

PRINCIPLE

The calorimetric system is based two temperature sensors which are positioned within good temperature conductivity versus the liquid involved.

One sensor is permanently heated with the effect that a constant temperature difference between the sensors will be established. In case of a velocity of the liquid this temperature difference is modified. This modification is the measure for the flow control.

The unheated sensor registers the liquid temperature and triggers a temperature compensation. This effects a stability of temperature behaviour with flow velocity and an accurate flow control.



The PKP calorimetric flow switches monitor a variety of substances.

Advantages :

- no moving parts (versus turbine or variable area)
- unity of wetted material spec
- compact design
- one sensor for all diameters
- low pressure loss
- high operational pressures
- optional integrated temperature control

The variety of sensor options fits almost all operational conditions. If not we are in the position to adjust our instrument to the individual application.

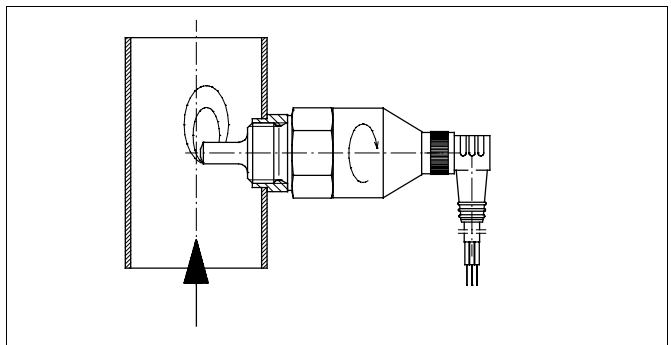


Figure 1: Extraction of heat by current

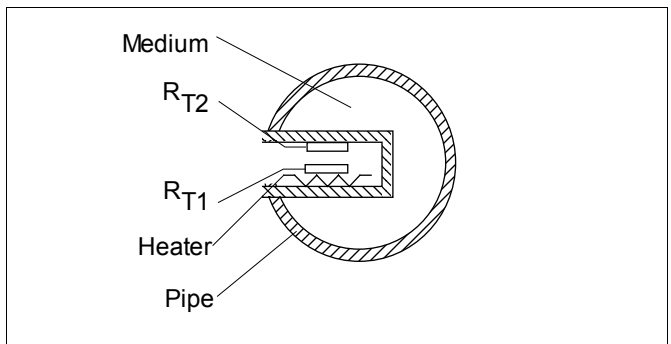


Figure 2: Basic arrangement of the sensor elements

FIELDS OF USE

- **Metal processing industry:**
control of coolants and lubricants
- **Steel industry:**
circuits for cooling agents
- **Chemical industry:**
protecting pumps against running dry,
monitoring for leaks, supervising levels
- **Beverage industry:**
monitoring cleaning operations
- **Air conditioning and ventilation industry:**
controlling fans and aeration / ventilation systems

INFLUENCE OF MEDIUM AND MATERIALS

Various liquids and different sensor housing materials affect the response time, because the thermal conductivity is changing. Generally, the lower the thermal conductivity of the medium and the housing material, the higher the medium flow rate must be to receive satisfactory results.

- Medium water sensor stainless steel
heat conductivity high => low flow rate required
approx. 1...150cm/s
- Medium oil sensor stainless steel
heat conductivity medium => medium flow rate required
approx. 3..300cm/s

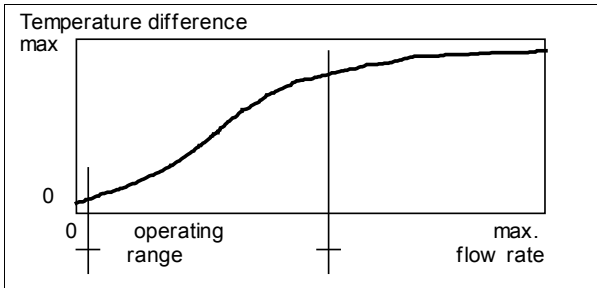


Figure 2: Principal characteristic curve for a calorimetric sensor

The slope of the curve for a calorimetric sensor becomes less as the flow rate increases, which means that the difference signal to be evaluated becomes increasingly smaller.

