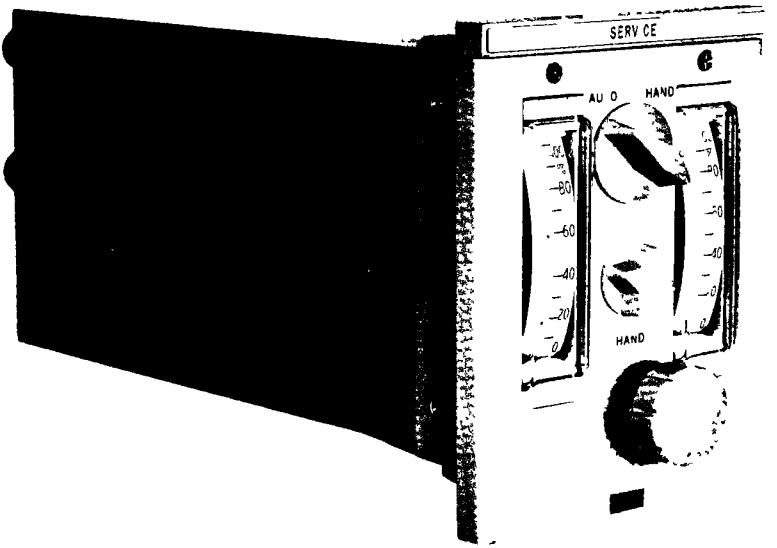
Bailey

SECTION
P91-3

PRODUCT INSTRUCTIONS

MINI-LINE* 500 HAND/AUTOMATIC STATION WITH ADJUSTABLE SET POINT



*REG. U.S. PAT. OFF

BAILEY METER COMPANY • WICKLIFFE, OHIO 44092

FORM P9 3.46*
L THO N U S A

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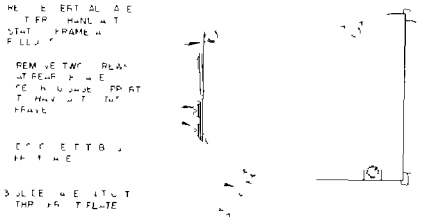


FIGURE 1 Removing Vertical Gage Unit from H A Station

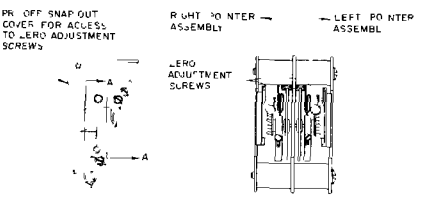


FIGURE 2 Vertical Gage Unit Zero Adjustment Screws

INSTALLATION

Pre Service Adjustment Check

IMPORTANT Before placing H A Station in service check adjustment of vertical gage unit as outlined below to insure that factory calibration was not disturbed in transit For convenience, perform this check at a test bench before the H A Station is installed in the panel

1 With H A Station mounted or positioned at angle at which it will be mounted in service, check that indicating pointers read minimum scale If pointers read correctly, proceed to step 5

2 If pointers do not read minimum scale, remove vertical gage unit from H A Station as outlined in Figure 1

3 Remove snapout cover (Figure 2) and turn zero adjustment screw until pointer reads correctly

4 Apply midrange and maximum range input pressures to gage unit If pointer readings correspond to applied inputs proceed to step 5 If readings are incorrect, refer to "Vertical Gage Unit Adjustment", page 9

Mounting H A Station on Panel

Hand Automatic Stations with Adjustable Set Point are designed for plug in mounting in a panel mounted enclosure (Figure 3) Install enclosure as follows

5 Make panel cutout in accordance with Figure 3

6 Loosen mounting screws on front plate which secure H A Station to enclosure and remove Station

7 Slide enclosure thru cutout from front of panel

8 Place mounting clips (in bag tied to enclosure) in position on enclosure Tighten clip securely against panel

9 Slide H A Station into enclosure and secure with mounting screws in front plate

Installing Connecting Piping

10 Connect external tubing to manifold connections on rear of enclosure (Figure 3) Connection ports are 1 4 13 NPT female Use 1 4 inch O D copper, aluminum, or plastic tubing

Cleaning Scale Cover

11 Remove protective tape from scale cover Clean cover with toothpaste or Plastar" plastic cover cleaner and polish (obtainable from Bailey Meter Company in 10 ounce jar specify Part Number 199274-1)

CAUTION Do not use a solvent which will scratch cover finish or react with plastic cover

