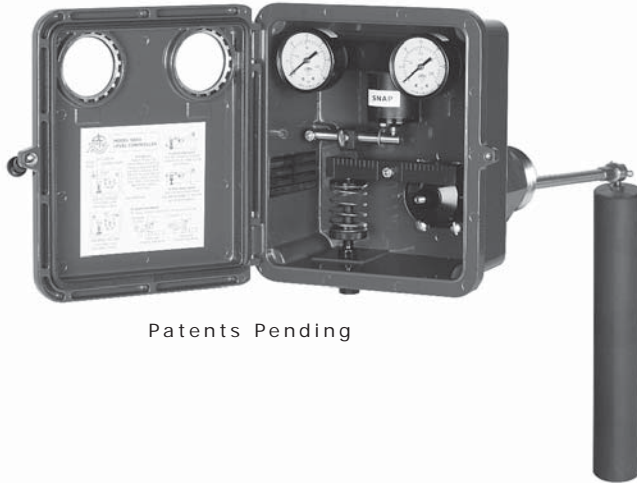




Model 5000 Level Controller



Patents Pending

Figure 1 Model 5000 Level Controller

The Dyna-Flo 5000 series level controllers are implemented for use in many demanding applications, including oil and gas production and chemical process industries. Typical applications would be on gas scrubbers and separators, where liquid level control is required as well as natural gas compressors and process control applications.

The 5000 level controller (Figure 1) utilizes an innovative relay manifold design providing easy maintenance and greater safety. The controller provides a pneumatic signal output for use with a control valve. The design allows for operational consistency through high and low pressure applications. Incorporated into the 5000 controllers design is unique access to the seal around the displacer arm, making maintenance easy.

The Dyna-Flo 5000 series level controllers are manufactured to a superior level of quality and design to ensure impeccable performance and customer satisfaction.

Features

Multiple Configurations

The 5000 level controller is easily configured for either reverse or direct actions for both pneumatic and electric pilot options. The pneumatic pilot is available in snap acting and throttling designs. The displacer can be easily changed from vertical to horizontal without any parts.

Rugged, Durable and Simple

Our Model 5000 has proven that it will outperform in demanding applications. The simple design lends itself to these rugged environments and the familiar adjustability makes tuning seamless. Powder coated case for outstanding resistance to weather and corrosion.

Field Reversible Configuration

The output of the 5000 controller can be field adjusted to be reverse or direct acting without additional parts. Also, this controller features adjustable gain sensitivity.

No Bleed Relay

The 5000 controller does not bleed supply gas during steady state operation, this helps reduce harmful emissions and lowers operating costs.

NACE Service

Standard construction materials comply with the recommendations of (NACE) National Association of Corrosion Engineers MR0175.

ASME Pressure Rating

The vessel connection components are designed and rated for ASME B16.34 Class 1500 service.

Sealed, Vented Case

Standard sealed doors facilitate the use of flammable supply gases allowing these gases to be vented through tubing to a remote area.

Easy Maintenance

This model supports efficient access to all internal components for easy inspection and maintenance. Seals can be replaced without disrupting the vessel connection.

Universal Back Mounting

Versatile back mount design suits all mounting positions.



Model 5000 Level Controller

Specifications

Configurations

Controllers

Throttling
Snap-acting

Sensors

Pivotal movement of displacer arm is transmitted to the controller by a displacer-style liquid level sensor mounted to the side of tank.

Standard Displacer Size

1-7/8" x 12 inches, 33 inches³
(48 x 305 mm, 541 cm³)

Minimum Specific Gravity

Snap-Acting Controller

Minimum specific gravity (specific gravity differential for interface applications) 0.1

Throttling Controller

Minimum specific gravity (specific gravity differential for interface applications) 0.1

End Connection	Maximum Pressure Rating at 38°C (100°F)
MNPT	3750 Psig (41,400 kPag)
150 RF	285 Psig (1965 kPag)
300 RF	740 Psig (5100 kPag)
600 RF	1480 Psig (10,200 kPag)
600 RTJ	1480 Psig (10,200 kPag)
900 RF	2220 Psig (15,200 kPag)
900 RTJ	2220 Psig (15,200 kPag)
1500 RF	3750 Psig (25,900 kPag)
1500 RTJ	3750 Psig (25,900 kPag)

Pilot

Pneumatic (standard)

Snap (on/off) 0-20 / 0-30 psig output
Throttle (modulating) 3-15 / 6-30 psig output

Electric (optional)

SPDT - Explosion Proof
DPDT - Explosion Proof

Supply Pressure Requirements

Snap-Acting Controller

3-15 or 0-20 psig output: 20-30 psig min.
6-30 or 0-30 psig output: 35-40 psig min.

