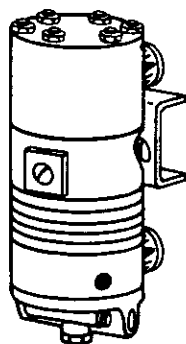




SD50
Issue: 13
Date: 2/90

SERVICE INSTRUCTIONS



**MODEL 50
TWO-MODE
NULLMATIC® CONTROLLER**

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GENERAL DESCRIPTION

The Model Series 50 Nullmatic Controller is a two-mode controller which operates on the pneumatic "Null" balance principle. It controls the process variable in response to a signal from the process transmitter. The controller incorporates adjustable proportional band (gain) and reset action.

The normal input/output range for the controller is 3 to 15 psig. However, it can be recalibrated to operate at any input/output range from a minimum of 0 to 50" H₂O to a maximum of 0 to 45 psig.

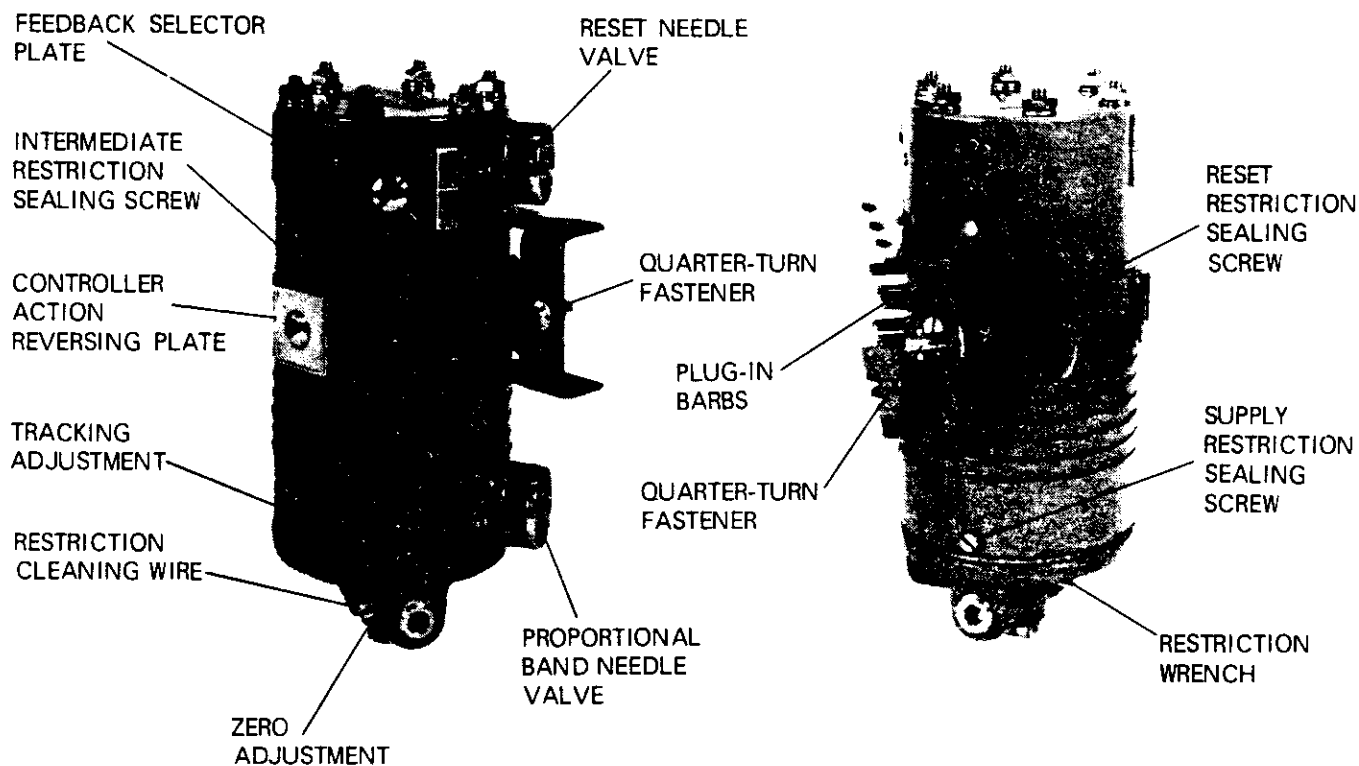


FIGURE 1 - Model 50 Controller

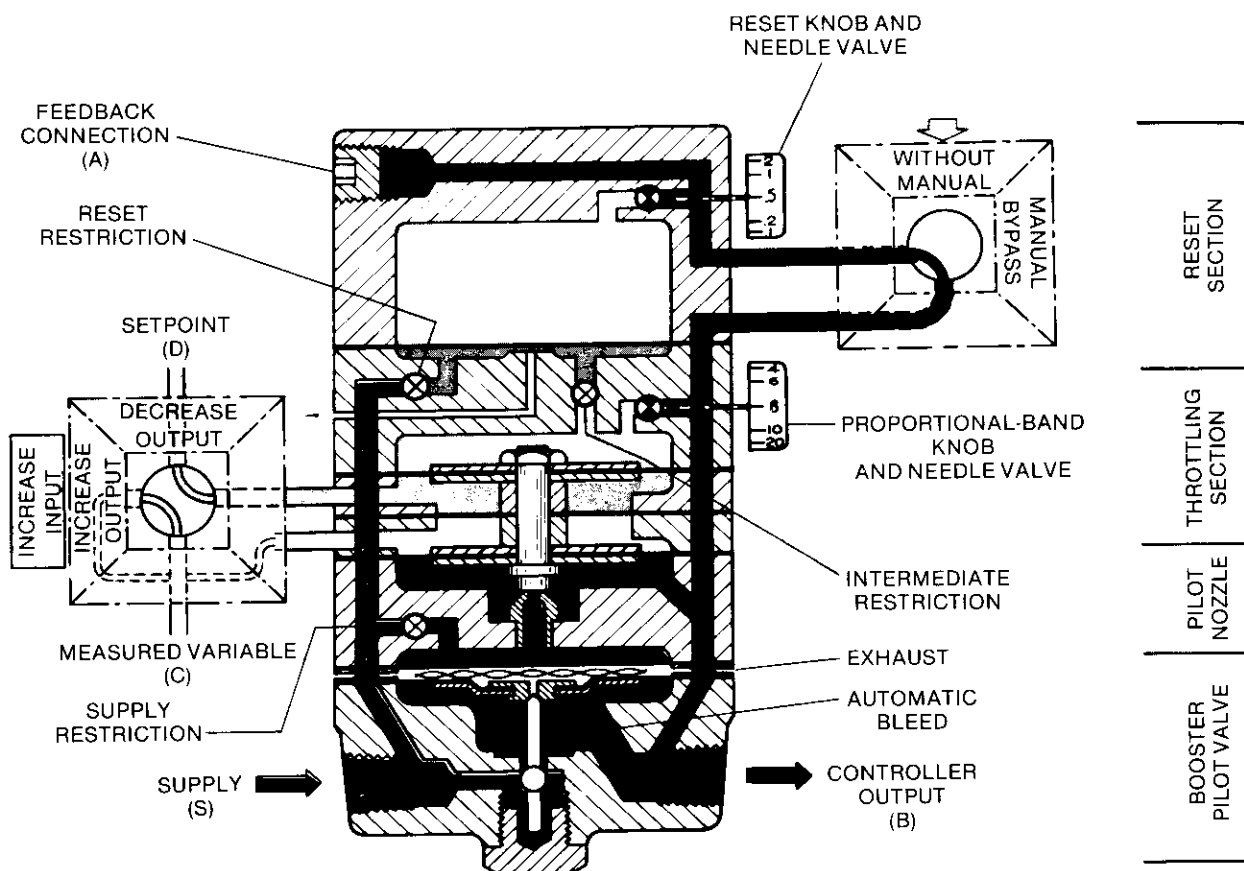
MODEL DESIGNATION

CONTROL FUNCTIONS	Pipe Connection	Plug-In Manifold	% Proportional Band	Reset Time Minutes/Repeat
Std. Proportional Band and Reset	50	50M	2-200	.1-50
Std. Proportional Band and Fast Reset	50F	50MF	2-200	.01-5
Wide Proportional Band and Reset	50W	50MW	5-500	.1-50
Wide Proportional Band and Fast Reset	50FW	50MFW	5-500	.01-5
Fast Reset - No Proportional Adjustment	50FY	50MFY	200	.01-5



NULLMATIC CONTROLLER MODEL 50

PRESSURES



Fast Reset (Suffix "F")

The operating principle of the fast reset controller is identical to that of the conventional controller except that it provides a reset rate 10 times faster than standard.

Wide-Band Controller (Suffix "W")

The operating principle of the wide proportional band controller is identical to that of the conventional controller. In the wide band controller, however, the effective area of the small, center diaphragm is 20% less than that of the large diaphragm. This establishes the maximum proportional band at 500%.

GENERAL SPECIFICATIONS

- Supply Pressure: 20 psig – normal
50 psig – maximum
3 psig above maximum output – minimum
- Input/Output Range: 3 to 15 psig – standard
0 to 45 psig – maximum
- Proportional Band: 2 to 200% – standard
5 to 500% – optional
200% (Fixed) – optional
- Reset: 0.1 to 50 min./repeat – standard
0.01 to 5 min./repeat – optional
- Mounting: Pipe mounting or plug-in manifold
- Ambient Temp. Limits: -40°F to +180°F

PRINCIPLE OF OPERATION

PROPORTIONAL ACTION (See Schematic)

Assume the reset reference pressure remains fixed at mid-scale and the reset needle valve is closed. The reset reference pressure acts on the reset diaphragm which is part of a 1:1 reproducing relay. Supply air passes through a restriction and out the exhaust nozzle. The diaphragm baffles the nozzle to make the reset pressure equal the reset reference pressure.

If the proportional band needle valve is closed, the intermediate chamber pressure will equal the reset pressure since they are connected via the intermediate restriction.

The measured variable pressure pushes upward on the small center diaphragm and downward on the large diaphragm. The effective area of the large diaphragm is twice that of the small diaphragm. Therefore, measured variable pressure produces a net force downward. Likewise, the setpoint pressure gives a net force upward.

If the measured variable pressure equals the setpoint, the resultant forces from these two sources cancel

each other; and the output will match the reset or intermediate chamber pressure, bringing all forces on the throttling section to balance. If the measured variable pressure increases 1 psi, the output will increase 1/2 psi. This is because the output acts on the full area of the bottom diaphragm -- whereas the measured variable acts downward on a net effective area equal to one-half that amount. Thus, with the needle valve closed, the widest proportional band (minimum gain) is established; this band being 200% on standard controllers.

If the proportional band needle valve is wide open and the measured variable increases above setpoint, the output will increase instantly -- because of the imbalance of forces. The increase in output will directly affect the intermediate pressure, which will further require the output to increase. This regenerating action will continue so that a very small error will produce a large change in output. The wide-open needle valve position, therefore, establishes the minimum proportional band; this band being 2% on standard controllers.