EXPLANATION OF TERMS RELATED

Temperature gradient = change of medium temperature per time unit (K/min). When rapid temperature changes occur in the medium, they can only be compensated within a certain range. Correct operation is guaranteed in the specification range quoted. If the temperature of the medium exceeds this temperature, the system may generate a fault indication for a short time. Of course, such fault signal can be filtered by switching delays, compromising the standard on-off response time.

The **stand-by time** is the time for the sensor to reach its specified operating mode. With a supply voltage, all the indicating LEDs illuminate. After approx. 3 s the display changes to the range set via the potentiometer. Then the switch-off range can be defined by turning the potentiometer.

The **switch-on and switch-off times** are the periods after which the regular measuring variable is acquired following a rapid increase or decrease in the flow rate. With a medium temperature of approx. 25 °C and with a stainless steel sensor used in water, the average switch-on and switch-off times are approx. 2 s. Please bear in mind that this time depends on the operating conditions. In cases where the media or sensor materials are poor thermal conductors, the switching times might increase.

The **temperature range** of the medium is the range of medium temperature in which the calorimetric sensor works without problem.

The **ambient temperature** is the temperature surrounding the sensor. This mainly involves devices and equipment generating or dissipating heat in the vicinity of the sensor.

The **housing material** is the material exposed to the medium. Critical issues for instrument selection:

- the chemical compatibility of wetted materials
- abrasive properties of the material
- reaction time of the sensor
- pressure and temperature characteristics

As a standard the sensors are made in stainless steel (1.4571). However, our range also includes sensors made of with hard teflon coating.

DIFFERENT DESIGNS AND OPTIONS

Calorimetric sensors are manufactured by PKP in probe configuration. The probe type is suitable for use with a wide range of pipe cross-sections. Both designs are manufactured either as compact sensors with integral electronic units or as sensors for use with external electronic units.

This temperature switch can be used as a safety switch for prohibitive temperature ranges (please take into account an accuracy of 10%, reproducibility of 1% and hysteresis of 10%).

