Masoneilan 12800 Series Liquid Level Controllers Instructions

Instruction No. EU7000E
Rev. A 4/84

PRELIMINARY STEPS

1. Unpack carefully.
2. Inspect for parts which may have become loose or broken in transit.
3. Record serial number for future reference.
4. Remove all straps, etc. on links and levers, and shipping blocks securing displacer in displacer chamber.
5. Before installing, read instructions.

CAUTION: To prevent damage during shipment, the displacer is anchored to the chamber with a threaded rod and nut through the bottom opening in the chamber. The **rod, nut** and **holder** must be removed from the unit before installation. Where the bottom connection to the changer is side mounted, a pipe plug is supplied and must be installed into the hole from which the shipping rod was removed.

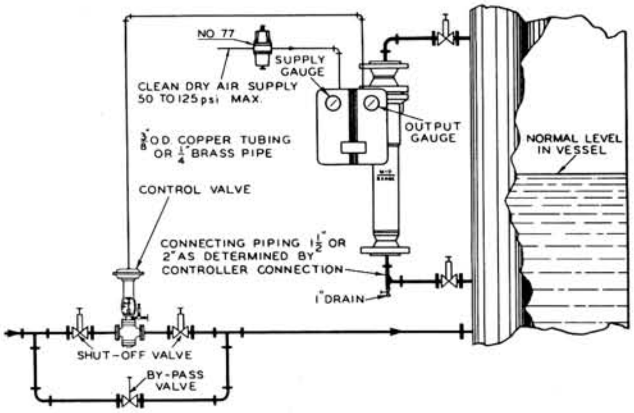


Fig. 1 Typical Installation

SECTION I — INSTALLATION

The controller should be located, if possible, at some easily accessible, well lighted place on the vessel. Location should also be such that ambient temperatures at the controller case do not exceed 180°F. If the controller is subjected to freezing temperatures, special arrangements must be made for drying supply air.

MOUNTING

Chamber Type Models (Fig. 1)
Install the controller in a vertical position on the side of the tank or vessel so that the $\frac{\text{MID}}{\text{RANGE}}$ mark is located at the normal level. The equalizing lines should be the same size as the chamber connections. Install a block valve in each line. On top and bottom connected units, the use of a drain connection as shown in Fig. 1 is recommended.

Top Flange Mounted (Fig. 2)
When the controller is top flange mounted, the displacer may be attached before the chamber flange is bolted to the nozzle flange. In installations where lack of overhead room dictates the use of a detachable hanger extension, the displacer should be lowered part way into the tank before attaching the extension. After the extension has been screwed into the displacer and pinned, the displacer may be hooked to the torque arm and the entire unit lowered into position.

Side Flange Mounted (Fig. 3)
When the controller is side flange mounted, a manway must be provided to permit attaching the displacer after the chamber flange is bolted in place. To attach the displacer, reach into the end of the protective housing and depress the torque arm. Then bring the displacer hanger up through the hole in the bottom of the housing and slip the displacer hanger over the torque arm pin. Lower the displacer until the pin engages the top of the slot in the hanger.

Guide Bracket (Internally Mounted Displacers)
If the liquid is in motion, it will be necessary to provide a bracket as shown in Fig. 3 to guide the lower end of the displacer. Locate the centerline of the hole so that the displacer hangs free. The diameter of the hole should be 1″ to 1½″ larger than the diameter of the displacer for ranges to 6 feet and 2″ to 3″ larger on longer ranges. Locate the bracket 2″ to 3″above the lower end of the displacer.

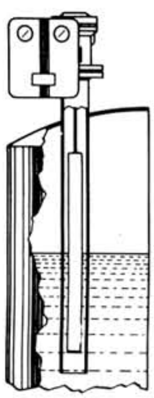


Fig. 2

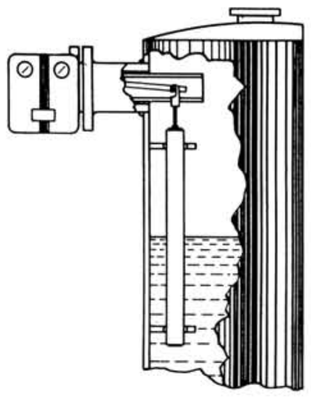


Fig. 3

Stilling Well (Internally Mounted Displacers)
If the liquid is turbulent, a stilling well as shown in Fig. 2 should be provided. The well is made from tubing or pipe of suitable diameter to allow the clearances noted above. It should be approximately as long as the displacer and mounted so that it extends at least 3″ below the displacer when the displacer is hanging free. The well should be fitted with an end plate at the bottom and should have a number of drilled holes in the side and bottom to allow free circulation of the liquid.

CONTROL VALVE
Refer to instructions accompanying the control valve.

AIR PIPING (Fig. 1)
For continuous trouble-free operation, the air supply to the filter regulator must be clean and dry and held between 50 and 125 psi gauge. Blow out all pipe, tubing and fittings before connecting the controller. If thread compound or shellac is used, apply it only above second or third male threads in moderate amounts.

Supply Header
When two or more controllers are installed in a group, it is usually desirable to use an air supply header. Use brass pipe and fittings (at least ½″ size) for the header. Always make connections of supply line to controllers on the top or side of the header, never on the bottom. Install a shutoff valve and a filter-regulator on each controller.

Air Supply
Pipe the air supply to the ¼″ NPT connection in the filter-regulator mounted behind the instrument case. For 3-15 psi output pressure range, adjust the supply pressure to 20 psi on proportional and proportional-reset controllers; to 18 psi on differential-gap control. For 6-30 psi out pressure, adjust the air supply to 35 psi.

Note: If the air supply contains excessive amounts of moisture or oil, necessary steps should be taken to remove it before air supply reaches the instrument supply piping.

Pneumatic Set Connection
Pipe the output of the loading source to the ¼″ NPT connection on the back of the case below the "Supply" and "Output" manifold.

Output Air
Use ¼″ brass or ³/₈″ O.D. copper tubing for the air line to the control valve. Tubing and compression fittings are preferable. The ¼″ NPT connection (marked "Output") is located at the back of the case. The output air piping MUST be air-tight.

SECTION II — DESCRIPTION AND OPERATION

GENERAL
Level Measuring Element: converts change in level to primary motion.
Relay: amplifies pressure variations at the nozzle.
Reversing Arc: provides (1) motion take-off from torque tube; (2) means of reversing control action and; (3) adjustment for specific gravity.
Proportional Unit: converts primary motion to a proportional output air pressure.
Reset Unit: used in place of proportional unit on proportional-reset controllers.
Differential-gap Unit: used in place of proportional unit on differential-gap contollers.
Control Setting Unit: provides a means of varying the set point.

RELAY (Fig. 4)
The relay is secured to the air manifold by two screws. It contains the orifice and relay mechanism. The supply air passes to the underside of the relay plug. A small quantity of this air passes through the orifice and serves as nozzle supply. When the nozzle is covered by the flapper, the following events take place more or less simultaneously:
1. Nozzle pressure builds up over the upper diaphragm.
2. Diaphragm block moves downward.

