DIFFERENTIAL PRESSURE TRANSMITTER

with Remote Seal Elements

323T, 324T

IB-2B208
Issue 3
Aug 1984

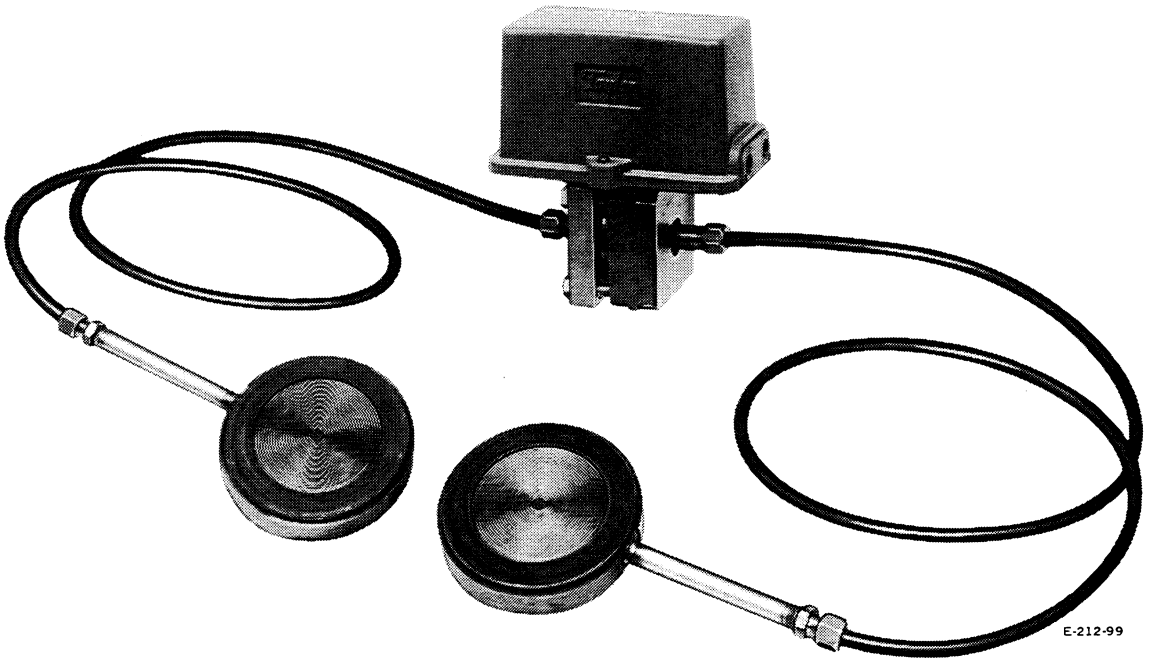

Figure 1—Differential Pressure Transmitter, 323T

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C—Refer to *Servicing and Trouble Shooting* Section IB-2B902

ABB Instrumentation

INTRODUCTION

DESCRIPTION

The Taylor 320T Series Differential Pressure Transmitters with Remote Seal Elements are force balance instruments which measure process differential pressures and transmit a proportional 3 to 15 psig output signal. The remote seals limit process contact to the seal element surface.

Several seal element types are available. They provide for process connection to chemical tees, 3-inch ANSI flanges, or 1/2-inch welding necks. An extended diaphragm element, suitable for connection to a 3-inch flanged tank nozzle or flanged tee, permits the process diaphragm to be located flush with the inside of a tank or pipe.

The transmitters are available in medium and high range forms, providing capability for measuring differential spans from 20 to 800 inches of water at operating pressures ranging from full vacuum to 1500 psig. The span of each transmitter is continuously adjustable. A micrometer type scale on the span adjustment permits any previously calibrated span to be reproduced without recalibration.