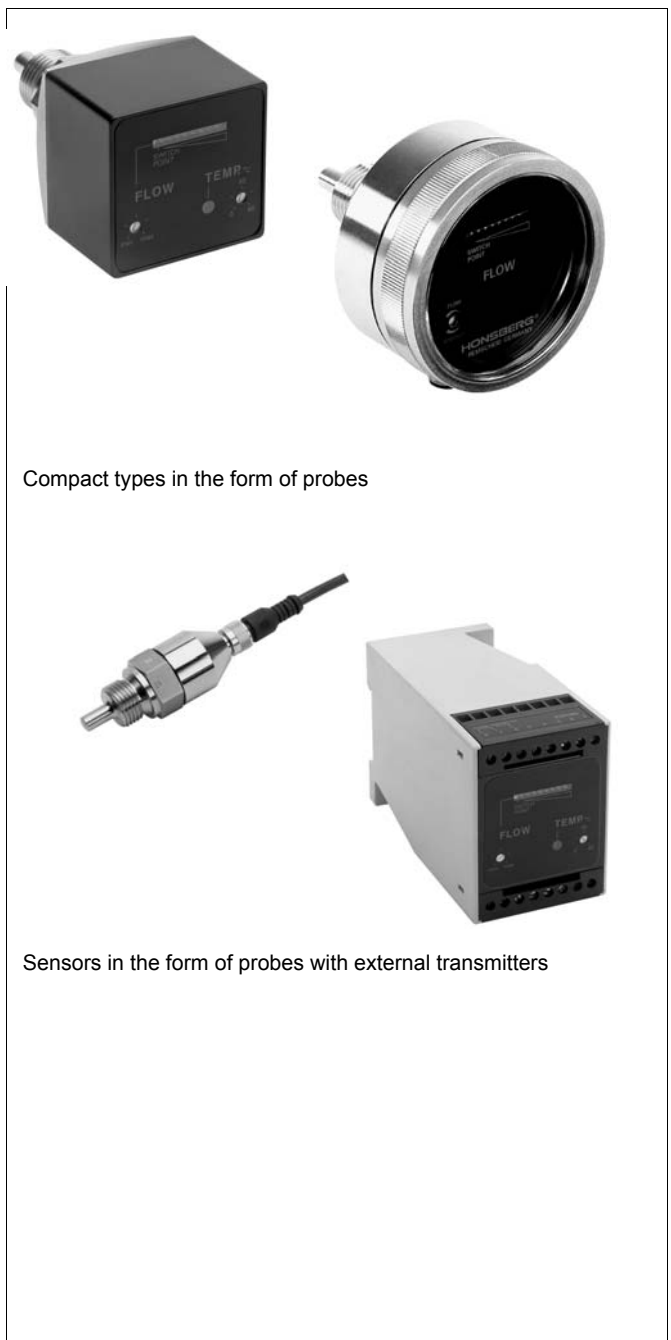


Figure 3: Various designs of PKP calorimetric sensors

MOUNTING INSTRUCTIONS

In principal all installation locations are feasible where the sensor housing may be positioned into circumferent contact with the liquid (see drawing):

Contamination and air bubbles should be avoided. In case of bending tube sectors the liquid conditions may change which might cause flow whirls and other instability effecting the quality of emitted signals

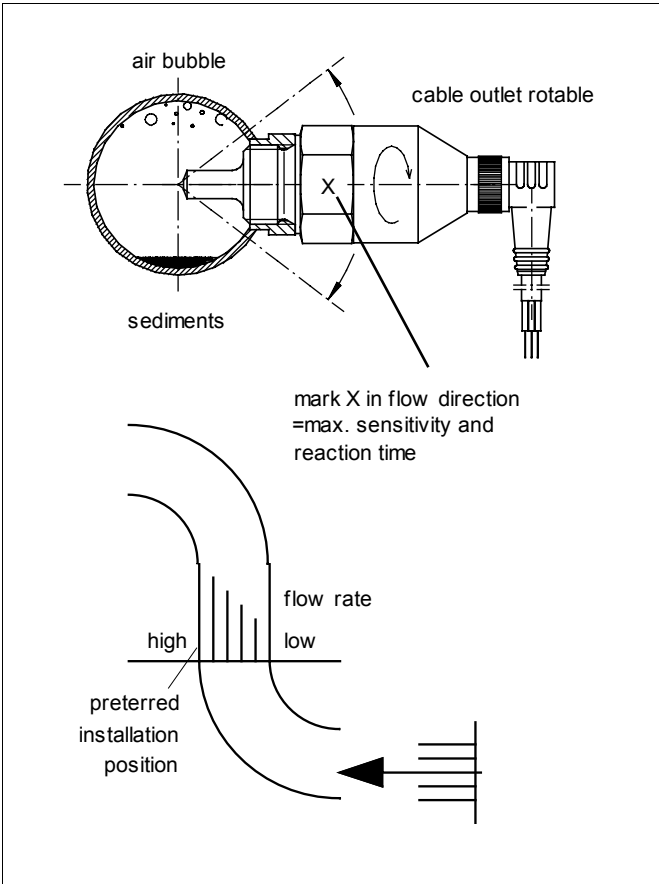


Figure 5: Mounting position and flow rate profile after a bend

After insertion and sealing (e.g. using a Sikurit seal) all sensors can be rotated with continuous adjustment of the head. This feature facilitates the precise orientation of the cable and, for the compact-type of sensor, the easy alignment of the indicating head.

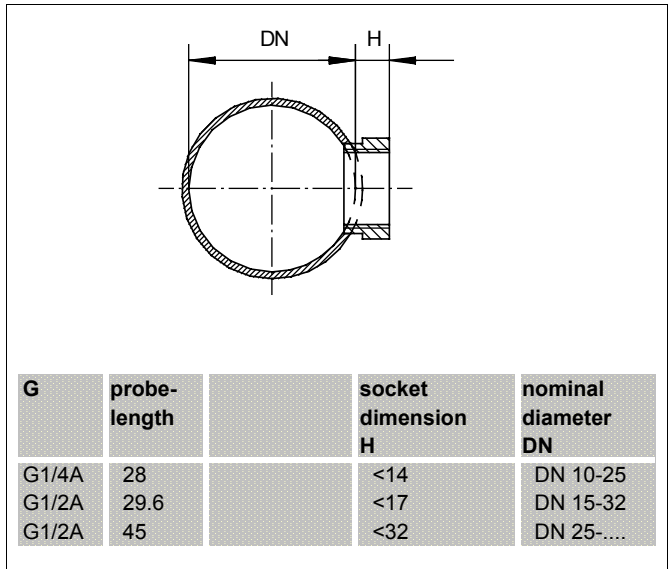


Figure 6: socket and nominal size (standard)