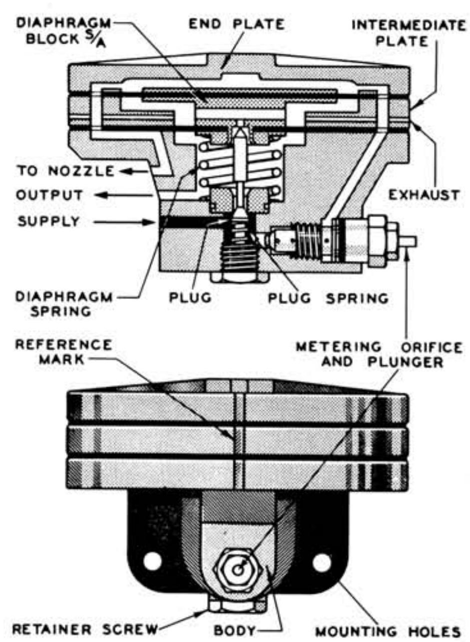


Fig. 4 Relay

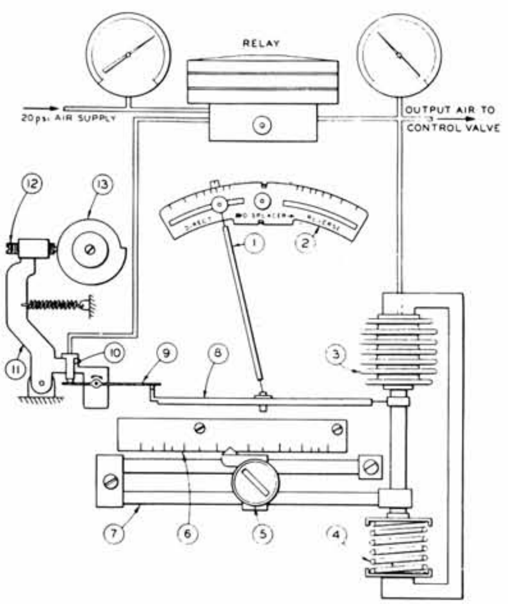
3. Relay plug seals exhaust seat in diaphragm block and opens inlet seat.
4. Output pressure builds up under lower diaphragm.
5. Diaphragm block moves upward.

The inlet seat remains open until equilibrium is reached between nozzle pressure and output pressure. When this balance is established, there is theoretically no flow of air into or out from the relay. Actually, a small bleed is provided between supply and output to increase the relay responsiveness when at equilibrium.

Conversely, a decrease in nozzle pressure opens the exhaust seat, allowing output air to escape between the two diaphragms through horizontal ports in the intermediate plate. The ratio of effective areas between upper and lower diaphragms is such that a change of about 3½ psi in nozzle pressure will result in an output pressure change of 12 psi (i.e. 3 to 15 psi).

REVERSING ARC (Figs. 5, 6, 7, 8, 9)

The reversing arc serves as a motion take-off arm from the torque tube. It is provided with a slot on each side of the center so that the link can be connected for either direct or reverse control action. With the instrument mounted to the left of the displacer and the link connected in the lefthand slot, rising level will cause the reversing arc to rotate counterclockwise, forcing the link downward. This lowers the control arm allowing the flapper to cover the nozzle and thus increase the output pressure. With the link connected in the righthand slot, rising level causes the flapper to uncover the nozzle and the output pressure to decrease. If the instrument is righthand mounted, these effects will be reversed. The slots in the reversing arc provide an adjustment to compensate for effect of specific gravity on displacer travel. Thus, for all liquids within the specific gravity range of the controller, setting can be made so that a unit change in level will produce the same primary motion.



LEGEND

1. Control Link
2. Reversing Arc
3. Proportional Bellows
4. Bellows Spring
5. Proportional Band Clamp
6. Proportional Band Scale
7. Proportional Spring
8. Control Arm
9. Flapper
10. Nozzle
11. Nozzle Bracket
12. Alignment Micrometer
13. Control Setting Cam

Fig. 5 Proportional Controller (Model 12800)

PNEUMATIC PROPORTIONING MECHANISM

The pneumatic proportioning mechanism includes the relay nozzle and proportional unit. Fig. 5 illustrates the operation of this mechanism diagrammatically. Relay output pressure is brought directly to the proportional bellows (3).

An increase in level allows the torque tube to rotate the reversing arc (2) in a counterclockwise motion. This motion is transmitted through the link (1) to the control arm (8) lowering the arm and allowing the flapper (9) to cover the nozzle (10). The resultant increase in nozzle pressure actuates the relay, increasing the output pressure. The increase in output pressure expands the proportional bellows moving the right hand end of the control arm downward. This causes the control arm to rotate clockwise about the link as a pivot, so that the arm contacts the flapper, moving it away from the nozzle.

Since the movement of the flapper necessary to produce a 12 psi change in air pressure is extremely small (approximately .001″), the position of the flapper may be considered fixed. Any change in the position of the link due to a change in level either tends to cover or uncover the nozzle. The resultant relay action causes the proportional bellows to move the flapper in the opposite direction to establish equilibrium. Therefore, for any position of the link there is only one possible position of the proportional bellows which will establish this equilibrium.

Since the movement of the proportional bellows is proportional to

1. movement of the link (primary motion) and
2. output pressure of the relay

then the output pressure must be exactly proportional to movement of the link as long as this movement does not require an output pressure beyond the range of the supply pressure.

Shifting the point of contact of proportional band clamp (5) along the proportional spring (7) varies the effective length of the spring. This varies the amount of force developed by the proportional bellows necessary to produce a given movement of the control arm and hence changes the relative effect of primary and feedback motions on the flapper. With the clamp in the extreme lefthand position, feedback will have maximum effect. With the clamp in the extreme righthand position, feedback will have minimum effect.

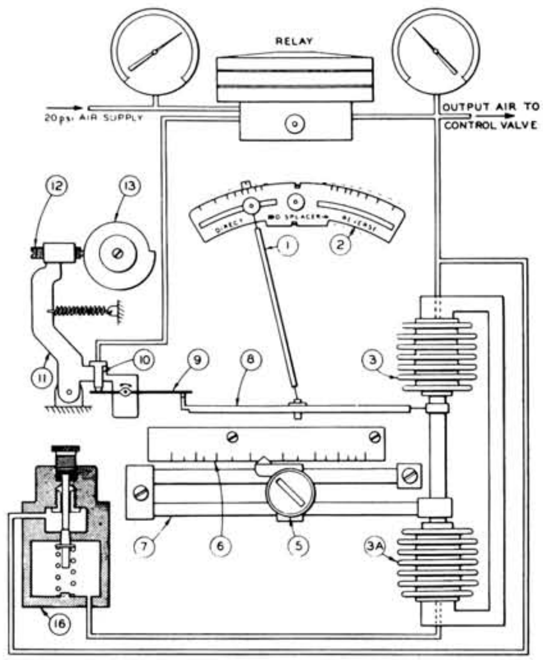
Proportional-reset Action (Fig. 6)

The construction of the reset unit differs from the proportional unit in that the reset bellows (3A) replace the bellows spring. A resistance unit (16) and capacity tank are included in the air circuit connecting the proportional and reset bellows.

When the level is at the set point under equilibrium conditions, the pressures in the proportional and Reset bellows are equal. A departure from the set point causes the proportioning mechanism to operate exactly as in a proportional controller; the change in output pressure alters the pressure in the proportional bellows. Because of the resistance between the proportional and reset bellows, an initial pressure differential exists between them. The resulting bellows movement rotates the control arm about the link pivot repositioning the flapper. Two simultaneous effects are initiated:

1. output pressure starts to change in a direction to bring level back to the set point.
2. air flows through resistance unit between proportional and reset bellows in a direction to equalize pressure in the two bellows.

