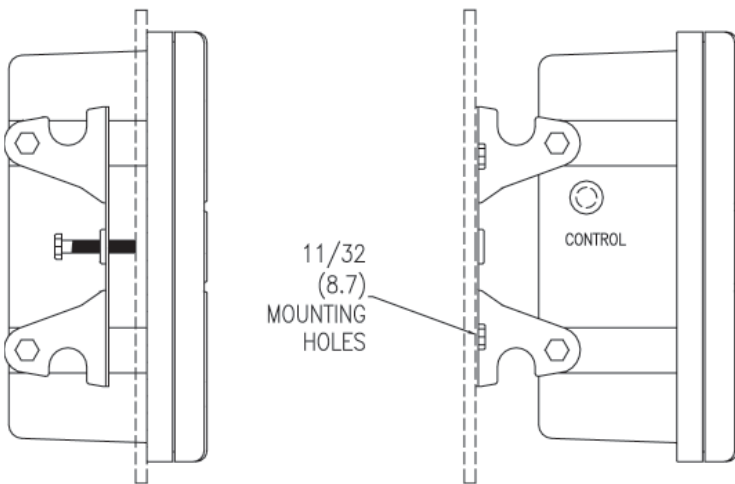
Figure 9 Dimensions, and Panel, Wall, and Pipestand Mounting



Pipestand Mounting

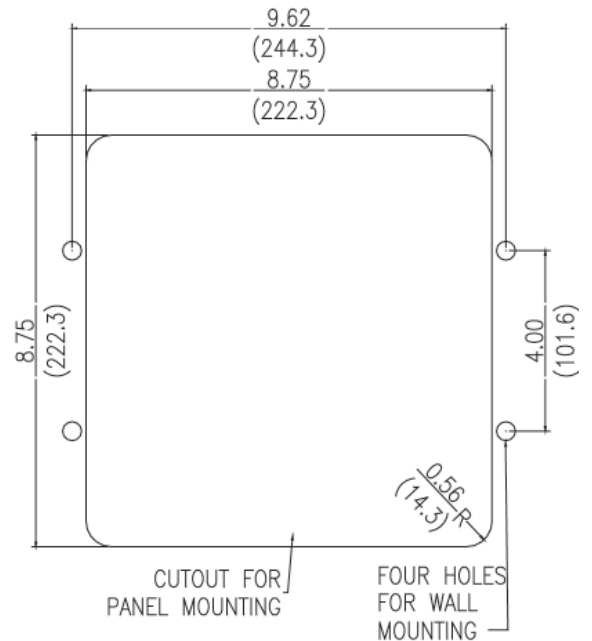


Back View



Panel Mounting

Wall Mounting



INCH
(mm)

Model 4000LB Pressure Controllers

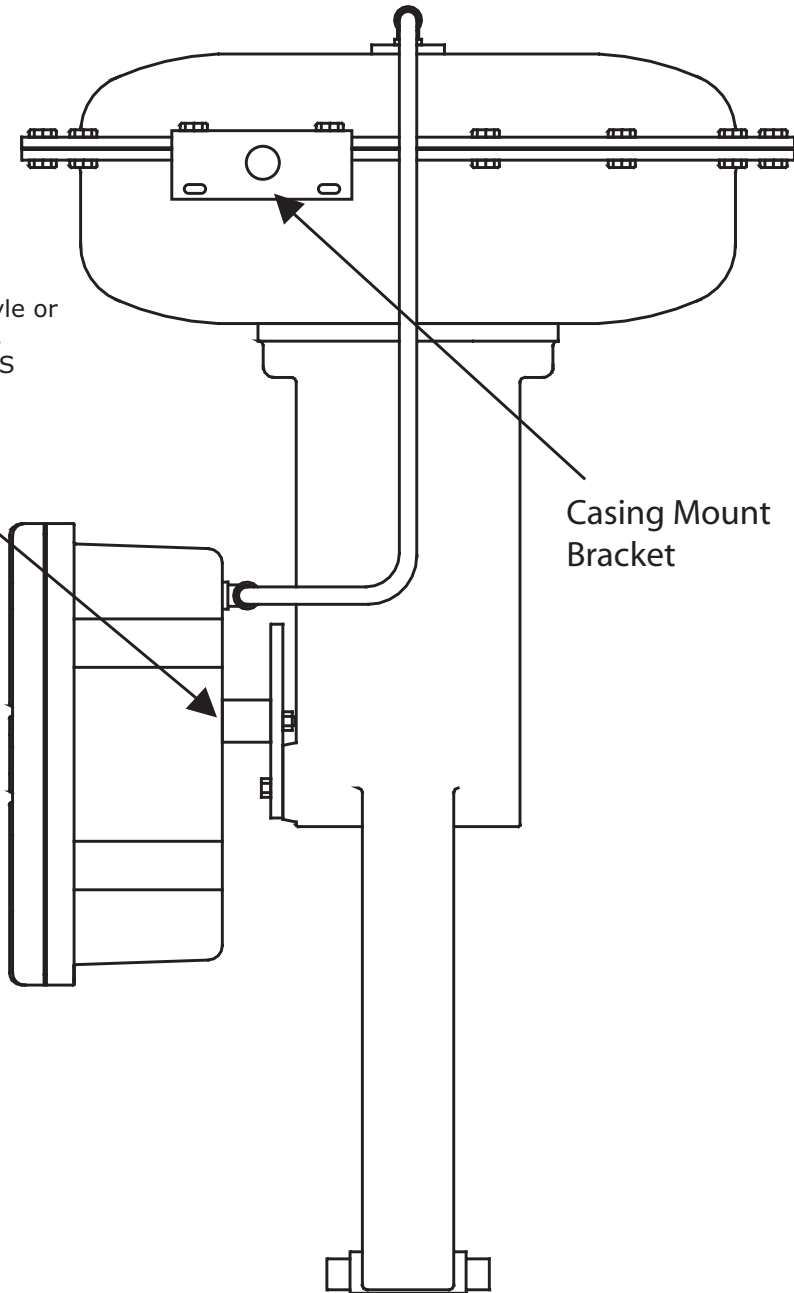
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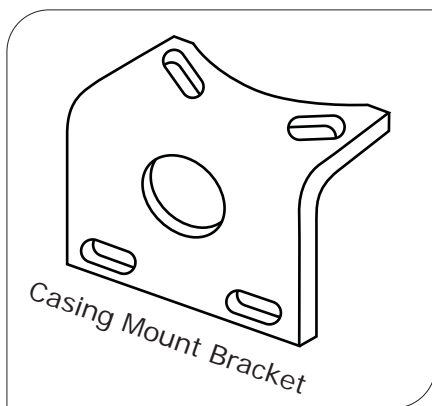
Figure 10
Actuator Mounting

