Flow Measurement – Different Methods, One Aim

Advantages and special features of the calorimetric measuring principle

The measurand "flow" is one of the standard measurements in modern measurement and control technology. Depending on the measurement medium used, the accuracy that is required, and the ambient conditions, a number of methods can be used for this. One of the traditional methods is to derive the flow rate from the flow velocity using impellers or turbine meters. Measuring the flow using the differential pressure is also a long-established method. The new generation of approaches includes magnetic-inductive, ultrasonic, and Coriolis measuring methods. But devices that operate on the calorimetric principle are still largely unknown, although experts are already labelling this method as 'one to watch'. With the PINOS L01, JUMO GmbH & Co. KG has a flow sensor that uses this technology in its program.

Image caption: the new PINOS L01 flow sensor from JUMO

Flow sensors are used in a broad range of practical applications. These include monitoring coolant circuits, leakages, compressors, pumps, and heat exchangers. To do this, the calorimetric measuring method makes use of the physical effect that a flowing medium discharges thermal energy. Based on this principle, two temperature sensors and a heating element are integrated into the device. These two components are in direct contact with the medium to be measured. The sensor is submerged in the flowing medium, which washes around it. The heating element is continuously supplied with a small amount of electrical energy whilst this temperature increase in the sensor is discharged through the flowing liquid. The resulting temperature conditions are measured by the temperature sensor. In simple terms, the faster the liquid is flowing, the greater the heating element is cooled.In this way, the flow velocity of the liquid can be determined using a simple temperature measurement.

Devices that work on the basis of the calorimetric measuring principle can be used universally for fluids, gases, or vapor. They can be activated quickly and are characterized by the high reproducibility of measured values and their outstanding long-term stability. There are hardly any limitations to the viscosity or electrical conductivity of the measurement medium.

The new JUMO PINOS L01 flow sensor is designed for water and watery media and works on the basis of the calorimetric measuring principle. This measuring method does not use moving parts that are prone to wear.

This represents a considerable advantage over measuring devices that use impellers, for example, because the sensor can also be used in liquids that are polluted with solids. Calorimetric measuring devices also have a very compact design. As a result, there is only a relatively low loss of pressure and consequent loss of energy in the pipelines of the measuring environment. The sturdy design (the sensors are housed in a probe tube) allows these devices to be used even under high rated pressures. With the PINOS L01, this means anything up to 25 bar. Another advantage is the fact that the medium to be monitored only comes into contact with one material on a calorimetric sensor. In contrast, impeller sensors, for example, are made up of a whole range of different materials.With these sensors, users have to laboriously check a list to see whether each material used is compatible with the measurement medium and ensure that it cannot be weakened by products such as acids or alkalis.

Image caption: thanks to the compact design, there is hardly any drop in pressure in pipelines

The JUMO PINOS L01 has another special feature: the developers have succeeded in designing the device so that it can be mounted without requiring a preferred direction (360°). It can even be mounted upside down. This is a benefit that cannot be underestimated, particularly in difficult installation locations. The special design also allows the PINOS L01 to work in both flow directions.

The measuring range for flow velocity is between 0.1 and 1.5 m/s. The JUMO PINOS L01 is available in two different versions. One has an analog output 0(4) to 20 mA and the other has a switching output suitable for using as a flow monitor. In the version

with the switching output, the switching point can be set directly on the device by means of a pushbutton. A so-called window opening/closing function is included on the PINOS L01 so that customers can set their own measuring ranges. The measurable medium temperature can range between -25 and +80 °C. Reliable operation at ambient temperatures between -25 and +70 °C is guaranteed thanks to the device's sturdy design.

The switching output can be used as a monitoring function on cooling systems or heat exchangers for instance, and can prevent pumps from running dry. With the analog output, low flow velocities can be measured in a cost-effective way, for example in machine and plant manufacturing.

The sensor is configured via a micro USB interface with a convenient and user-friendly setup program. This is used also in a number of other JUMO products. No additional auxiliary voltage is required to complete the setup. A voltage supply through the USB interface, for example with a laptop, is sufficient. If the customer wishes to set up a customized configuration, the sensor can be supplied ex works.

The process connection is established using provided stainless-steel T fittings. Customized versions are also available on request. JUMO has a range of indicators and control devices, from paperless recorders to automation solutions, to help in the processing of measured signals.

The following application example describes usage in a coolant circuit. The JUMO PINOS L01 acts as a monitoring instrument, ensuring there is enough coolant present. This is essential for machining processes, for example. If there is no coolant in the work process, the flow sensor with switching output forwards information to the connected JUMO mTRON T automation system, which protects the machines from any damage. A high degree of system safety is thereby ensured.

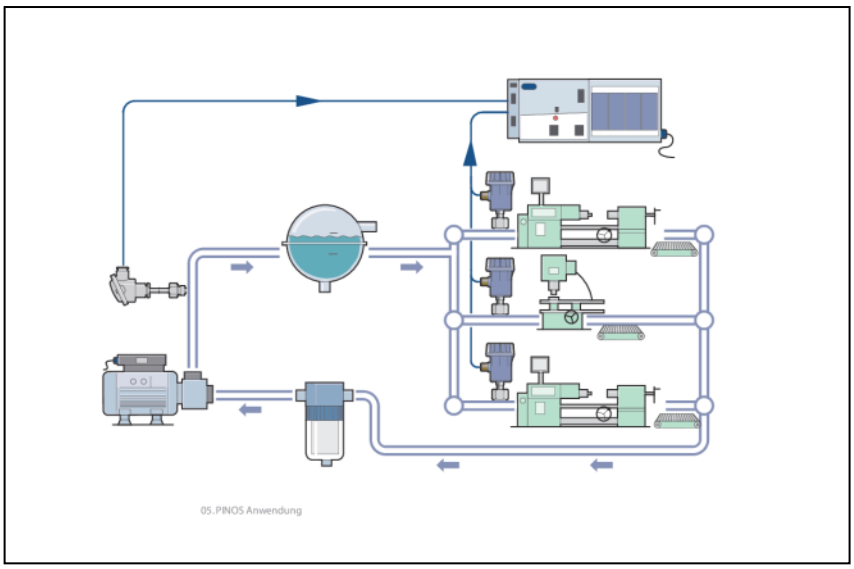

Image caption: in this application, a PINOS L01 is used to monitor a coolant circuit.

Image caption: a lack of coolant can cause expensive damage, as with this drilling machine.

Author:
Stefan Büchner
Product Manager
JUMO GmbH & Co. KG, Fulda, Germany
Tel.: +49 (0)661 6003-2475
E-mail: stefan.buechner@jumo.net
www.jumo.net