These effects continue until equilibrium is restored with level at the set point.



1. Control Link
2. Reversing Arc
3. Proportional Bellows
3A. Reset Bellows
5. Proportional Band Clamp
6. Proportional Band Scale
7. Proportional Spring
8. Control Arm
9. Flapper
10. Nozzle
11. Nozzle Bracket
12. Alignment Micrometer
13. Control Setting Cam
16. Resistance Unit

Fig. 6 Proportional-reset Controller (Model 12810)

Using the reasoning as for proportional action (that the flapper can be considered fixed for all equilibrium conditions) equilibrium will result only when the pressures in the proportional and reset bellows have equalized and the level has returned to the set point.

Reset rate depends upon the particular process and is varied by changing the value of the resistance between the reset and proportional bellows.

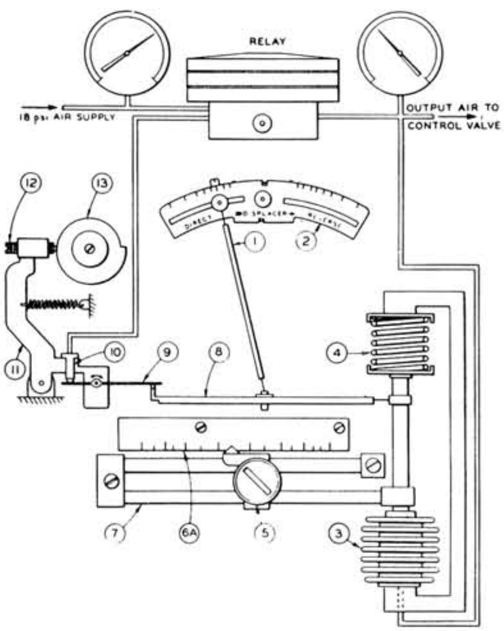
DIFFERENTIAL-GAP MECHANISM (Fig. 7)

The differential-gap controller is identical with the proportional controller except that (a) the positions of the proportional bellows (3) and bellows spring (4) are reversed. (Note: The proportional controller may be converted in the field by reversing the bellows and spring as above. No extra parts are required except a different length of air tubing and, if desired, a differential-gap scale.) When movement of the control link causes the flapper to cover the nozzle, reaction of the proportional bellows will cause the flapper to cover the nozzle further. The level will then have to change a certain amount in the opposite direction to cause the flapper to uncover the nozzle.

The difference between the levels at which the nozzle is covered and at which it is uncovered is termed the "differential-gap". The magnitude of the differential-gap is determined by the position of the differential-gap clamp along the proportional spring. The control setting establishes the midposition of the differential-gap.

TRANSMITTER MECHANISM (Fig. 8)

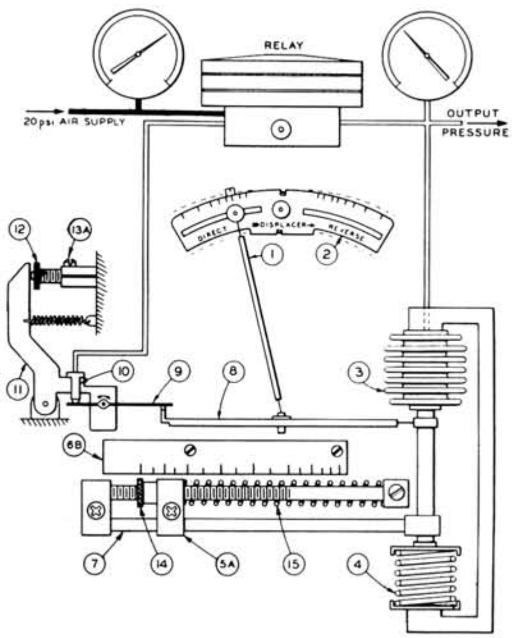
The transmitter mechanism is similar to that of the proportional controller except that (a) the setting cam is replaced by an alignment micrometer (12) and lock and (b) the proportional band adjustment is modified to include a proportional micrometer (14).



LEGEND

1. Control Link
2. Reversing Arc
3. Proportional Bellows
4. Bellows Spring
5. Differential-gap Clamp
6. Differential-gap Scale
7. Proportional Spring
8. Control Arm
9. Flapper
10. Nozzle
11. Nozzle Bracket
12. Alignment Micrometer
13. Control Setting Cam

Fig. 7 Differential Gap Controller (Model 12830)



LEGEND

1. Control Link
2. Reversing Arc
3. Proportional Bellows
4. Bellows Spring
5. Clamp
6. Transmitter Scale
7. Proportional Spring
8. Control Arm
9. Flapper
10. Nozzle
11. Nozzle Bracket
12. Alignment Micrometer
13. Alignment Micrometer Lock
14. Proportional Micrometer
15. Proportional Micrometer Spring

Fig. 8 Pneumatic Transmitter (Model 12820)

PNEUMATIC SET MECHANISM (Fig. 9)

In pneumatic set controllers an additional subassembly (bellows unit) provides for pneumatic positioning of the set point. (The normal control setting mechanism is omitted.) This remote setting is accomplished by using the 3 to 15 psi output from another controller, a transmitter or a manually adjusted loading regulator. Loading the pneumatic set bellows (17) turns the nozzle bracket (11) about its axis, varying the position of the nozzle flapper assembly in relation to the control arm. The 100% pneumatic set band width is not adjustable.

Note: Increase in pneumatic set loading pressure always increases controller output pressure.

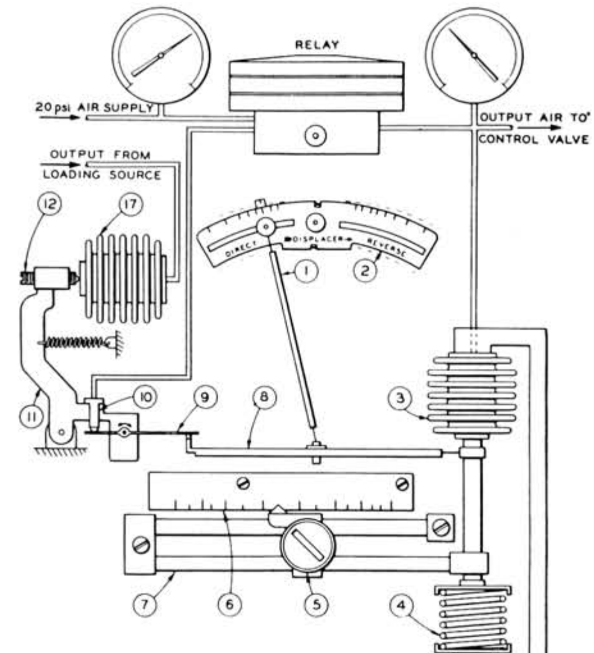
CONTROL SETTING MECHANISM (Figs. 5, 6, 7)

The control setting knob is connected through the gear and pinion to the control setting cam (13). Rotating the cam turns the nozzle bracket (11) about its axis, varying the position of the nozzle-flapper assembly in relation to the control arm. The alignment micrometer (12) upon which the cam bears, is provided as a means for aligning the control setting Index with the actual level.

DUPLEX INSTRUMENTS

Duplex instruments contain two separate controller mechanisms in the same case and actuated by a common torque tube. Each controller unit is adjusted and calibrated individually in the same manner as in a single controller.

