NORTHERN ALBERTA INSTITUTE OF TECHNOLOGY
EDMONTON ALBERTA

INSTRUMENTATION TECHNOLOGY

DIFFERENTIAL PRESSURE TO CURRENT TRANSMITTER (D/P CELL)

The Foxboro 613DM D/P Cell Transmitter is a force balance instrument that measures differential pressure, ΔP, and transmits it as a proportional electrical d-c ma signal.

input signal: 0-20 to 0-205 inches of water pressure, continusously adjustable by span adjustment screw. (Low pressure capsule).

0-200 to 0-850 inches of water pressure (High pressure capsule).

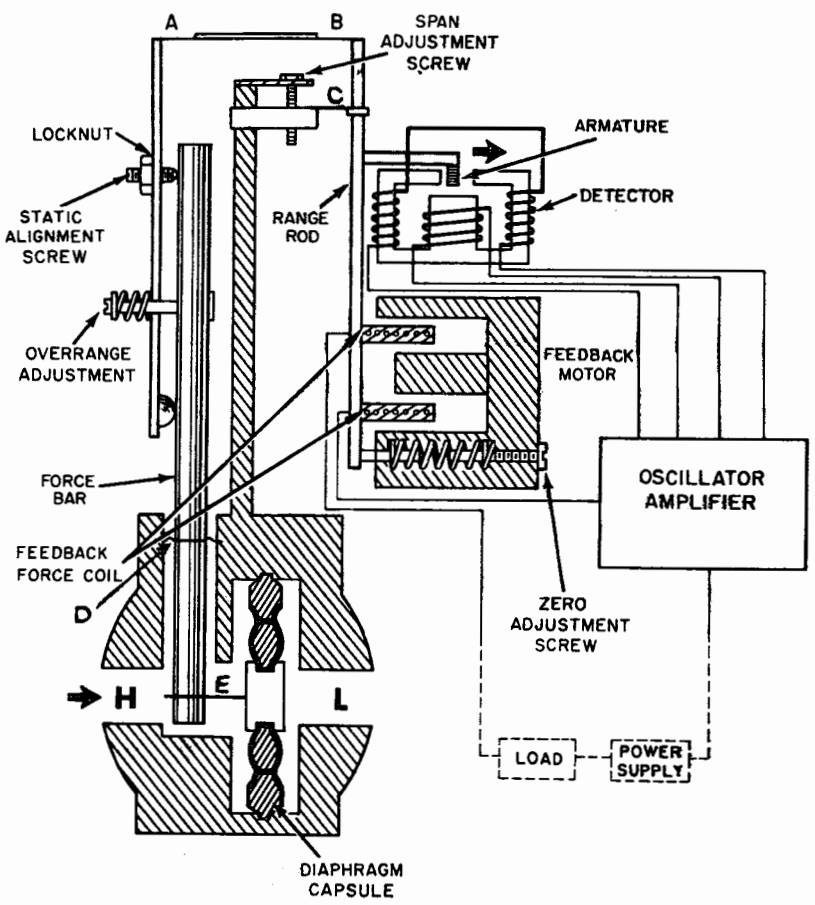
output signal: 10-50 ma d-c into 600 ohm load $\pm$10%