NOTE - Do Not Use Supply Pressure Below 20 psig (140 kPag)

Maximum Sensor Operating Pressure

Conforming with Class 1500 pressure temperature ratings per ASME B16.34 up to maximum pressure of 3750 psig (25850 kPag)

Maximum Displacer Operating Pressure

3750 psig (25800 kPag)

Standard Pressure Gauge Indications (Supply and Output)

Triple scale gauges in 0 to 60 psig / 0 to 0.4 MPa / 0 to 400 kPag

Controller Connections

Output

1/4 inch NPT female located on back of case

Supply

1/4 inch NPT female located on the back of case

Case Vent

1/4 inch NPT located on bottom of case, vent screen apparatus included

Vessel to Sensor Connection

1-1/2", 2", 3", and 4" threaded (NPT) or flanged

Sensor Temperature Limits

PVC Displacer

-29 to 80°C (-20 to 175°F)

HSN (Highly Saturated Nitrile) O-Rings

-40 to 204°C (-40 to 400°F)

Viton O-Rings

-26 to 204°C (-15 to 400°F)

316 SST Displacer

Non-limiting

Operative Ambient Temperature Limits

For Controller: -40 to 204°C (-40 to 400°F)



Model 5000 Level Controller

Specifications - Electric Pilot

Output - proportional band adjustment

SPDT (single pole double throw)

7 - 55%

DPDT (double pole double throw)

20 - 150%

Switch Rating

UL and CSA listed: L96

15 amps, 125, 250, or 480 V.A.C.

1/8 Hp, 125 V.A.C.; 1/4 Hp, 250 V.A.C.

1/2 amp, 125 V.D.C.; 1/4 amp, 250 V.D.C.

Electric Pilot Model Number

SPDT (single pole double throw)

EX-Q

DPDT (double pole double throw)

EXD-Q

Certifications

Approvals: UL, CSA, ATEX (CE), IEC EX

Designations:

Div. 1 & 2, Class I, Groups B, C, & D

Div. 1 & 2, Class II, Groups E, F, & G

II 2 G; EEX d IIB + H2 T6

Temperature Rating

-40 to 71°C (-40 to 160°F)

Electric Pilot Wiring Instructions

Use up to size #14 AWG solid or stranded wires to connect to the pressure-type connector terminals. Use green wires for ground leads, red wires for NC leads, blue wires for NO leads, and black for common leads.

ELECTRIC PILOT GENERAL INFORMATION

The flame paths of Honeywell's EX explosion-proof switches cool exploding gases below the ignition temperature before they reach explosive gases surrounding the housing. The enclosed replaceable basic switch is accessible when the cover is removed. EX series products are NEMA 1 rated and therefore are not recommended for use in areas when they will be subjected to liquid splash.

EX series products are listed by Underwriters' Laboratories and CSA for use in hazardous locations NEMA 7, Class I, Groups C & D, and NEMA 9, Class II, Group E, F, and G. This includes vapors of ethyl ether, gasoline, petroleum, alcohol, acetone, lacquer solvent, natural gas, and atmospheres charged with grain dust, metal dust, carbon black, coal, or coke dust. Select EX listings are also listed for Class I, Group B (hydrogen) atmospheres. CSA requires the following statement for Class I, Group B requirements.

! DANGER !

EMISSION OF HOT PARTICLES - Joint surfaces must be thoroughly cleaned before closing.
Failure to comply with these instructions will result in death or serious injury.



Model 5000 Level Controller

ELECTRIC PILOT GENERAL INFORMATION CONTINUED

All EX series products comply with UL Standard: UL 894 and UL 1203, CSA Standard: C22.2 no. 25-1966, C22.2 no. 30-M1986. EX series products also meet NEMA 1 enclosure requirements.

Select EX Series products also meet the European Hazardous Locations Designation: Exd IIB + H2 T6 category II 2 G, KEMA 04ATEX2312X and complies with the European Directive on Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres (94/9/EC) commonly referred to as the ATEX Directive. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN50014:1997, EN50018:2000 and EN50281-1-1:1998. EX series products have a temperature range of -40°C to 70°C (-40°F to 158°F), and when used within the maximum voltage and current specified on the product will have no heating problems.

NOTICE - INSTALLATION INSTRUCTIONS

Cable Connection

The cable entry device shall be certified in type of protection flameproof enclosure "d", suitable for the conditions of use and correctly installed.

For ambient temperatures above 60°C (140°F), cables and cable glands suitable for a temperature of at least 80°C (176°F) are required.

Conduit Connection

A certified sealing device in type of protection flameproof enclosure "d", such as a conduit seal with setting compound shall be provided immediately to the entrance of the enclosure.

For ambient temperatures over 60°C (140°F), suitable heat resistant wiring and setting compound in conduit seal shall be used. Blanking elements of unused apertures shall be certified in type of protection flameproof enclosure "d", suitable for the conditions of use and correctly installed.