CAUTION: The control link (1) of both units must remain connected to the reversing arc (2) while calibrating each unit individually. Otherwise, the calibrations will not be accurate.



LEGEND

1. Control Link
2. Reversing Arc
3. Proportional Bellows
4. Bellows Spring
5. Proportional Band Clamp
6. Proportional Band Scale
7. Proportional Spring
8. Control Arm
9. Flapper
10. Nozzle
11. Nozzle Bracket
12. Alignment Micrometer
17. Pneumatic Set Bellows

Fig. 9 Pneumatic Set Controller (Model 12840)

Note: In pneumatic set controllers, the control setting is made by loading the pneumatic set bellows. A 3 psi load on the bellows corresponds to low level; 15 psi to high level.

SECTION IIIA — ADJUSTMENTS

CONTROL ACTION

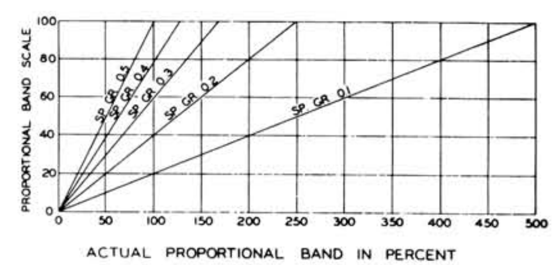
The controller is set at the factory for the control action specified. To check the over-all action, determine from the type of application whether a rise in level should open or close the control valve. (Refer to chart below.) To obtain the desired control action, check to see that arrow on reversing arc points toward displacer (reversing arc may be turned over if necessary) and then connect control link in appropriate reversing arc slot.

CONTROL SETTING

The control setting for a proportional controller is adjusted by turning the control setting knob. Be sure control setting scale indicates desired control action. (If it does not, loosen two screws securing it and turn over; also reverse knob plate.)

SPECIFIC GRAVITY

The position of the control link index on the reversing arc scale determines the specific gravity setting. The reversing arc scale is graduated only for specific gravities as low as 0.5. However, the standard controller and displacer may be used for gravities (or gravity differences in interface service) as low as 0.1. In such applications, the control link index should be set at 0.5. The values on the proportional band scale now, however, are relative. The actual values of proportional band can be found from the curves below.



APPLICATION	CONTROL VALVE	CONTROLLER		
If a rise in level should	and the control valve action is	then link must be in slot of reversing arc marked	control setting scale should read	setting knob plate marked
close the valve	air-to-close	direct	direct	D
close the valve	air-to-open	reverse	reverse	R
open the valve	air-to-close	reverse	reverse	R
open the valve	air-to-open	direct	direct	D

PROPORTIONAL BAND (Models 12800, 12810)

The figures on the proportional band scale indicate the percentage of total level range through which the level must travel in order to change the output pressure from 3 to 15 psi. The setting of the proportional band index then indicates the width of the band.

In order to keep level variation to a minimum, the proportional band should be set as narrow as the process will permit without cycling. If the process is such that it is impossible to narrow the proportional band sufficiently to maintain the spread within the desired limits, it may be necessary to add reset.

RESET RATE (Model 12810)

The reset rate knob is graduated in "repeats" per minute (i.e. the number of times that the effect of the proportional action with a given deviation is repeated per minute by the reset action).

With the reset rate at a low value (e.g. .02 to .2, depending on the process) which will not interfere with the proportional band adjustment, narrow the proportional band as much as the process will permit without cycling. Widen the band by approximately 50%. Slowly turn the reset rate knob I clockwise, increasing the reset rate until cycling occurs. Note the value of the reset rate when cycling occurs, then set the reset rate for approximately one-half that value.

DIFFERENTIAL-GAP (Model 12830)

The width of the differential-gap is determined by the position of the differential-gap index along the scale. The position of the control setting index determines the position of the gap within the instrument range.

SECTION IIIB — ALIGNMENT

PROPORTIONAL CONTROLLERS (Model 12800)

With displacer hanging free (zero level) —

1. Set control link index to proper specific gravity value on reversing arc scale.
2. Set proportional band index at 100% and control setting index at 5.
3. Adjust alignment micrometer to bring output to 3 psi if control is set for direct action; to 15 psi if control is set for reverse action.
4. Set control setting index to desired value on scale and proportional band index at a value in accord with past experience. If no value is suggested by experience, we suggest a setting of approximately 40%.
5. Admit process liquid to controller and adjust proportional band to stabilize control.
6. Adjust control setting knob to bring level to the desired position.

Note: In interface service (with chamber filled with upper phase liquid) set control link index at proper specific gravity difference and continue with steps 2 through 6 above. If gravity difference is less than .5, set control link index to 0.5 and refer to chart inside of instrument cover for actual setting to obtain 100% band.

PNEUMATIC SET CONTROLLERS (Model 12840)

In pneumatic set controllers vary proportional controller procedure at points indicated, as follows:

1. Set proportional band index at 100% and load pneumatic set bellows with 9 psi (indicated by output gauge of loading source).
2. Load pneumatic set bellows with required pressure to obtain desired control setting (e.g. 9 psi set at mid-range or 18 psi for 6-30 psi output range) and set proportional band index at a value in accord with past experience.
3. To change control setting adjust pressure in pneumatic set bellows.

Reset Controller (Model 12810)

Alignment (calibration) for controllers with reset is the same as that for proportional controllers except that 9 psi, or mid output for other than 3-15 psi range, should first be locked in the reset bellows.

Set reset index at 6 (open position) and adjust control setting index for 9 psi output. (18 psi for 6-30 psi range) When 9 psi output remains constant for at least 30 seconds, set reset rate index at white dot (locking mid output in reset bellows), and follow proportional controller procedure for calibration.

Note: If the output drops when the reset rate index is turned to the dot, there is an air leak in the reset circuit. This leak or leaks must be found and repaired before proper calibration can be performed. The most common causes for leaks are defective O-rings in the reset unit or loose fasteners at the tubing ends on the reset housing or bellows.

DIFFERENTIAL-GAP (Model 12830)

With displacer hanging free (zero level) —

1. Set supply pressure at 18 psi and control link index to proper specific gravity value on reversing arc scale.
2. Set control setting index at 5 and differential-gap index at 100%.
3. Adjust alignment micrometer to bring output to 18 psi if control is set for direct action; or to 0 psi for reverse action. Turn alignment micrometer **slowly** until output changes to 0 psi for direct action; or to 18 psi for reverse action. Lock micrometer at point where change just occurs.
4. Desired gap is obtained by setting differential-gap index at desired value on the scale.
5. Admit process liquid to the chamber or vessel and adjust control setting to position differential-gap at desired point within the instrument range.

PNEUMATIC TRANSMITTER (Model 12820)

For satisfactory results the pneumatic transmitter must be adjusted after it has been connected to the receiver. With the displacer hanging free (zero level) —

1. Set control link index to proper specific gravity value on reversing arc scale.
2. Loosen clamp screw one turn and turn proportional micrometer (which also acts as an index) to 100. Tighten clamp screw.
3. Loosen alignment micrometer lock and adjust alignment micrometer to obtain 3 psi output pressure.

4. Raise level to top of the range and observe corresponding output pressure. If output pressure is less than 15 psi, loosen clamp screw one turn and rotate proportional micrometer (clockwise) to move clamp to the right (to narrow transmitter band). If output pressure is more than 15 psi, move clamp to left. Tighten clamp screw.
5. Adjust alignment micrometer to obtain 15 psi.
6. Lower level to zero and observe output. If not 3 psi, make adjustments as in 3, 4 and 5 above — first transmitter band then alignment micrometer — until output is at desired values at both high and low level. Be sure to tighten clamp screw and alignment micrometer lock after each adjustment.