If the proportional band needle valve is open to a setting where its resistance equals that of the intermediate restriction, the following will occur: When measured variable pressure increases by 1 psi, the output (by design) will instantly increase by 1/2 psi. The 1/2 psi increase will cause a flow from the output through the proportional band needle valve in the intermediate chamber and through the intermediate restriction to the reset reproducer. Since the restriction and needle valve resistances are equal, the pressure drops will divide equally, resulting in a 1/4 psi increase in the intermediate chamber pressure. This 1/4 psi increase directly increases controller output an additional 1/4 psi; which divides again into a 1/8 psi increase in the intermediate chamber pressure. This action continues until equilibrium is reached -- with the output changing a total of 1 psi, and intermediate chamber pressure increasing 1/2 psi. In this instance, a 1 psi change in the measured variable resulted in a 1 psi change in output. Therefore, this needle valve opening provides a 100% proportional band.

RESET ACTION

If every process could be controlled with a 2% proportional band (practically on-off), there would be no need for reset action. In practice, however, there is always a limit to how narrow a band may be used without incurring instability. For fast or noisy processes, the band may have to be very wide to avoid instability. With proportional action, if any change in valve pressure is required because of a change in load, the change can be produced only when an error develops between measured variable and setpoint. Therefore, instead of controlling at setpoint, a control offset will result. In most cases, this is intolerable and reset action is used to eliminate offset.

If the reset needle valve is open, the controller output will continue to change in the corrective direction, ad infinitum if necessary, until the measured variable is brought exactly on setpoint. When reset is active, the controller comes to equilibrium only when the measured variable equals the setpoint and when the output, reset, and intermediate pressures are equal to each other (but not necessarily equal to setpoint and measured variable). If any difference exists between measured variable and setpoint, then because of proportional action, the output will differ from the reset-reference pressure. Due to the resulting flow through the reset needle valve, the reset pressure will continue to change; thus providing a continuous reinforcing action – until equilibrium ultimately results.

INSTALLATION

Reversing Plate

The position of the controller's reversing plate determines the controller action, whether direct or reverse. Controllers are shipped for reverse action (INCREASE INPUT – DECREASE OUTPUT). The controller action can be changed by rotating the reversing plate so that the arrow points to INCREASE INPUT – INCREASE

OUTPUT. The correct controller action for a given installation depends upon the action of the control valve and its effect on the process.

Feedback Selector Plate

The position of the controller's feedback selector plate determines the source of the controller's feedback. Plug-in controllers, Model Series 50M, are shipped for external feedback (WITH MAN. BY-PASS). Pipe-mounted controllers are shipped for internal feedback (WITHOUT MAN. BY-PASS). The source of the feedback is determined by the presence or absence of devices connected in series with the controller output, or by the necessity to limit or alter the controller's reset action. For plug-in controllers, the "A" connection on the field mounting block is used when external feedback is required. It is plugged when internal feedback is used. For pipe-mounted controllers, the "A" port on the controller is used when external feedback is required. It is plugged when internal feedback is used. The source of feedback can be changed by rotating the feedback selector plate so that the arrow points to the desired source: WITH MAN. BY-PASS or WITHOUT MAN. BY-PASS. For additional information on reset feedback, request Bulletin AD50-7.