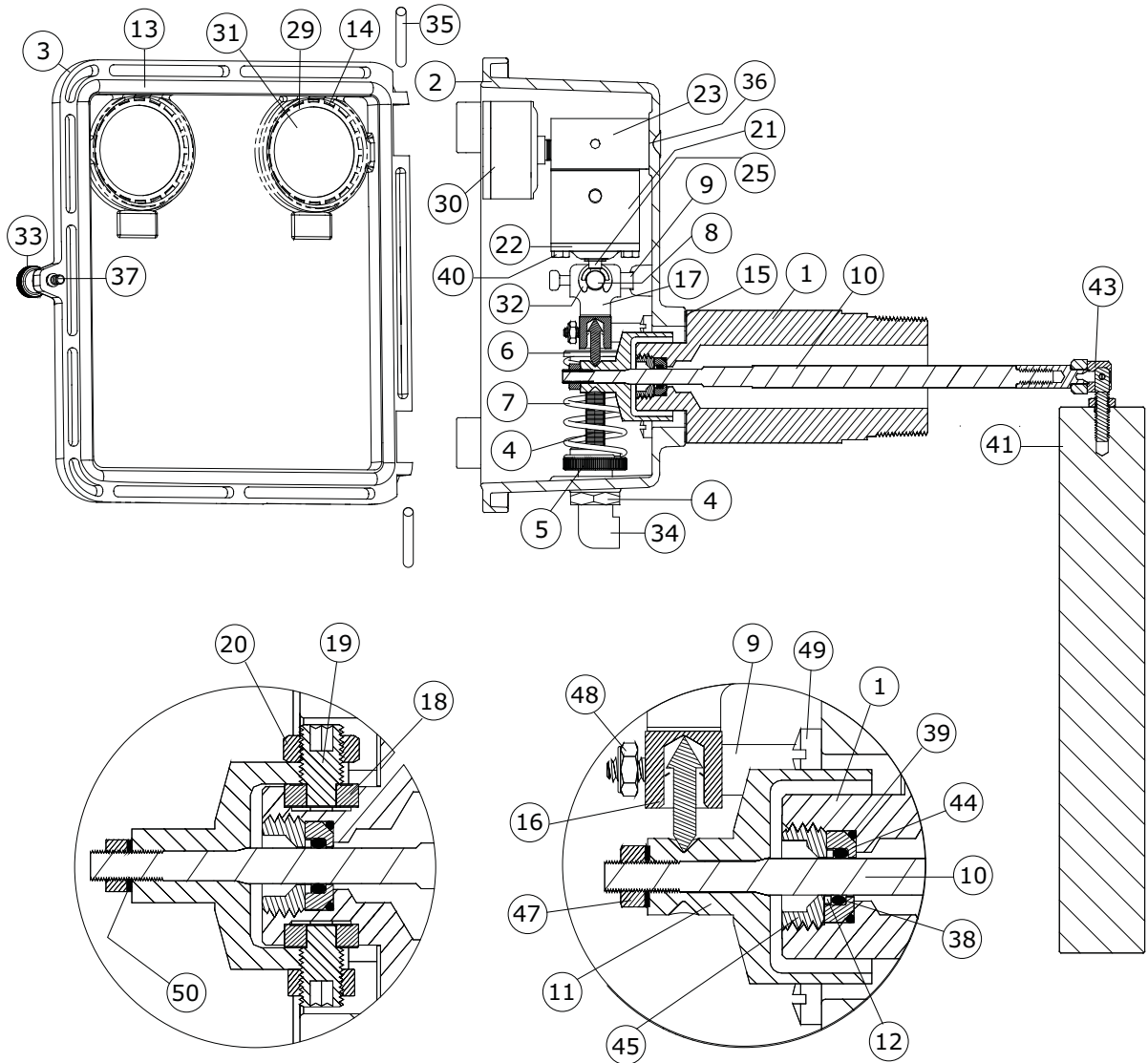
ELECTRIC PILOT SWITCH CIRCUITRY

CODE	MICRO SWITCH CIRCUITRY	ELECTRICAL RATING
"E" EX-Q	<p>Single - Pole Double - Throw</p>	<p>A</p> <p>UL and CSA Listed: 15 amps, 125, 250 or 480 VAC 1/8 hp, 125 VAC; 1/4 hp, 250 VAC; 1/2 amp, 125 VDC; 1/4 amp, 250 VDC</p>
"D" EXD-Q	<p>Green - GROUND BLACK - COM 1 BLACK - COM 2 Double - Pole Double - Throw</p> <p>BLUE - N. O. 1 RED - N. C. 1 BLUE - N. O. 2 RED - N. C. 1</p>	<p>B</p> <p>UL and CSA Listed: 10 amps, 125 or 250 VAC; 0.3 amp, 125 VDC; 0.15 amp, 250 VDC</p>