accuracy: 0.5 % of span

power supply: 65 volts d-c $\pm$5%

OPERATION

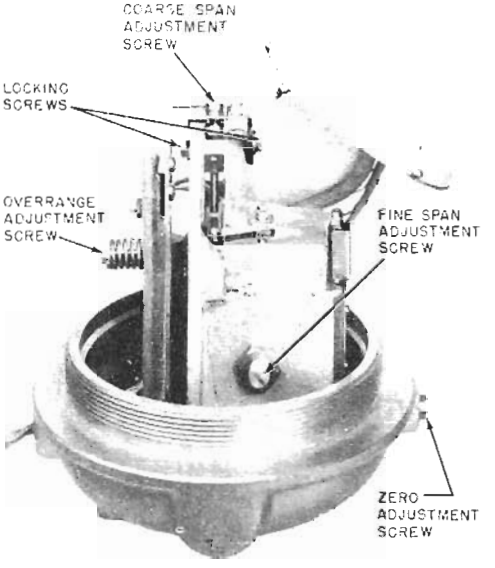
Pressures are applied to opposite sides of the silicone-filled diaphragm-capsule through the high and low pressure connections. Any difference between these pressures, ΔP, exerts a force on the diaphragm-capsule, which is rigidly connected to the force bar by the flexure (E). The Elgiloy diaphragm (D) acts as a seal and as a fulcrum for the force bar. The force bar transmits a force, which is exactly proportional to the differential pressure on the diaphragm-capsule, through the flexure (A-B) to the range rod causing the range rod to pivot about point C.



Any movement of the range rod is detected by the armature of the differential-transformer detector. If, for instance, there is an increase in pressure on the high pressure side of the diaphragm-capsule, the armature moves toward one secondary winding (direction shown by arrow) of the detector, thus strengthening the inductive coupling and increasing the secondary voltage. If this secondary voltage is of the correct phase (positive feedback), the oscillator will oscillate at 1000

cps and its output will increase. This 1000 cps output is then rectified, filtered, and applied as bias voltage to the d-c amplifier which produces a proportional increase in current output. The amplifier current is applied simultaneously to the feedback motor and the receiver or load. Since the force generated by the feedback motor is proportional to the current through it, the increase in current increases the feedback motor force until it balances the force generated by the differential pressure. In operation, the movement of the range rod is continuously adjusting the detector to maintain a condition of force balance, hence, the output current which establishes the force balance is proportional to the differential pressure across the capsule.

