Simply Practical – the Magnetic-Inductive Flow Measurement

The aphorism "Panta rhei" (everything flows) is said to come from the Greek philosopher Heraclitus. He probably wasn't thinking of measurement technology when he invented this saying. And yet today, "flow" is one of the most important physical measurands. As a result, many processes can be implemented, depending on the measurement medium used, the required accuracy, and the environmental conditions.

Traditional methods include deriving the flow rate from the flow velocity using paddle wheels or turbine counters. Measuring using differential pressure is also a method which has been proven for many years. New developments include magnetic-inductive ultrasound or the Coriolis measurement principle.

Particularly in extreme operating conditions, such as saturated steam measurement, the difference or differential processes have proven their worth thanks to the impervious design. This process is generally used with gases or low-viscous media. However, here, the greatest possible measuring range places high requirements on the pressure transducer, as the measurement error caused by the quadratic ratio of flow to differential pressure is very high in the lower area.

However, magnetic-inductive flowmeters (magnetic inductive flow sensors) are characterized by a very high measuring dynamic with high accuracy. Further advantages are the extremely low loss of pressure and the absence of mechanically moving parts in the volume flow. These devices are therefore relatively impervious to pollutants in the medium. With a market share of around 25 percent, magnetic-inductive flow measurement is therefore one of the most widespread methods used worldwide. Thanks to the measuring principle, the application options are virtually limitless and can be used in many industries.

The physical foundations of the law of induction make this type of measurement possible. According to these, an induced voltage is generated in a wire when it moves through a magnetic field. With the magnetic inductive flow sensor, a constant magnetic field is produced perpendicular to the measuring pipe. The flowing liquid acts as the moved wire. The induced voltage is tapped across two electrodes and is proportional to the flow. This therefore clearly indicates that there is a minimum requirement as regards the medium: the conductivity must be at least 5 µS/cm. For comparison: tap water has a conductivity of around 300 µS/cm.

Another advantage of the magnetic inductive flow sensor is the short inlet and outlet sections. In some processes, a straight pipeline with a length that is 50 times the DN pipeline cross section may need to stabilize the flow after it has been swirled through bends, valves, or cross section changes, or has been subjected to turbulence. For the magnetic inductive flow sensor, an inlet of 3 x DN and an outlet of 2 x DN are sufficient.

The hygienically flawless design of the magnetic inductive flow sensor is another important feature. It does not need moving parts or inconvenient contours. On the contrary, the measuring section is a straight pipe, which has the same cross section as the rest of the pipe system. A pressure drop, which would lead to additional energy costs, is therefore prevented.

The new flow measuring devices from the manufacturer JUMO are based on the magnetic-inductive measuring principle due to the advantages described. The devices from the flowTRANS series are suitable for various application areas. You can measure the flow of acids, lyes, food, water, wastewater, and many other liquids.

The JUMO flowTRANS MAG S01 is the standard version of the new series. Potential application areas are in water and wastewater engineering, paper and pulp production, the metal industry, mechanical engineering, and the chemical and energy industries.

It is available for nominal widths ranging from DN 10 to DN 300. The minimum conductivity of the measurement medium must be greater than 5 µS/cm; the maximum temperature lies at 130 °C. Further versions can be purchased upon request. The flowmeter comes either as a compact device with protection type IP67 or with a separate transmitter (IP68). DIN versions or ASME versions are available as a flange.

As standard, the flowmeters are lined with PTFE. This material is largely impervious to acids and lyes, and abrasion resistant to small particles. A more cost-effective lining made of hard rubber is available for larger nominal widths.

The JUMO flowTRANS MAG H01 was specially developed for hygienic applications and is suitable for use in breweries, dairies, mineral water production, or in the pharmaceutical industry.

It is available for nominal widths ranging from DN 3 to DN 100 and also designed in protection type IP67 or IP68. The following variable process connections can be selected: welded socket, screw connection, Tri-Clamp, or connection flange. A special welding aid facilitates and ensures correct installation of the welded sockets.

These devices are simple and convenient to configure, either on the device itself or using PC software. They are operated using a configurable, backlit display. The transmitter electronics and the sensors can be checked for proper function and the operating conditions can be monitored through integrated diagnostic functions. Error messages are shown according to the NAMUR recommendation.

The measured value can be transmitted via a current signal – and also transmitted with HART® or impulse output as standard. PROFIBUS PA can also be used for communication. Binary inputs and outputs, such as counter resetting or device status, can be configured.

In summary, the magnetic inductive flow sensor provides an excellent cost-benefit ratio. Measuring quality, user friendliness, effectively no maintenance and wear, as well as no additional energy costs through pressure drops, ensure a high level of measurement quality for the service life.

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Fig 1: With the magnetic-inductive flowmeters of the flowTRANS MAG series, JUMO uses a proven measuring principle.

Decorative picture