

Level measurement using 266-series multivariable transmitters

Measurement made easy

High-precision level measurement with increased safety and availability



Hydrostatic level measurement using differential pressure transmitters has proven its worth in countless applications for many years. This measurement method is a cost-effective solution if high pressures and/or high temperatures need to be taken into account in the measurement process.

Additional benefits that must not be forgotten include simple assembly—even in difficult operating conditions—and the availability of process-wetted parts with almost any level of corrosion resistance that may be required.

However, hydrostatic level measurements are subject to several particularities, as the density of the measuring medium changes depending on the temperature, thus producing incorrect measurement results. Temperature variations of 20 K result in changes in the density of fluids of 1 to 2 %, directly causing measurement errors.

For this reason, in certain operating conditions it can be very useful to record the process pressure and process temperature in addition to the differential pressure. This way, changes in the density of the measuring medium can be corrected by means of calculations in the measuring device, and the quality of the measurement result can be improved significantly.

The ABB 266 multivariable transmitter was designed specifically for this application. Using sophisticated multisensor technology, three process values are recorded and evaluated simultaneously.

The differential pressure, process pressure and process temperature are measured by an externally connected temperature sensor to provide all the parameters that are required in order to fully correct the change in density. The fluid level, fluid volume or fluid mass in a tank can be selected as the output measurement result.

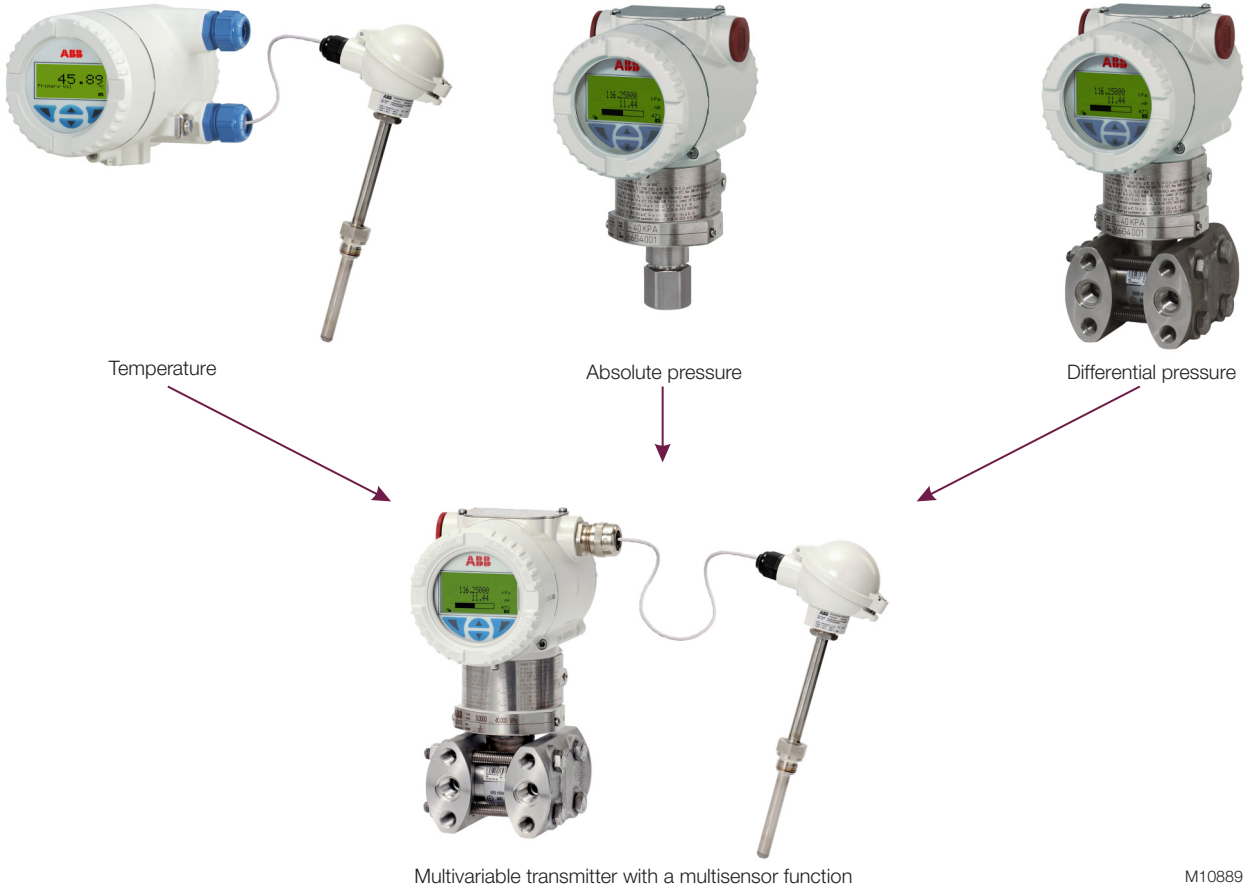
Using only one measuring device instead of three has considerable advantages for the user: the simple setup of measuring points, fewer shut-off valves required, fewer process connections, fewer electrical connections, less cabling and fewer I/O modules for transferring measurement results to higher-level systems. All these factors combined result in potential cost savings of 30 to 40 %.