SECTION IV — MAINTENANCE

GENERAL

The following should be checked at regular intervals to obtain maximum performance of the control system:

1. **Filter-Regulator** — Accumulation of condensate from the air supply line should be removed by opening the petcock in the bottom of the dripwell.
2. **Control Valve** — Refer to control valve instructions.
3. **Air Circuit** — The frequency with which metering orifice and nozzle should be checked will depend on the condition of the air supply.

DISPLACER (Fig. 10)

To Remove: On chamber type models, close stop valves in connecting lines and drain chamber before disassembly.

The procedure for disassembly is as follows:

1. Remove top flange and protective housing flange.
2. Depress torque arm and unhook displacer. On chamber type models, allow the displacer to rest at the bottom of the chamber. On top flange mounted internal displacer type models, the displacer must be suspended in the tank with the hanger below the torque arm. A simple hook made of 1/8″ round stock will greatly facilitate unhooking the displacer. The hook may be inserted in one of the holes in the hanger.
3. Detach torque arm from torque tube plate by removing screws and withdraw torque arm from chamber.
4. Lift displacer from chamber or tank.

To Replace

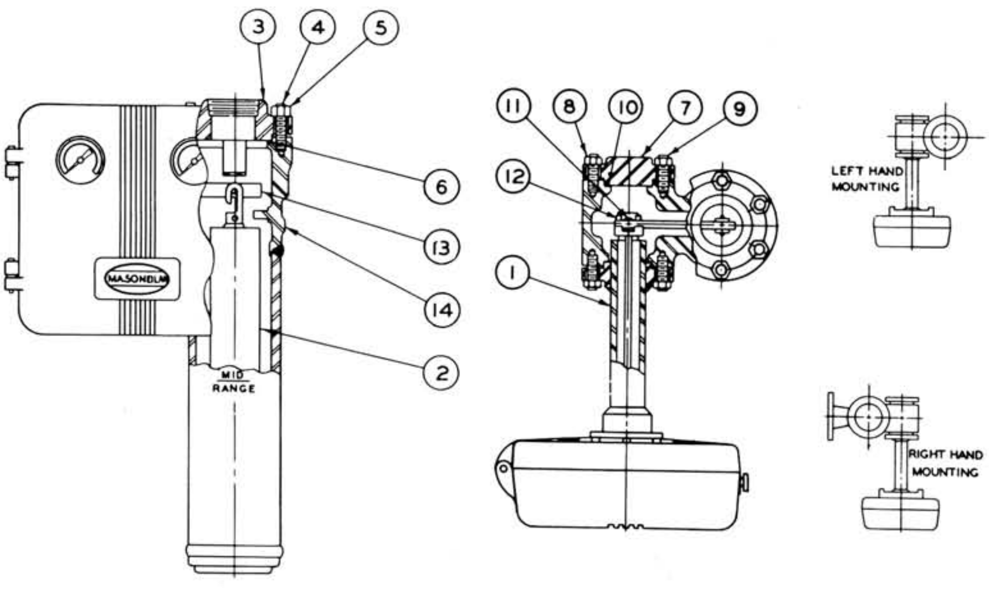
Reverse above procedure.

INSTRUMENT CASE MOUNTING (Fig. 10)

Standard case mounting is left hand; i.e., with case to left of displacer. Right hand mounting is optional.

To reverse case mounting in the field proceed as follows:

1. Remove torque arm from protective housing as outlined in Steps 1 through 3, previous paragraph.
2. Detach torque tube housing assembly from protective housing assembly by removing stud nuts.
3. Attach torque tube housing assembly on opposite side of protective housing assembly.



NO.	PARTS
1	TORQUE TUBE & HOUSING S/A
2	DISPLACER
3	TOP FLANGE
4	TOP FLANGE STUDS
5	TOP FLANGE NUTS
6	TOP FLANGE GASKET
7	BLIND FLANGE
8	FLANGE & HOUSING NUTS
9	FLANGE & HOUSING STUDS
10	FLANGE & HOUSING GASKETS
11	INTERNAL KNIFE EDGE
12	MACHINE SCREWS
13	TORQUE ARM
14	INTEGRAL CHAMBER

Note: On this and following pages parts references are NOT factory part numbers. For part numbers consult Parts List.

Fig. 10 Displacer, Torque Arm, Instrument Mounting

4. Reassemble torque arm, protective housing flange and top flange.
5. Disconnect control link from reversing arc.
6. Loosen nut securing reversing arc. Turn reversing arc over and replace nut. Before tightening nut, however, be sure arc is positioned so that tabs line up with slots. (Arrow on reversing arc should point toward displacer).
7. Connect control link for desired control action and specific gravity.
8. Check control setting scale to see that it agrees with control action. If necessary, reverse scale and knob plate.

RELAY (Fig. 11)

Metering Orifice

The metering orifice for the nozzle air supply is fitted with a cleanout plunger which forces a small wire through the jewel orifice.

Disassembly

The metering orifice can be removed for cleaning while the relay remains fastened to the air manifold. If further disassembly is required, proceed as follows:

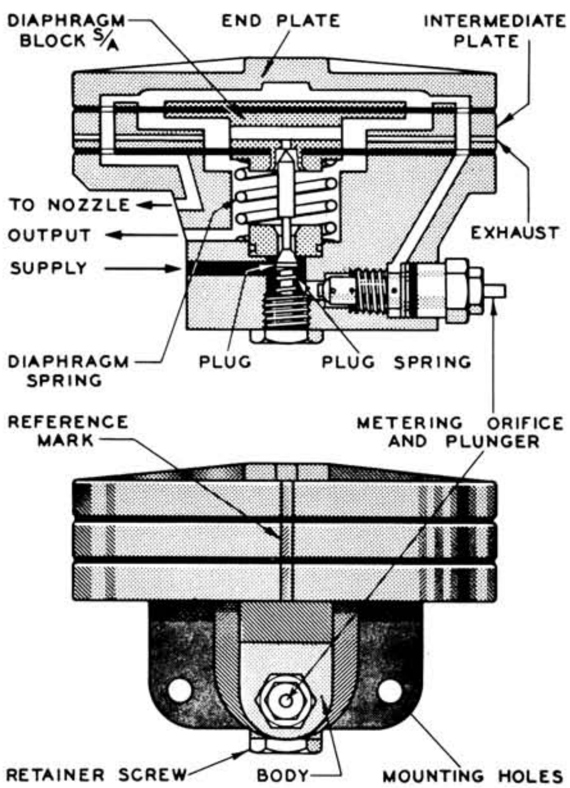


Fig. 11 Relay

1. Unscrew mounting screws which hold relay to air manifold. Break joint carefully to avoid damaging the relay gasket.
2. Remove metering orifice body and retainer screw and drop relay plug and plug spring from relay body. Remove six screws which hold end plate, intermediate plate and diaphragms to relay body. Remove diaphragm spring from relay body and disassemble diaphragm block from intermediate plate.
3. Clean parts with clean soft cloth. Use solvent if oil and grease are present. Blow out ports in body, Intermediate plate and end plate with clean dry air.