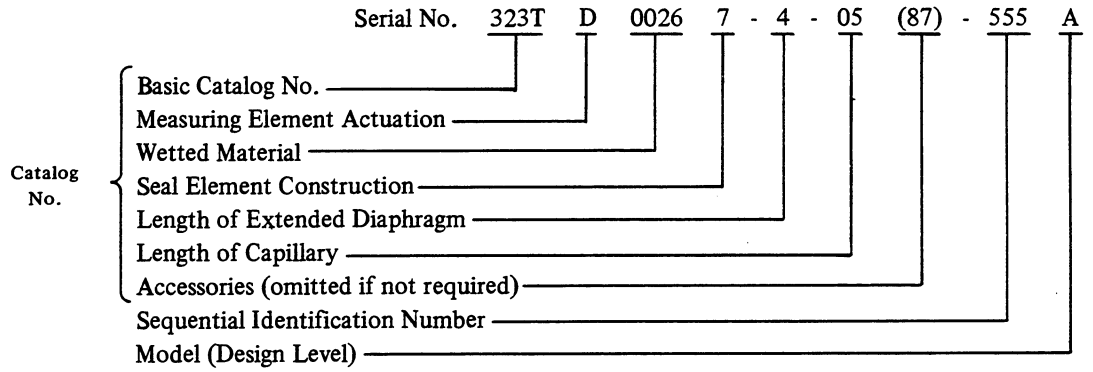
A weatherproof die-cast aluminum case houses the pneumatic transmitter section which includes a direct acting non-bleed output relay. Case and transmitter assembly is identical on all forms of the instrument.

The zero adjustment is accessible through the instrument cover. Adjustment sensitivity is the same on all forms of the transmitter at all span settings. An optional suppression/elevation spring is available for biasing zero when required by the application.

SERIAL AND CATALOG NUMBERS

The serial number stamped on the data plate consists of the catalog number and a sequential identification number. The catalog number describes the construction of the transmitter.

An *X* before the serial number indicates that the instrument has been built to meet a customer's special requirements.



Basic Catalog No.

323T – Medium Range Transmitter
Span Adj from 20 to 250 in. water (5 to 60 kPa)

324T – High Range Transmitter
Span Adj from 300 to 800 in. water (5 to 200 kPa)

Measuring Element Actuation

D – Differential Pressure

Wetted Material

0006 – Type 316 SST[2] per NACE Standard MR-01-75 (1980 Rev)
0016 – Hastelloy-C[1] diaphragm and type 316 SST trim
0026 – Type 316 SST[2]
0036 – Hastelloy-C[1]
0046 – Monel
0056 – Nickel
0076 – Tantalum
0099 – Special

[1]Reg. T.M. of Union Carbide Corp.
[2]Type 316L when seal element is wafer type (Seal Element Construction Digit 3)

Seal Element Construction

1 – Diaphragm Element
Chemical Tee Type

3 – Diaphragm Element
Wafer Type for use with 3-inch ANSI flanges

4 – Diaphragm Element
Welding Neck Type, 1/2-inch schedule 40 pipe

7 – Diaphragm Element
Extended Type with 3-inch, 150 lb ANSI raised face flange

8 – Diaphragm Element
Extended Type with 3-inch 300 lb ANSI raised face flange

Length of Extended Diaphragm

0 – No extension
2 – 2 inches (5.1 cm)
4 – 4 inches (10.2 cm)
6 – 6 inches (15.2 cm)
9 – Special

Length of Capillary

Digits indicate length in feet
05 (five) thru 35 (thirty-five)
(1.52 m thru 10.67 m)
99 – Special

Accessory Number	Filter Regulator	Air Supply Gage	Air Supply Gage 0-200 kPa	Output Gage 0-100% ±1	Output Gage 0-100% ±1 (20-100 kPa)	Output Gage 0-10 Sq Rt ±1%	Output Gage 0-10 Sq Rt ±1% (20-100 kPa)
(103)	X						
(104)	X	X					
(105)	X	X		X			
(107)	X	X				X	
(109)				X			
(111)						X	
(297)	X	X			X		
(298)	X	X					X
(299)					X		
(300)							X
(302)			X				