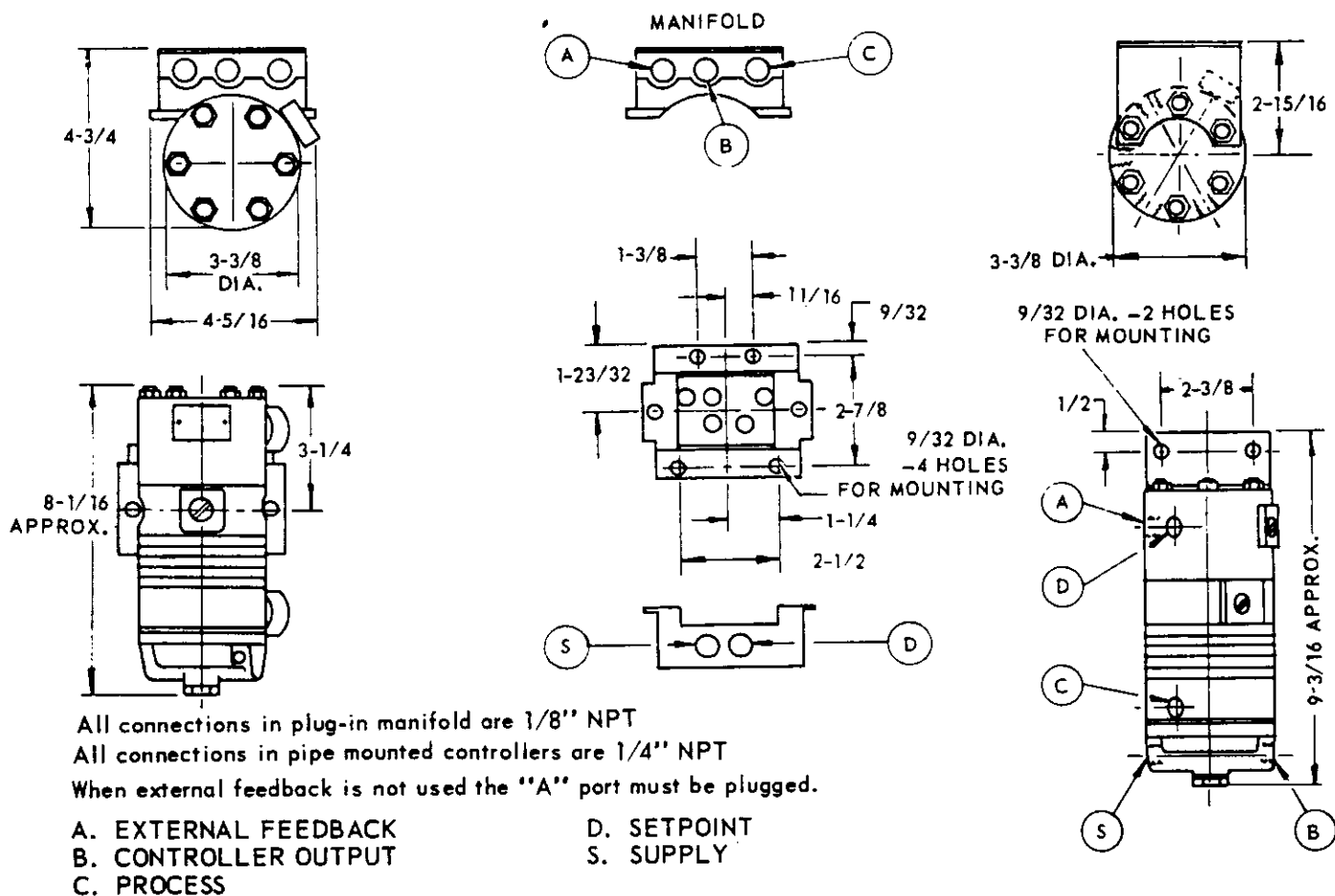


FIGURE 2
Installation Dimensions & Piping Connections

MOUNTING

Refer to Figure 2 for mounting dimensions.

The controller may be mounted in any position without affecting its operation. It must, however, be calibrated in the same position in which it is to be mounted.

Caution

Exceeding the specified ambient temperature limits can adversely affect performance and may cause damage.

Pneumatic Connections

All connections on the pipe-mounted controller are 1/4" N.P.T. All connections on the plug-in manifold are 1/8" N.P.T.

1/4" O.D. tubing is recommended for piping to the controller, although any scale-free piping may be used.

Blow out all piping before connections are made to prevent the possibility of dirt or chips entering the controller.

Use pipe sealant sparingly, and then only on the male threads. A non-hardening sealant is strongly recommended.

Connect the controller to a source of clean, dry, oil-free instrument air. See SUPPLY AIR REQUIREMENTS.

Caution

Pressure in excess of 100 psig to the process, setpoint, feedback or output ports may cause damage.

Figure 3 shows a typical installation piping diagram for a plug-in controller.

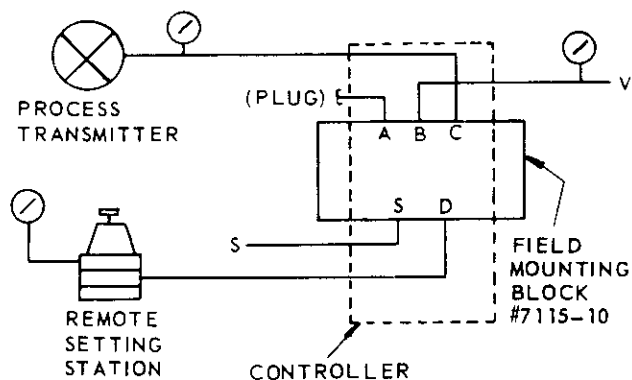
Supply Air Requirements

Connect the controller to a source of clean, dry, oil-free supply air. Failure to do so will increase the possibility of a malfunction or deviation from specified performance.

Caution

Synthetic compressor lubricants in the air stream at the instrument may cause the controller to fail.

There are many types of synthetic compressor lubricants. Some may not be compatible with the materials used in construction of the controller. Wetting of these materials by such an oil mist or oil vapor, etc., may cause them to deteriorate. This may ultimately result in the failure of



When connection "A" is not used (plugged), the switch plate must be WITHOUT MAN. BYPASS

- A. EXTERNAL FEEDBACK
- B. CONTROLLER OUTPUT
- C. PROCESS
- D. SETPOINT
- S. SUPPLY

FIGURE 3
Installation Piping Diagram

the controller. The following materials are in contact with the supply air: ALUMINUM, BRASS, STAINLESS STEEL, BUNA-N, DELRIN, NEOPRENE and NYLON.

The requirements for a quality air supply can be found in the Instrument Society of America's "Quality Standard for Instrument Air" (ISA-S7.3). Basically this standard calls for the following:

Particle Size – The maximum particle size in the air stream at the instrument should be no larger than 3 microns.

Dew Point – The dew point – at line pressure – should be at least 10°C (18°F) below the minimum temperature to which any part of the instrument air system is exposed at any season of the year. Under no circumstances should the dew point – at line pressure – exceed 2°C (35.6°F).

Oil Content – The maximum total oil or hydrocarbon content, exclusive of noncondensibles, should not exceed 1 ppm under normal operating conditions.

CALIBRATION

When calibrating the Model 50 controller, it should be mounted in the same position as it will be used.

1. Set up the controller as per Fig. 4.
2. Set the reversing plate to Inc./Inc. The controller bypass plate can be in either position.
3. Open the reset knob (0.1 on standard controllers; 0.01 on fast reset models).
4. Open the proportional band knob to 30% on standard controllers; 75% on wide-band models.
5. Adjust the regulator to 10% of span.

