JORDANVALVE
3170 Wasson Road • Cincinnati, OH 45209
Phone 513.533.5600 • Fax 513.871.0105 (f)
info@richardsind.com • www.jordanvalve.com

I & M Mark 4150 and 4160 Series

Installation & Maintenance Instructions for the Mark 4150 and 4160 Series Pressure Controllers

Warning: Jordan Valve Control Valves must only be used, installed and repaired in accordance with these Installation & Maintenance Instructions. Observe all applicable public and company codes and regulations. In the event of leakage or other malfunction, call a qualified service person; continued operation may cause system failure or a general hazard. Before servicing any valve, disconnect, shut off, or bypass all pressurized fluid. Before disassembling a valve, be sure to release all spring tension.

INTRODUCTION

The Mark 4150 and 4160 Series pressure controllers are designed to provide years of reliable and accurate service.

These instructions cover maintenance, adjustment, and changes in mode of control.

These instructions are intended for the controllers in general. Any instructions that apply to specific controllers will be indicated by model number in the instruction.

Model numbers are stamped on the nameplate located inside the cover of the controller (Key 29, Figure 4).

Controllers

Inspect the controllers for shipping damage and foreign debris when uncrating.

Valve
Ensure the pipeline is free of welding slag, chips and other debris by blowing out the line prior to installation.

It is recommended that a strainer be installed up stream of the valve to protect the valve from foreign debris in the line. Jordan Valve recommends a standard three-valve maintenance bypass be installed. This allows isolation of the control valve without shutting down the pipeline system.

The valve should be positioned on the line so the flow direction indicator corresponds to the direction of the flow of the pipeline.

If the body is flanged, the bolts should be tightened up evenly to reduce risk of damage to the valve body and the flange.

A good quality thread lubricating compound should be used on all male connections if the body has screwed connections.

Control Line Connectors

The connections should be made in an area of the pipeline that is free of bends and elbows. Piping connections should be made with 1/4" or 3/8" pipe or tubing.

Tap the pipeline as close to the valve body as possible allowing for these limiting factors.

1. The tap area should be an area that is free from abnormal velocities.
2. The ideal distance away from the body should be 10 x the pipeline diameter.

The control pressure line is run from the tapped hole in the side or the back of the case to the main pipeline.

Install a lock shield needle valve in the control line to slow down the controlled pressure or to dampen out any pulsations. While the control valve is operational, the needle valve must never be entirely closed.

An air vent is provided on all controllers and works well when air is used as the operating medium. When gas is used the vent can be removed, this allows for an additional 1/4" NPT connection for gas to be piped away.

Operation

Although the output for these controllers are set prior to shipping, upon arrival the following items should be checked.

Bellofram Mark 50 Filter Regulator

Bellofram Mark 50 Filter Regulator is a self-contained filter regulator designed to deliver air or gas to the pilot at a constant pressure. The Bellofram Mark 50 is designed to handle inlet pressures up to 250 psi. The Series 4150/4160 delivers an outlet pressure of 3 - 15 psi when the regulator is set to 20 and it will deliver 6-30 psi output when the regulator is set to 35 psi.

The filter component ensures that operation is clean and dry.

The relief valve is geared to open when the pressure is reduced to 1 psi above the regulator set point.

Releasing the lock nut and adjusting the adjusting screw located on the top of the regulator can reduce pressure setting for the regulator.

Proportional Controllers

Most of the proportional controls will be used in applications that require a band set to approximately 15%. The following steps are used to test this setting.

1. The air supply should be connected to Bellofram Mark 50 filter regulator.
2. Zero the pressure setting dial.
3. Set the proportional band adjustment to 15%
4. There should be no pressure sent to the mea suring element.
5. For direct or reverse acting controllers the range and output should be set as follows.

Range	Output
3-15 psi	8-10 psi
6-30 psi	16-20 psi

Proportional-Reset Controllers

1. The reset dial should be set to maximum.
2. The air supply should be connected to Bellofram Mark 50 filter regulator.
3. Zero the pressure setting dial and proportioned setting dial.
4. There should be no pressure sent to the measuring element.
5. For direct or reverse acting controllers the range and output should be as follows.

Range	Output
3-15 psi	8-10 psi
6-30 psi	16-20 psi

Start Up

Proportional Controllers

1. The air supply should be connected to Bellofram Mark 50 filter regulator.
2. Connect the control pressure line and open the lock shield needle valve.
3. Ensure all piping and connections are free from leaks.
4. Set the pressure to the desired control point.
5. Proportional band should be set at 15% of the bandwidth.
6. Open the manual control valves that are up stream and downstream, at the same time close the by-pass valves.
7. Set the controller near the desired control point. When it reaches that point, begin to broaden the proportional band. Broaden the band as little as possible. The narrowest band that will not result in cycling provides the best control. This band adjustment will affect the zero. Re-zero the unit.
8. Test the bandwidth by changing the pressure setting adjustment for a moment. If this causes cycling, then broaden the proportional band and test again. This procedure is to be repeated until stability is reached.