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Figure 2–Accessory Numbers for Air Sets

Accessories

(87) – Suppression/Elevation Spring
( ) – Air Sets, refer to Figure 2
(129) – 3-inch, 150 lb ANSI raised face slip-on flange with stud bolts and nuts for use with Seal Element No. 3
(130) – 3-inch, 300 lb ANSI raised face slip-on flange with stud bolts and nuts for use with Seal Element No. 3
(131) – 3-inch, 600 lb ANSI raised face slip-on flange with stud bolts and nuts for use with Seal Element No. 3
(132) – 3-inch, 900 lb ANSI raised face slip-on flange with stud bolts and nuts for use with Seal Element No. 3

Example

Serial No. 323TD00267-4-05(87)-555A identifies a medium range transmitter (323T) adjustable from 20 to 250 inches of water (5 to 60 kPa) actuated by differential pressure (D). It has type 316 SST wetted material (0026), and extended type seal elements with 3-inch, 150 lb ANSI raised face flanges (7). The length of the extended diaphragm is 4 inches (4), and the length of capillary is 5 feet (05). The transmitter has a suppression/elevation spring (87). The sequential identification number is 555, and the design level is Model A.

WETTED MATERIAL IDENTIFICATION

The following abbreviations are used on the instrument data plate to identify materials wetted by the process.

Hastelloy-C – HAST
Type 316 SST – 316
Monel – MON
Nickel – NI
Tantalum – TANT

When the instrument has more than one wetted material the data plate identifies the materials in the following sequence:

Process Diaphragm – Trim

FILLING MEDIUM IDENTIFICATION

The following abbreviations are stamped on the diaphragm capsule to identify the filling medium:

SI – Silicone
FL – Fluorolube

SPECIFICATIONS

Span

323T: Adjustable from 20 to 250 in. water (5 to 60 kPa)

324T: Adjustable from 200 to 800 in. water (50 to 200 kPa)

Range Limits – Refer to Figure 3

Calibration Accuracy

Better than ±0.5% of span (±0.25% typical)

Output

3 to 15 psig (20 to 100 kPa)

Air Supply Pressure

20 psig (140 kPa) – recommended
18 psig (125 kPa) – minimum
25 psig (170 kPa) – maximum

Air Consumption

0.2 scfm maximum (0.0057 m^3/min)

Ambient Temperature Limits

Case, Body and Capillary: −40°F (−40°C) min
+180°F (+83°C) max
Seal Elements: −40°F (−40°C) min
+400°F (+204°C) max

Working Pressure Limits

Minimum

0 psia at 300°F (149°C) max when seal elements are at or above elevation of transmitter*

Maximum

32_TD_ _ _ _1: 300 psig (2000 kPa)

32_TD_ _ _ _3: Same as rating for ANSI flange but not to exceed 1500 psig (10 000 kPa)

32_TD_ _ _ _4: 1500 psig (10 000 kPa) to 400°F (204°C)

32_TD_ _564: 1000 psig (7 000 kPa) to 400°F (204°C)

32_TD_ _ _ _7,8: Class 150 Flange at 100°F (38°C) is 275 psig (1900 kPa) at 400°F (204°C) is 180 psig (1240 kPa)
Class 300 Flange at 100°F (38°C) is 720 psig (5000 kPa) at 400°F (204°C) is 665 psig (4580 kPa)

Seal Element Elevation

Minimum Pressure – 0 psia:
Element must be at or above elevation of transmitter*

Minimum Pressure – Atmospheric:
Element can be above or below elevation of transmitter
If element is below, limits are as follows:
323T: 31 ft (9.5 m) max
324T: 30 ft (9.1 m) max
[If transmitter is more than 1000 ft (305 m) above sea level, reduce limit by 1.2 ft (36.6 cm) per 1000 ft* (305 m) of altitude]

Overrange Pressure Limit

Same as maximum working pressure

Weight (Approx)

25 lbs (11.4 kg)

*On vacuum service installations, seal element can be located below transmitter when minimum process pressure is above 0 psia. Refer to *Process Application* Section for limits.