Model 5000 Level Controller

Figure 2 Model 5000 General Details





Model 5000 Level Controller

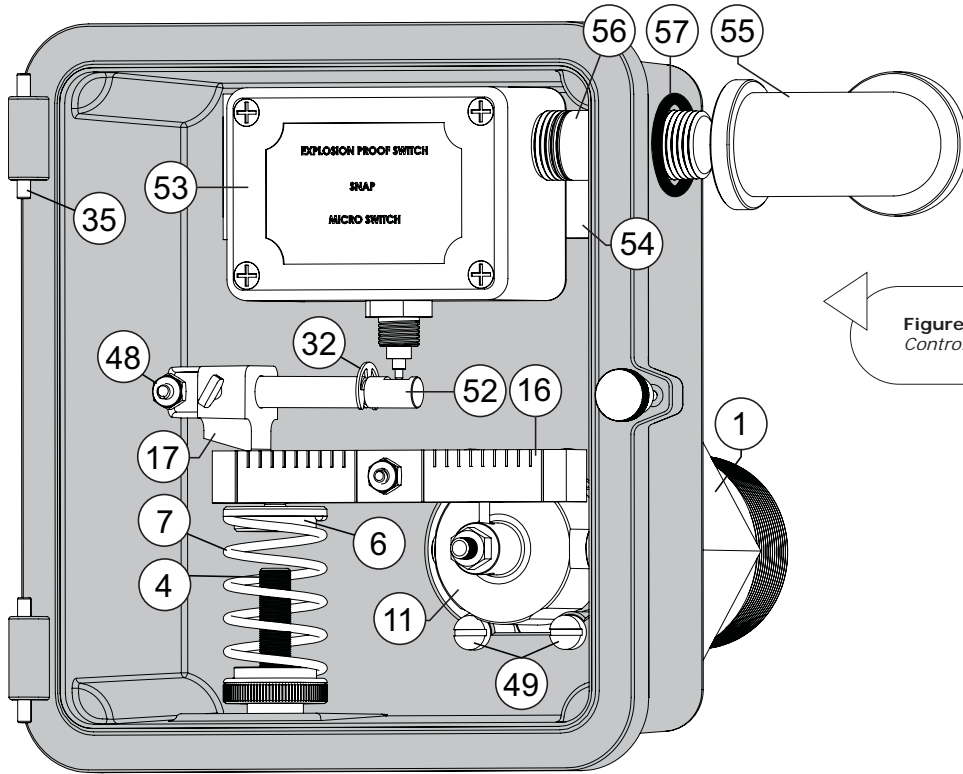


Figure 3 5000E Level Controller (Front View)

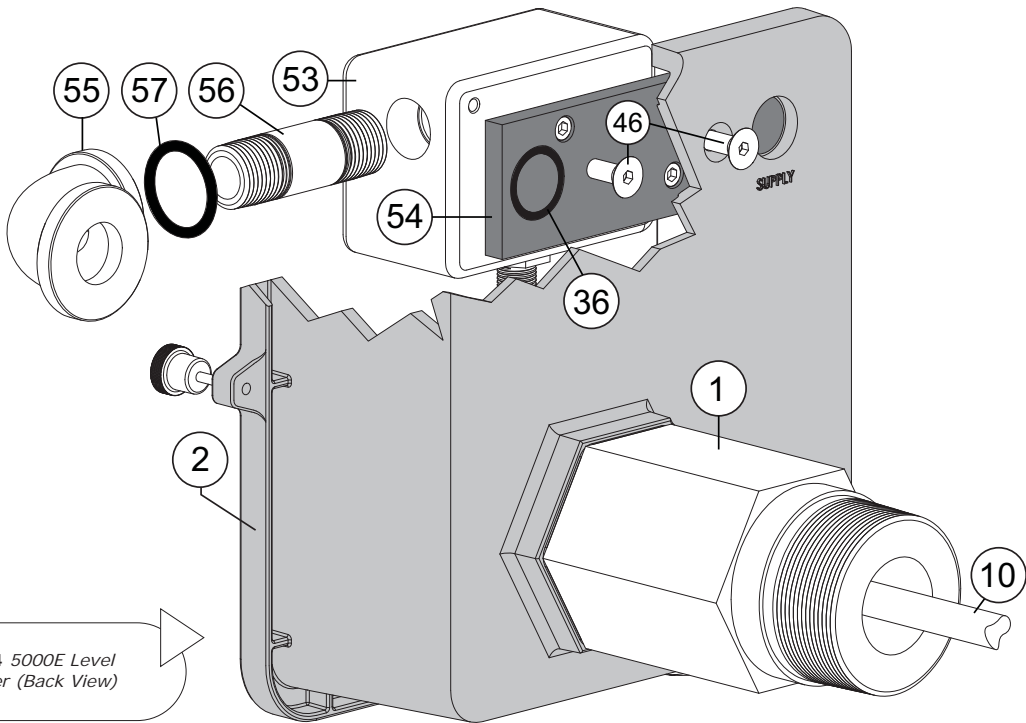


Figure 4 5000E Level Controller (Back View)