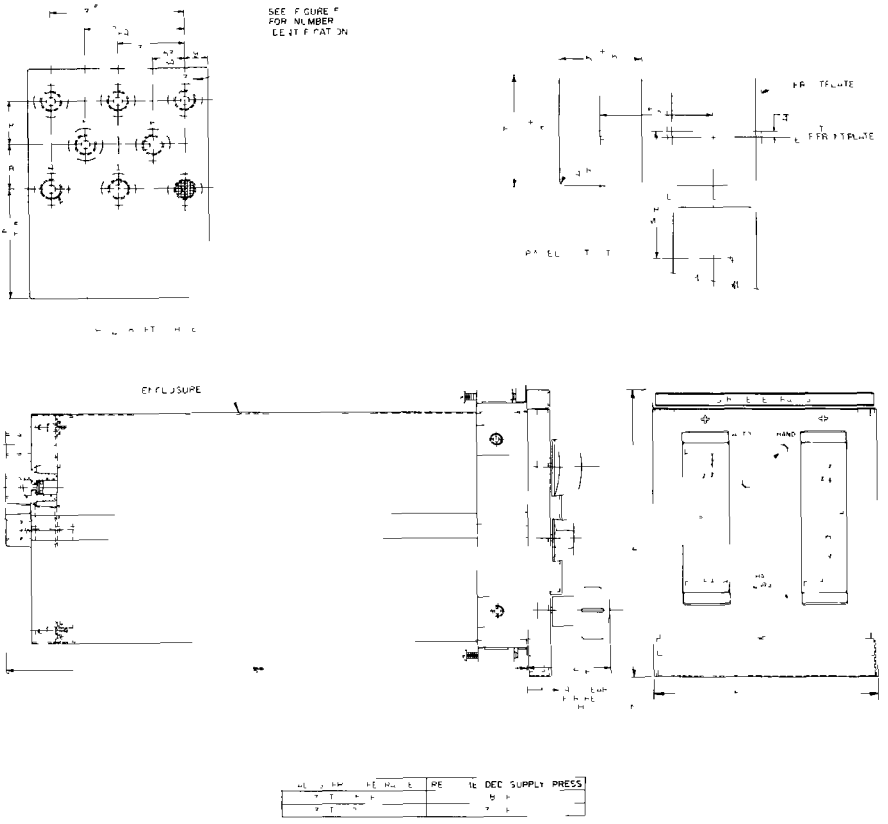


FIGURE 3 H/A Station Mounting Dimensions

OPERATION

Before transfer, conditions within the control system must be set so there is little or no variation in control pressure to the power unit as transfer takes place Procedures for transferring from AUTO to HAND and from HAND to AUTO are outlined below Refer to Figures 4 and 5

Transfer from AUTO to HAND

1 With HAND control knob, set transfer pressure (gage C) equal to control pressure (gage D)

2 Turn transfer switch to HAND

Transfer from HAND to AUTO

1 With HAND control knob, slowly set control pressure (gage D) equal to transfer pressure (gage C)

2 Turn transfer switch to AUTO

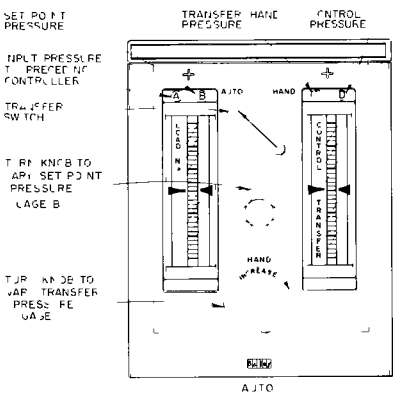
Alternate HAND to AUTO Transfer

The procedure above for transferring from HAND to AUTO may not always be practical. In this case, the alternate method given below may be followed NOTE This alternate procedure should be used only where the set point may be changed without endangering the process

1 With SET POINT control knob, adjust set point until transfer pressure (gage C) is equal to control pressure (gage D)

2 Turn transfer switch to AUTO

3 Return set point to desired value



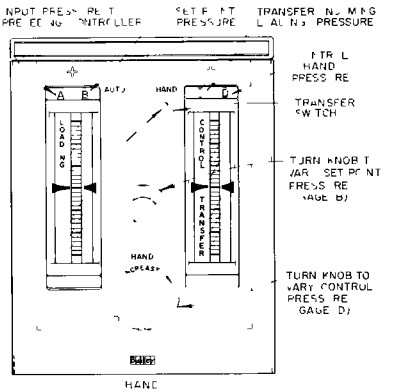
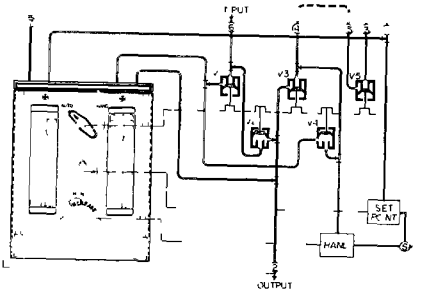
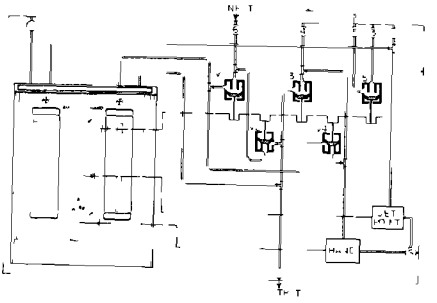