Assembly

1. Assemble diaphragm block in intermediate plate as shown (Fig. 11).
2. Replace diaphragm spring in relay body. Align holes in diaphragms with those in intermediate plate and end plate and insert screws. Then assemble on relay body. The correct alignment of intermediate plate and end plate on relay body is simplified by use of reference marks.
3. Assemble relay plug, plug spring, retainer screw and metering orifice.
4. Position the relay gasket on air manifold.

After establishing correct position, slip relay gasket over the two mounting screws on relay and fasten relay to air manifold.

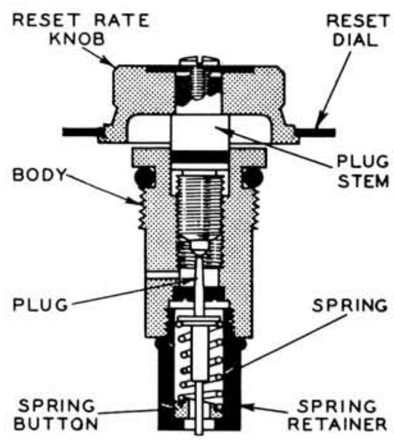


Fig. 12 Resistance Unit

NOZZLE

To Clean

Shut off air supply.

Disconnect nozzle tubing from air manifold. Loosen set screw securing nozzle in nozzle bracket and withdraw nozzle.

Diameter of nozzle hole is .020 (No. 76 drill). Push drill or wire of smaller diameter through hole. Blow out tubing with clean dry air.

Replace nozzle in nozzle bracket. Hold nozzle firmly against shoulder in nozzle bracket and tighten set screw. Connect tubing to air manifold.

RESISTANCE UNIT (Fig. 12)

On Model 12810 proportional-reset controllers, the resistance unit may require occasional cleaning.

Disassembly

1. Turn reset knob counterclockwise and lift reset pointer so that it clears stop on the reset dial.
2. Unscrew reset knob to end of thread and remove.
3. Use wrench on hex of resistance unit body and turn counterclockwise to end of thread.
4. Pull resistance unit body from frame with twisting motion to overcome friction of O-ring.
5. Unscrew spring retainer from body and remove spring, spring button, plug and O-ring.
6. Blow out ports and wipe parts with clean, lint-free cloth.

Assembly

1. Reassemble spring retainer, spring, spring button, plug and O-rings on body.
2. Replace body in reset frame.
3. Replace reset knob in body and turn until it contacts the plug. If the contact point cannot be found easily, remove the reset knob and insert a small screwdriver into the body. Press in on the plug and release quickly. Re-insert the knob until it makes contact with the plug. Lift pointer so that it clears stop on dial. Turn knob back slightly to make sure that plug is fully seated.
4. Loosen screw in center of knob and turn knob to .02 mark on the dial.
5. Tighten screw in center of knob.

CHANGING MODE OF CONTROL

The 12800 Series Level Controllers are designed so that conversion from one mode of control to another can be made easily in the field. Kits containing the necessary additiional and replacement parts for any changeover are available.

Proportional to Proportional-reset
Parts Required:

Bellows Tubing Assembly
Reset Bellows Assembly
Resistance Unit Assembly

In order to convert from proportional to proportional-reset control it is necessary to replace the bellows spring assembly with a reset bellows unit and add a resistance unit in the air circuit between the proportional and reset bellows. The procedure for conversion is as follows:

1. Remove output pressure gauge using wrench on flats at back of gauge.
2. Disconnect bellows tubing assembly from air manifold and proportional bellows assembly.
3. Move proportional band index to extreme left. Compress bellows spring, until spring button is clear of male thread at end of proportional spring assembly. Then remove bellows spring unit.
4. Raise end of proportional spring assembly slightly, slide reset bellows assembly into place and tighten.
5. Mount resistance unit in lower left hand corner of case.
6. Attach new bellows tubing assembly connecting air manifold, proportional bellows, reset bellows and resistance unit. Be sure to use the copper gasket supplied, between tubing adapter and screw head.
7. Replace Output Pressure Gauge.
8. Align control mechanism as outlined in Section III.

Proportional to Differential-gap
Parts Required

Bellows Tubing Assembly
Differential Gap Scale

To change from proportional to differential gap control, it is necessary only to reverse the positions of the proportional bellows assembly and bellows spring assembly.

The procedure for conversion is as follows:

1. Remove proportional bellows assembly and bellows spring assembly following steps 1 through 3 above.
2. Raise end of proportional spring assembly and slide proportional bellows assembly into position formerly occupied by the bellows spring assembly.
3. Depress proportional spring assembly slightly and insert bellows spring assembly into position from which bellows was removed.
4. Attach new bellows tubing assembly connecting proportional bellows and air manifold.
5. Replace output pressure gauge.
6. Align control mechanism as outlined in Section III.

SECTION V — TROUBLE SHOOTING

Difficulty in securing good controller performance may be caused by the process or by faulty installation. The following sources of difficulty are frequently overlooked.

Cycling may be caused by:

(a) cvcling of other controllers in the process;
(b) pulsations caused by pumps or steam traps;
(c) faulty air supply system;
(d) sticking control valve; or
(e) oversized control valve. With an air-to-open valve, this is indicated by a normal output pressure of 4 psi or less; with an air-to-close valve, by a normal output pressure of 13 psi or more.

Drifting may be caused by:

(a) inadequate quantity of air, or supply pressure set too low;
(b) leaks in output air system;
(c) excess pressure drop in the control valve line and fittings, which would greatly reduce the ability of the control valve to increase flow. This condition can be corrected only by increasing the upstream pressure; increasing valve size will not produce desirable flow reactions.

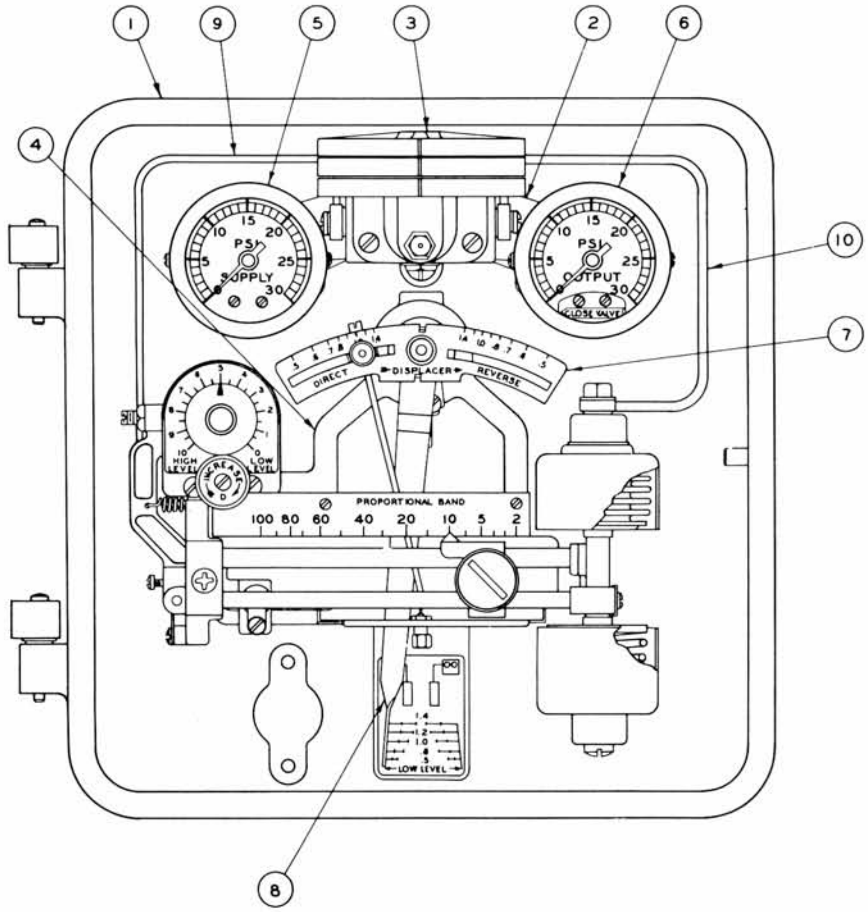
Within the controller, poor control can be caused by:

(a) dirt in relay system;
(b) friction in mechanism due to mechanical injury;
(c) partially plugged air nozzle;
(d) partially plugged metering orifice.