Proportional-Reset Controllers

1. The air supply should be connected to Bellofram Mark 50 filter regulator.
2. Connect the control pressure line and open the lock shield needle valve.
3. Ensure all piping and connections are free from leaks.
4. Set pressure to the desired control point.
5. Proportional band should be set at 100% of bandwidth.
6. Maximize the setting on the reset dial.
7. Open the manual control valves that are up stream and downstream, at the same time close by-pass valves.
8. Set the controller near the desired control point. When it reaches that point, begin to narrow the proportional band until a cycling condition exists. Broaden the band slightly until a stable condition is reached. There is no need to reset the zero in controllers that have reset.
9. Try to obtain the fastest reset time without intro ducing cycling control carefully by adjusting the reset rate.
10. Test the bandwidth and the reset rate by chang- ing the pressure setting adjustment for a moment. If this causes cycling, then broaden the proportional band and test again. This procedure is to be repeated until stability is reached.

The goal for the controller setting is to have the narrowest proportional band and the fastest reset rate that will not cause cycling.

Changing Controller Action

One advantage of the Mark 4150/4160 is the ease at which you can change from one mode of control to another. There is a connection for both direct and reverse action in all modes of control. There is also a screw (key 5, figure 6) provided to plug the hole opposite of the nozzle. It will be necessary to follow INITIAL SETTINGS after any change in mode of control.

Adjustments

Proportional Band Width Adjustments

The proportional band width adjustment determines the change in control pressure required to cause the control valve to travel full open or full closed.

Example: with the proportional band set @ 1 (10%), using a Bourdon tube of 0-1000 psi that is set @ 500 psi on the pressure dial. The full travel of the valve would occur between 450 psi (3 psi output) and 550 psi (15 psi output) to try to maintain the set point.

Using this theory, an input pressure of 500 would give you an output pressure of 9 psi. The greater the proportional band setting is the slower the reaction.

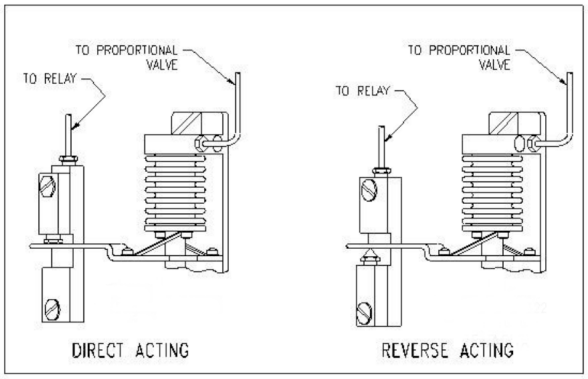


Figure 1: Pressure Connections for Proportional Controller

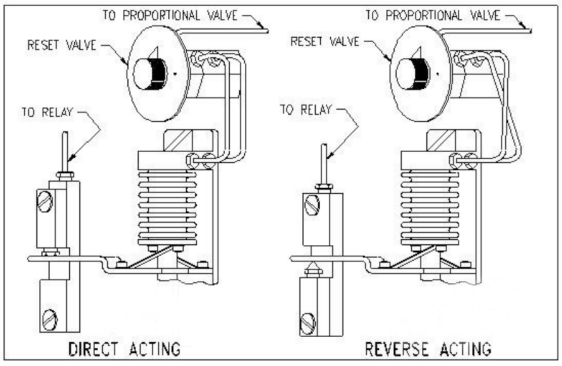


Figure 2: Pressure Connections for Proportional-Reset Controller

Reset Rate Adjustment

By definition the reset rate is the number of minutes that it takes to adjust the controller to adjust the output pressure up or down by the same amount of proportional change output caused by the process change.

The reset rate is calibrated in minute per repeat.

Pressure Setting Adjustment

The Mark 4150 and 4160 come with calibrated set point adjustment. The dial is calibrated for pressure ratings of the measurement element. If start up instructions are followed, the pressure setting dial is correct for any settings on proportional-reset controllers.

Mark 4150 Pressure Controller

The theory of operation can be broken down into steps. Refer to the schematic diagram figure 3.

I. The pressure first enters the Bourdon tube. As the pressure increases the Bourdon tube straightens causing the beam (B) attached to the end of the Bourdon tube to move closer to nozzle (C).

2. Closing the nozzle (C) will cause a build up of pressure in chamber (D) from the constant air or gas supply through the orifice (E).

