Technical note TNE-02

Precision vs. uncertainty

Modern gas analyzers operate with many measurement principles. However, they have one thing in common; an electrical signal coming from a detector where the reading is independent of the concentration of the measured component. Gas analyzers are not intelligent instruments, so they need a reference to be able to give meaningful results.

Example 1:

Modern electronics industry has developed very reliable and stable electronic circuits. Numerous measurements of the same sample give practically the same reading on the instrument. The analyzers are very precise. The results are repeatable. But this will not tell anything about the concentrations of the components of interest. Therefore, a reference standard is needed. In gas analysis, this reference standard is the calibration standard. Ideally, you want a calibration standard that is a copy of the process flow you are analyzing, but in most cases, practical difficulties will limit this.

When the readings are precise, the readings become the same over and over again, as shown in the targets in Figure 1. By calibrating with a known reference, the readings can be adjusted to the center of the target. These readings then become both precise and accurate (small uncertainty). See Figure 1.

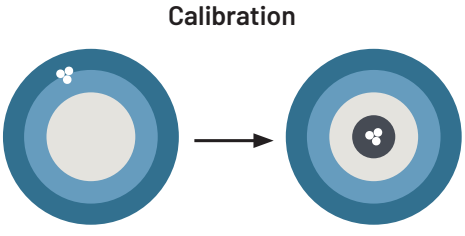

Fig.1

	Accuracy (Uncertainty)	Precision
Temperature	±1% of read	
Pressure	±1% of read	
Gas analysis	1%	±1% of read

Fig.2

Example 2:

In the chemical process industry, the process is normally controlled by three main parameters:

- Temperature - pressure - chemical analysis

Temperature is a basic unit in the SI-system (International System of Units) and is thus clearly defined. Pressure is a derived SI unit and thus this is also under control. The instruments that measure these parameters have an uncertainty as shown in Figure 2.

When it comes to gas analysis, the analyzers have good precision and the accuracy of the analysis system depends on the uncertainty of the calibration standard. This means that the weakest link in a process control system is the calibration standard for the analyzes. Great attention should therefore be paid to this detail.