Catalog No.	Calibration	Range Limits			
		Inches of Water		Kilopascals	
		Lower (3 psi output)	Upper (15 psi output)	Lower (20 kPa output)	Upper (100 kPa output)
323T Medium Range	Zero Based	±5% of Span	+19 to +250	±5% of Span	+4.8 to +60
	Suppressed Zero	0 to +230	+20 to +250	0 to +55	+5 to +60
	Elevated Zero	−250 to 0	−230 to +250	−60 to 0	−55 to +60
	Center Zero	−125 to −10	+10 to +125	−30 to −2.5	−2.5 to +30
324T, High Range	Zero Based	±5% of Span	+190 to +800	±5% of Span	+48 to +200
	Suppressed Zero	0 to +600	+200 to +800	0 to +150	+50 to +200
	Elevated Zero	−800 to 0	−600 to +800	−200 to 0	−150 to +200
	Center Zero	−400 to −100	+100 to +400	−100 to −25	+25 to +100
Instruments with suppression/elevation spring, Accessory (87), can be calibrated for suppressed, elevated, or center zero.					

Figure 3–Range Limits

INSTALLATION

MOUNTING

Refer to the *Process Application* Section for information on locating the transmitter for specific applications.

Carefully unpack the transmitter and uncoil the tube systems.

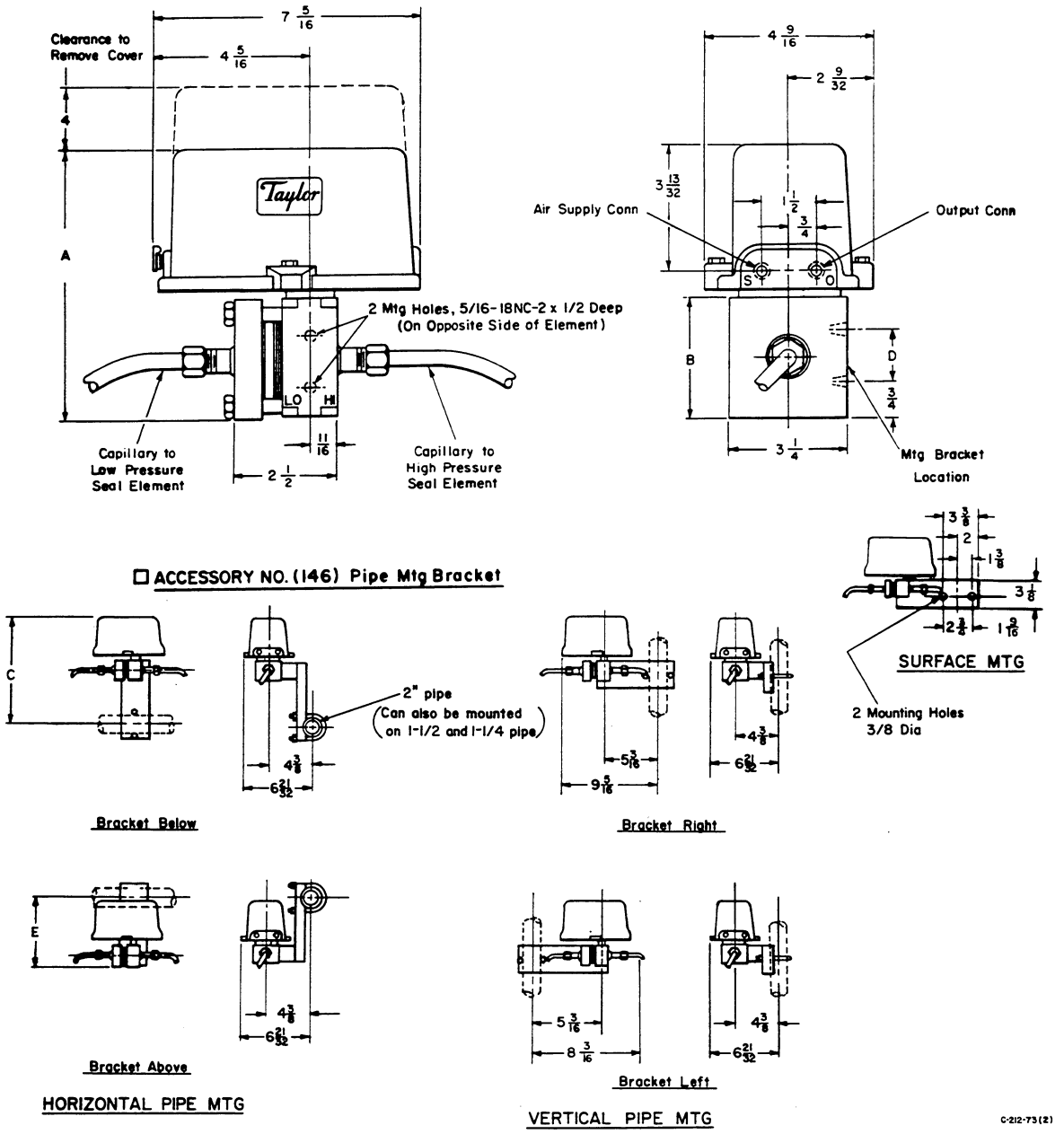
> *Caution*
>
> The process diaphragms will be damaged if the seal elements are lowered too far *below* the transmitter. Refer to *Specifications, Seal Element Elevation,* page 4.
>
> Do not remove the protective covers from the seal elements until ready to connect them to the process.