FIGURE 4 H/A Station Controls and Gages



AUTO POSITION



HAND POSITION

FIGURE 5 Schematic of H/A Station

ROUTINE MAINTENANCE

1 Maintain a clean air supply, free of oil or moisture

2 Check filter in the supply inlet port on the housing assembly connecting manifold shortly after installation If replacement is necessary, remove wire mesh disc, felt pad, and second wire mesh disc Install new filter, making certain wire mesh disc is inserted in inlet port before inserting felt pad

3. Periodically depress orifice clean-out plunger (Figure 6) on rear of hand relay to insure that the orifice remains open and clean CAUTION This operation should only be performed when relay is being bench tested since depressing the plunger while relay is in service may disrupt the process

4 Whenever necessary, clean plastic scale cover as follows

a. Remove (and replace) scale cover as shown in Figure 7.

b Clean cover with a soft cloth which will not scratch the plastic surface Use toothpaste or "Plastar . plastic cover cleaner and polish (obtainable from Bailey Meter Company in 10-ounce jar - specify Part No 199274-1) Do not use a solvent which will scratch cover finish or react with plastic cover

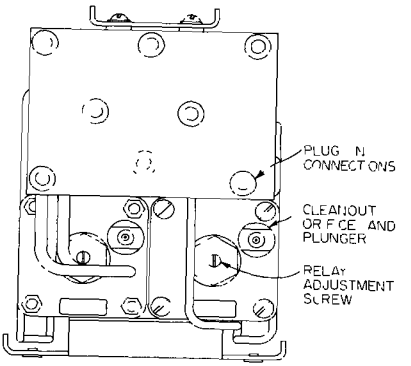


FIGURE 6 - Rear View of H/A Station (Removed from Enclosure)

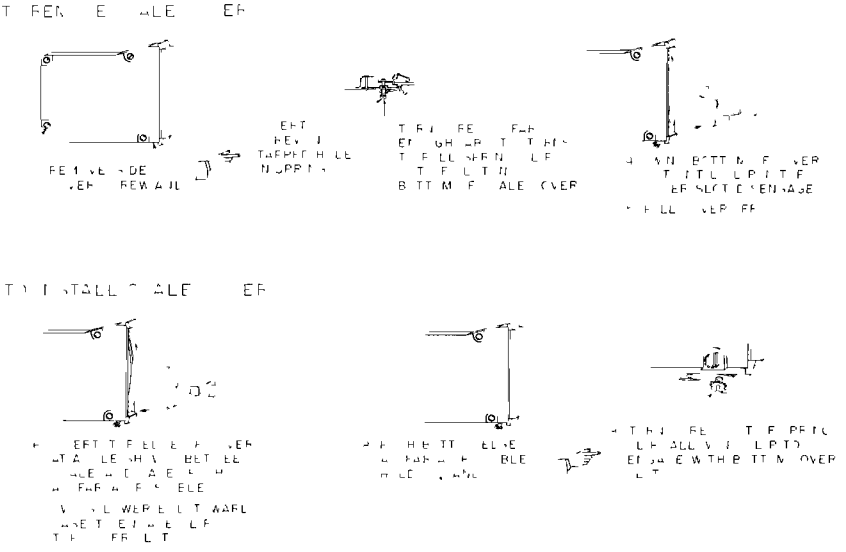


FIGURE 7 Removing and Replacing Vertical Gage Unit Scale Cover

CORRECTIVE MAINTENANCE

Vertical Gage Unit Adjustment

If operational faults occur which are traced to the vertical gage units, make the following adjustment checks.

1 Remove gage unit from H/A Station as shown in Figure 1. Pry off snapout cover and remove side cover for access to gage unit adjustments (see Figure 2).

2 Apply pressure to Bourdon tube and check block assembly for leakage with a soapsuds solution If a leak is found, replace entire gage unit The damaged unit may be returned to the factory for repair

3 Check all links to see that they are properly connected and that they move freely with Bourdon tube movement.

4. Make certain that indicating pointer does not rub against side or face of scale If necessary, bend pointer slightly until it clears scale

5 Check pointer adjustment as outlined below

a Apply pressure to gage equivalent to first major scale division above 0% scale. If pointer does not read correctly, turn zero adjustment screw (Figure 8) until desired reading is obtained.

b. Apply pressure to gage equivalent to first major scale division below 100% scale If pointer does not read correctly, turn range adjustment screw (Figure 8) until desired reading is obtained.

c. Repeat steps 5 a and 5b until pointer reads correctly at both scale divisions

d. Apply pressure to gage equivalent to midscale division If pointer does not read correctly, but does read correctly in steps 5a and 5b above, alter the shape of U link at free end of Bourdon tube as follows

