



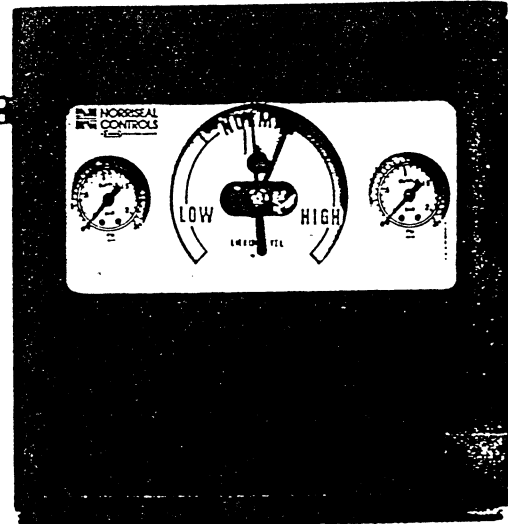
NORRI SEAL
CONTROLS

OPERATING and MAINTENANCE MANUAL

SERIES 1400, TYPE 72-45 INDICATING PNEUMATIC LEVEL CONTROLLERS

TO INSTALL

- I. Mount Controller rigidly to appropriate surface.*
- II. Blow out instrument air line to remove foreign solids and liquids.
- III. Install Instrument air regulator to 1/4" NPT "Supply" connection. Do not use Teflon tape on piping connections.
- IV. Tie process to the Controller as follows:
 - A. 72-44 Pressure Controller
Connect process piping at 1/4" NPT "Process" connection.
 - B. 72-46 Temperature Controller
Install capillary bulb in piping or apparatus at a point where good circulation is assured.
 - C. 72-45 Level Controller
 1. Remove all shipping brackets.
 2. Check torque in torque tube (element should bounce freely).
 3. If the torque tube is torqued properly ignore paragraphs a thru f and proceed with start up instructions. If the torque tube is not torqued properly it may be retorqued by the following procedure:
 - a. Make sure that input crank is loose on torque tube input shaft.
 - b. Loosen bolts on rear of instrument mounting flange so that torque tube bearing housing can be rotated.
 - c. From inside instrument case, apply 5/8" wrench to torque tube bearing housing to lift the displacement element in the displacer chamber.
 - d. Lower the displacement element until it is touching bottom and then raise it until it just barely lifts off the bottom (1/4" to 3/8").
 - e. While holding this torque on the torque tube bearing housing, tighten the mounting flange bolts to lock it in place keeping the instrument case level.
 - f. Set proportional band dial at 10% direct or reverse as process requires.
 4. Slide input crank hub on torque tube input shaft. Push lightly against felt washer but DO NOT LOCK SET SCREW. (5/64 Allen wrench)
 5. Set specific gravity on approximate gravity scale (1 for water). For Controllers which are mounted on the left of their displacer chamber, the gravity scale "R" should be used. For Controllers mounted on the right of their displacer chamber, the gravity scale "L" is used.