NOTE

When using yoke style or pipestand mounting, DON'T PUNCH HOLES in back of case. Use drill (5/16 bit).



Casing Mount Bracket



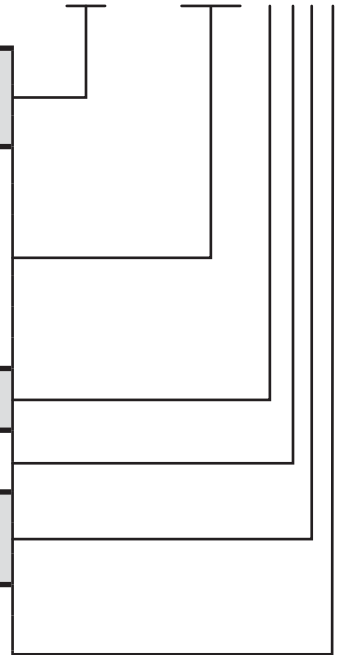


Model 4000LB Pressure Controllers

MODEL NUMBERING SYSTEM

SAMPLE PART NUMBER: 4000LB-010-D-10

CONTROLLER MODE				00
00	PROPORTIONAL	10	PROPORTIONAL + RESET	
20	BELLOWS SENSING	30	DIFFERENTIAL GAP	
INPUT SIGNAL RANGE				
003	0 to 30 PSIG (0 TO 207 KPAG)	006	0 to 60 PSIG (0 TO 414 KPAG)	010
010	0 to 100 PSIG (0 TO 689 KPAG)	020	0 to 200 PSIG (0 TO 1,379 KPAG)	
030	0 to 300 PSIG (0 TO 2,068 KPAG)	060	0 to 600 PSIG (0 TO 4,137 KPAG)	
100	0 to 1,000 PSIG (0 TO 6,895 KPAG)	150	0 to 1,500 PSIG (0 TO 10,342 KPAG)	
300	0 to 3,000 PSIG (0 TO 20,684 KPAG)	500	0 to 5,000 PSIG (0 TO 34,474 KPAG)	
NOTE: CONSULT DYNA-FLO FOR HIGHER INPUT SIGNAL RANGES.				
CONTROLLER ACTION				
D	DIRECT	R	REVERSE	
OPTIONS				-
-	NONE (STANDARD)	S	BOURDON TUBE STOP	
CONTROLLER OUTPUT				1
1	3 TO 15 PSIG (21 TO 103 KPAG) / 0 TO 20 PSIG (0 TO 138 KPAG)			
2	6 TO 30 PSIG (41 TO 207 KPAG) / 0 TO 30 PSIG (0 TO 207 KPAG)			
OPTIONS				0
0	NONE	1	NACE PROCESS ONLY	
2	SOUR INSTRUMENT ONLY	3	NACE PROCESS AND SOUR INSTRUMENT	
X	SPECIAL			
NOTE: ORDER MOUNTING KITS SEPARATELY.				



40 LB - - - - - -