(1) If midscale pointer reading is low, spread link slightly

(2) If midscale pointer reading is high, close link slightly

e. Repeat steps 5a thru 5d until pointer reads correctly over full scale

6 To return gage unit to service, reverse the order of operations outlined in step 1 above.

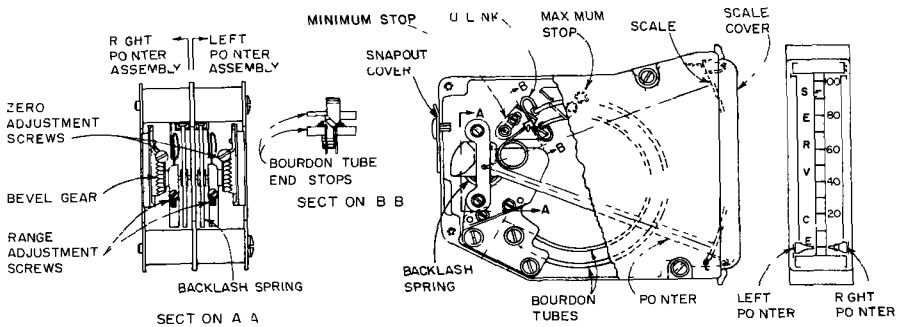


FIGURE 8 - Vertical Gage Unit Adjustments

Hand Relay Disassembly

To disassemble the Hand Relay (Part Number 5321995 □) for cleaning or replacement of parts, proceed as follows

1 Refer to Figure 11 Disconnect tubing and remove two screws (26) holding gage support (13) to support bracket assembly (30).

2 Remove two fillister head screws (39) holding manifold to Relay and slide manifold and support bracket rearward

3 Remove two socket head screws (36) holding Relay to support bracket (30) and remove Relay

4 Refer to Figure 12 Unscrew valve cap (7) and remove valve stem (11), inlet valve seat (13), and valve seat spring (15). CAUTION Do not disturb setting of relay adjustment screw (Figure 6) at center of valve cap This setting is factory set and should not be distrubed unless control bellows has been removed or replaced (see 'Hand Relay Adjustment")

5 Unscrew orifice clean out assembly (4) and orifice (14)

6 Relieve spring compression by rotating *center adjustment gear (27) counterclockwise* until it turns easily

7 Remove four nuts (at corners of valve housing face) and screws securing spring housing (23) to valve housing (9) and separate housings

8 Pull control bellows assembly (16) from valve housing (9) Control bellows assembly is held by exhaust valve diaphragm which snaps into place around valve seat)

9 If desired, unscrew loading spring assembly (19) from adjustment shaft (left hand thread)

10 To reassemble, reverse above procedure, observing the following precautions

a When replacing control bellows assembly (16), make certain exhaust valve diaphragm (29) is properly snapped into place around exhaust valve seat

b When replacing orifice clean out assembly (4) make certain that clean out wire is not bent and passes cleanly thru the orifice

c Make certain that all O rings are undamaged and properly installed Apply lubricant to O rings when reassembling relay

Hand Relay Adjustment

1 Connect output pressure line of Relay, thru a petcock, to a volume chamber equipped with a suitable pressure gage (*0-30* psig) for indicating chamber pressure. Volume chamber may be any pressure tight container with volume of about 300 cubic inches

2 Open petcock and adjust H/A Station control knob to obtain 3 psig pressure in volume chamber

3 Close petcock and adjust control knob to obtain 27 psig (for 3 27 range) or 15 psig (for 3-15 range) output pressure from Relay (read output pressure on H/A Station gage).

4. Open petcock and note time rate of pressure increase in volume chamber

5 Close petcock and adjust control knob to obtain 3 psig output pressure from Relay

6 Open petcock and note time rate of pressure decrease in volume chamber

7 *If inlet valve seat is properly adjusted,* the time rate of pressure increase as noted in step 4 will be equal to the time rate of pressure decrease as noted in step 6 If these rates are not equal (or if the control bellows or nozzle bellows has been replaced), it will be necessary to make the following adjustment

a If time rate of pressure increase is greater than the rate of pressure decrease, turn adjustment screw (Figure 6) counterclockwise

b If time rate of pressure decrease is greater than the rate of pressure increase, turn adjustment screw clockwise NOTE By turning the relay adjustment screw (Figure 6) on the rear of the H/A Station, the inlet valve seat position can be changed with respect to the neutral position of the exhaust valve seat, in effect, controlling the relative openings of the inlet valve and exhaust valve for a given position of the control bellows

Front Plate Disassembly

1 Remove vertical gage units as shown in Figure 1

2 Refer to Figure 11. Remove HAND control knob (27) by driving out steel lockpin (28) and pulling knob off shaft Remove SET POINT control knob by inserting a small screw driver in slot behind knob and pushing outward (from front plate) on spring holding knob on shaft. Then slide knob off shaft. AUTO-HAND transfer switch need not be removed.

3. Remove two screws (15) at rear of front plate (17) which secure plate to H/A Station frame.

4. To reassemble, reverse the above procedure, observing the following precautions

a When placing front plate (17) on H/A Station frame, fit pins at top and bottom of plate into corresponding slots in frame, and align transfer switch and valve operator lever (22) so that transfer switch pin fits into hole at top of lever (22)

b When replacing control knobs, slide knobs on respective shafts Replace lockpin in HAND control knob shaft

Shut Off Valve Disassembly

1. Refer to Figure 11. Disconnect tubing at vertical gage units and remove screws (39) at Relay.

2. Remove screws (12) and (14) (two at front end of plate and two at rear end next to name plate) which secure shut-off valve mounting plate (top of H/A Station) to frame. Do not disturb screws holding valve to plate.