Select a mounting location where there is minimum vibration. Ambient temperature should not be less than minus 40°F (−40°C) or more than 180°F (83°C).

Mount the transmitter horizontally with the measuring element below the case as shown in Figure 4. Operation is not affected by mounting in other positions but some rezeroing will be required (refer to *Field Zero Adjustment).*

An optional mounting bracket kit, Accessory (146), provides a bracket, U-bolts, spacer, and fasteners, Figure 5. The bracket is suitable for either pipe or surface mounting. For pipe mounting, the bracket accepts 1-1/4 through 2-inch pipe and can be positioned for use on horizontal or vertical pipes, Figure 4.

INSTALLATION



INCHES	mm	INCHES	mm	INCHES	mm
5/16	7.94	2-1/2	63.50	5-3/16	131.76
3/8	9.53	2-3/4	69.85	6-13/32	162.72
1/2	12.70	3-1/8	79.38	6-9/16	166.69
11/16	17.46	3-7/32	81.76	6-21/32	169.07
3/4	19.05	3-1/4	82.55	6-11/16	169.86
1-3/8	34.93	3-3/8	85.73	7-5/16	185.74
1-1/2	38.10	3-13/32	86.52	7-11/32	186.53
1-9/16	39.69	4	101.60	8-3/16	207.96
1-3/4	44.45	4-5/16	109.54	9-5/16	236.54
2	50.80	4-3/8	111.13	10-23/32	272.26
2-1/4	57.15	4-9/16	115.89	10-27/32	275.43
2-9/32	57.94				