3. The resulting pressure built up in chamber (D) cause the diaphragm (F) to push up and open valve (G).

4. An open Valve (G) will cause the constant air or gas supply to flow into chamber (H).

5. The build up of pressure in chamber (H) causes diaphragm (F) to be pushed back to its original position and therefore closes valve (G).

6. The increase in pressure in chamber (H) sends the supply pressure to flow to the diaphragm of the control valve causing the control valve to start to close.

7. At the same time, the pressure flows through the three-way valve (K) causing an increase in pres sure in bellows (I).

8. The increase in the pressure bellows (I) cause the beam (B) to move away from nozzle (C). As a result there will no longer be a build up of pressure in (D). The control valve is now at the desired pressure setting.

If there is a decrease in control pressure the above mentioned steps will proceed in reverse. The control pressure will bleed out through the exhaust vent (J).

Please note that the changes in pressure are continuous in nature. The process has been explained in steps for ease of explanation.

As seen in the figure 3, schematic illustration of Mark 4150, the output pressure from relay chamber (H) goes to both the proportional band adjustment relay three-way valve (K) and the control valve diaphragm. The amount of feedback to the proportional bellows (I) can be adjusted by adjusting the orifice. If valve (K) is fully open, then the total of the diaphragm pressure is sent to the bellows chamber (I).

This causes the beam (B) to move away from nozzle (C) allowing the pressure to be released from chamber (D). The result of this is 100% proportional band based on the rating of the Bourdon tube. Closing the three-way valve (K) will result in a lowering of proportional band response. The proportional band would be approximately 3% when fully closed.

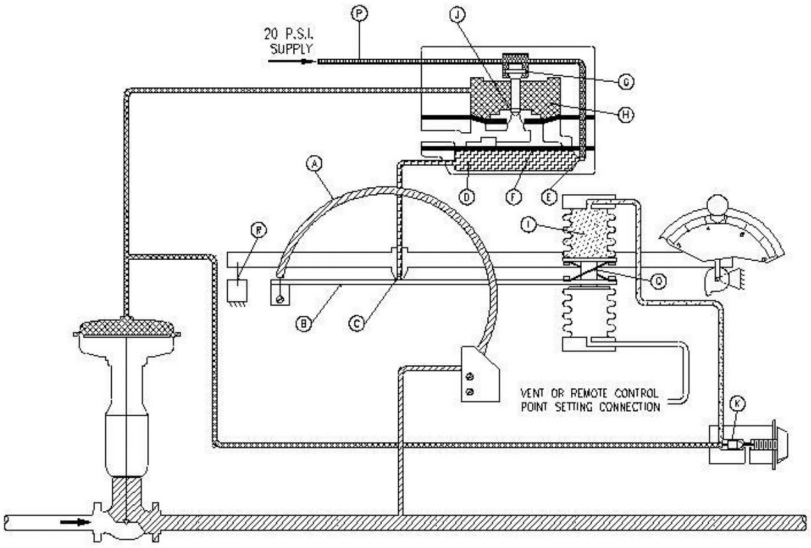
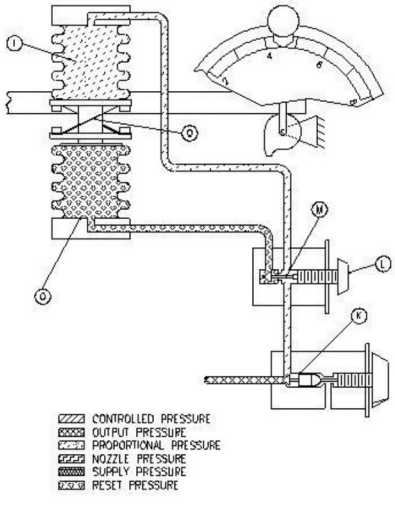


Figure 3: Schematic Illustration of Mark 4150 Proportional Controller



Schematic Illustration of Mark 4150 Proportional-Reset Controller

Mark 4160 Pressure Controller

The operation of Mark 4160 - proportional-reset controller, is the same as the Mark 4150 with the addition of a reset rate adjustment (L). Follow steps 1-6 from operation of the 4150 then proceed with the following:

1. In step No. 7, for the Mark 4160 the pressure will flow through the three-way valve (K), to reset valve (M) where a portion of pressure will be diverted to the bellows (O).
2. The pressure will be built up in bellows (O) pushing beam (B) to nozzle (C) and therefore increased pressure to valve and to bellows (I). This process will continue until control pressure is equal to the set point.
3. The proportional bandwidth determines how much the pressure will deviate from the set point. The reset determines the amount of time the deviation is away from the set point.