3. Set transfer switch (23) (or valve operator lever (22) if front plate has been removed) in vertical position between AUTO and HAND

4. Slide shut-off valve assembly (10) (plate, valves, and tubing) to rear to disengage valve stems from valve operator shaft When disengaged, assembly can be lifted from H/A Station

5. To disassemble individual shut-off valve, unscrew plug (10E) at bottom of valve and remove spring (10D), stem (10B), and diaphragm (10F). To reassemble, reverse the above procedure Valve stems must be in alignment to engage valve operator shaft.

Valve Operator Lever and Shaft Disassembly

1 Remove vertical gage units (shown in Figure 1), front plate (see above), and shut-off valve assembly (see above)

2 Refer to Figure 11 Remove hex nut (25) at front end of shaft and slide valve operator lever off shaft

3. Unscrew bearing (9) which supports end of shaft.

4 Slide shaft to rear until front end clears supporting bearing. Remove shaft from frame.

5. To reassemble, reverse the above procedure

Drive Shaft Disassembly (Control Knob to Relay)

1 Remove vertical gage units (as shown in Figure 1) and front plate (see above)

2 Refer to Figure 11. Remove retaining ring (34) at rear end of shaft.

3. Back off cone point set screw (32) in perimeter of gear (33) until gear is free of shaft

4 Slide shaft out thru front of unit and remove gear.

5. To reassemble, reverse the above procedure

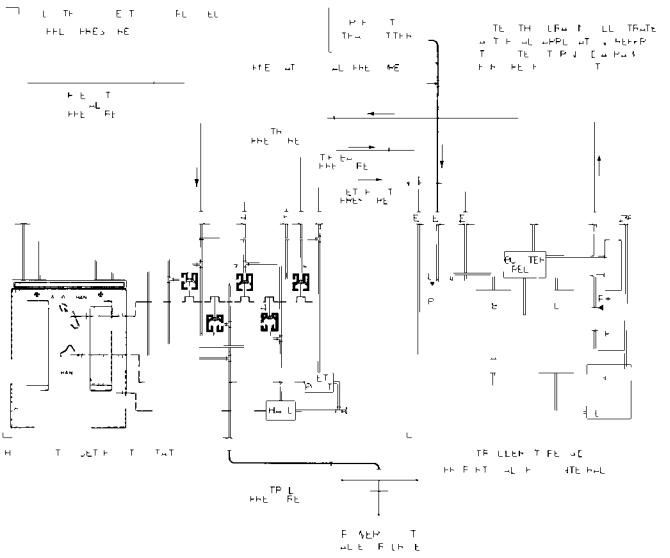


FIGURE 9 Typical Application of H,′A Station

SCHEMATIC OPERATION

Typical Application of Set Point Station

Figure 9 shows a typical control application A signal pressure, proportional to the measured variable is applied to the A bellows of the Proportional plus Integral Controller (indicated on gage A) Output pressure of the Controller (from D bellows) is transmitted thru the H, A Station to the power unit

Set point pressure from connection 1 is applied to the B bellows of the Controller Since the Controller is balanced when the pressures in the A and B bellows are equal the set point of the system is established by the H A Station SET POINT control Comparison of readings on gages A and B indicates whether the system is at set point

When the H A Station is in the HAND position, tie back pressure is provided from connection 4, thru connection 5, shut off valve V5 and connection 3, to the C bellows of the Controller. On HAND operation, the tie back pressure holds the Controller output pressure approximately equal to the control pressure, facilitating smooth transfer to automatic operation. Where tie back pressure is not required, connection 4 is plugged and connections 3 and 5 are left open to atmosphere

Hand Relay

Hand and Set Point pressures are established by the Hand Relay (Figure 10) Compression of the loading spring is opposed by pressure in the control bellows so that forces due to spring compression and output pressure are always equal when the unit is balanced Pressure in the control bellows is regulated by the inlet exhaust valve assembly At balance, the inlet valve is held closed by the difference between

supply pressure and control bellows (output) pressure Leakage of supply air thru the bleed orifice maintains the exhaust valve in a floating position

Turning the control knob (HAND or SET POINT) in the "increase" direction compresses the loading spring, compressing the control bellows, closing the exhaust valve, opening the inlet valve, and admitting supply air to the control bellows. Control bellows pressure increases until bellows expansion is sufficient to restore the inlet exhaust mechanism to its original position (inlet valve closed, exhaust valve floating). Output pressure is then proportional to the increased loading spring compression

Turning the control knob in the "decrease" direction reverses the operation described above.