For reference only; not for construction

Air Supply and Output Connections 1/4 Int NPT

All dimensions in inches

Figure 4—Mounting Dimensions for Case and Body of 320T Series Transmitters

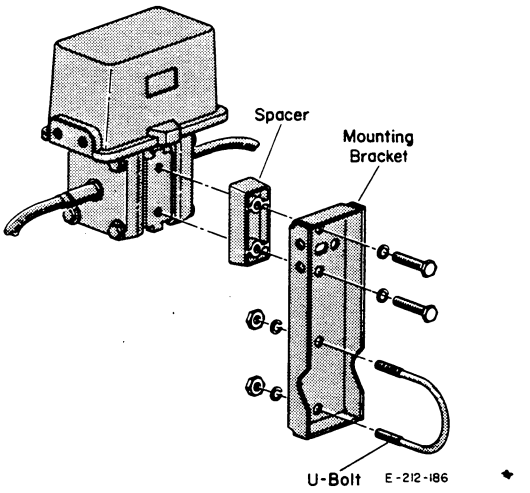


Figure 5 — Assembling Optional Mounting Bracket Kit, Accessory (146)

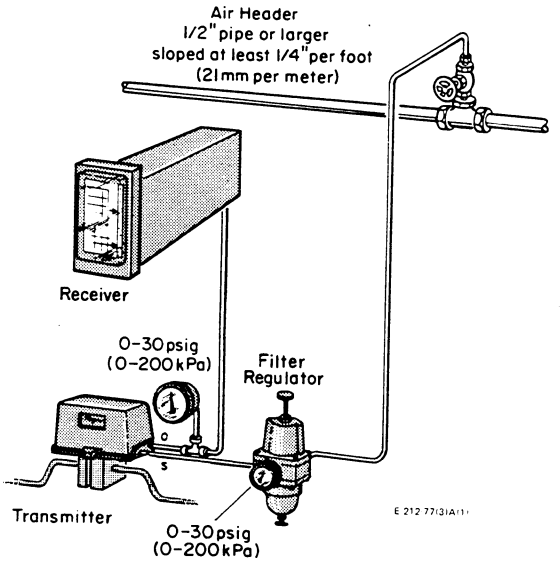


Figure 6—Pneumatic Connections

PNEUMATIC CONNECTIONS

The air supply and output ports are located on the end of the transmitter case, Figure 6. Both ports are 1/4-inch Int NPT. 1/4-inch (6.35 mm) tubing is recommended for air lines.

Connect a clean, dry, 20 psig (140 kPa) air supply to the port marked S. Connect the output from the port marked 0 to the reciever. Make certain the output line is free from leaks.

OPERATION

PUTTING INTO OPERATION

To put the transmitter into operation, turn on the air supply and adjust it to 20 psig (140 kPa), then follow the procedure for *Field Zero Adjustment*.

FIELD ZERO ADJUSTMENT

To adjust zero on an installed transmitter proceed as follows:

FLOW SERVICE

Shut off flow to obtain zero differential across measuring element. Output should be 3 psig (20 kPa).

If it is not, adjust zero screw through access hole in end of cover. Clockwise rotation increases output.

LIQUID LEVEL SERVICE

1. Bring liquid to minimum level or to a known reference level.
2. Determine the required output pressure using the following equation:

$$\text{Output} = 12\left[\frac{(\text{Ref Level} - \text{Min Level})\,G_t}{\text{Span}}\right] + 3$$

Where: Min Level – Lowest level to be measured (at or above datum line)
Ref Level – Any known level between minimum and maximum
G_t – Specific gravity of process liquid

Transmitter datum line is at the center of the HI side process diaphragm.

3. If output does not agree with the value obtained in Step 2, remove cover and turn *bias screw,* Figure 7, to obtain required output.

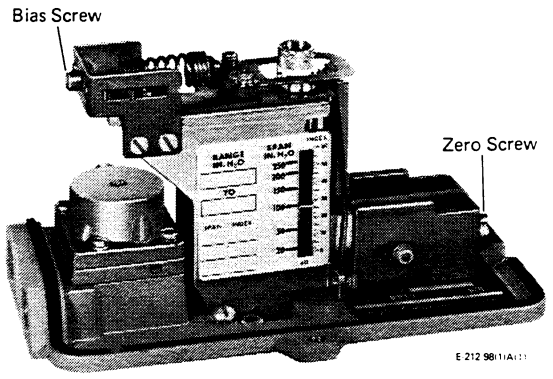


Figure 7–Zero Adjustments

After replacing cover, trim zero if necessary by adjusting *zero screw* through access hole in end of cover. Clockwise rotation of either screw increases output.