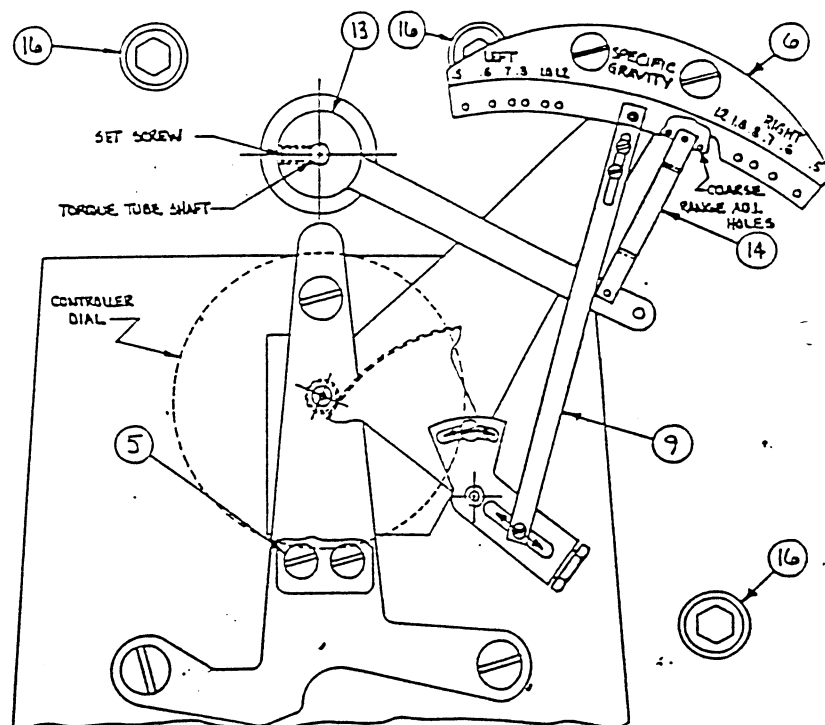


* See figure "A" for mounting on liquid level controller using 3 - 1/4 inch Allen head bolts.

Caution: Before disassembly or maintenance, all pressures in this device must be relieved. Failure to relieve pressures may result in personal injury or device damage. The resulting uncontrolled venting or spilling of line fluids may cause personal injury, loss of process control or environmental contamination.

ASSEMBLY OF CONTROLLER TO LIQUID LEVEL SENSOR

- 1) REMOVE TWO (2) DIAL SCREWS AND REMOVE DIAL.
- 2) ATTACH CONTROLLER CASE TO LEVEL DISPLACER WITH ITEM 16 (3 PIECES)
- 3) SLIP ITEM 13 ON TORQUE SHAFT. (NOTE: SLIGHT SANDING OF TORQUE SHAFT END MAY BE NEEDED.)
- 4) ASSEMBLE ITEM 14 IN HOLES AS SHOWN.
- 5) PUT LINK (ITEM 9) IN APPROPRIATE SPECIFIC GRAVITY HOLE SO INCREASE IN LEVEL CAUSES ITEM 9 TO MOVE TOWARDS THE TOP OF THE CASE.
- 6) POSITION ITEM 13 AXIALLY ON TORQUE SHAFT SO LINKS ARE IN ALIGNMENT, TIGHTEN SET SCREW SO BLACK POINTER IS AT LOW END OF SCALE.
- 7) CALIBRATE BLACK POINTER TO PROCESS LEVELS AS DESCRIBED IN CALIBRATION INSTRUCTIONS IN FORM 937 INSTRUCTIONS. TO ADJUST COARSE RANGE, MOVE ITEM 14 TO ANY OF THE THREE (3) COARSE RANGE HOLES. ZERO ADJUST IS MADE BY LOOSENING SET SCREW AND REPOSITIONING ITEM 13 ON TORQUE SHAFT.