Multivariable transmitters

Multivariable transmitters not only generate cost savings, but also increase the availability of measuring points. A multivariable transmitter has a significantly lower probability of failure than three transmitters.

Simple configuration and parameterization options via the Device Type Manager (DTM), handheld terminal or directly on

the LCD indicator through the housing cover by means of Through The Glass technology (TTG), as well as extensive diagnostics functions, all help to improve operational security. As an example, the transmitter monitors the leads to the connected temperature sensor and, of course, the sensor itself.

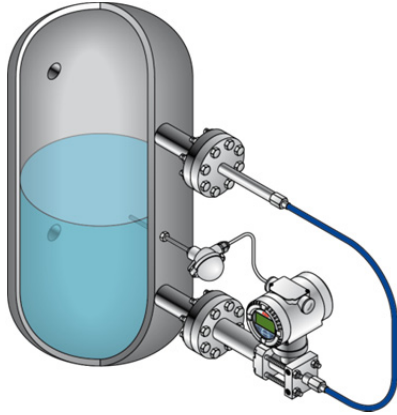


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Application

The measurement of the drum water level in a steam boiler can be seen as an exemplary use of the multivariable transmitter, since it is particularly sophisticated in terms of device functionality.

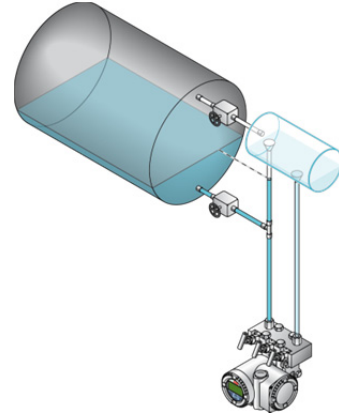
Saturated steam conditions are prevalent in the drum. Every process-related pressure variation, which also means a simultaneous change in temperature, results in considerable changes to the densities of water and steam in the boiler.



Level in open or closed tanks with or without pressure sensor

The level (water level) must be recorded precisely in order for the process to flow uninterrupted. This is essential in order to meet the requirements for system safety. Only in this way can overheating and damage to the superheater due to water ingress be prevented.

If the process is carried out with varying pressure levels, measuring the level without calculating the compensation for the variations in pressure and temperature would be inconceivable.



Measuring the drum water level

Device specification

Measuring spans

Differential pressure	Absolute pressure
0.05 to 1 kPa / 0.5 to 10 mbar / 0.2 to 4 in. H ₂ O	0.6 MPa / 6 bar / 87 psi 2 MPa / 20 bar / 290 psi
0.2 to 6 kPa / 2 to 60 mbar / 0.8 to 24 in. H ₂ O 0.4 to 40 kPa / 4 to 400 mbar / 1.6 to 160 in. H ₂ O 2.5 to 250 kPa / 25 to 2500 mbar / 10 to 1000 in. H ₂ O 20 to 2000 kPa / 0.2 to 20 bar / 2.9 to 290 psi	2 MPa / 20 bar / 290 psi 10 MPa / 100 bar / 1450 psi 41 MPa / 410 bar / 5945 psi

Measured and calculated values

Level
 Volumes of tanks of any form
 Tank contents in mass flow units
 Differential pressure
 Process pressure
 Process temperature
 Density of the measuring medium
 Sensor temperature

One of the first three values mentioned can be assigned to the 4 ... 20 mA current output signal.

Measuring accuracy

Level better than 0.25 %
 Differential pressure better than 0.04 %
 Process pressure better than 0.1 %
 Process temperature better than 0.3 K

Density calculation for open or closed tanks

The transmitter calculates the material densities required for the correction

- Fluid density in the tank
- Gas density in the tank
- Gas density in the compensating line or fluid density in the capillary tube

Temperature for the density calculation:

- Measurement of the temperature of the medium in the tank by means of Pt100
- Sensor temperature or fixed value to correct the density of the medium in the compensating line and in the capillary tube

Density Calculation for the Drum Water Level Measurement

The transmitter calculates the material densities required for the correction

- Fluid density in the tank
- Steam density in the tank
- Fluid density in the compensating line

Density calculation:

- Measurement of the saturated steam pressure in the tank
- Pt100 measurement or sensor temperature or fixed value to correct the density of the medium in the compensating line

All benefits at a glance

- High-precision level measurement by means of multisensor technology
- Replaces three standard transmitters and a measurement computer
- For open and closed tanks and for drum water levels
- Compensation of fluid and gas density variations in the tank and compensating line
- Application-specific configuration performed free of charge on delivery or easily on site by means of DTM, a handheld terminal or the LCD indicator directly on the device
- Increased reliability and availability due to the use of only one device

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