CALIBRATION INDEX

The calibration index provides a means of repeating span settings and thereby reproducing any previously calibrated span within 1/2% without recalibration. The index scale, Figure 8, divides the span scale into 60 increments. One full turn of the span screw moves the scale indicator one increment and the vernier scale on the span screw divides the increment into tenths. Using these scales, span settings can be converted into index numbers.

For example, if a transmitter has been calibrated for 100 inches of water, the index reading might be 26.50. Digits in front of the decimal are read from the index scale using the top edge of the indicator. Digits after the decimal are read from the vernier scale. With the index number noted, the span can be changed and then returned to precisely 100 inches by adjusting the scale indicator to the index number. Only rezeroing may be required.

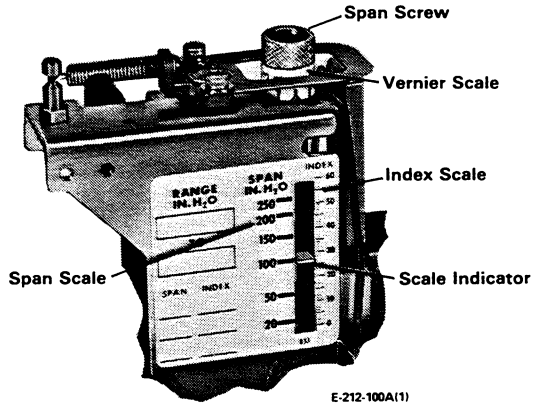


Figure 8–Calibration Index

DESCRIPTION OF OPERATION

TRANSMITTER

The transmitter operates on the force balance principle; force developed by the measuring element is balanced by the force produced by output pressure acting on the follow-up bellows, Figure 9.

An increase in differential pressure, acting on the process diaphragms, is transferred through the liquid fill to the primary diaphragm. Force is developed which moves the lower end of the force beam to the right. The nozzle-baffle gap decreases and nozzle back pressure increases. This pressure is fed to chamber A of the output relay.

As the pressure in chamber A increases, the diaphragm assembly moves the relay stem downward, closing the vent port and opening the air supply port to increase the output. The output increases until it balances the downward force on the diaphragm assembly.

The output pressure is fed to the follow-up bellows which applies force to the span lever. This force is transferred through the flexible strip back to the force beam. The nozzle-baffle gap is approximately restored to its original position as equilibrium is established between measuring element force and follow-up force. Since the follow-up force is produced by output pressure, the output is proportional to differential pressure

SUPPRESSION/ELEVATION SPRING

The suppression/elevation spring, Figure 9, biases output to compensate for the effect of initial head pressure. This pressure can be developed by a difference in elevation between the seal elements or by a column of process liquid.

If the LO side seal element is located below the HI side element, initial output will be above the required zero value [3 psig (20 kPa)]. The suppression/elevation spring, compressed by adjustment of the bias screw, provides force which balances the