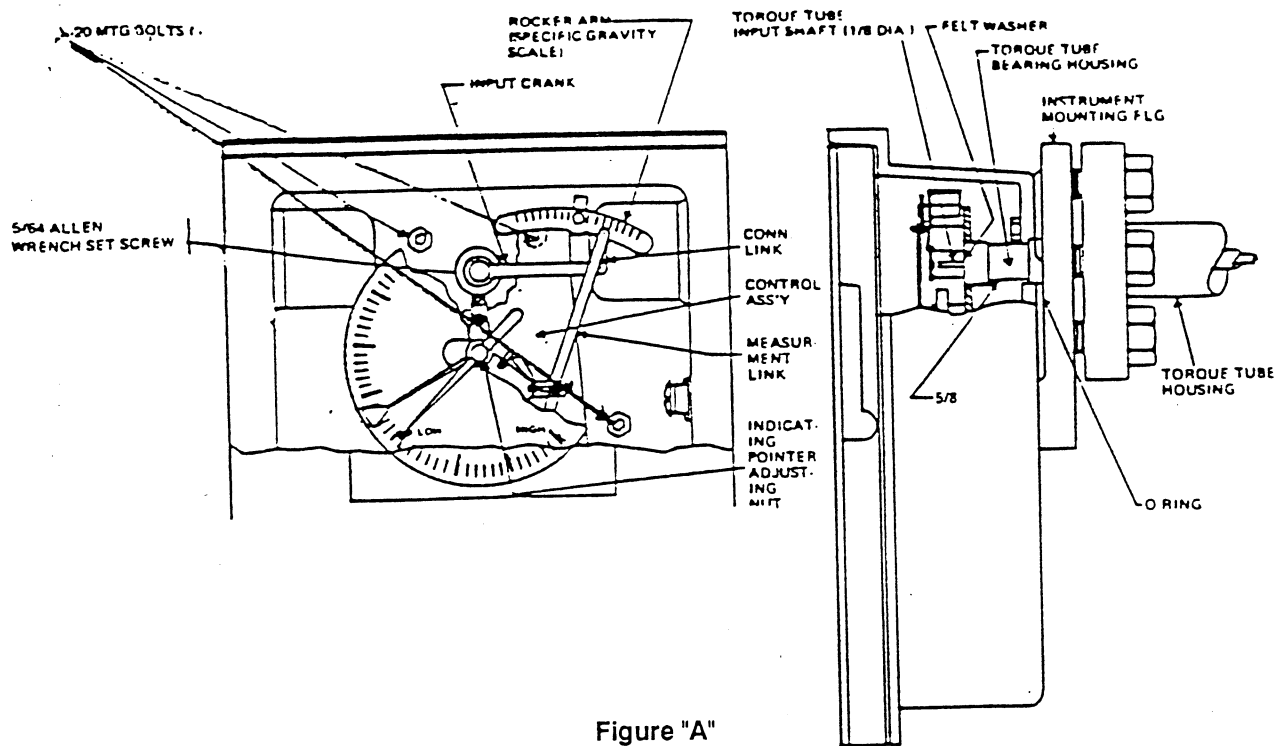


Figure "A"

6. Setting approximate indicator Travel (Dry Displacer)
 - a. With input crank hub not locked to torque tube, move rocker arm so that the black pointer moves through its complete travel which should be slightly more than 360 degrees.
 - b. With the 1/4" wrench hold the adjusting nut and set black indicator* so that half its full travel is 50% scale. This will center the indicator for calibration. Do not lock the set screw at this time.
 - c. With the set point adjusting knob (Red knob) move the red pointer through its complete travel.
 - d. With the 1/4" wrench hold the red pointer adjusting nut and set red pointer* so that half its full travel will be 50% scale.

* **CAUTION:** Apply torque near center of the indicator and pointer to avoid bending it.