ANALYZING UNDER MANUAL CONTROL

When rules for proper adjustment of the controller sensitivity do not seem to apply, it is often desirable to place the process under manual control and observe the behavior of the controlled level.

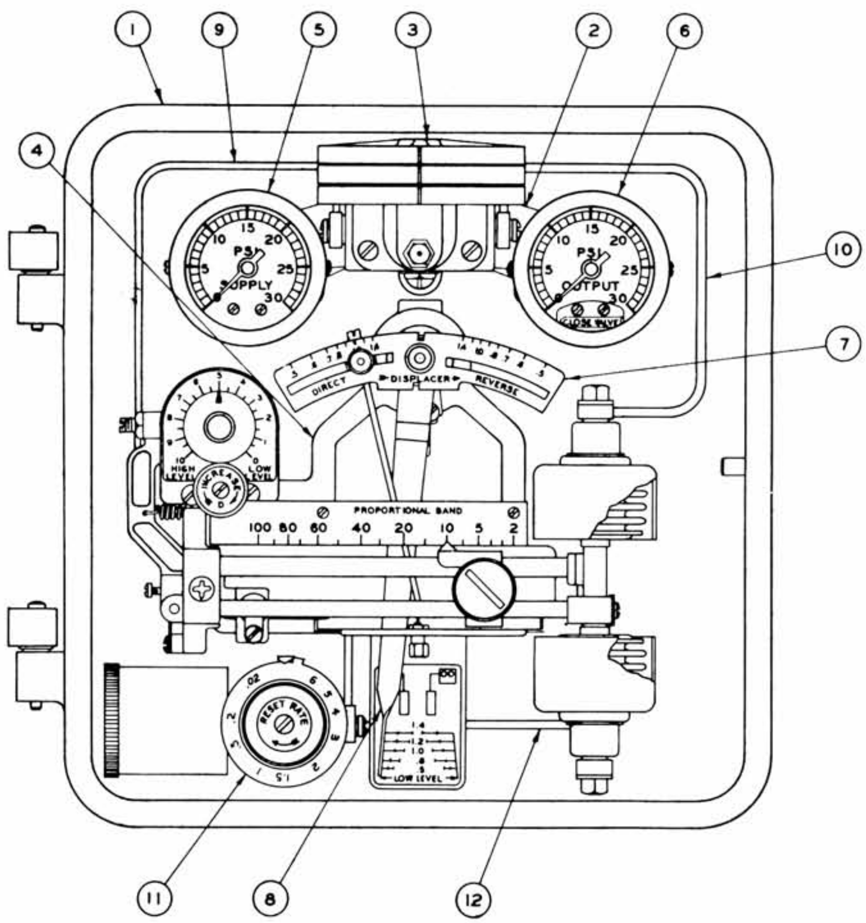
Continuous cycling under manual control indicates external cycling disturbances. If these conditions cannot be eliminated, the controller sensitivity should be **increased** (instead of decreased). This will enable the controller to resist the external disturbance and thus reduce the magnitude of the cycling. The best setting can be secured by adjusting and then observing the control performance.



No.	NAME OF PART
1	CASE S/A
2	AIR MANIFOLD S/A
3	RELAY S/A
4	MECHANISM BRACKET S/A
5	SUPPLY GAUGE
6	OUTPUT GAUGE
7	ARC LEVER
8	LEVEL INDICATING POINTER
9	NOZZLE TUBING S/A
10	BELLOWS TUBING S/A

12800
PROPORTIONAL
LEVEL CONTROLLER

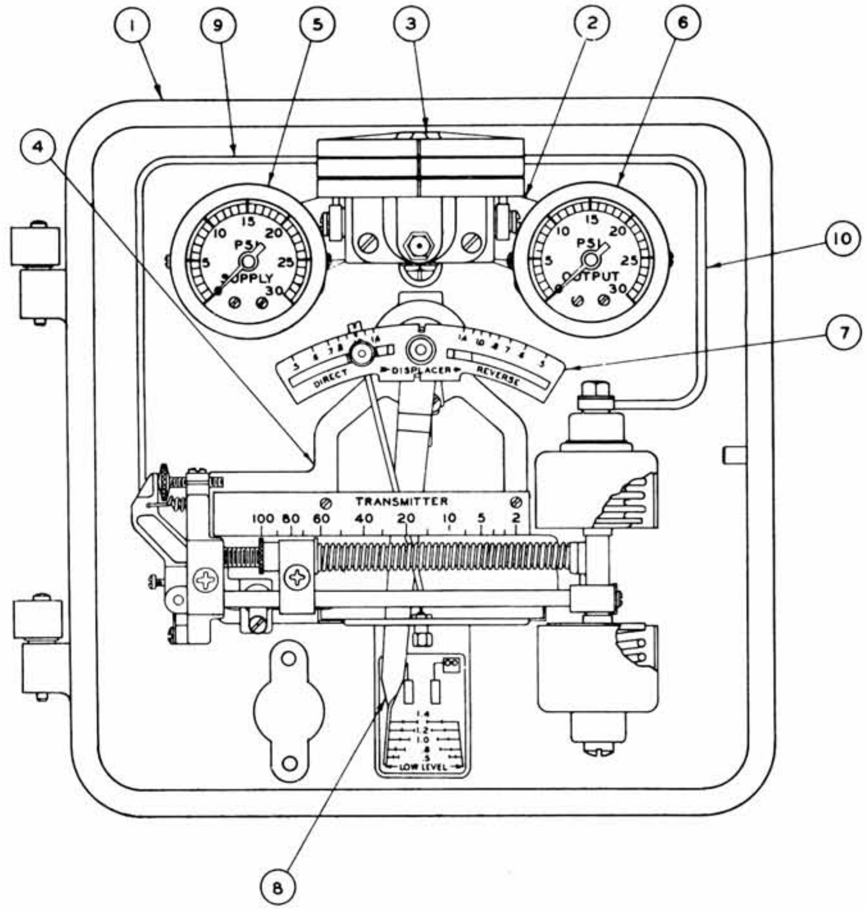
DATE	DRAWING NO.	SHEET NO.
3-24-53	A-51570	- 1



No.	NAME OF PART
1	CASE S/A
2	AIR MANIFOLD S/A
3	RELAY S/A
4	MECHANISM BRACKET S/A
5	SUPPLY GAUGE
6	OUTPUT GAUGE
7	ARC LEVER
8	LEVEL INDICATING POINTER
9	NOZZLE TUBING S/A
10	BELLOWS TUBING S/A
11	RESISTANCE UNIT S/A
12	RESET BELLOWS TUBING S/A

