From the pressure to the tank contents: process transmitters designed for flexibility

Bernd Reichert

Plant operators desire measuring components that are versatile and can be used economically. Wika developed a generation of universal process transmitters for pressure measurement that is tailored for this profile of requirements. In addition to its primary task, the model UPT-2x can determine, for example, both the level and the volume of tank contents.

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About

Company name: Wika Alexander Wiegand SE & Co. KG
Headquarter: Klingenberg, Germany
Turnover: € 800 Mio. (Wika Group)
Employees: 8,500 (Wika Group)
Products: pressure, temperature and level measurement technology

Generally speaking, a process transmitter is used for measuring a pressure in pipes and ducts through which liquids or gases are flowing. However, using the hydrostatic pressure in vessels also opens up the possibility of another application, identifying the level by using the ‚liquid column' as a reading of the height. The only requirement for this: The substance being measured and, with this, its density must be known.

The default setting of the UPT is based on the density of 1 kg/dm³, being the density value for water. Any difference in the medium (for example, mineral oil with a density of 0.8 kg/dm³) can easily be implemented in the instrument via the display menu or through its communication software. The height reading is then displayed either in metres, centimetres, millimetres, feet or inches.

Volume via shape

The UPT offers the possibility of displaying the actual tank contents in volume units such as litres or cubic metres. So that the transmitter can determine this value based on the filling height, the internal shape of the vessel must be defined. The most common of these are horizontal or vertical cylindrical tanks and also spherical tanks. Calculation formulas for these three types are pre-programmed into the transmitter.

To then determine the volume, the only missing data is the maximum filling height of the container. This dimension is input via the measuring instrument's display, and thus it displays the volume.

Furthermore, with the UPT, vessels with a custom shape can also be included. The transmitter features a HARTv.7 interface for an easy connection of the system. Via this communication channel, the instrument software can also transmit ‚holding points'. These are value pairs of height in percent and volume in percent, which the operator has determined through calculation or through a test filling of the tank. The UPT handles 30 such value pairs, through which the form of the tank can be sufficiently described. This method also works for tank shapes that are, for example, composed of different bodies. The following figure illustrates the system (for the sake of simplicity given by the example of a horizontal cylindrical tank): When one generates the volume from the fill level, one gets an S-curve.

Indication in weight units

When an empty tank starts to fill, the filling height increases very quickly, even though a large volume has not yet flowed into it. In the central area of the tank, filling height and the increase in volume proceed at a fairly even ratio. Once the tank is almost full, the initial effect occurs yet again: A relatively small "amount" can drive the filling height up quickly. If correspondingly programmed, the UPT can alert you to the risk of an overflow.

And with this the instrument's informative capability is not yet exhausted. Users have the ability to utilise a further "free unit" for the calculated tank contents. It would be conceivable, for example, to indicate the measured value for the filled tank, not in units of volume, but in units of weight such as tonnes or kilonewtons. Through the operating software or directly on the display, ten display digits are available for such a custom unit. The desired value is calculated with respect to the specific gravity of the filling medium. This additional feature makes the new instrument a truly universal "volume transmitter".

High accuracy and resilience

The foundation for the overall measurement performance of the UPT-2x is the accuracy – up to 0.1 percent of the measuring span. The sensor is available with pressure ranges from 0 - 400 mbar to 0 - 1,000 bar

The measured value can be displayed in weight units

in nine increments. Intermediate values can be set using the scaling.

The potential of this new generation of transmitters primarily arises from the requirement to ensure the accuracy of the specified measurement, even under extreme process conditions over a long period of time. As a result, the transmitter features a rugged plastic housing. To obtain a full ATEX approval, this housing is also made of a conductive material. The resilience of the instrument – and thus the process safety – can be further and considerably enhanced by combining it with a diaphragm seal assembly.

User-friendly versatility

The construction of the UPT underlines its versatility. The electrical installation of the instrument can be completed quickly and with hardly any need for tools. The process connection is available with a pressure port or a flush diaphragm. The display can be placed in four positions, each separated by 90°, and rotated through 330° around the process connection. In this way, it can be adapted to any installation situation. The 58 mm wide display is also still clearly readable up to five metres (or more) away.

All technical features of the UPT generation are geared towards the principle of versatility. For particularly demanding requirements on the exterior of the process transmitter, Wika has added a stainless steel housing for the instrument to the programme. With this, customers in the field of sanitary applications can also be fully supported now. With the UPT, the user has access to a product in which many functions are combined. This allows the variety of instruments in the plant to be reduced and the process safety to be increased. To use the UPT in explosives atmospheres, we now have ATEX, IECEx and EAC approval for safe intrinsically instruments.

Photographs: *teaser fotolia*

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