NOTE: After each change of the regulator setting, allow ample time for the controller reset action to balance out. This will be longer for standard reset controllers.

6. Adjust the controller's zero screw until the pointers match.
7. Adjust the regulator to 90% of span.
8. If the pointers do not match, adjust the controller's tracking screw. Make a three-fold overcorrection.

EXAMPLE: If the red pointer is at 90% and the black pointer is at 91%, adjust the tracking screw to move the black pointer to 87%. The amount of overcorrection is approximate and may vary a little between controllers.

9. Adjust the controllers zero screw until the pointers match.
10. Repeat steps 5 through 9 until the pointers match when the regulator is changed from 10% to 90% of span.
11. Set the reversing plate to the original position.

TUNING

The following method is only one of many methods of tuning a two-mode controller in a control system.

1. Place station in manual.
2. Open the controller reset needle valve (lowest numerical setting).

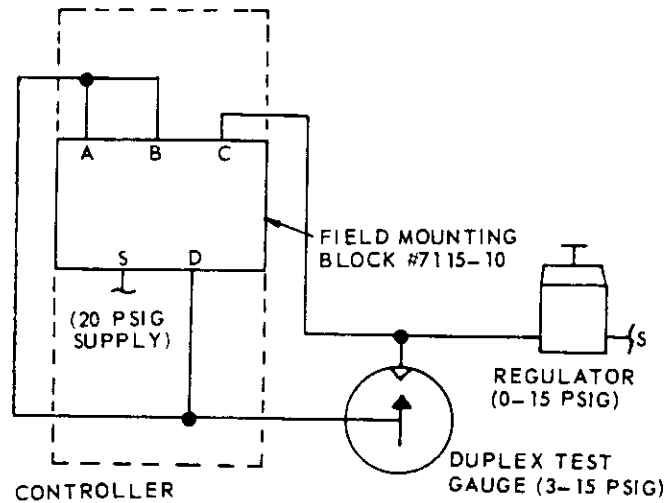


FIGURE 4
Calibration Set-Up

3. Bring the process to the desired control point using manual control.
4. Close the controller reset needle valve, trapping the valve pressure in the reset chamber.
5. Close the proportional band needle valve (highest setting).
6. Switch to automatic control.
7. Simulate process upset by making a small change in the control point. Look for a sustained process cycle. Continue to decrease proportional band in increments of $\frac{1}{2}$, introducing setpoint changes after each adjustment, until a sustained cycle of constant amplitude first appears.
8. Note the lowest proportional band setting at which the sustained cycling occurs. This is the ultimate proportional band (PBu).
9. Time the process cycle peak to peak in minutes. This is the ultimate period (Tu).
10. The following settings are recommended as a starting point. Fine tuning will be necessary to obtain the response best suited to a particular process.

$$\text{Proportional Band} = \text{PBu} \times 2.2$$

$$\text{Reset Time} = \text{Tu} \times .833 \text{ minutes}$$

MAINTENANCE

General

Most problems associated with pneumatic instruments can be prevented by using a clean, dry and oil-free supply air. Refer to **INSTALLATION, SUPPLY AIR REQUIREMENTS**.

Plug-in manifolds used for station or field-mounting of the Model Series 50M have filtering protection in the external feedback, output and supply ports. 100-mesh screens stop particles .006" and larger, thus protecting the controller restrictions which are nominally .0115" to .012".

Servicing

Figures 5, 6 and 7 show the items that may normally require servicing.

Cleaning

Figure 5 shows the removal of the valve plunger. The large spherical surface is the supply face; the top is the exhaust face. Use non-abrasives for cleaning. The supply and exhaust seats in the controller should also be cleaned. The supply seat is readily accessible; the exhaust seat can be reached with a tobacco pipe cleaner.

Figure 6 shows the removal of a restriction screw. Three restriction screws are used in the controller. The supply restriction is located in the pilot ring assembly; the reset and intermediate restrictions are located in the center housing assembly. All three restrictions are interchangeable. After removal of the sealing screw, a restriction may be removed and cleaned with the hex wrench and clean-

ing wire stored in the bottom forging assembly. Stubborn deposits may require softening in solvent before the cleaning wire can be passed through the orifice. When reinstalling, ensure that the sealing screw and restriction are screwed in tightly.

Figure 7 shows the removal of a needle valve. The two needle valves in the controller (proportional band and reset) are not interchangeable. The needle valves and valve bodies have matching identification letters stamped on them. The proportional band needle valve and valve body have the letter "T"; the reset needle valve and valve body have the letter "R" or "RF". Use non-abrasives for cleaning. Inspect the O-ring on the needle valve (and the O-rings on the valve body, if removed). Replace if cut or gouged. Refer to the Lubrication section for O-ring lubrication before reinstalling.

If a filter screen in the field mounting block becomes clogged, blow through the screen with compressed air in the reverse direction. If the dirt is still not dislodged, loosen it mechanically or chemically and blow through it in the reverse direction again. The screens are retained in the field mounting block by fiber washers. If a screen is to be removed, take care when removing the washer. It is recommended that spare washers be kept on hand. They are available under P/N 7115-44. If a screen is damaged, it should be replaced. These filter screens are available under P/N 7115-43.

Lubrication

If a needle valve has been removed, or if its knob moves away from a setting immediately after making a setting, its O-ring should be relubricated. If the needle valve body is removed, the larger O-ring should be relubricated. Use a suitable O-ring lubricant such as Vaseline or silicone.