MAINTENANCE

Two steps should be carried out in regular scheduled maintenance. A cleaner button allows you to clean the passages in the relay orifice. This button should be pushed regularly. The second step is using the drain cock that is located on the underside of the drip well in the Mark 50 filter. This drip well, should be allowed to bleed off to atmosphere to prevent moisture from contaminating the controller.

TROUBLE SHOOTING

1. The control valve continually cycling or hunting.
   - 1.1. The constant cycling of a controller can occur if the reset rate is set too fast or the band setting is set too narrow.
   - 1.2. Ensure that the controller valve plug is not sticking.
   - 1.3. A control valve always operating near its seat will indicate an oversized control valve.

2. Incomplete Pressure Change on the Diaphragm.
   - 2.1. Ensure an accurate reading is being displayed from the diaphragm pressure gauge.
   - 2.2. Verify that lines and connections are free from leaks.

The Mark 4150/4160 Series Bourdon Tubes can be replaced. They may be replaced due to changes in pressure regulations or for maintenance.

Replacing Bourdon Tube
(Refer to Figure 6)

1. Detach the connecting link and bearing (Key 37) from the beam.
2. Unscrew the two fixing screws (Key 8) holding the tube. Detach tube from the sub-assembly.
3. Replace the Bourdon tube by removing the connecting link and bearing from the exist ing tube. Attach the connecting link and bearing on the new Bourdon tube.
4. Zero the pressure dial.
5. Install the Bourdon tube in the sub-assembly. Reconnect the connecting link and bearing to the beam.
6. Ensure that the tube is in a horizontal position and that there is tension in the connect ing link. The tension can be adjusted by bending the cross springs (Key 28).
7. Adjust and calibrate for start-up.

Replacing Bellows
(Refer to Figure 6)

1. Detach sub-assembly from controller.
2. Remove the connecting link and bearing (Key 37) from the beam.
3. Remove the bellows unit from the frame (Key 16)
4. Install the bellows in the control assembly. Begin by ensuring that the beam is horizontal and with the pressure setting dial at zero.
   Then attach the connecting link and the bearing link to bellows and beam. Ensure that there is tension on the connecting link. Tension can be added by bending the cross springs (Key 28).
5. Adjust and calibrate for start up.

Calibration of Controllers

1. Move the calibration adjuster (Key 30, Figure 6) to the right or the left.
2. Repeat the nozzle adjustment and step 5 for proportional controller or step 6 for proportional-reset controller.
3. To release the calibration adjuster, loosen the two screws, above and below the beam, to the left of the nozzle.

Calibrate Zero on Proportional Controllers

1. Depending on the controller type the supply pressure will be 20 or 35 psi. Attach a suitable pressure gauge to the output pressure.
2. Connect the pressure source to the pressure block and set the proportional bandwidth to 15% (1.5).
3. Zero the pressure setting dial.
4. Raise or lower the nozzle (Key 34, Figure 6) to get the desired setting of zero as per chart below. Nylon insert will hold the nozzle in place.
5. Allow maximum pressure to the measuring element. Set the pressure dial to maximum. Output pressure should comply with the zero setting column in the following table, if not go to Note 1.

Note 1 - These steps are to be used if the zero setting pressure or output range is not obtained when maximum pressure is applied to the measuring element.

1. Move the calibration adjuster (Key 30, Figure 6) to the right or the left.
2. Repeat the nozzle adjustment and Step 5 for proportional controller, or Step 6 for proportional-reset controller.
3. To release the calibration adjuster, loosen two screws, above and below the beam, to the left of the nozzle.

Control Action	Output Range	Supply Pressure	Zero Setting
Direct	3-15 psi	20 psi	8-10 psi
Direct	6-30 psi	35 psi	16-20 psi
Reverse	15-3 psi	20 psi	8-10 psi
Reverse	30-6 psi	35 psi	16-20 psi

Calibrate Zero on Proportional- Reset Controllers

1. Depending on the controller type the supply pressure will be 20 or 35 psi. Attach a suitable pressure gauge to the output pressure.
2. Connect the pressure source to pressure block and set the proportional bandwidth to zero.
3. Set the reset dial to .005 minutes per repeat.
4. Zero the pressure setting dial.
5. Raise or lower the nozzle (Key 34, Figure 6) to get the desired setting of zero as per chart below. Nylon insert will hold the nozzle in place.
6. Allowing maximum pressure to the measuring element. Set the pressure dial to maximum. Output pressure should comply with the zero setting column in the following table, if not go to Note 1.