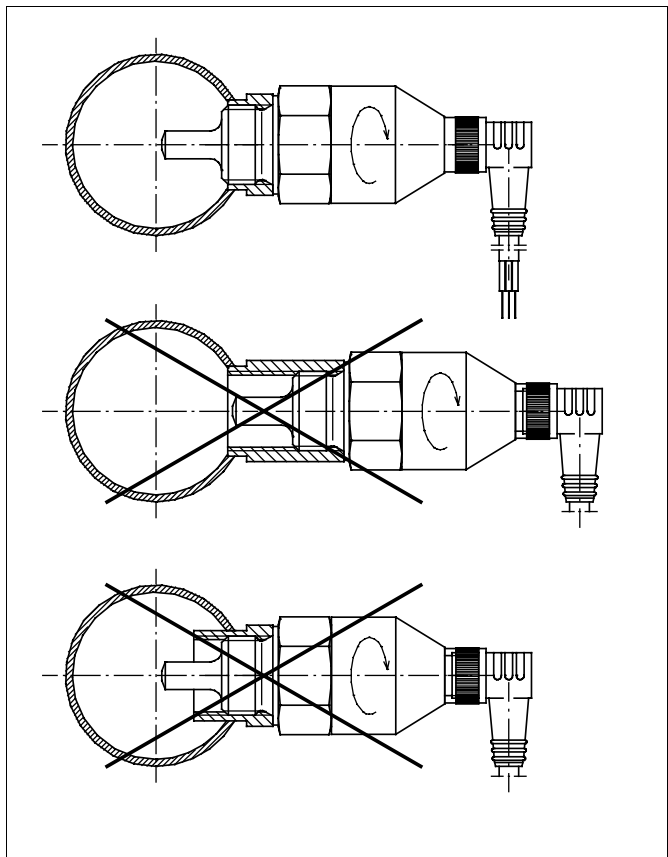


Figure 7: Thread projection of the sensor

ELECTRICAL INSTALLATION

Probe-type sensors without integral evaluation units are supplied with a cable of length 2 m (0.25 mm²) as standard. This cable cross-section is used if the external electronic units are less than 20 m away. If longer distances need to be covered, the use of an extension cable with full shielding is recommended, along with the selection of an appropriate diameter corresponding to the cable length.

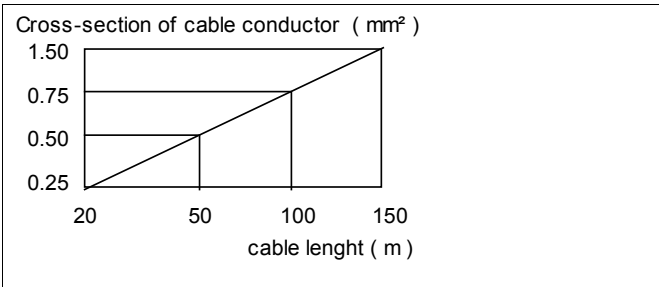


Figure 8: Recommended cable cross-section for various cable lengths

FAQ

● **Installation of the sensor**

All sensors are marked by an "X" on the body. If this marking is positioned towards flow the best possible sensitivity (reaction) will be provided.

● **Setting of the sensor**

The operational delay time (electrical connection versus full operation) takes ca. 3 sec. Subsequently the switch may be set according to individual instructions.

● **Maintenance**

The sensor does not require any periodical maintenance. Contamination of the sensor housing and mechanical cleaning be avoided. Teflon coating helps in case of high contamination contact of the liquid.

● **Transport**

To provide best possible protection should rest in the special package until finally used.

● **Electrical connection**

The following conditions are important to receive a safe performance of the unit.

- supply voltage meets specification and is free of inductive loads
- avoid electrically noisy environment
- in case of long distance wiring the use of shielded cable is recommendable.