Model 5000 Level Controller

Table 1

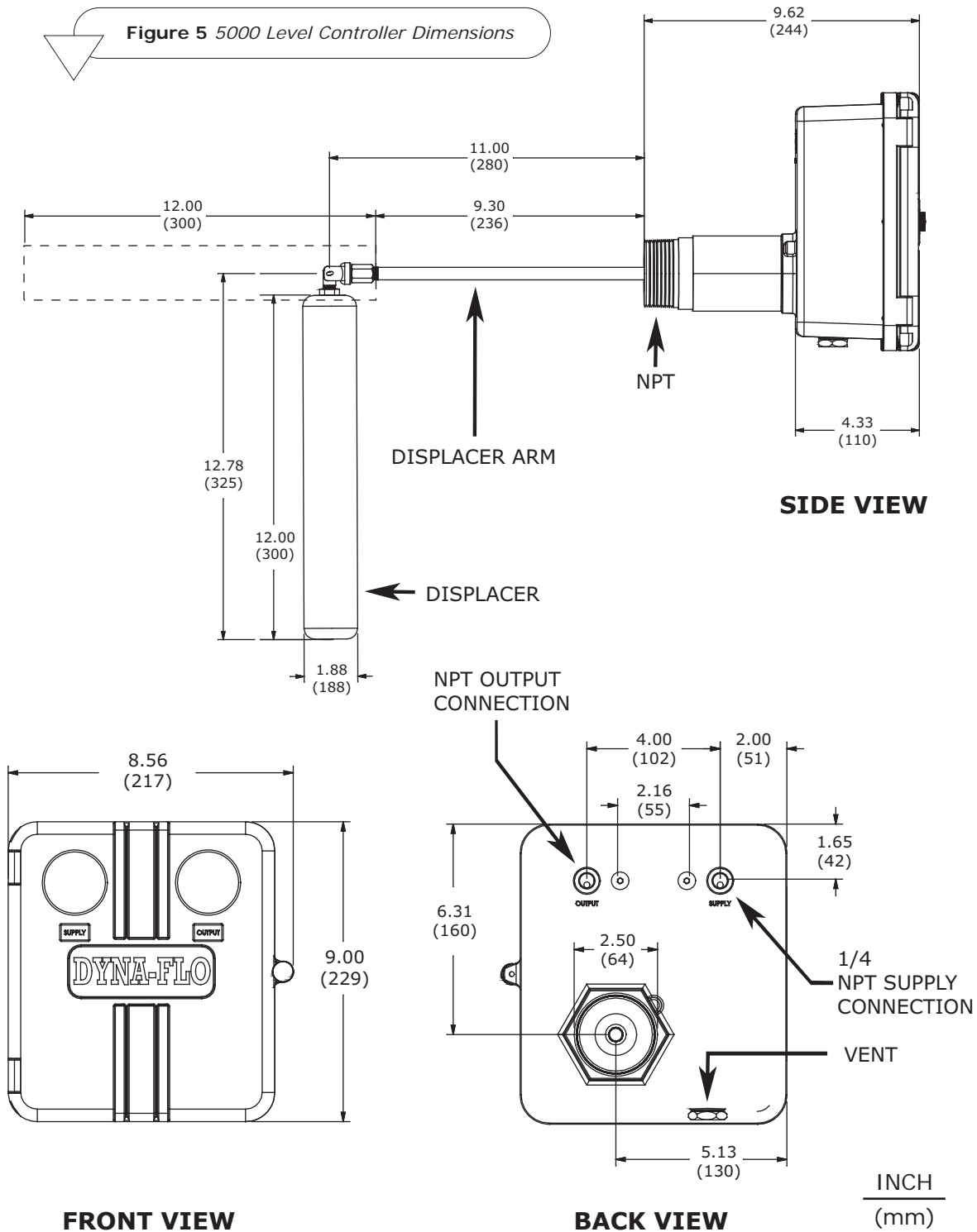
Model 5000 Construction Materials

Key	Description	Standard Materials
1	Body (2" NPT)	A350 LF2
2 / 3	Case / Cover	Aluminum
4	Adjusting Thread	Aluminum
5 / 6	Spring Adjuster / Spring Seat	Aluminum
7	Spring	302 SST (S30200) Wire
8 / 52	Flapper Shaft / Flapper Shaft Electric Pilot	303 SST (S30300)
9	Mounting Pins	303 SST (S30300)
10	Displacer Arm	316 SST (S31600)
11	Trunnion Head	Aluminum
12	Backup Ring	PTFE
13 / 14 / 15	Gaskets (Cover / Gauge Glass / Body)	Neoprene
16	Fulcrum Bar Assembly	303 SST (S30300) / 18-8 SST (S18800) / Aluminum
17	Fulcrum Block Assembly	18-8 SST (S18800) & Nylon
18	Trunnion Bearings	440 SST (S44004)
19	Bearing Screws	303 SST (S30300)
20	Jam Nut (Bearing Screw)	18-8 SST (S30400)
21 / 22 / 23	Pilot Body / Cap / Manifold	Aluminum
24	Pilot Filter	Cellulose
25 / 26	Pilot Thrust Pin / Throttle Thrust Pin	316 SST (S31600)
27	Throttle Pin Assembly	316 SST / Neoprene / Nylon / Teflon
28	Throttle Spring	302 SST (S30200) Wire
29	Glass Retainer	Stainless Steel
30	Gauge	Brass
31	Gauge Glass	Lexan
32	Retaining Ring	Zinc Plated
33	Case Cover Screw	Plastic & Stainless Steel
34	Elbow Vent	Plastic & Metal Screen
35	Spring Pin (Door)	Zinc Plated
36 / 37 / 57	O-Ring (Manifold / Door Screw Retainer / Elbow Fitting)	Nitrile
38 / 39	O-Ring (Displacer Arm / Seal Carrier)	HSN / Viton
40	Socket Cap (Manifold)	Stainless Steel
41	Displacer	PVC / Stainless Steel
42	Ball Bearing	302 SST (S30200)
43	Swivel Assembly	316 SST (S31600) & 18-8 SST (S30400)
44 / 45	Seal Carrier / Retainer	316 SST (S31600)
46	Mounting Screws (Case)	18-8 SST (S30400)
47	Nut (Displacer Arm)	Zinc Plated
48	Nut	18-8 SST (S30400)
49	Machine Screw	18-8 SST (S30400)
50	Lockwasher	Zinc Plated
51	Retainer Removal Tool	4140 HTSR (Zinc Plated)
53	Explosion Proof Switch (Electric Pilot)	Aluminum Case
54	Base Adapter	Aluminum
55 / 56	Elbow Fitting / 1/2" Nipple	Galvanized Steel