Control Action	Output Range	Supply Pressure	Zero Setting
Direct	3-15 psi	20 psi	8-10 psi
Direct	6-30 psi	35 psi	16-20 psi
Reverse	15-3 psi	20 psi	8-10 psi
Reverse	30-6 psi	35 psi	16-20 psi

Changing of Controller Output

Controllers having an output range of 3-15 psi, can be converted to having an output range of 6-30 psi. This can be done by changing the two color coded control bellows. The green bellows is for 3-15 range, and yellow bellows for 6-30 psi range.

When the pressure range is changed, it is necessary to change the pressure gauges. This can be completed by unscrewing the old pressure gauges from their boss and screwing in the new gauges.

ASSEMBLY

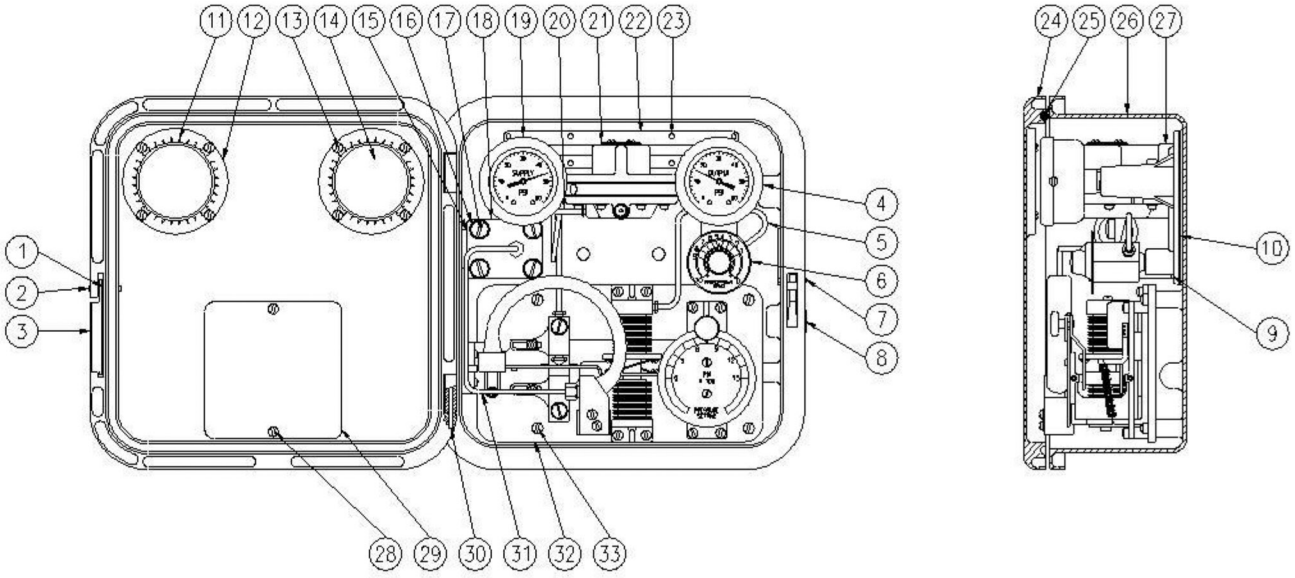


Figure 4: **Mark 4150 Proportional Pressure Controller with Bourdon Tube Measuring Element**

PARTS REFERENCE

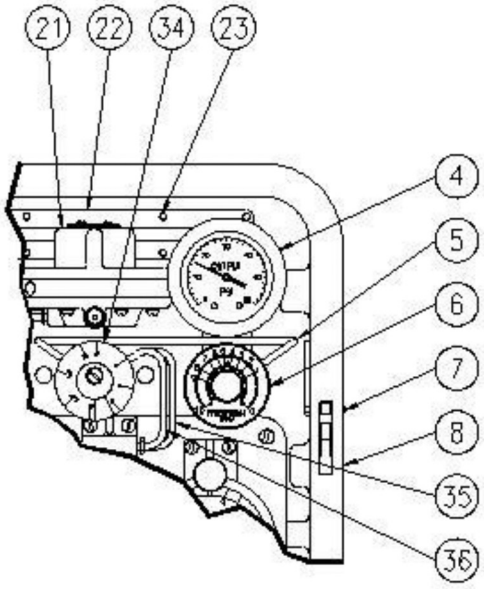


Figure 5: **Partial view of Mark 4160 Pressure Controller Showing the Reset Valve and the Arrangement of Tubing**

Controller Main Assembly (Refer to Figures 4 and 5)