12810
PROPORTIONAL-RESET
LEVEL CONTROLLER

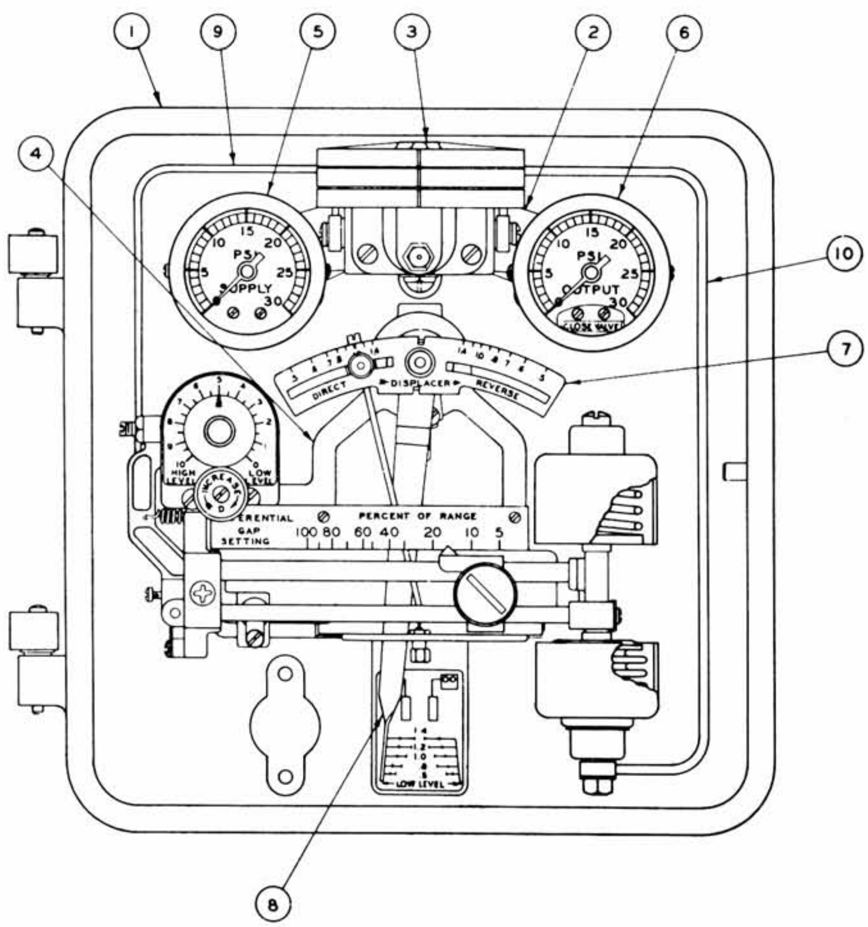
DATE	DRAWING NO.	SHEET NO.
7-6-53	A-51570	- 2



No.	NAME OF PART
1	CASE S/A
2	AIR MANIFOLD S/A
3	RELAY S/A
4	MECHANISM BRACKET S/A
5	SUPPLY GAUGE
6	OUTPUT GAUGE
7	ARC LEVER
8	LEVEL INDICATING POINTER
9	NOZZLE TUBING S/A
10	BELLOWS TUBING S/A

12820
PNEUMATIC
LEVEL TRANSMITTER

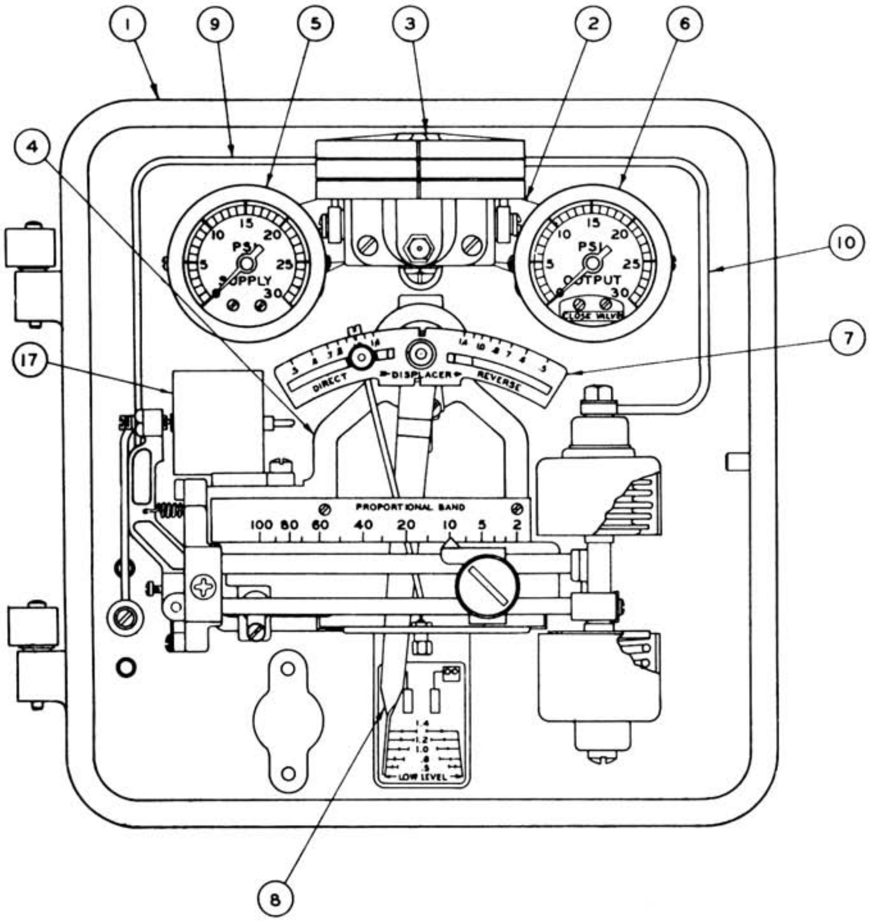
DATE	DRAWING NO.	SHEET NO.
7-2-53	A-51570	- 3



No.	NAME OF PART
1	CASE S/A
2	AIR MANIFOLD S/A
3	RELAY S/A
4	MECHANISM BRACKET S/A
5	SUPPLY GAUGE
6	OUTPUT GAUGE
7	ARC LEVER
8	LEVEL INDICATING POINTER
9	NOZZLE TUBING S/A
10	BELLOWS TUBING S/A

12830
TWO-POSITION
DIFFERENTIAL-GAP
CONTROLLER

DATE	DRAWING NO.	SHEET NO.
7-3-53	A-51570	- 4



No.	NAME OF PART
1	CASE S/A
2	AIR MANIFOLD S/A
3	RELAY S/A
4	MECHANISM BRACKET S/A
5	SUPPLY GAUGE
6	OUTPUT GAUGE
7	ARC LEVER
8	LEVEL INDICATING POINTER
9	NOZZLE TUBING S/A
10	BELLOWS TUBING S/A
17	PNEUMATIC SET BELLOWS S/A

12840
PROPORTIONAL LEVEL
CONTROLLER
PNEUMATIC SET

DATE	DRAWING NO.	SHEET NO.
7-27-53	A-51570	– 5

Facilities: **Belgium, Brazil, Canada, China, France, Germany, India, Italy, Japan, Korea, Kuwait, Malaysia, Mexico, Netherlands, Nigeria, Russia, Saudi Arabia, Singapore, South Africa, Spain, United Arab Emirates, United Kingdom, United States**

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