

LIQUID LEVEL (DEPTH) TRANSMITTER

Compact version

TPn-100



- Piezoresistive silicon pressure sensor developed and fabricated in MTM
- Ranges 0-100mbar or 0-1m H₂O to 0-20 bar or 0-200m H₂O.
- Standard outputs 4-20mA or 0-20mA
- Compact and economical design, small overall dimensions, low weight.
- 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 closed vessels in which there is no pressure overload above liquid.

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.

Compact and economical design, IP65 mechanical protection, choice of material in contact with process fluid, and good technical and metrological characteristics provide its extremely wide application range and 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. The zero and range potentiometers fitted in the electronic amplifier provide additional correction of the manufacturer-preset range in the limits up to $\pm 5\%$.

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 of 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 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 is either cable (standard length 2m) or connector.
- Zero suppression: 100% of range
- Elevation: standardly 20% of range
- The measurement range is manufacturer-preset, and the user may perform additional corrections during transmitter operation in the range $\pm 5\%$.
- 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 $\varnothing 22$ or $\varnothing 30$

- Mounting of electronic block to its support: hollow screw, self supporting nut or flange, upon request.
- Mechanical protection IP65

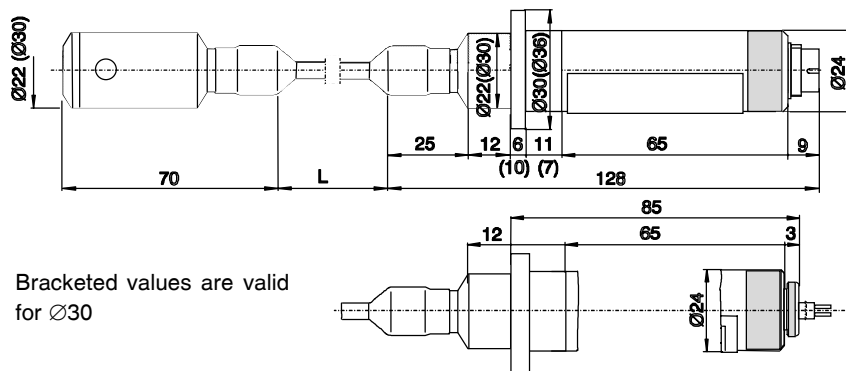


TABLE 1: GENERAL AND OPERATING CONDITIONS

| 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 |