Key No.	Part No.	Part Description	Material
1	1H2889	Spring Washer	Steel Cd. Pl
2	1H2891	Groove Pin	Aluminum
3	1H2886	Cover Latch	Steel Cd. Pl
4	1H2712	Output Pres. Gauge 30 psi.	Sub-Assy
	1H3048	Output Pres. Gauge 60 psi	Sub-Assy
5*	1H2753	Compensator Tubing Assy	Copper
	1H6864	Compensator Tubing Assy	304 SST
	1H2966	Reset Tubing Assy	Copper
	1H6866	Reset Tubing Assy	304 SST
6	367X3	Proportional Band Adj. Assy	Sub-Assy
7	1H2890	Groove Pin	Aluminum
8	1C8937	Screen and Elbow Assy	Sub-Assy
9*	1C3286	Cont. Pres. Block Gasket	Neoprene
10*	1H2887	Relay Base Gasket	Neoprene
	1N8737	Relay Base Gasket Hi-Temp	Si Rubber
11*	0T0191	Glass Gasket, 2 Req'd	Neoprene
12	1A4658	Retaining Ring, 2 Req'd	Galv, Steel Cd. Pl.
13	1A5120	Screw, 8 Req'd	Steel Cd. Pl
14*	0T0192	Gauge Glass, 2 Req'd	Acrylic
15*	1C3762	O-Ring	Buna-N
16	1C2256	Lockwasher, 4 Req'd	Steel Cd. Pl
17	1C3333	Screw, 4 Req'd	Steel Cd. Pl
18	1H2698	Cont. Pres. Block	Steel
	1H2895	Cont Pres. Block	316 SST
19	1H3435	Supply Pres. Gauge 0-30 psi	Sub-Assy
	1H3436	Supply Pres. Gauge 0-60 psi	Sub-Assy
20	1H2759	Relay Tubing Assy	Copper
	1H6861	Relay Tubing Assy	304 SST
21	536X47	Pilot Relay	
	536X84	Pilot Relay Hi-Temp	
22	3H2885	Relay Base	Zinc
23	1H5269	Screw, 17 Req'd	Steel Cd. Pl
24	4H2684	Cover	Aluminum
25*	1J24075	Cover Gasket	Sponge Rubber
26	4H2699	Case	Aluminum
27*	1C8974	Relay Gasket	Neoprene
	1N8738	Relay Gasket, Hi-Temp	Silicone Rubber
28	1C9419	Screw, 2 Req'd	Steel Cd. Pl
29	1H2702	Instruction Plate	Aluminum/ SST
30	1H2888	Roll Pin, 2 Req'd	Steel Cd. Pl
31*	1H3013	Cont. Tubing Assy, 4150, 4160	Copper
	1H4528	Cont. Tubing Assy.	Copper
	1H3011	Cont. Tubing Assy, 4150, 4160	304 SST
	1H4526	Cont. Tubing Assy.	304 SST
32	ML536X	Cont. Sub-Assy. 4150, 4160	Sub-Assy.
	ML536XH	Cont. Sub-Assy. Hi-Temp, 4150, 4160	Sub-Assy.
33	1A3321	Screw, 6 Req'd	Steel Cd Pl
34	536X61	Reset Valve	
	536X15	Reset Valve, Hi-Temp	
35*	1H2755	Compensator Tubing Assy.	Copper
	1H6870	Compensator Tubing Assy.	304 SST
36*	1H2757	Conpensator Tubing Assy.	Copper
	1H6870	Conpensator Tubing Assy.	304 SST
37	1H5271	Screw, 2 Req'd	Steel Cd. Pl
38	1H5270	Screw, 4160	Steel Cd. Pl
39	1A7675	Pipe Plug	Steel
	1A7675	Pipe Plug	316 SST

* Recommended Spare Parts

PARTS REFERENCE

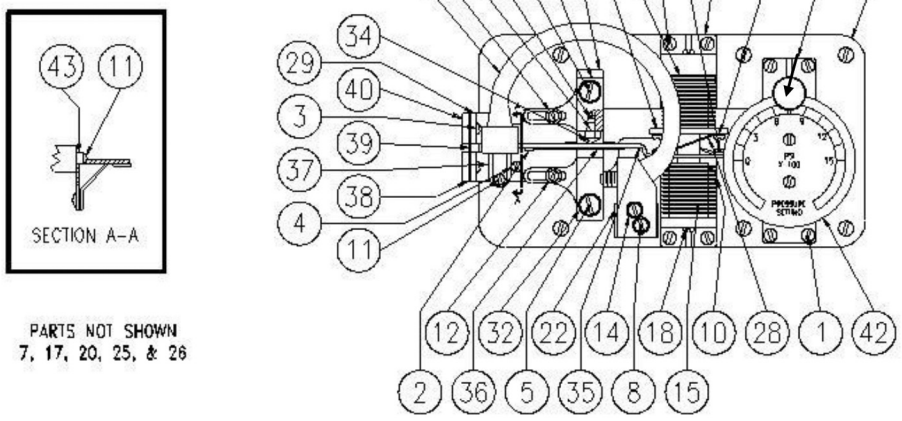


Figure 6: Controller Sub-Assembly for Bourdon Tube Controllers Mark 4150 and 4160

