Technical Information TI/266/MV_101-EN

Flow measurement using 266-series multivariable transmitters

Measurement made easy

High-precision flow measurement with increased safety and availability

Flow measurement with the differential pressure procedure using differential pressure transmitters has proven its effectiveness in numerous applications over many years. Reliability and versatility are the main characteristics of this procedure. Differential pressure transmitters are the most cost-effective alternative to other measurement methods when dealing with high pressures and/or temperatures or large pipeline sizes.
Wetted parts are available in almost any corrosion resistance for additional moderate investment. The transmitters require nearly no maintenance.
However, a change in the density of the measuring medium leads to a false measuring result with this type of flow measurement. Therefore, dependent on the operating conditions, it is advisable to measure the process pressure and process temperature in addition to the differential pressure in order to correct the density change in the measuring medium. This will lead to a considerable improvement in the accuracy of the measurement result.

The 266-series multivariable transmitters from ABB, with advanced multisensor technology, are tailored specifically to meet these requirements.
Differential pressure, process pressure and process temperature can be measured simultaneously.
The quality of the measurement is considerably enhanced by a dynamic compensation that considers changes in density as well as variable flow parameters such as the flow coefficient, Reynolds number and pipe and orifice diameter.
The mass or standard volume flow of the measuring medium can be selected as the measurement result to be output; the heat flow can also be selected when measuring water or steam. Thanks to the binary output, the system can control external counters.

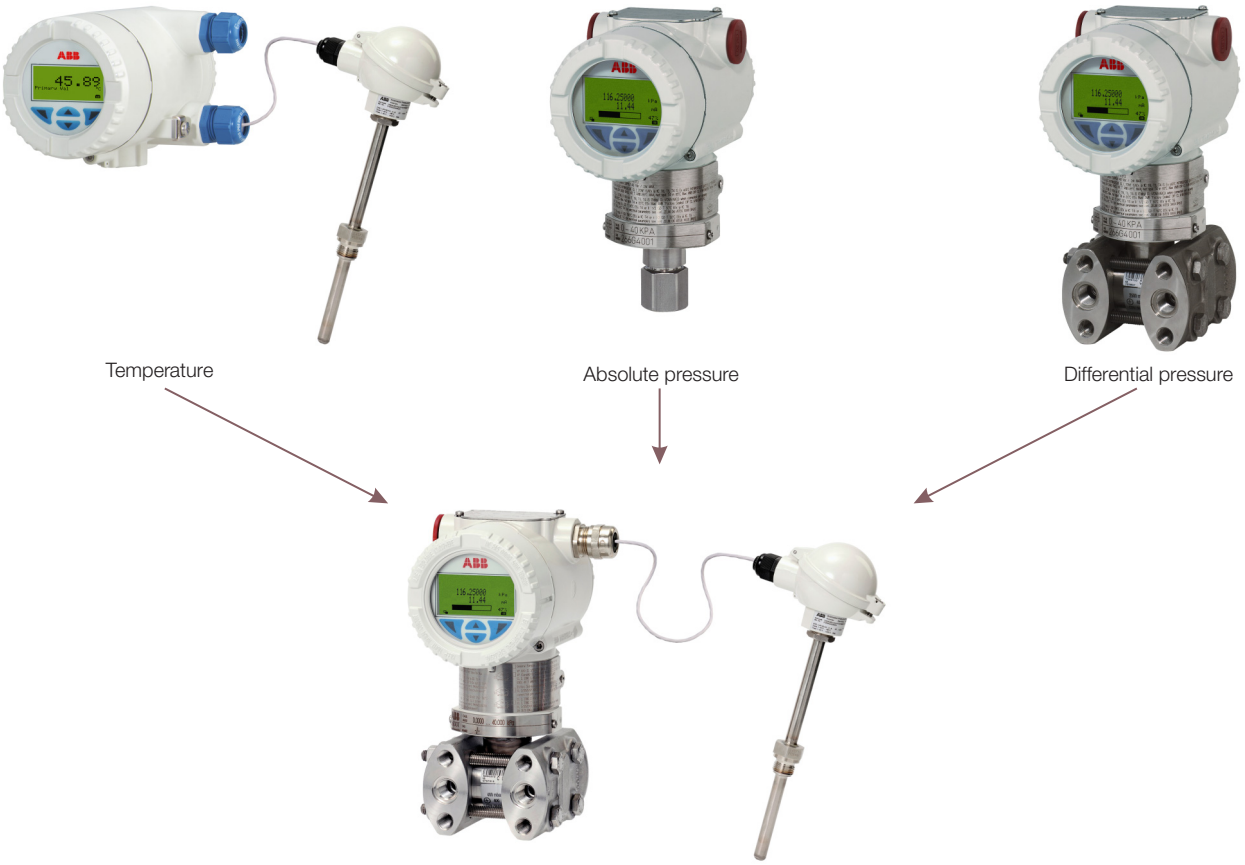
Using only one measuring device instead of three has considerable advantages for the user:
Easy setup of the measuring point, and a reduced need for shut-off valves, process connections, electrical connections, cabling and I/O modules for transferring measurement results to higher-level systems — all of these factors combined result in potential cost savings of 30 to 40 %.