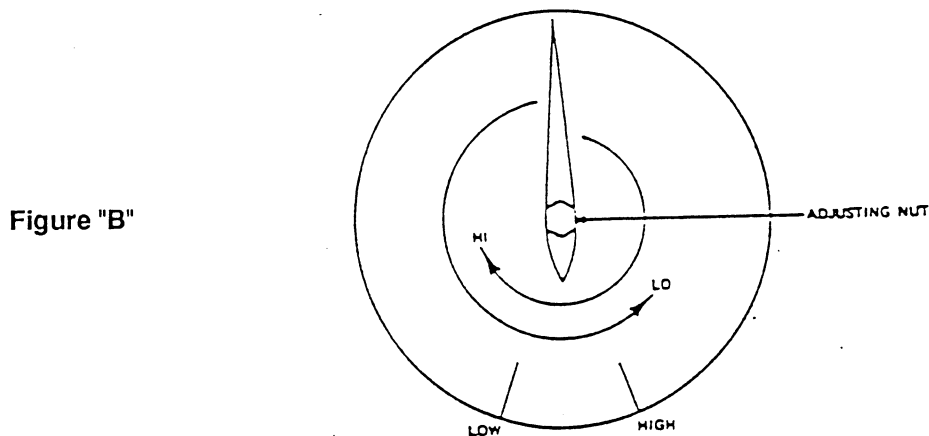


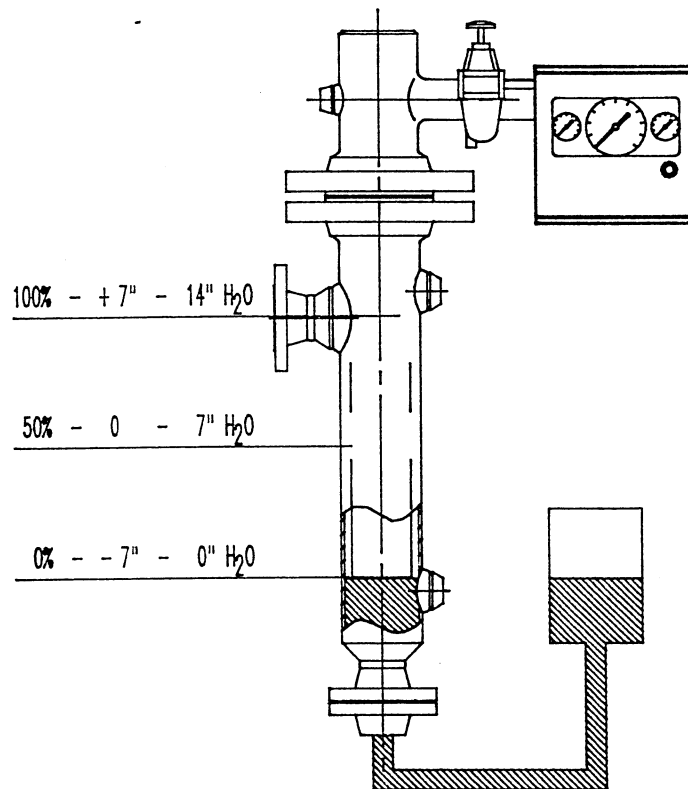
Figure "B"

7. Water bottle calibration

NOTE: The 72-44 pressure and 72-46 temperature controller may be calibrated in somewhat the same procedure as described below except by using the pressure or temperature to set the movement to 50% of range for mid span calibration.

- a. The displacer housing will be supplied marked with a centerline. Information for a reference measurement will be provided if the displacer housing centerline mark has been covered by insulation. The range of the level controller will be subdivided in a way to give the range of level control equal travel from centerline in both directions. On any displacement type level controller the 50% mark will be centerline. The example Figure C shows the more common 0-14" H₂O level controller (71-06-6HV).

Figure "C"



- b. Using a water bottle to change level, set level at 50%.
- c. With set point knob place red pointer at 50% scale. (This is done because the position of the set point has an effect on the level indicator position.)
- d. With 5/64" Allen wrench set input crank so that level indicator (black indicator) is on 50% aligned atop the red pointer.
- e. With proportional band set at 10% and Reset fully open (clockwise), apply 20 psig (3-15 instruments), 35 psig (3-27 instruments) instrument air to controller.
- f. Turn set point adjust knob until output is mid span 9 psig (3-15) 15 psig (3-27) and carefully close reset completely (full counter clockwise) trapping mid span pressure in reset chamber.
NOTE: If mid span pressure cannot be trapped in reset chamber, a nozzle flapper adjustment should be made at this time.
- g. Hold set pointer hub with 1/4 wrench and turn red pointer to 50% so that both red pointer and black indicator are on 50% and output is mid span* pressure. If output has moved, repeat steps f and g until this is accomplished.
- h. Move water level to 0% of level control. The level indicator (black pointer) should have moved to 0% scale as the level changed.
- i. With the set point adjust knob move red set pointer until it aligns with 0% water level on the dial regardless of where the black indicator stopped.
- j. If the black indicator doesn't align with 0% water level on the dial, a span adjustment must be made.* If the indicator is below zero, turn range adjusting nut clockwise to decrease indicator travel. If the indicator is above zero, turn range adjusting nut counter clockwise to increase indicator travel. (See figure "E")
- k. Move water back to 50% level and with set point adjust knob move red pointer back to 50% scale.
- l. Hold indicator hub with 1/4 wrench and turn black indicating pointer to 50% scale aligning it with red pointer.
- m. Repeat steps h, i, j, k, and l until black indicator is correct between 0% and 50% scale.
- n. A check at 75% or 100% is needed at this time. If you are correct from 0-50% the upper half of scale will be very close.

* (9 PSIG for 3-15 controller; 15 PSI for 3-27 controller)