Controller Sub Assembly (Refer to Figure 6)

Key No.	Part No.	Part Description	Material
1	1C8969	Screw, 4 Req'd	Steel Cd. Pl
2	1B2751	Screw	Steel Cd. Pl
3	1C8990	Screw, 4 Req'd	Steel Cd. Pl
4	1A5733	Screw, 8 Req'd	Steel Cd. Pl
5*	1H2674	Screw	Steel Cd. Pl
6*	1H2673	Screw	Steel Cd. Pl
7	1H2676	Screw, 2 Req'd	Steel Cd. Pl
8	1H2677	Screw, 2 Req'd	Steel Cd. Pl
9*	1H2678	Screw, 2 Req'd	Steel Cd. Pl
10*	1B2776	Screw, 2 Req'd	Steel Cd. Pl
11*	1A3319	Screw, 2 Req'd	Steel Cd. Pl
12	1E8730	Washer, 2 Req'd	Steel Cd. Pl
13	1H2671	Washer, 2 Req'd	Steel Cd. Pl
14*	1H2672	Washer, 2 Req'd	Acrylic
15*	1H2655	Bellows Assy. 3-15 psi, 2 Req'd	
	1H2680	Bellows Assy. 6-30 psi, 2 Req'd	
16	1H2653	Bellows Frame	Aluminum
17	1H2654	Bellows Frame Gasket	Neoprene
	1N8735	Bellows Frame Gasket, Hi-Temp	Si Rubber

Key No.	Part No.	Part Description	Material
18	1D3976	Bellows Screw, 2 Req'd	18-8 SST
19*	1D3970	Bellows Gasket, 2 Req'd	Neoprene
	1N8736	Bellows Frame Gasket, 2 Req'd	Si Rubber
20	1H2658	Bellows Stud	18-8 SST
21*	1E2226	O-Ring	Buna-N
	1N8387	O-Ring, Hi Temp	Viton
22	1H2650	Bourdon Tube Mounting Bracket	Aluminum
23	2H2651	Mounting Plate	Steel
24	536X4	Pressure Adj. Assy.	
	536X8	Zero Adj. Assy.	
25	1H2652	Adj. Spacer 2 Req'd	Steel
26	1J4234	Rotary Shaft Spring	302 SS
27	1H2659	Spacer	Zinc
28	1H2660	Cross Spring, 2 Req'd	304 SS
29	1H2661	Pressure Set Arm	Steel
30	2H2662	Calibration Adj.	Zinc
31	1U6392	Reversing Block Assy.	
32*	1H2664	O-Ring, 3 Req'd	Viton
33	16A0976	Nylon Insert	Nylon

* Recommended Spare Part

Controller Sub Assembly Continued,

Key No.	Part No.	Part Description	Material
34*	1U6391	Nozzle	316 SS
35	1H2668	Beam	Steel
36*	1H2669	Flapper	Spring Steel
37	1L3796	Connecting Link	316 SS
38	1C8977	Flexure Strip Base	Steel, Cd Pl
39	1C8978	Flexure Base	Spring Steel
40	1C8975	Flexure Strip Nut, 2 Req'd	Steel, Cd Pl
41*	1R8729	Bourdon Tube, 0-30 psi	316 SS
	1R8730	Bourdon Tube, 0-60 psi	
	1R8731	Bourdon Tube, 0-100 psi	
	1R8732	Bourdon Tube, 0-200 psi	
	1R8733	Bourdon Tube, 0-300 psi	
	1R8734	Bourdon Tube, 0-600 psi	
	1R8735	Bourdon Tube, 0-1000 psi	
	1R8736	Bourdon Tube, 0-1500 psi	
	1R8737	Bourdon Tube, 0-3000 psi	
	1R8738	Bourdon Tube, 0-5000 psi	
	2H2883	Bourdon Tube, 0-8000 psi	
	2H2884	Bourdon Tube, 0-10000 psi	
	2H6785	Bourdon Tube, 0-15000 psi	
42	1H3044	Press. Adj. Dial, 0-30 psi	Aluminum
	1H3034	Press. Adj. Dial, 0-60 psi	
	1H3035	Press. Adj. Dial, 0-100 psi	
	1J5237	Press. Adj. Dial, 0-200 psi	
	1H3036	Press. Adj. Dial, 0-300 psi	
	1H3037	Press. Adj. Dial, 0-600 psi	
	1H3038	Press. Adj. Dial, 0-1000 psi	
	1H3039	Press. Adj. Dial, 0-1500 psi	
	1H3040	Press. Adj. Dial, 0-3000 psi	
	1H3041	Press. Adj. Dial. 0-5000 psi	
	1H3042	Press. Adj. Dial. 0-8000 psi	
	1H3043	Press. Adj. Dial. 0-10000 psi	
	1H3043	Press. Adj. Dial. 0-15000 psi	