Model 5000 Level Controller

Figure 5 5000 Level Controller Dimensions





Model 5000 Level Controller

Operation Principles

The Series 5000 liquid level controller utilizes the "Force Balance System" (Fig. 5). Force is applied to the Fulcrum Bar distributed from the displacer-style level sensor using a series of levers and rods. The application of force to the Fulcrum Bar is a direct result of the weight of the displacement type sensor. Forces acting on the Fulcrum Bar are balanced using a compressed spring on one side of the bar. As fluid levels in the tank increase the buoyant force acting on the displacer decreases its relative weight. Force applied to the Fulcrum Bar is, in turn, decreased resulting in the rotation of the Fulcrum Bar until the forces are balanced again. A fulcrum mounted to the Flapper Shaft relays rotation of the Fulcrum Bar to the Pilot. Desired controller output can be regulated by adjusting the position of the fulcrum on the Fulcrum Bar. By using a Throttling pilot, a pneumatic modulating signal is achieved. A Snap-Acting pilot will result in a pneumatic on/off signal. Electrical SPDT or DPDT output is attained by utilizing an electrical limit switch.

Controller Action

The installation of the Flapper Shaft determines controller action (Fig. 6). When controller output is effected in the same as liquid level, the control is considered "Direct-Acting". When the vessels liquid level increases, the output signal will increase and vice versa. For example, when the Flapper Shaft is positioned on the left hand mount, the result is "Direct-Acting" control. "Reverse-Acting" control is achieved when change in liquid level results in a reverse effect to the pilot. As liquid level increases, controller output will decrease. When the Flapper Shaft is positioned on the right hand mount, the controller is considered "Reverse-Acting".

Proportional Band

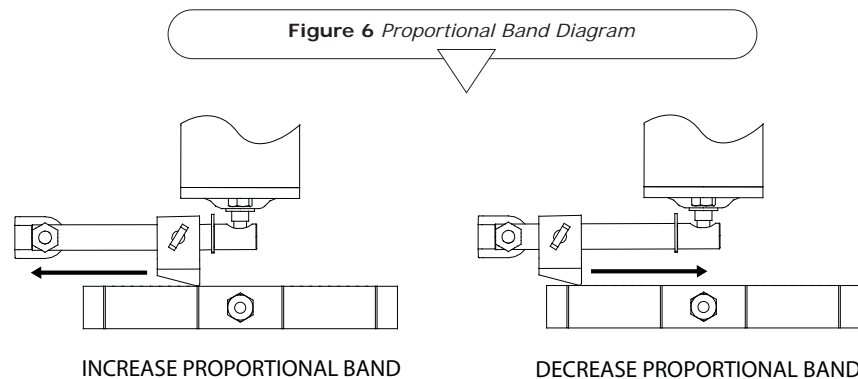
Proportional Band is the ratio of used displacer length versus the total length of the displacer. Proportional Band is used in order to achieve a desired output signal (Fig. 3).

For example if a 12" long vertical displacer is used with six inches of fluid level change in order to develop a required output signal (ex: 3-15 psig), then the controllers Proportional Band is considered to be 50%.

Adjusting the Fulcrum (on the Flapper Shaft) towards the Pivot Pin away from the Snap-Ring will increase Proportional Band (decreasing sensitivity)(Fig. 3). By adjusting the Fulcrum away from the Pivot Pin towards the Snap-Ring will decrease Proportional Band (increasing sensitivity). Adjusting the Fulcrum as described above (over any portion of the displacer) can achieve a desired output signal such as 3-15 psig or 6-30 psig.

Electric Level Switch

The electric level switch uses the force balance principle to open and close an electrical switch in response to rising or falling levels. Two standard switches are available, single pole double throw (SPDT) or double pole double throw (DPDT), both with explosion-proof enclosure.