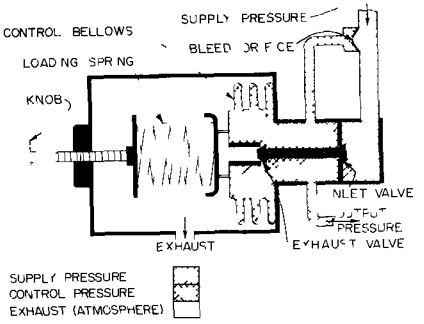


FIGURE 10 - Schematic of Hand Relay

REPLACEMENT PARTS

Spare Parts Kits

The Spare Parts Kits shown in Figures 11, 12, and 13 should be carried in stock. Specify the Spare Parts Kit part number to order a complete kit

Ordering Individual Parts

Figures 11, 12, and 13 are Parts Drawings of Set Point Stations Normally these drawings apply to the unit furnished However, there may be individual differences in specific units because of

a Design changes made since the printing of this Instruction Section, or

b Special design of the Set Point Stations to make them suitable for a special application

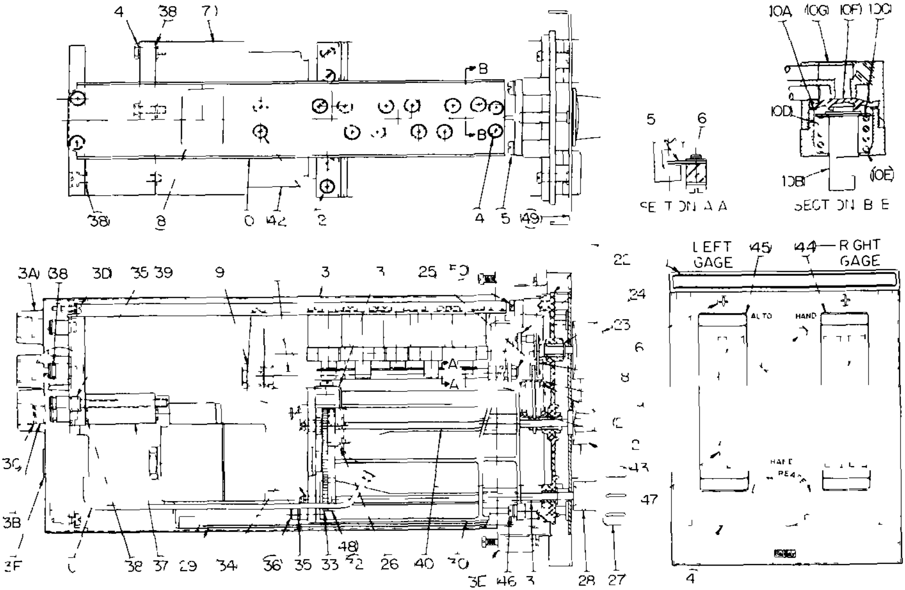
Therefore, when ordering parts assure the receipt of correct replacements by specifying the H/A Station Module Part Number

EXPLANATION OF NOMENCLATURE

H/A STATION MODULE PART NO.	H/A STATION NOMENCLATURE*	RANGE (PSIG)	LEFT GAGE SCALE LEGEND	
			LEFT INDICATOR	RIGHT INDICATOR
5321865 1	AJ02A10	3-27	METER	SET POINT
5321865 2	AJ02A50	3-27	DIRECT READING**	SET POINT
5321865 3	AJ01A10	3-15	METER	SET POINT
5321865 4	AJ01A50	3-15	DIRECT READING**	SET POINT

*NOMENCLATURE appears only on the H/A Station Specification Sheet included in Instruction Books furnished on system or contract jobs. A "5" in the third position of the Nomenclature indicates that the H/A Station module is complete with enclosure, Part No. 5322407 2. An "X" in any Nomenclature position indicates that the instrument is special.