* Recommended Spare Part

Pilot Relay Assembly

Key No.	Part No.	Part Description	Material
1	1A3319	Screw, 4 Req'd	Steel
2	1H2697	Spring Plate	Steel
3*	1H2696	Spring Plate Gasket, Temp. To 150°F	Neoprene
	1K7000	Spring Plate Gasket, Temp. To 150°F-250°F	Sil. Rubber
4	0X0836	Valve Plug Spring	Inconel
5*	1C8961	Relay Spring	Inconel
6*	0Y0617	Valve Plug	316 SS
	0Y0617B		Brass
7	1C9370	Dia. Assy. Temp To 150°F	Sub Assy.
	1K6996	Dia. Assy. Temp 150°-250°F	
8	1L5556	Top Dia., Temp 150°F	Buna-N
9*	1C8969	Screw Temp to 150°F 6 Req'd	Steel
	1A3294	Screw 150°F-250°F 6 Req'd	
10*	1D6875	O-Ring	Syn. Rubber
11*	1H8266	Restriction Plug Orifice Assy.	Sub Assy.
12	1E2303	Core & Wire Assy.	Sub Assy.
13	2H2693	Relay Body	Zinc
14*	2K4404	Spacer Ring	Zinc
15*	1C9369	Diaphragm Case Assy	Sub Assy.
16	1K7001	Bottom Gasket (Not Shown) Temp. 150°F-250°F	Sil. Rubber
	1K7002	Top Gasket, Temp 150°-250°F	
17	1P8261	Washer, 6 Req'd (Not Shown)	Steel

* Recommended Spare Part

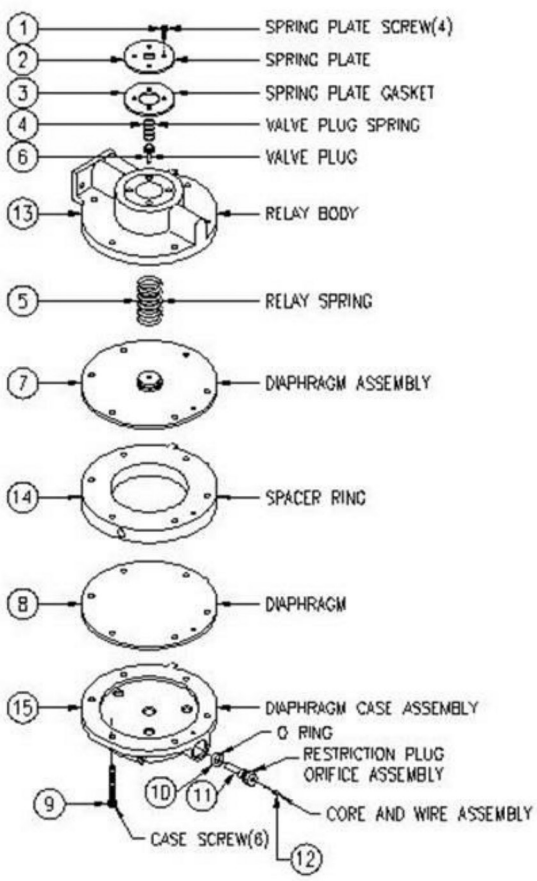


Figure 7: **Exploded View of Pilot Relay used in Mark 4150 and 4160 Controllers**

Supply Pressure Data

Output Signal Range		Normal Operating Supply Pressure (*)		Maximum Allowable Supply Pressure to Prevent Internal Damage		Steady State Air Consumption SCFH of Air at 60°F and 14.7PSIA (Normal M3/Hr of Air at 0°C and 1.01325 Bar)	
Psig	Bar	Psig	Bar	Psig	Bar	Min[A]	Max[B]
3 to 15 or 0 & 20 (on-off)	0.2 to 1.0 or 0 & 20 (on-off)	20	1.4	50	3.4	4.2 (0.12)	27 (0.76)
6 to 30 or 0 & 30 (on-off)	0.4 to 2.0 or 0 & 2.4 (on-off)	35	2.4	50	3.4	7 (0.20)	42 (1.2)

* Stability and control may be compromised if pressure is exceeded.
A Proportional Band setting of 0-10
B Proportional Band setting of 5

JORDANVALVE

Jordan Valve, a division of Richards Industries
3170 Wasson Road • Cincinnati, OH 45209
513.533.5600 • 800.543.7311 • 513.871.0105 (f)
info@richardsind.com • www.jordanvalve.com