Model 5000 Level Controller

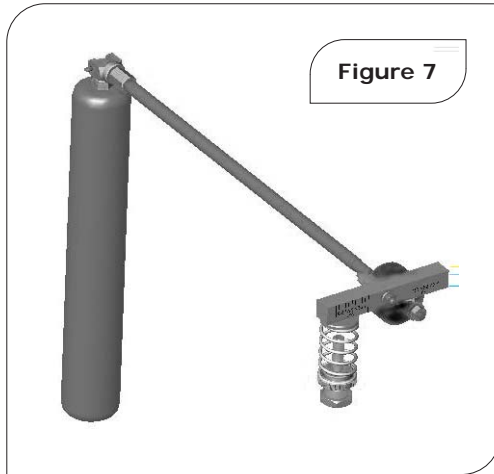


Figure 7

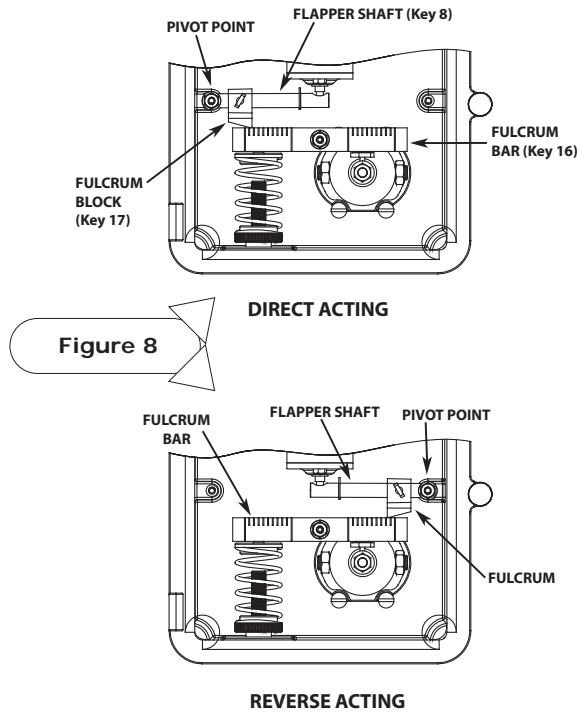


Figure 8

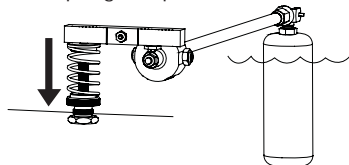
Activation

Adjust the Spring compression by setting the Spring Adjuster to position the Displacer Arm. Test the Fulcrum Bar by hand to check that the Displacer Arm is not resting against the vessel connection.

Figure 9 Level Adjustment Diagram

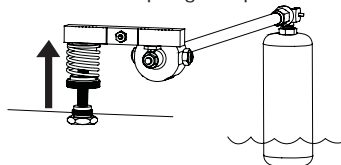
To Increase Level:

Turn the Spring Adjuster clockwise to decrease spring compression.



To Decrease Level:

Turn the Spring Adjuster counter-clockwise to increase spring compression.



Our Commitment of Quality

Dyna-Flo is committed to continuous improvement. All efforts have been taken to maximize the accuracy of this information. Without notification, product specifications and designs may be modified at any time. The issue of this document is for information only, and does not imply suitability, a warranty, or guarantee for a specific service.



Model 5000 Level Controller

Snap Pilot Operation

Two valves compose the Snap pilot (Fig. 9); one valve to exhaust system pressure and one to admit supply pressure. Flow of supply pressure gas into the pilot is controlled by Ball 'A' (Key 39), force exerted by supply pressure holds the pilot closed by forcing Ball 'A' on the pilot seat.

When sufficient force is transferred from the Flapper Shaft (Key 8) to the Thrust Pin 'B' (Key 25), Ball 'A' will snap off the seat, releasing supply gas through the output port. As soon as Ball 'A' snaps open, the seating end of Thrust Pin 'B' seats and simultaneously closes the exhaust port. Because the Thrust Pin has a smaller seating area than Ball 'A', the Thrust Pin can remain seated against the force of supply pressure until force from the Flapper Bar subsides.

The "snap" action occurs as a result of differences in seating area between the Ball and Thrust Pin. Once force from the Flapper Shaft subsides, supply pressure will unseat the Thrust Pin 'B' and simultaneously seat Ball 'A'. As Thrust Pin 'A' is unseated it opens the exhaust port, venting supply gas.

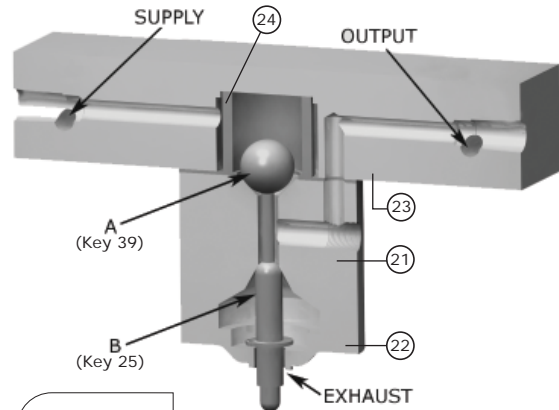


Figure 10

Throttle Pilot Operation

A Throttle pilot (Fig. 10) is similar to the Snap pilot, both consist of two inner valves. The difference between Snap and Throttle being the use of a Resilient Diaphragm 'C'. A Force Balanced pilot is created utilizing the Resilient Diaphragm in conjunction with valves 'A' and 'B'. Force Balance occurs as a result of supply pressure acting on the Resilient Diaphragm equalizing force applied to it and force exerted by the Flapper Shaft.

In a Throttling pilot the force applied by the Flapper Shaft to the lower seat becomes relational to the force of output pressure. Increasing the amount of force applied to the Flapper Shaft will proportionally increase the amount of output pressure.