Multivariable transmitters

It is not only costs that can be reduced through the use of multivariable transmitters. At the same time, the availability of the measuring point is also increased, and the possibility of leaks is reduced. 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. The PILD function (plugged impulse line detection) requests preventative maintenance before the measuring point fails altogether.
The new functions also mean that the system can be used for a wide range of applications and is convenient to use

— Two integrated totalizers
— Programmable binary output for activating external totalizers
— Calculation of compressibility factors in accordance with AGA 8 or GERG88



Multivariable transmitter with a multisensor function

M10889

Application

A practical example of flow measurement is the standard volume flow value measurement of natural gas, e.g. when filling or emptying underground storage caverns under high static pressure.
The consumption of natural gas is heavily seasonal, and is also subject to fluctuations during the course of the day. In order to ensure a continuous supply, it is necessary to store the gas being delivered. This occurs, for example, in underground caverns at a high pressure of about 350 to 380 bar.
The gas flow must be measured with a high degree of accuracy during the filling process as well as during removal. Flow measurement using the differential pressure procedure is cost-effective when dealing with measurements at high pressure in particular, as is the case here.

As the temperature and pressure can change with this application, the requested information can only be obtained when the occuring density change in the gas is considered and the measured value is specified as standard volume flow of the natural gas. This is the only way to ensure that the recording of the stored quantity always makes clear reference to the specified reference conditions.

Pitot tubes are also deployed as the primary equipment at the listed measuring points for cost reasons, and are known for their ease of installation; however, they unfortunately have very small differential pressure measuring ranges. The differential pressure spans of up to 0.5 mbar that are achievable with types 266C and 266J make multivariable transmitters the first choice when used with pitot tubes.

Measurement setups with differential pressure transducer

OriMaster with orifice plate

WedgeMaster with wedge element

PitoMaster with pitot tube

Device specification

Measuring spans

Differential pressure	Absolute pressure
0.05 to 1 kPa / 0.5 to 10 mbar / 0.2 to 4 in. H2O	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. H2O 0.4 to 40 kPa / 4 to 400 mbar / 1.6 to 160 in. H2O 2.5 to 250 kPa / 25 to 2500 mbar / 10 to 1000 in. H2O 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

Function

Measurement of the mass flow of fluids, gas or steam, or the standard volume flow of gas in accordance with AGA 3 and DIN EN ISO 5167 with the utmost of accuracy thanks to:

— Dynamic flow correction with continuous calculation of Reynolds number and flow coefficient
— Temperature and pressure-dependent density correction of the measuring agent
— Correction of the thermal expansion of the differential pressure transducer and piping
— Linearization of the differential pressure transducer

Measuring accuracy

Differential pressure better than 0.04 %
Process pressure better than 0.1 %
Process temperature better than 0.3 K
Mass or standard volume flow rate 0.7 % ... 0.9 %

All benefits at a glance

— Replaces three standard transmitters and a measurement computer
— Increased accuracy for flow measurement using the differential pressure procedure
— Reduced costs for planning, equipment investments, installation and wiring
— Increased reliability and reduction in possible leaks due to fewer devices
— Increased availability of a measuring point

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