**SCALE LEGEND engraved in terms of variable, such as, FLOW, LEVEL, PRESSURE



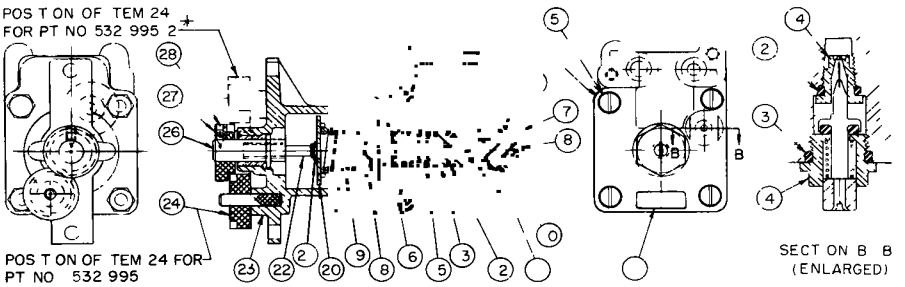
TEM	PART NO	NAME
1	961431 2	DESIGNATION PLATE
3	53?24? 2	ENCLOSURE INCLUDES
3A	5?21474 1	CONNECTION MANIFOLD
3B	532 414 1	FELT PAD 2 REQD
3	532 413 1	W RE MESH DIS 4 REQD
3D	? 32x5 16	PA HD SEMS NT 4 REQD
3E	5314614	MOUNTING CL P 4 REQD
3F	NAMEPLAT	SPECIFY TYPE AND MODEL FOR CORRECT ENGRAVING
4	SEE TABLE	HAND AUTOMAT STATION ASSY NCL TEMS 5 THRU ??
5	531??1? 1	VALVE OPERAT R
?	6 2x3 8	PAN HD SEMS NT 5 REQD
?	53?199? 1	HAND RELAY ASSEMBLY*
8	196235? 1	NAMEPLATE
9	5314645 1	VALVE SHAFT BEAR NG
10	532?612 1	P PING ASSEMBLY INCL DES
10A	531486?	DIAPHRAGM WASHER 5 REQD
10B	53148?0 1	VALVE STEM 5 REQD
10C	53148 1	THRUST WASHER 5 REQD
10D	5316092 1	SPRING ? REQD
10E	5314868 1	AIR VALVE PLU 5 REQD
0F	53 45 4 1	AIR VALVE D APH ? REQD
0?	53149?6 1	#5 AIR VALVE BODY
1	5314644 1	VALVE OPERATING SHAFT
?	1? 32x3	PAN HD SEMS INT 6 REQD
3	5316?3?	GAGE S PPORT BRKT ? REQD
4	10 32x 8	FILL HD SEMS NT ? REQD
5	10 32x 8	PAN HD SEMS EXT ? REQD
6	5323289	SPECIAL MTG SCREW ? REQD
7	5?29629 1	FRONT PLATE
?	?32303?	KNOB SHAFT ASSEMBLY
9	? 6 ?5	SPRING GUIDE ASSEMBLY
?0	?31465? 1	VALVE OPE RATOR SPRING
?1	53 4661 1	SPRING HOLDER
??	5314651 1	VALVE OPE RATOR LEVER
?3	53?2944	SELECTOR KNOB
?4	198173 3	RETAI NG RING
5	19? 2 3	ELASTI STOP N T
6	? ?x1 4	PAN HD SEMS INT 4 REQD
?	532?9?1 1	CONTROL KNOB
28	1 16x3 4	ROLL PIN
29	53?3?49 1	BRACKET ASSEMBLY
0	53239?3	S PPORT BRACKET ASSEMBLY
31	5322 ? ?	DRIVE SHAFT
3?	61617	HEX SOC HD ON E PT SS ? REQD
33	53 6?93 1	AD STMENT GEAR ? REQD
34	?8173	RETAIN NG RIN 2 REQD
35	? ? ?00	SHAKEPROOF LK WASH 6 REQD
36	0 3?x3 8	HEX SOC HD S REW 4 REQD
3?	?322398	SPACER MAN FOLD
38	531142? 3	O RING GASKET 14 REQD
39	0 3?x2 1 4	FILL HD SCREW ? REQD
40	??2 ?8 1	DRIVE SHAFT
41	10 32x?	HEX HD SEMS EXT ? REQD
42	?3?199? ?	HAND RELAY ASSEMBL *
43	?3?2 43	AD USTMENT KNOB
44	SEE TABLE	VERTICAL GAGE R HT *
45	SEE TABLE	VERTICAL GA E LEFT **
46	1 32x1 ?	PAN HD SEMS INT ? REQD
47	?3 435 ?1	SCALE ASSEMBLY SEE TABLE
48	? 4x1 8	HEX SO HD P PT SS ? REQD
49	?3?43?5 1	FRONT PLATE ASSEMBLY
?0	6 ?x ?	PA HD SEMS EXT 3 REQD

*FOR DETAILS OF HAND RELAY PT NO 532199? D SEE PARTS DRAWING P9 ?
**FOR DETAILS OF VERT AL A E N T SEE PARTS DRAW NG P ? 5

TABLE				
TEM 4	RANGE PSIG	TEM 44	ITEM 45	TEM 47
?3?1865 1	3 2	?314945 24	?314945 ?3	OMIT
5 ?18?? ?	3 ?	3 4945 24	5314945 22	REQD
5321865 3	? 1?	531 1 4 ?	? 18134 20	OMIT
53? 865 4	3 5	531? ?4 ?1	?318134 19	1 REQD