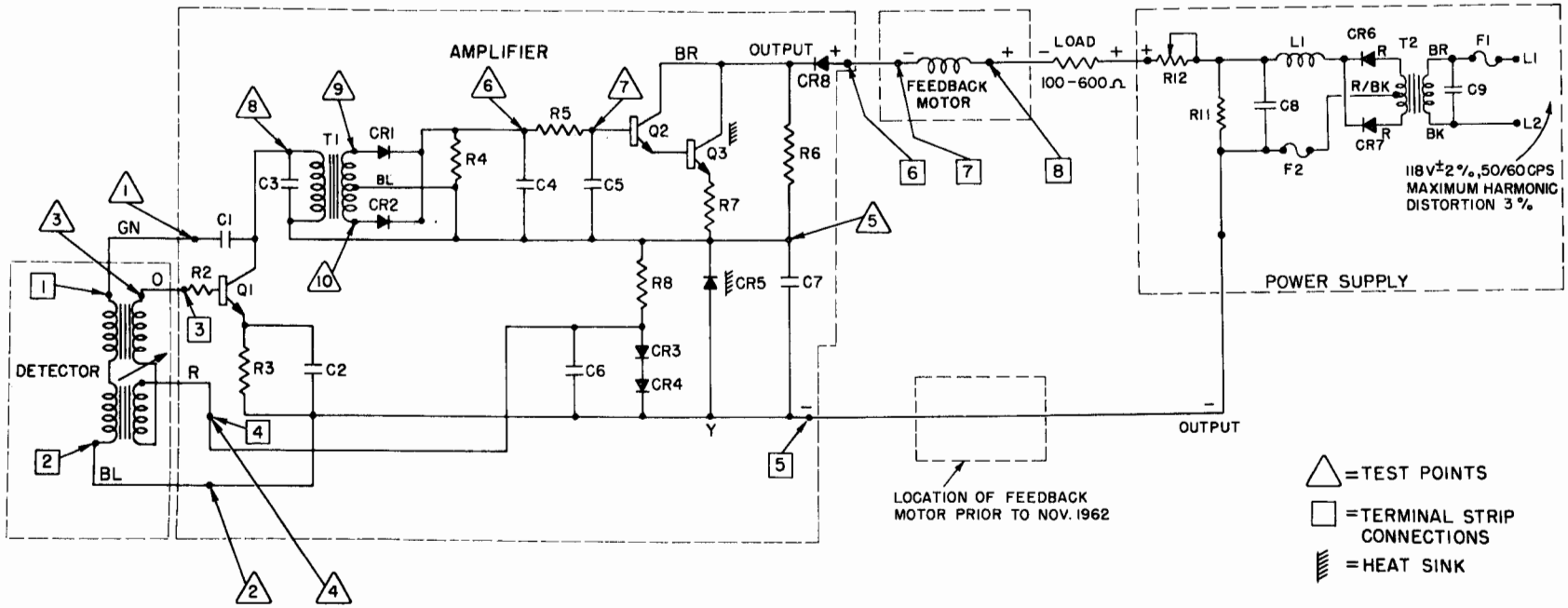
CALIBRATION ADJUSTMENTS



ZERO ADJUSTMENT - All output readings are moved up or down scale an equal amount by turning the zero adjustment screw.

COURSE SPAN ADJUSTMENT - This adjustment makes possible an increase of decrease of the total span of the instrument.

FINE SPAN ADJUSTMENT - This adjustment has a total range of adjustability equal to 4% of the total span.



Item	Description	Part No.
C1, C4, C6	Capacitors, electrolytic, 1 μf, 75 volts	N-119-LY
C2	Capacitor, tantalum, electrolytic, 1.2 μf ±10%, 35 volts	N-119-MB
C3	Capacitor, tubular, 0.033 μf ±20%, 100 volts	E-123-KY
C5	Capacitor, electrolytic, 50 μf −10% +100%, 25 volts (Type 613 Transmitters)	N-110-EB
C5	Capacitor, tantalum, 325 μf ±10%, 6 volts (Type 611 Transmitters)	N-119-NN
C7	Capacitor, electrolytic, 10 μf, 50 volts	N-119-LT
C8	Capacitor, electrolytic, 100 μf +50% −10%, 150 volts	N-114-YR
C9	Capacitor, Mylar, 0.1 μf ±10%, 400 volts	N-121-BX
R2	Resistor, carbon, 150 ohms ±5%, ½ watt	N-110-LZ
R3	Resistor, carbon, 330 ohms ±5%, ½ watt	N-116-KR
R4	Resistor, carbon, 2.2K ±5%, ½ watt	N-110-BX
R5	Resistor, carbon, 10K ±5%, ½ watt	E-102-CS
R6, R8	Resistors, carbon, 22K ±10%, ½ watt	K-109-BF

Item	Description	Part No.
R7	Resistor, carbon, 10 ohms ±5%, ½ watt	N-119-LW
R11	Resistor, fixed, wire wound, 6.8K ±5%, 3 watts	N-121-CT
R12	Potentiometer, wire wound, 500 ohms ±5%, linear	N-111-BE
CR1, CR2, CR3, CR4, CR8	Diodes, silicon, Type 1N538	N-100-AA
CR5	Diode, Zener, 18 volts ±5%, Type 3Z18	N-119-ME
CR6, CR7	Diodes, silicon power rectifier, Type 1N645	N-109-EZ
Q1	Transistor, Type 2N656 (OSCILLATOR)	N-119-MA
Q2	Transistor, Type 2N657 (DRIVER	N-119-KT
Q3	Transistor, Type 2N657 (FINAL AMPLIFIER)	N-119-KT
T1	Transformer, d/p Cell Amplifier	N-119-LZ
T2	Transformer, power, primary 115 volts, 50-60 cps	N-121-BK
L1	Choke, filter input, 2.7 henries, 25 ohms	N-121-BL
F1	Fuse, ⅜-ampere, 250-volt, fast acting	N-121-EB
F2	Fuse, ⅜-ampere, 250-volt, slow blow	N-121-BF
DETECTOR	Detector Assembly	N-119-NX

Schematic Diagram, d/p Cell Amplifier and Power Supply