As force applied to the Thrust Pin changes, the pilot compensates by unseating valve 'A' to increase output pressure or by exhausting supply output at valve 'B', resulting in a new balance point. While the pilot is in balance, supply gas will not flow.

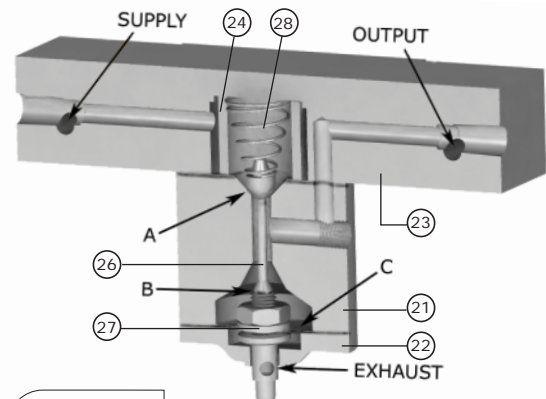


Figure 11

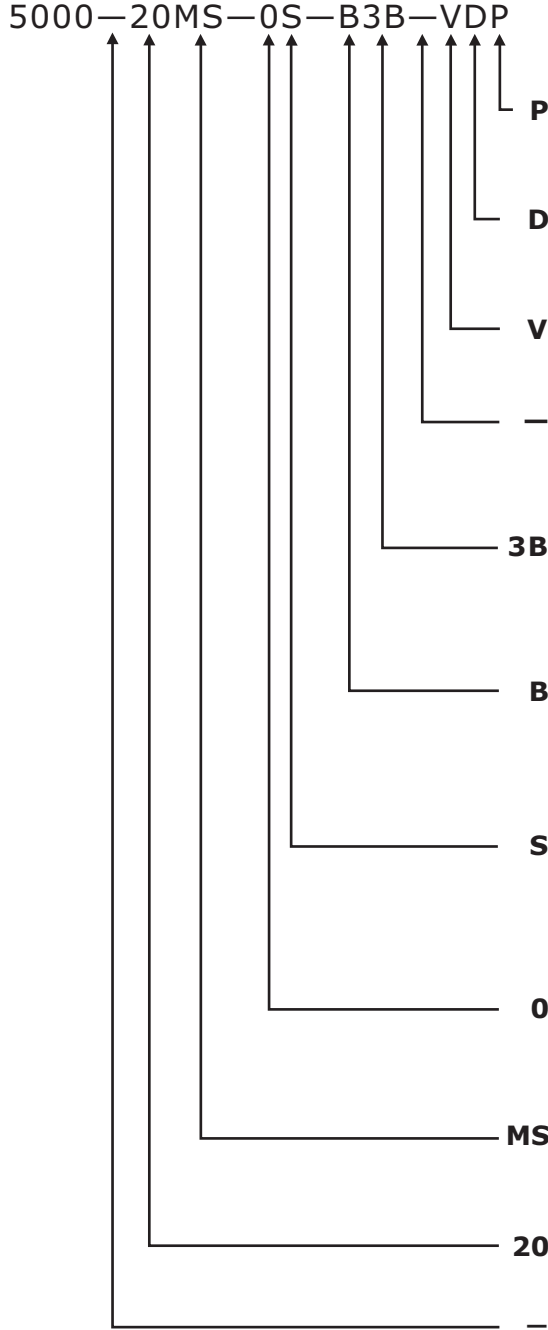


Model 5000 Level Controller

Ordering Guide

Dyna-Flo 5000 Liquid Level Controller | Model Numbering System

Sample Part Number



Code	Description
Displacer Material	
P	PVC
S	Stainless Steel
Displacer Size	
D	Standard (12")
B	6"
E	6" + 12"
X	Special
C	9"
F	4" + 4" + 4" / 2 chain links
Displacer Type	
V	Vertical
H	Horizontal
Displacer Arm	
-	Standard (17")
E	20"
C	11"
D	14"
F	24"
Gauge Type	
3B	0-30 Psi, Brass Internals
6B	0-60 Psi, Brass Internals
00	Model 5000E
3S	0-30 Psi, 316 SST Inte
6S	0-60 Psi, 316 SST Inte
Seal Material / Backup Ring	
B	HSN (Highly Saturated Nitrile)(NACE) / CPTFE
V	Viton / CPTFE
X	Special
Pilot	
S	Snap (Pneumatic On/Off Pilot)
T	Throttle (Pneumatic Modulating Pilot)
P	SPDT (Electric Pilot)
D	DPDT (Electric Pilot)
Pressure Rating	
0	MNPT (3750 Psig)
1	ASME 150 (285 Psig)
3	ASME 300 (740 Psig)
6	ASME 600 (1480 Psig)
9	ASME 900 (2220 Psig)
5	ASME 1500 (3750 Psig)
End Connection Type	
MS	Screwed MNPT
RF	Raised Face Flange
RJ	Ring Type Joint Flange
SP	Special
End Connection Size	
15	1.5"
30	3"
20	2"
40	4"
Model	
-	Pneumatic
E	Electric