

Traceability requires known measurement uncertainty

STRAIGHT FROM THE LAB

A traceability chain begins in an accredited laboratory for the quantity in question – in this case temperature – and ends in a process reading.

The accredited laboratory has traceability to the ITS-90 temperature scale. Normally, a company's in-house laboratory calibrates the process sensor via a working standard, which in its turn is calibrated at an accredited laboratory. In order to be able to assert traceability, the calibration chain must be documented. See Figure 1.

The correction term gives the deviation from ITS-90 with the opposite sign. Uncertainties

such as rounding off the readings, resolutions and the distribution of the measurement values mean that the correction is not exact. The measurement uncertainty states how uncertain the correction is. See Figure 2.

The correction terms in the calibration certificates and in-house certificates give the total correction for the process sensor. Normally, the correction is done in the software after the measuring has been done. If the process sensor is adjusted it must be recalibrated in order to verify the correction.

The measurement uncertainty accumulates through all the calibration steps, which means that the previous certificate's

measurement uncertainty is included in the next certificate as the first partial uncertainty. It is advisable to avoid doing a lot of calibration steps because the total measurement uncertainty often increases almost tenfold for every calibration level.

Pentronic's training courses discuss the properties of temperature sensors and include calibration experiments during which students perform measurement uncertainty analyses.



Pentronic's laboratory is accredited since 1988

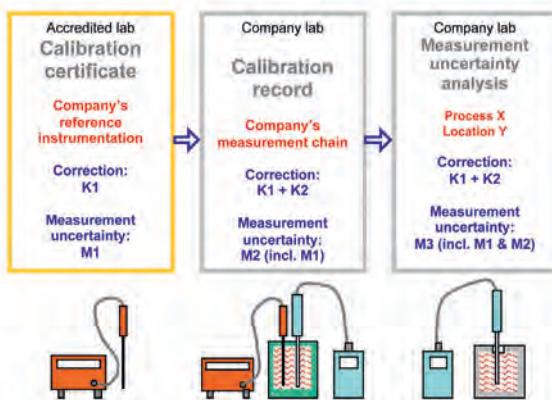


Figure 1. An example of a traceability chain for temperature that begins in an accredited laboratory and ends in a process reading. The accredited laboratory has traceability to the ITS-90 temperature scale. Measurement devices are adjusted to ITS-90 using the correction term.

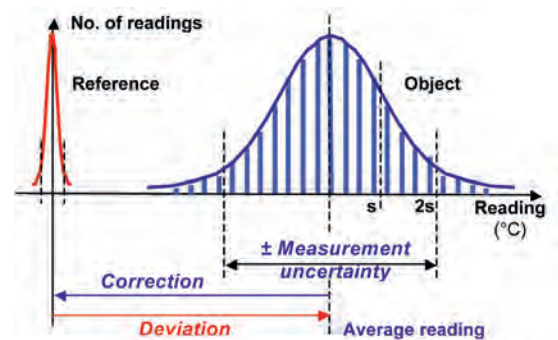


Figure 2. Definitions in a hypothetical histogram of a comparative calibration in which the bars show how many times the same measurement value has occurred. The measurement uncertainty is normally distributed and totals two standard deviations ($\pm 2s$), which means that approximately 95% of all readings are included.