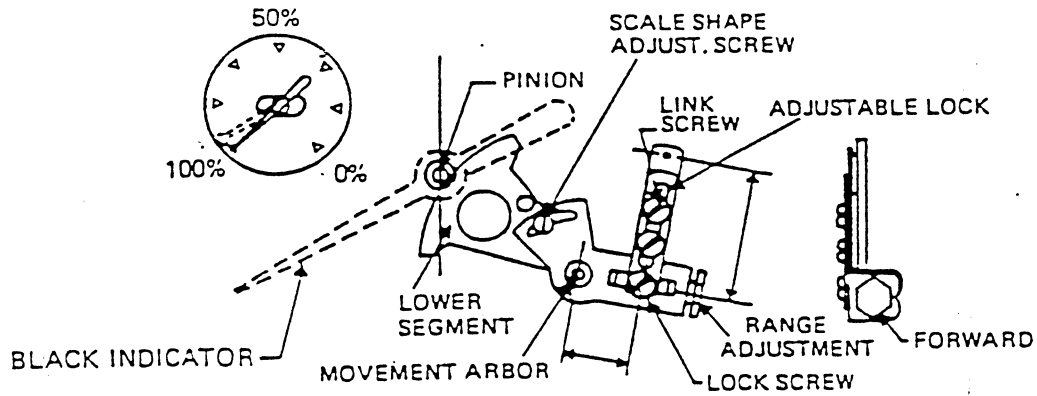


Figure "E"

NOTE: To make adjustments to the movement, the dial must be removed. This may be accomplished without removing the pointers, by first aligning the red and black pointers with one another by using the set knob, removing the two dial screws, and manipulating the elliptical center hole over the pointers. In this way, successive adjustments and calibration checks with the dial on may be made without having to disturb the pointers.

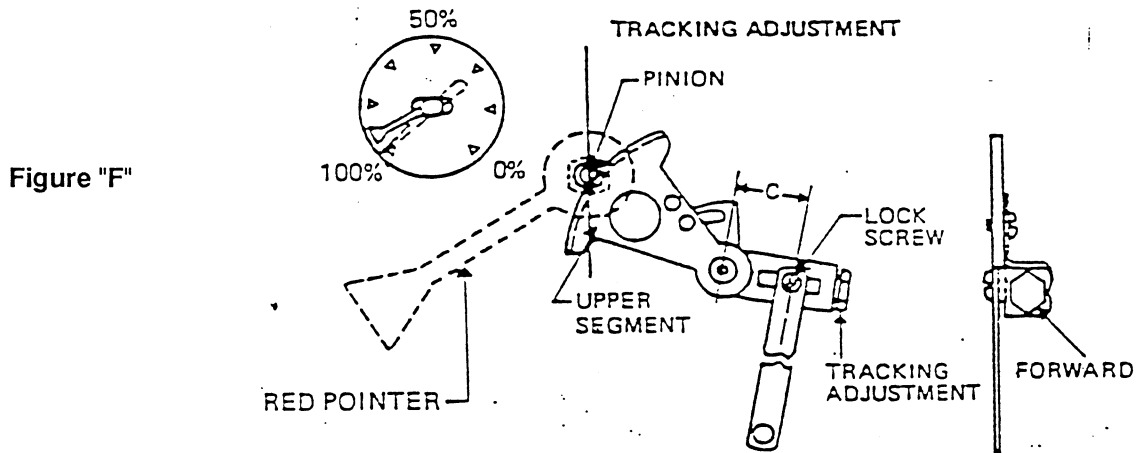


Figure "F"

- o. At any point on scale the red point should be aligned with black indicator to give a mid span* 9 PSIG output. If this condition doesn't exist, move red pointer with set knob until output reads mid span. Note in what direction pointer has to move to accomplish mid span pressure. This is more easily done with water level at 50%. Make a tracking adjustment to correct pointer travel in the same way that the range adjustment on the black indicator was made (steps j-l). Use the range adjustment closest to the front of the instrument. At any point on scale the red pointer should track (align) with the black indicator to give a mid span* output. This enables the controller to control at any set point equally as well.

After the pointer alignments are made and the output is correct (mid span*) for all positions where the pointers are aligned, the proportional band can be aligned to give a stable output throughout the band.