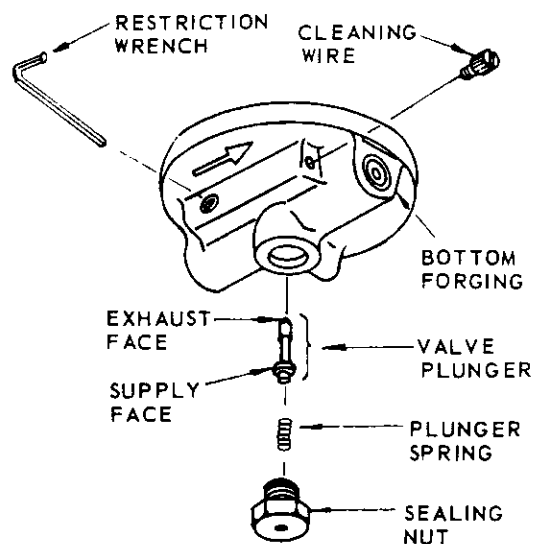


FIGURE 5
Valve Plunger

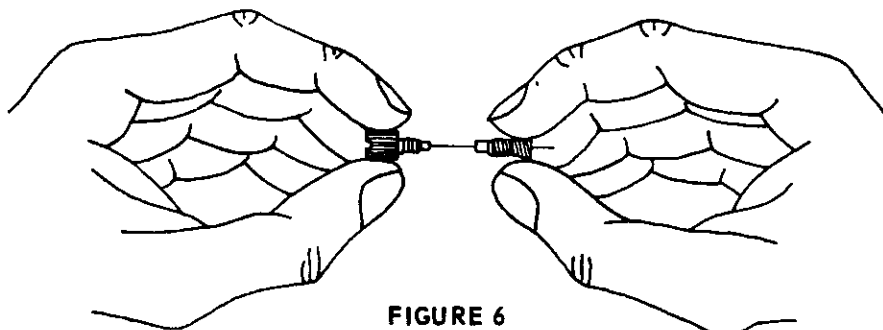
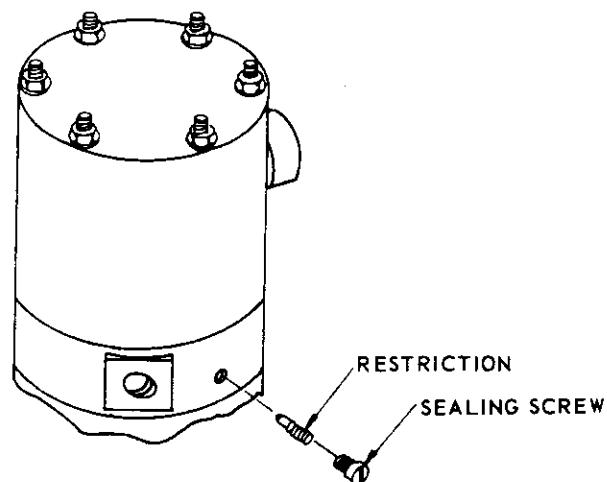
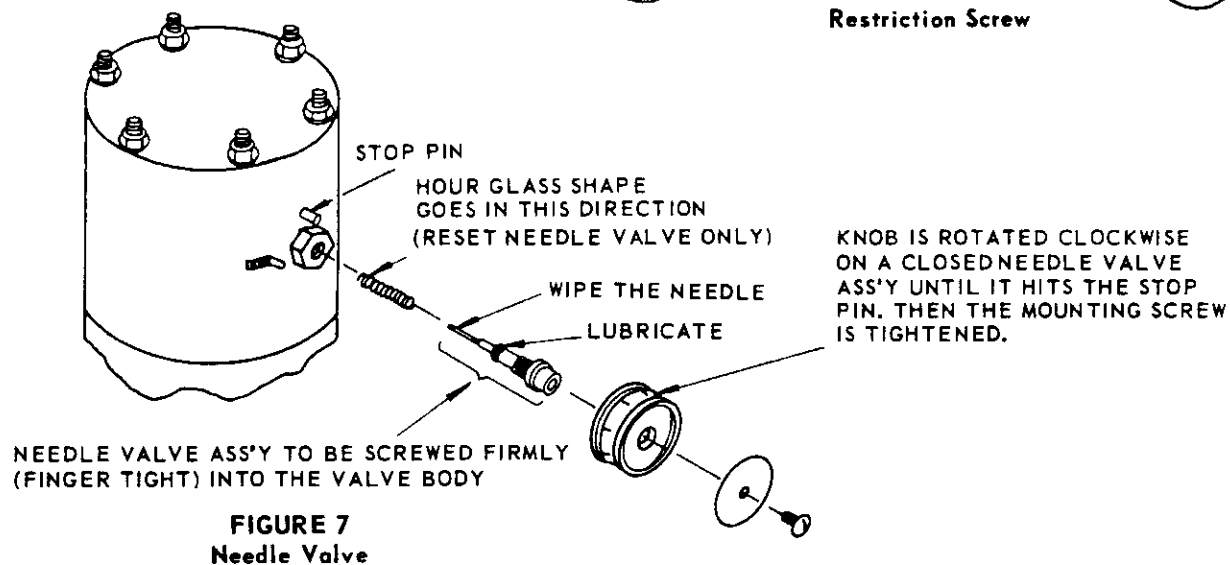


FIGURE 6
Restriction Screw



TROUBLE ANALYSIS

The probable causes in the following table are in the order of most to least likely. Most symptoms are difficult to analyze while the controller is operating. They are most readily seen in a test set-up.

SYMPTOM	PROBABLE CAUSE	REMEDY
No output	No supply.	Turn on supply air.
	Controller reversing plate incorrectly set.	Set according to control valve action and its effect on the process.
	Clogged supply restriction.	Clean the restriction.
	Motion stop not properly positioned when controller is assembled.	Insert motion stop properly (check top control diaphragm for damage).
Output will not increase to full-scale value.	Supply pressure too low.	Raise supply pressure to recommended value.
	Controller zero or tracking adjustment.	Calibrate the controller.
	Pilot plunger being held off of exhaust seat by a thread shaving, a piece of pipe dope, a shred of Teflon tape, etc.	Remove plunger and clean it and the exhaust seat.
	Bent pilot nozzle.	Replace.
Output will not decrease to a minimum-scale value.	Zero or tracking adjustment.	Calibrate the controller.
	Loose supply or reset restriction screws.	Tighten the restrictions.
Proportional action disagrees with indicated setting.	Misadjusted proportional band knob and needle valve.	Tighten needle valve finger-tight and mount knob against stop with index pointing to the highest number (200% or 500%).
	Clogged intermediate restriction.	Clean the restriction.

SYMPTOM	PROBABLE CAUSE	REMEDY
Proportional action disagrees with indicated setting (cont'd)	Coated proportional band needle valve (carbon, etc).	Clean the needle valve and its seat.
	Loose proportional band needle valve body.	Tighten the body into the controller.
	Damaged "O" ring at tip of proportional band needle valve body.	Replace "O" ring.
No reset action.	Clogged reset restriction.	Clean the restriction.
Reset action disagrees with indicated setting.	Misadjusted reset knob and needle valve.	Tighten needle valve finger-tight and mount knob against stop with index pointing to the highest number (5 min. or 50 min.).
	Coated reset needle valve (carbon, etc.).	Clean the needle valve and its seat.
	Loose reset needle valve body.	Tighten the body into the controller.
	Damaged "O" ring at tip of reset needle valve body.	Replace "O" ring.

DISASSEMBLY

The controller uses a convenient "stack" construction that allows easy and complete disassembly for inspection, cleaning or replacement of parts. Remove the six nuts, separate the diaphragms and rings, and lift the parts off the studs. Experience has shown that a dull table knife works best to separate the diaphragms and rings.

Caution

Because of an internal motion stop arrangement, shown in Figure 8, the "control diaphragm assembly" and the "pilot ring assembly" must be lifted off the studs before they can be separated from each other. These two assemblies must be slid apart in a certain direction. Otherwise, the pilot nozzle, and possibly the pilot nozzle seat, will be damaged. Use the procedure that follows:

To disengage the control diaphragm and pilot ring assemblies from each other:

1. Loosen the control diaphragm assembly from the pilot ring assembly. Do not pry! The diaphragm between these two assemblies must not adhere to the pilot ring assembly.

2. Hold the two parts with their locating grooves aligned and with the dot on the control diaphragm assembly facing you.
3. Hold the pilot ring assembly and push the control diaphragm assembly away from you.

ASSEMBLY

To reassemble the controller, use the parts drawing for the sequence of parts, and align the rings by the locating grooves on their periphery.

The control diaphragm and pilot ring assemblies must be assembled to each other before being placed on the studs. Use the following procedure:

1. Hold the pilot ring assembly so the "zero" adjustment screw faces you.
2. Position the control diaphragm assembly above and behind the pilot ring assembly. Line up the dot on the bottom ring of the control diaphragm assembly with the "zero" adjustment screw on the pilot ring assembly.
3. Slide these two assemblies together. While doing so, guide the zero adjustment leaf spring into the opening formed by the motion stop, and make sure the "U" shaped plate engages under the head of the pilot nozzle.

