

LIQUID LEVEL (DEPTH) TRANSMITTER

Process purpose version

TPn-101



- Piezoresistive silicon pressure sensor developed and fabricated in MTM
- User-defined changes and adjustments of measurement range
- Standard outputs 4-20mA or 0-20mA
- Rugged process-purpose design
- Twin unit housing, dividing electric connections from amplifier
- High accuracy, repeatability, long term stability and reliability

APPLICATION

Measurement of level or depth of liquid based on hydrostatic pressure measurement in open tanks, wells, accumulations, etc, as well as in nonpressurized closed vessels.

Electronic block housing is mounted above liquid to an immobile roof or support, and a cable with a capillary tube and with the probe at its end is lowered into the liquid. The position in the liquid in which the sensor is placed denotes the zero level point.

Rugged process-purpose design, IP65 mechanical protection, quality of material in contact with process fluid, excellent technical and measurement characteristics provide reliable application in control and measurement circuits with standard and more strict requirements, with full compatibility with standard automatic regulation and control systems

STRUCTURE

Sensing probe, the primary part of the transmitter, is positioned at the lowest level of the liquid, and its parts are central section and probe housing. Diaphragm type central section contains separating diaphragm, section housing and sensor chip. The diaphragm is fabricated in special stainless steel and its purpose is to separate process fluid from oil fill and the sensor. A relative pressure sensor is typically used, and in the cases when it is necessary to perform measurement corrections by

either changing the measured value or by including barometric pressure variations, an absolute pressure sensor is used. All the parts of the central section are fully welded to each other and the interior is filled with high quality silicon oil. The probe housing contains all the above parts in an airtight unit.

Electronic block is situated outside or above the measuring liquid. Its main part is electronic amplifier, which supplies sensors and converts its output signal into the standard electric signal. Two or three wire electrical connection at the transmitter output is intended simultaneously for supply and measurement. Zero and range potentiometers fitted in electronic amplifier provide output signal correction within the factory preset range.

Cable with the capillary tube connect measurement probe and electronic block. The purpose of the capillary tube is to bring barometric pressure to the "-" side of the sensor. If there is danger to move, swing or damage measurement probe, it is necessary to supply a protective tubing or to apply the transmitter option with an appropriate protective sheet.

OPERATION

Hydrostatic pressure, which is directly proportional to the level of measured liquid, affects "+" side of sensor. However, the measurement vessel is open and thus barometric pressure of air is simultaneously applied with the hydrostatic pressure. To nullify it, barometric pressure is simultaneously brought to the "-" side of the sensor. Thus the transmitter measures only the hydrostatic pressure $p = \rho gh$, i.e. the level of liquid h . The hydrostatic pressure affects separating diaphragms and oil fill, and deflects the sensor diaphragm. The deflection causes an unbalance of the Wheatstone bridge (four piezoresistors integrated into the diaphragm edge). The bridge unbalance is detected electronically, the obtained signal is further processed in the electronic amplifier and finally sent to the transmitter output. The output signal is linearly dependent on measured hydrostatic pressure, i.e. on the level of process liquid.

CHARACTERISTICS

- Available ranges (0... 100... 500) and (0...400... 1000) mbar and (0... 0,8... 2), (0... 1... 5), (0... 4... 10), (0... 8... 20) bar, i.e. (0... 1... 5), (0... 4... 10), (0... 8... 20), (0... 10... 50), (0... 40... 100) and (0... 80... 200) m H₂O.
- The lengths of cable with measurement probe: for water up to 1, 5, 10, 20, 50, 100 or 200m; for other fluids this length is multiplied by the ratio of fluid density to water density.
- Two-wire (4-20)mA or three-wire (0-20mA) connection
- Electric output: via screw terminals, through cable conduit PG-13,5.
- Zero suppression: 100% of range
- Elevation: standardly 20% of range
- The measurement range is factory-preset, and the user may perform additional corrections during transmitter operation within the preset range

- Materials: electronic unit housing Al.Cu5.Mg1.55, diaphragm 316 Stainless Steel, probe housing Al.Cu5.Mg1.55 or carbon steel+gal.Zn or stainless steel, protective sheet of cable with capillary tube Al.Cu5.Mg1.55 or carbon steel+gal.Zn or stainless steel. Other materials upon request
- Probe diameter Ø22 or Ø30
- Mounting of electronic block to its support: hollow screw, self supporting nut or flange, upon request.
- Mechanical protection IP65

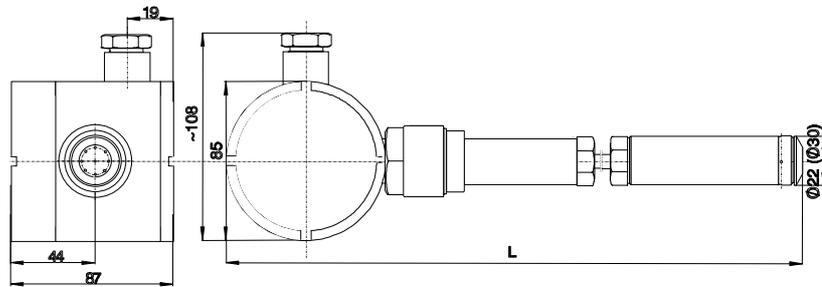


TABLE 1: GENERAL AND OPERATING CONDITIONS

Parameter	Units	Reference conditions	Normal conditions	Limit conditions	Transport conditions
Ambient temperature	°C	20±1	-30 to +80	-40 to +80	-50 to +100
Chamber temperature	°C	20±1	-30 to +80	-40 to +80	-50 to +100
Relative humidity	%	10 to 50	0 to 100	0 to 100	0 to 100
Vibration frequency	Hz			≤500	≤500
Vibration acceleration	9.81 m/s ²			≤2 ¹⁾	≤2 ¹⁾
Vibration amplitude	mm			≤0.21 ²⁾	≤0.21 ²⁾
Shock	9.81 m/s ²			≤100	≤100
Supply voltage	V	24±1	24±1	12 to 36	
Line resistance	Ω	600	600	0 to 1100	

1) Frequency range 60 to 500Hz; 2) Frequency range 10 to 60Hz

MEASUREMENT CHARACTERISTICS

- In accordance with IEC 770/84
- Accuracy (linearity, hysteresis, repeatability), table 2; independent on measuring range.
- Additional effects for minimum (4mA) and maximum (20mA) signal:
 - Power supply effect $\pm 0.01\%$ FS/1V,
 - Line resistance effect, $\pm 0.01\%$ FS/100 Ω .
 - Long term stability $\pm 0.2\%$ FS/1 year.

These effects are independent on measurement range.

- Effects of overload and ambient temperature are dependent on measurement range. They are measured for each transmitter separately and the data are enclosed in the data sheets.

TABLE 2: MEASURING ACCURACY ($\pm\%$ FS)

Class	0.20	0.40	0.60	1.00
Linearity	0.10	0.30	0.40	0.60
Hysteresis	0.05	0.05	0.10	0.20
Repeatability	0.05	0.05	0.10	0.20