Subject:
EMATEM Summer School 2023.

Lecture:
Peter Pasemann (Endress+Hauser Germany); Hanover, Germany.

Title:
Static thermal measurement deviations of industrial thermometers.

Summary:
Industrial thermometers always measure their own temperature. So, the actual local fluid (gas or liquid) temperature is generally unknown. The origin of the systematic measurement deviation is the geometric constructional heat dissipation. Its practical dependency relates to operating- and installation conditions, as well as the sensor structure around the embedded temperature transducer element. An exact calculation is complex and requires multiple attempts to validate the describing model. For this reason, a correction is often omitted in practice.

This lecture presents simple models, which allow rough estimations of these static thermal measurement deviations. The focus will not be on quantitative high accurate results, but rather on qualitative estimations, such as e.g.,

- Which influences will fluid property uncertainties have (e.g., condensate, natural gas, air, hydrogen)?
- What influence does the upstream flow velocity have?
- What influence does the operating pressure have in the case of gas media?
- What is the influence of the temperature distribution towards the surroundings?
- What is the effect of an immersion length which is too short?

These systematic measurement deviations are often underestimated, and

- falsify in general the calibration result, and
- must definitely not be treated as statistical measurement uncertainties; consequently, any uncertainty distribution (e.g., rectangular, normal) does not apply.

The lecture is intended to encourage to deal more intensively with systematic measurement deviations in future.