4. Hold the two assemblies together, align their locating grooves and place them on the studs.

If the control diaphragm assembly was disassembled, the "U" plate portion of the motion stop must be put back in the correct position. Align the open end of the "U" with the dot on the periphery of the bottom control diaphragm assembly ring.

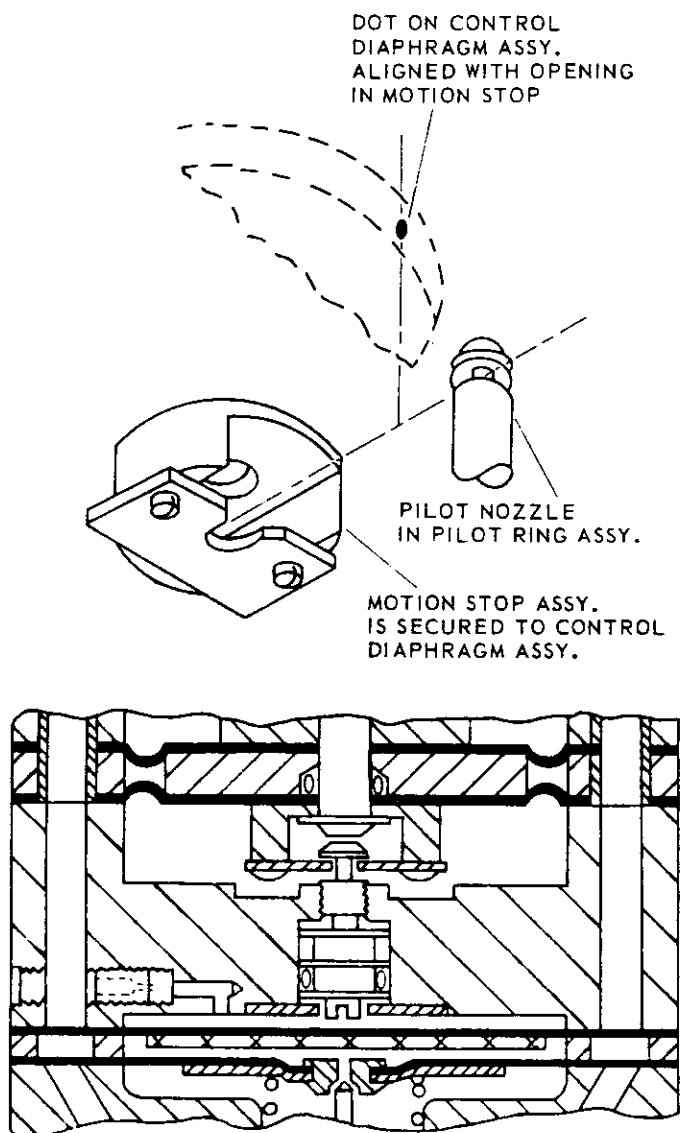


FIGURE 8
Control Diaphragm Assembly
Motion Stop

CONVERSIONS

Controllers can be converted from standard to wide proportional band, from standard to fast reset, and vice versa. See the table under "Model Designation" for the various two-mode controller configurations.

Use the parts list drawings as an aid while making the conversions and re-calibrate the controller when finished.

The following tabulations list the parts required for conversion.

STANDARD TO WIDE PROPORTIONAL BAND

Qty.	Description	Part No.
1	Control Diaphragm Ass'y.	14278-31
1	Throttling Knob Ass'y.	10880-50

WIDE TO STANDARD PROPORTIONAL BAND

Qty.	Description	Part No.
1	Control Diaphragm Ass'y.	14278-11
1	Throttling Knob Ass'y.	10880-45

STANDARD TO FAST RESET

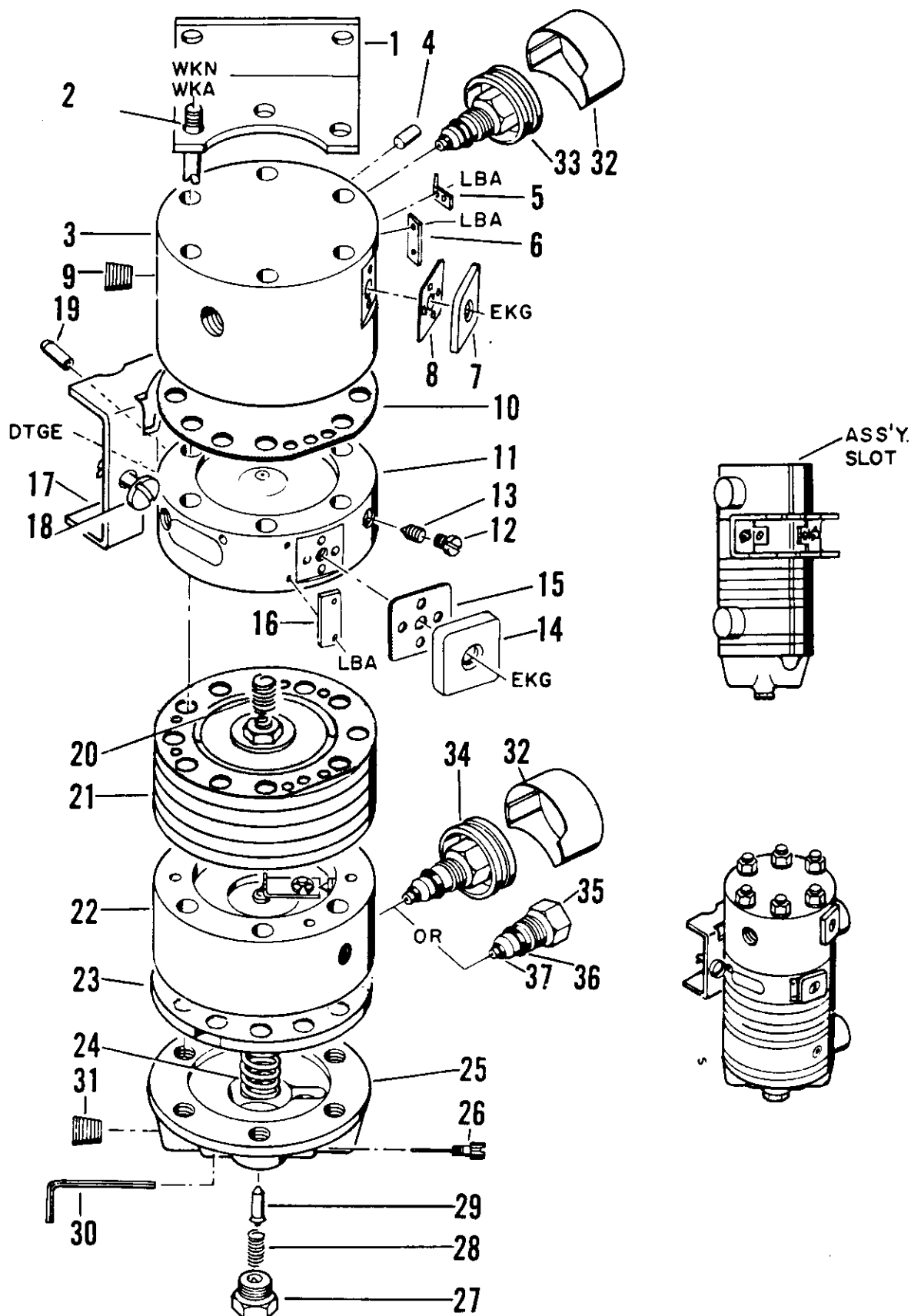
Qty.	Description	Part No.
1	Reset Valve Ass'y.	10880-2
1	Reset Knob Ass'y.	10880-42

FAST TO STANDARD RESET

Qty.	Description	Part No.
1	Reset Valve Ass'y.	10880-1
1	Reset Knob Ass'y.	10880-41

PARTS LIST
PIPE & MANIFOLD MOUNTED
NULLMATIC CONTROLLER

Drawing
No. 14281-61PL
(Sheet 1 of 2)



• Recommended On - Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.