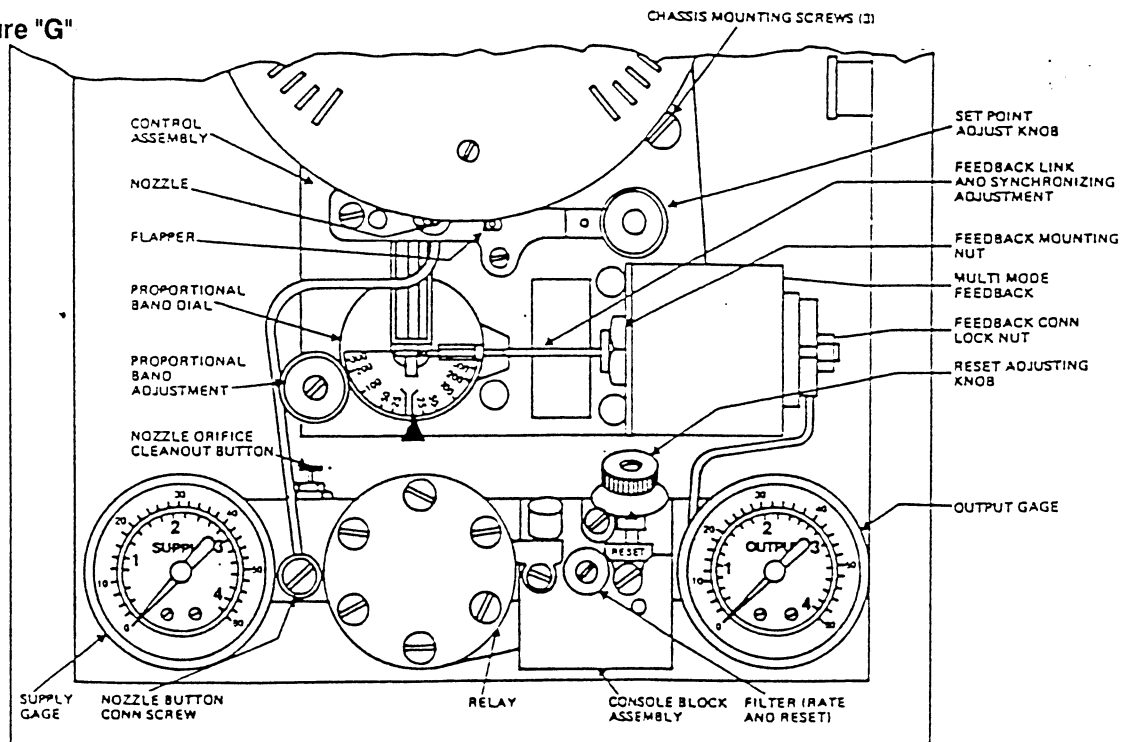
8. Alignment of Proportional Band
 - a. With all components assembled into the instrument and supply air turned on, set action reverse or direct as described under Selection of Control Action.
 - b. Set proportional band near lowest number.
 - c. For any controller having a rate valve, turn valve full clockwise to stop (fastest rate time).
 - d. For any controller having a reset valve,
 - (i) Move set pointer until output pressure is approximately at mid span* .
 - (ii) When output is at required pressure, quickly turn reset valve full counter clockwise (closed) to trap mid span* bias pressure in reset chamber. This enables operation as a proportional-only controller.
 - e. Adjust set pointer to get mid span* output pressure.
 - f. Turn proportional band to maximum setting. Note output pressure.

- g. Adjust the length of the feedback link to restore the output to mid span* pressure.
 - (i) Loosen feedback link lock-screw (5/32" hex) and back away from link tab.
 - (ii) To make coarse adjustments (approximately .020" per turn), leave the link tab in its clip in the center of the proportional band dial and screw on or off the link.
 - (iii) To make fine adjustments (approximately .005" per turn), leave the link tab in its clip and turn the rod feedback link rod. Take care not to exert excessive force on the feedback link.
- h. Return proportional band to near lowest number.
- i. Adjust set-point to obtain mid span* pressure.
- j. Change proportional band to maximum setting.
- k. Output should hold at mid span* pressure. If output drifts, adjust feedback link length and repeat above procedure.
- l. With output at mid span* pressure, the set pointer (red) should be coincident with the indicating pointer (black). If it is not, hold set pointer hub with 1/4" wrench (attached to door) and turn pointer until it coincides.

CAUTION: Grasp set pointer at wide section near hub to avoid bending it.