SPARE PARTS KIT	
KIT PT NO ?561?	
QUANTITY	TEM NO
	?
?	3B
4	?
?	1 E 10F
4	38

FIGURE 11 Parts Drawing P91 9, Hand/Automatic Station with Adjustable Set Point



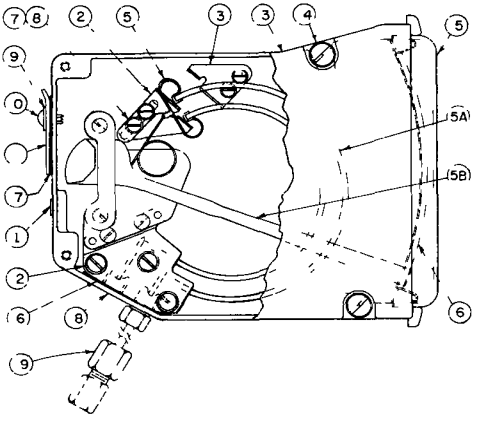
ITEM	PART NO	NAME
1	CODE LABEL	SPECIFY NO ON LABEL WHEN ORDERING PARTS
2	5311428 2	O RING GASKET
3	5311428 11	O RING GASKET
4	5316478 1	ORIFICE CLEANOUT
5	10 32-2 1 4	FIL HD SCREW 4 REQD
6	5311428 7	O RING GASKET
7	5316809 1	VALVE CAP
8	5316808 1	VALVE ADJ SCREW
9	5321892 1	VALVE HOUSING
10	5311428 20	O RING GASKET
11	5316811 1	VALVE STEM
12	5311428 23	O RING GASKET
13	5316977 1	VALVE SEAT ASSY
14	5316464 1	ORIFICE ASSEMBLY
15	5316844 1	VALVE SEAT SPRING

ITEM	PART NO	NAME
16	5316802 1	CONTROL BELLOWS ASSY
17	5311428 24	O RING GASKET
18	5316817 1	SPRING SUPPORT
19	5316819 1	LOADING SPRING
20	5316816 1	GUIDE & SPRING SUPPORT
21	198173 3	RETAINING RING
22	5316814 1	ADJUSTMENT SCREW
23	5323245 2	SPRING HOUSING
24	5316998 1	ADJUSTMENT GEAR
25	NO 10	PL PATT MED LK WASH 4 REQD
26	5316815 1	ADJUSTMENT SHAFT
27	5316793 2	ADJUSTMENT GEAR
28	661617 1	CONE PT SET SCR
29	5316812 1	EXHAUST VALVE DIAPHRAGM
30	5316813 1	DIAPHRAGM CLAMP
31	10 32	MED HEX NUT 4 REQD

*FOR HAND RELAY PT NO 5321995 2 ROTATE ITEM (24) 180° TO POSITION SHOWN BY DASHED LINES

SPARE PARTS KIT NO 256127 1
INCLUDES ITEMS 2 4, 6, 10, 12 15 17, 19, 21 29

FIGURE 12 - Parts Drawing P91 7, Hand Relay, Part No. 5321995 □



ITEM	PART NO	NAME
1	CODE LABEL	SPECIFY NO WHEN ORDERING PARTS
2	SEE TABLE	MINIMUM STOP
3	SEE TABLE	MAXIMUM STOP
5	SEE NOTE	MECHANISM ASSY INCLUDES ITEMS 5A & 5B
5A	SEE NOTE	BOURDON TUBE & BLOCK ASSY
5B	SEE NOTE	POINTER SEE TABLE
6	SEE NOTE	SCALE ASSY
7	#3 48x3 16	PAN HD STL SCR 4 REQD
8	NO 1203	SHK LK WASH 4 REQD
9	5316456 1	WASHER 2 REQD
10	5314337 1	FASTENER 2 REQD
11	5314336 1	COVER PLATE ASSY
12	6 32x7 8	PAN HD EXT SEMS 3 REQD
13	SEE NOTE	COVER
14	6 32x1 4	PAN HD EXT SEMS 4 REQD
15	5314294 1	SCALE WINDOW
16	SEE TABLE	GASKET
17	5322355 1	GASKET
18	SEE NOTE	CASE ASSY
19	5320314 2	TUBING ADAPTER ASSY (REQD FOR PM MULTI POINT GAGES ONLY FOR TUBING FOR OTHER INSTRUMENTS SEE APPLI CABLE PARTS DRAWING)

SPARE PARTS KIT NO 256028 1	
QUANTITY	ITEM NO
2	15

POINTER	GAGE UNIT RANGE	ITEM 2	ITEM 3	ITEM 16
DOUBLE	3 27 OR 5 25 PSIG	5315411 1	5315411 2	5322195 2
SINGLE	3 27 OR 5 25 PSIG	5315411 1	5315411 2	5322195 1
SINGLE	3 15 OR TYPE PM MODEL DO*	5315701 1	5315411 1	5322195 1
DOUBLE	3 15 OR TYPE PM MODEL DO*	5315701 1	5315411 1	5322195 2
SINGLE	TYPE PM MODEL V ONLY*	5315411 1	5315701 1	5322195 1

*RANGE PER ENGINEERING DATA (SEE NOTE)

NOTE SPECIFY TYPE MODEL SERIAL NUMBER AND RANGE OF INSTRUMENT
ALSO FOR POINTER (ITEM 5B) SPECIFY WHETHER LEFT RIGHT OR BOTH LEFT AND RIGHT ARE DESIRED
ALSO FOR SCALE (ITEM 6 SPECIFY LEGEND AND RANGE FIGURES

FIGURE 13 Parts Drawing P12 5, Vertical Gage Unit