PARTS LIST
PIPE & MANIFOLD MOUNTED
NULLMATIC CONTROLLER

50 — 14281-101S4
50F — 14281-102S4
50W — 14281-103S5
50FW — 14281-104S5
50FY — 14281-21N5
50Y — 14281-101S4(M3)

50M — 14281-106S4
50MF — 14281-107S4
50MW — 14281-108S5
50MFW — 14281-109S5
50MFY — 14281-20S5
50MY — 14281-106S4(M3)

MANIFOLD P/N 7115-10

Item No.	Part No.	Description	Required	Item No.	Part No.	Description	Required
2	7307-6	Studs	6	9	3092-35	Pipe Plug	1
* 10	2900-25	Diaphragm	1	11a	8855-79	Center Housing (Incl. Items 11b-16, EKG & LBA)	1
* 20	8106-32	Spring	1	11b	14278-150	Center Housing	1
21a	14278-11	Control Diaphragm (Except "W" Models) (Spare Parts Dwg. 14278-50PL)	1	* 12	2900-23	Sealing Screw	2
21b	14278-31	Control Diaphragm ("W" Models) (Spare Parts Dwg. 14278-50PL)	1	* 13	2900-22	Restriction	2
22a	14281-9	Pilot Ring Sub-Ass'y. (Pipe Mt'd Models) (Spare Parts Dwg. 14281-51PL)	1	14	3850-13	Switching Plate	1
22b	14281-10	Pilot Ring Sub-Ass'y. ("M" Models Only) (Spare Parts Dwg. 14281-51PL)	1	15	3092-3	Gasket	1
* 23	8003-8	Exhaust Diaphragm	1	16	3850-43	Nameplate	1
* 24	1447-13	Differential Spring	1	Models 50M, 50MF, 50MFW, 50MW 50MFY, & 50MY			
25	8855-1	Bottom Forging (Incl. Items 26-30 and two 2155-225 Filter Screens)	1	3a	8855-3	Top Housing (Incl. Items 3b-8, EKG & LBA)	1
* 26	1518-4	Cleaning Wire	1	3b	8051-19	Top Housing	1
* 27	8003-2	Retaining Nut	1	4	3035-1	Pin	1
* 28	2155-7	Plunger Spring	1	5	3092-31	Pointer	1
* 29	8003-5	Plunger	1	6	3850-12	Nameplate	1
30	3092-33	Restriction Wrench	1	7	3850-13	Switching Plate	1
32	3092-47	Knob Cover (1 Only for "Y" Models)	2	8	3092-3	Gasket	1
33a	10880-60	Reset Knob & Needle Valve (Except "F" Models) (See Spare Parts Dwg. 10880-76A)	1	11a	8855-74	Center Housing (Incl. Item 12-19, DTGE, EKG & LBA)	1
33b	10880-61	Fast Reset Knob & Needle Valve ("F" Models) (Parts Dwg. 10880-76A)	1	* 12	2900-23	Sealing Screw	2
34a	10880-62	Throttling Knob & Needle Valve (Except "W" & "Y" Models) (Parts Dwg. 10880-76A)	1	* 13	2900-22	Restriction	2
34b	10880-69P	Throttling Knob & Needle Valve ("W" Models) (Parts Dwg. 10880-76A)	1	14	3850-13	Switching Plate	1
35	4675-7	Plug ("Y" Models Only)	1	* 15	3092-3	Gasket	1
* 36	2938-3	"O" Ring ("Y" Models Only)	1	16	3850-43	Nameplate	1
* 37	2938-15	"O" Ring ("Y" Models Only)	1	17	7115-40	Mounting Bracket	1
MODELS 50, 50F, 50W, 50FW, 50FY & 50Y				18	7115-41	Stud	2
1	3093-3	Mounting Bracket	1	19a	7115-37	Tube (Short)	3
3	8855-2	Top Housing (Incl. Items 4-9, EKG & LBA)	1	19b	7115-38	Tube (Long)	2
4	3035-1	Pin	1	31	3092-35	Pipe Plug	2
5	3092-31	Pointer	1	- CODE -			
6	3850-12	Nameplate	1	- HARDWARE -			
7	3850-13	Switching Plate	1	DTGE	#10-32 x 1/2" Lg. Undercut Flat Hd. Screw ("M" Only)	2	Required
* 8	3092-3	Gasket	1	EKG	1/4-20 x 1/2" Lg. Oval Hd. Screw	2	
				LBA	0-1/8" Lg. Type "U" Drive Screw	6	
				WKA	1/4 Lockwasher	6	
				WKN	1/4-20 Hex Nut	6	

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.

PARTS LIST

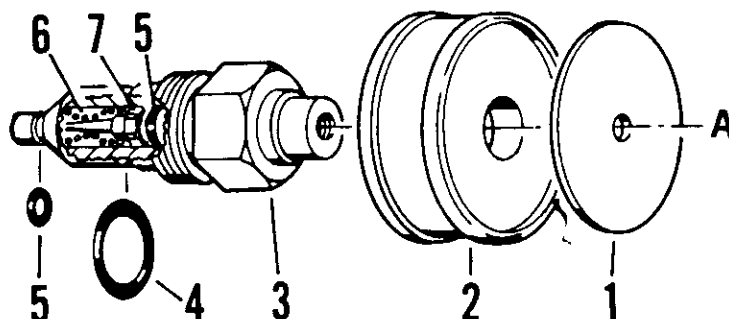


PROPORTIONAL BAND & RESET KNOB & NEEDLE VALVE ASSEMBLIES

Drawing No. 10880-76A

USED ON:

Model Series 50, 50X2, 501, 502,
503, 507, 508, 509, 55, 55X2, 561, 569, 688



PROPORTIONAL BAND KNOB & NEEDLE VALVE

Item	Part No.	Description	Req'd
P/N 10880-62 (STANDARD 2-200)			
1	3092-26	Knob Disc	1
2	10880-45	Knob	1
3	10880-3	Needle Valve Ass'y (Incl. Items 4 thru 7)	1
*4	2938-3	"O" Ring	1
*5	2938-15	"O" Ring	2
*6	10852-46	Comp. Spring	1
7	10852-59	Friction Washer	1
A	1-1192	#6-32 x 1/4 Lg. Truss Hd. Screw	1

P/N 10880-69P (WIDE 5-500)