* (9 PSIG for 3-15 controller; 15 PSIG for 3-27 controller)

Figure "G"



9. Checking Reset Action Min/Repeat

- a. After all previous calibrations have been made, set level at approximately 50% and align set point with indicator to simulate a stable level controller.
- b. Open reset valve to some value (3 or 4) with proportional band at 100% (or as desired).
- c. Leave set point in place and move level to produce an error between pointers. Approximately 1 in. will work fine.
- d. The output will be affected first by a proportional change and then continue to change by an integration rate (reset rate) that you selected.
- e. The output will continue to change until level is once again brought back to set point.
- f. This rate of change (response) of the controller is dependent upon:
 - (i) Amount of pointer deviation
 - (ii) Proportional band setting
 - (iii) Reset setting
- g. Now this controller can be tuned with proportional band and reset rate to give a proper level control at any reasonable position on the scale.

TO START UP

- I. Turn on instrument air - 20 psi for 3-15 psi controllers; 35 psi for 3-27 and 6-30 psi controllers.
- II. Determine proper controller action and position nozzle accordingly.
- III. Tune controller to process:
 - A. **PROPORTIONAL ONLY**
 1. Set red set pointer at desired value.
 2. Set Proportional band at desired value. Observe operation; if unstable increase band width until stability is achieved.
 - B. **PROPORTIONAL + RESET (LESS BYPASS)**
 1. With reset valve wide open (turned fully clockwise), move set pointer until output is at mid span.
 2. Turn reset valve fully counter clockwise to trap mid span pressure in reset chamber.
 3. Set red set pointer and adjust proportional band until process is stable.
 4. Open reset valve to a value process will tolerate.
 - C. **PROPORTIONAL + RESET (WITH BYPASS)**
 1. Turn red set pointer to minimum dial reading.
 2. Set proportional band at approximately 50%.
 3. Turn reset knob fully counter clockwise to close.
 4. Turn reset bypass switch to "off".
 5. Using built-in regulator, set mid span pressure in reset can. Check by depressing poppet valve.
 6. Slowly raise red set pointer to desired value.
 7. Adjust proportional band until process is stable under proportional control.
 8. Using built-in regulator, change bias pressure to eliminate offset between red set point and black process pointers.
 9. Turn reset bypass switch to ON.
 - D. **PROPORTIONAL + RESET + RATE**
 1. Proceed as for proportional + reset controllers except initially rate valve is to be turned fully open (clockwise).
 2. After process is under control of proportional + reset, tune in rate response.
 3. Adjust to value process will tolerate without instability.
 - F. **DIFFERENTIAL GAP**
 1. Set red set pointer to center of desired differential gap.
 2. Turn band to desired width on gap side of dial.
 3. Note extreme highs and lows of process. Adjust as necessary.

MEASUREMENT		
TROUBLE	COMMON CAUSES	
	Pressure	Temperature
No measurement, no movement of the black pointer	Stop valve shut, connection clogged, element broken or overranged	Overranged element, leak in element.
Reads High	Not adjusted for liquid head, element overranged	Overranged element - Vapor system not adjusted for head.
Reads Low	Air or vapor trapped in liquid leg, leak in connection line.	Overranged mercury or liquid filled element, leak in element.
Erratic	Linkage sticking, instrument vapor lock or liquid seal in connection.	Vapor element going through ambient. Linkage sticking.

CONTROL			
TROUBLE	COMMON CAUSES		
	Proportional	Proportional + Reset	Proportional + Rate
No supply pressure	Air supply valve shut, line frozen, regulator not set		
Low supply pressure	Regulator not set	Regulator not set, filters clogged.	
No output pressure	Wrong red pointer setting, dirt in orifice, loose connection in nozzle line, flapper bent or not seating, relay diaphragm broken, relay out of adjustment.		
Low output pressure	Low supply pressure, no output causes above.		
Output pressure remains high	Wrong red pointer setting, nozzle clogged, orifice assembly loose flapper jammed closing nozzle, relay out of adjustment.		
Process cycling	Proportional band too narrow, friction in valve or controller, valve oversize	Proportional band too narrow, Reset rate too fast, friction in valve or controller, friction in reset unit gland, valve oversize	Proportional band too narrow rate time too low, rate valve closed or clogged, friction in valve or controller, valve oversize
Process wanders	Proportional band too wide, valve undersize	Proportional band too wide, reset rate too slow, valve undersize	Proportional band too wide.
Process approaches control in steps			Rate time too high.
Black pointer away from red pointer	Normal offset due to load change not synchronized with synchronizing nut	Red pointer misadjusted	Normal offset due to load change not synchronized with synchronizing nut

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