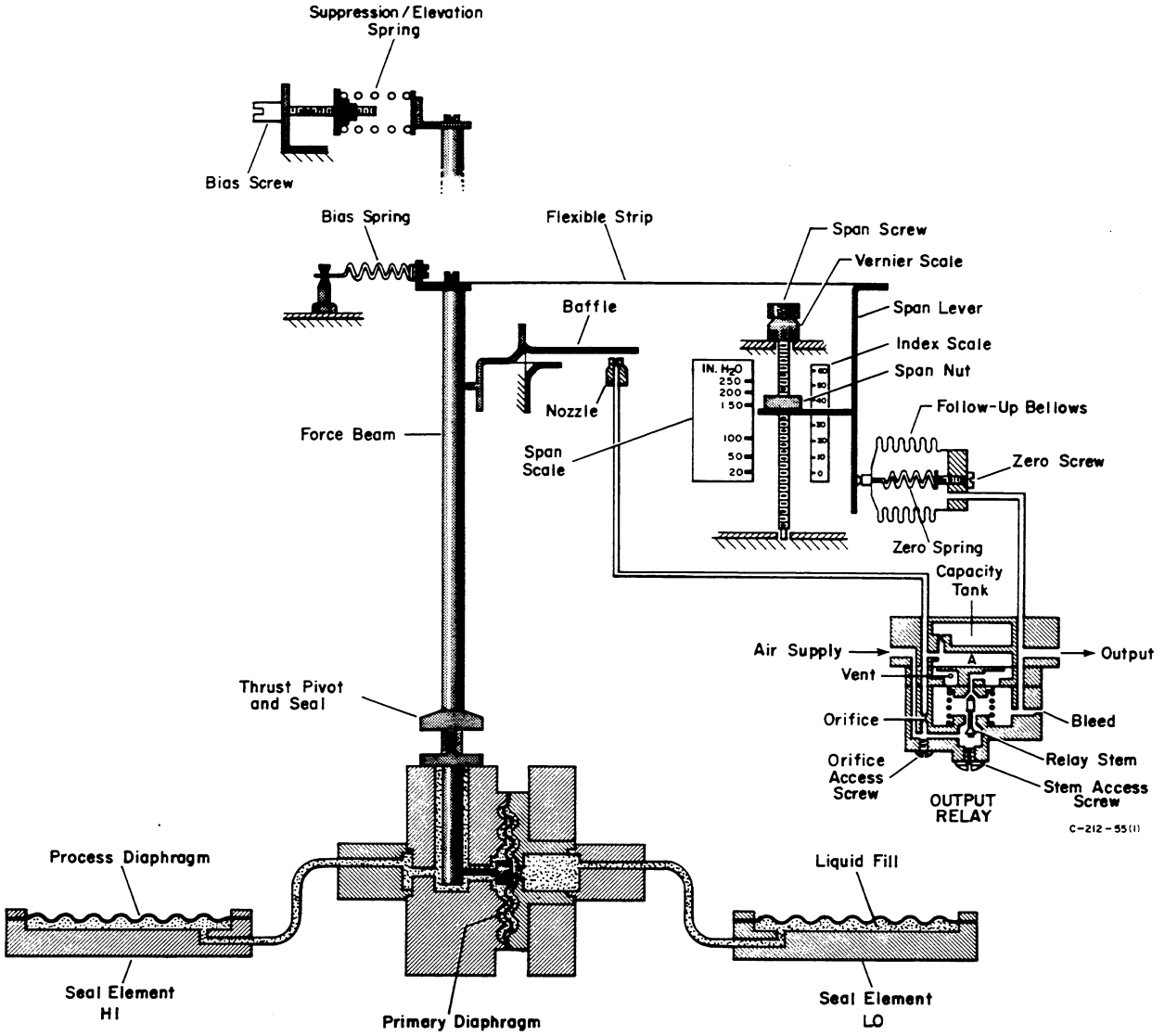


Figure 9–Schematic Diagram, 320T Series Transmitters

measuring element force resulting from the initial pressure. Thus, the spring *suppresses* the output down to the required zero value.

When the LO side seal is located above the HI side seal, as in a liquid level installation, initial output will be below the required zero value at minimum level. The suppression/elevation spring, tensioned by adjustment of the bias screw, provides balancing force which *elevates* the output up to the required zero value.

Suppression or elevation adjustments are made as part of the transmitter calibration procedure. The head pressures are simulated by air pressure applied to the HI or LO side seal element.