1	3092-26	Knob Disc	1
2	10880-50	Knob	1
3	10880-3	Needle Valve Ass'y (Incl. Items 4 thru 7)	1
*4	2938-3	"O" Ring	1
*5	2938-15	"O" Ring	2
*6	10852-46	Comp. Spring	1
7	10852-59	Friction Washer	1
A	1-1192	#6-32 x 1/4 Lg. Truss Hd. Screw	1

RESET KNOB & NEEDLE VALVE

Item	Part No.	Description	Req'd
P/N 10880-60 (STANDARD .1-50)			
1	3850-8	Knob Disc	1
2	10880-41	Knob	1
3	10880-1	Needle Valve Ass'y (Incl. Items 4 thru 7)	1
*4	2938-3	"O" Ring	1
*5	2938-15	"O" Ring	2
*6	10852-8	Comp. Spring	1
7	10852-59	Friction Washer	1
A	1-1192	#6-32 x 1/4 Lg. Truss Hd. Screw	1

P/N 10880-61 (FAST .01-5)

1	3850-8	Knob Disc	1
2	10880-42	Knob	1
3	10880-2	Needle Valve Ass'y (Incl. Items 4 thru 7)	1
*4	2938-3	"O" Ring	1
*5	2938-15	"O" Ring	2
*6	10852-8	Comp. Spring	1
7	10852-59	Friction Washer	1
A	1-1192	#6-32 x 1/4 Lg. Truss Hd. Screw	1

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or
Other Nameplate Information When Ordering Spare Parts

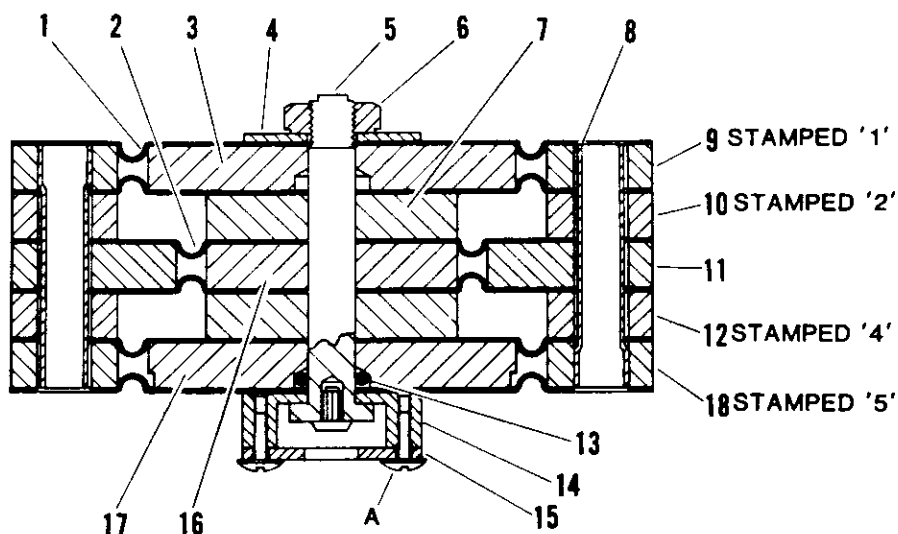


CONTROL DIAPHRAGM ASSEMBLIES

Drawing No. 14278-50PL

COMPLETE ASSEMBLY: P/N 14278-11 (Standard 2-200%)
P/N 14278-31 (Wide 5-500%)

USED ON:
Model Series 50, 50X-2, 509,
55, 55X-2, 561, 569 & 688



Item	Part No.	Description	Req'd.	
			200%	500%
* 1	8648-5	Diaphragm	4	4
* 2a	8648-4	Diaphragm	2	—
* 2b	8648-13	Diaphragm	—	2
3	4551-5	Upper Spacer - Outer	1	1
4	3092-40	End Plate	1	1
5	4551-22	Rod	1	1
6	3821-32	Jam Nut	1	1
7	4551-6	Center Spacer	3	2
8	4551-10	Dowel Tube	2	2
9	4551-1	Vent Ring — Upper	1	1
10	4551-90	Spacer Ring — Upper	1	1
11a	4551-3	Vent Ring — Center	1	—
11b	4551-50	Vent Ring — Center	—	1
12	4551-92	Spacer Ring — Lower	1	1
* 13	2938-1	"O" Ring	1	1
14	14278-12	Stop Bracket	1	1
15	14278-14	Stop Plate	1	1
16	4551-51	Center Spacer	—	1
17	14956-924	Lower Spacer	1	1
18	4551-81	Vent Ring — Lower	1	1
A	1-0650	#4-40 x 1/4 Lg. Truss Hd. Screw	2	2

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts

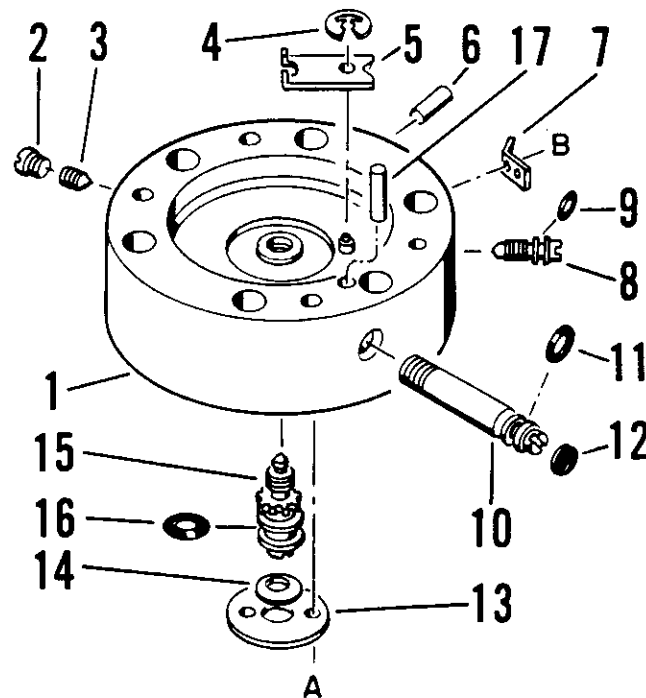


PILOT RING ASSEMBLIES

Drawing No. 14281-51PL

COMPLETE ASSEMBLY: P/N 14281-9 (with tapped "C" port) Issue 5
P/N 14281-10 Issue 5

USED ON:
Model Series 50, 50X-2, 55, 55X-2, 561 and 688



Item	Part No.	Description	Req'd.
1a	14278-5	Pilot Ring (For Assy. 14281-9)	1
1b	14278-34	Pilot Ring (For Assy. 14281-10)	1
* 2	2900-23	Sealing Screw	1
* 3	2900-22	Restriction	1
4	7044-1	Retainer Ring	1
5	8051-42	Leaf Spring	1
6	3035-1	Pin	1
7	3092-31	Pointer	1
8	8051-41	Zero Screw	1
* 9	2938-5	"O" Ring	1
10	14568-4	Tracking Screw	1
* 11	2938-4	"O" Ring	1
12	8051-56	Plug (Not Included with Assy.)	1
13	14278-43	Stop	1
14	14278-40	Curved Washer	1
15	14278-13	Nozzle	1
* 16	2938-2	"O" Ring	1
17	8179-2	Pin	1
A	1-0955	#5-40 x 5/16" Lg. Flat Hd. Screw Undercut	2
B	1-6818	#0 x 1/8" Lg. Type "U" Drive Screw	2

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.