

## Instrument Validation

### CALSYS<sup>®</sup> for Metering

- Instrument accuracy evaluation
- Integrated with Metering System
- SQL Server and OPC support
- Standard Procedures and Reports
- Flow computer integrity check
- On-line reference and samples
- Overall metering system uncertainty

## The solution to verify the overall metering uncertainty

The main purpose of any flow metering system is to determine the amount of fluid that is transferred from a supplier to a customer within a given period. It is of imminent importance that the uncertainty of this measurement is within the limit as agreed between the two parties and, in case of fiscal metering, as required by the authorities.

The **CALSYS<sup>®</sup> for Metering** software allows you to check and prove that your flow metering system is performing within its uncertainty limits in a traceable, objective and automated manner.

The software runs on Windows2003/XP and uses a SQL Server database for secure and robust data storage. It is based on the default OPC communications standard to automatically retrieve data from the field instruments.

### Accuracy and Uncertainty

Most people speak about accuracy, which is normally stated in terms of error (bias) e.g.  $\pm 1\%$  of span,  $\pm 0.6\%$  of reading,  $\pm 0.2$  degree. However the term uncertainty is better suited, because it combines the bias with a level of confidence that the value actually lays within the range e.g.  $30000 \pm 20$  kg/h at 95% confidence level

**CALSYS<sup>®</sup> for Metering** comes with standard and field-proven validation procedures and reports for all common flow metering principles, including:

- Pressure transmitters
- Temperature elements / transmitters
- Differential pressure transmitters
- Orifice plate inspection
- Ultrasonic meters (VOS check)
- Turbine master meter proving
- Coriolis zero flow check
- Gas chromatographs
- Density transducers
- Specific gravity transducers
- Dew point analyser
- AGA3 / ISO5167 calculation check

- Flow computer totaliser check
- In-series validation of flow meters / flow computers
- Overall meter run evaluation check

### Validation and Calibration

A validation is a sequence of activities to check the performance of a particular instrument, such as a flow meter, an analyser or a transmitter. If the instrument performs incorrectly, then it requires calibration (adjustment).

Note: Confusingly the terms calibration and adjustment are sometimes used instead of the terms validation and calibration respectively (as used in this brochure).

All common test / calibration equipment is supported such as dead-weight testers, pressure boxes, temperature baths, signal calibrators and calibration gases.

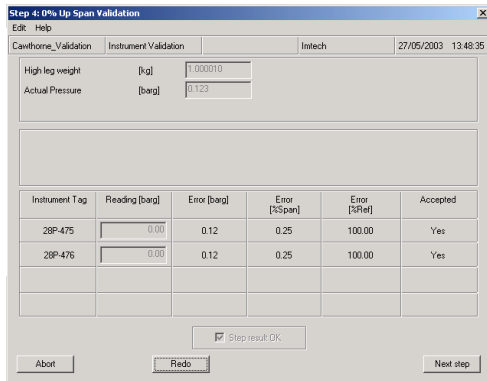
## Automation levels

A procedure may be automated up to any level, ranging from completely manual, in which all values (measured and reference) are entered manually, via a more integrated system in which the measurements are obtained through the flow computers, to a completely automatic system without any human intervention.

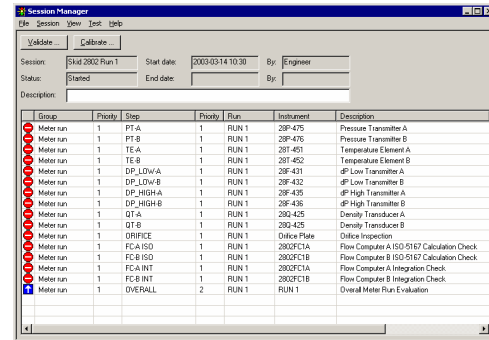
A typical automated validation system is a Gas Chromatograph in combination with a reference sample conditioning system. The validation procedure will automatically switch the analyser to reference stream and back to process stream and validation results are automatically processed and reported to the operator.

# Instrument Validation

For validation procedures that require human intervention dialogs are used to guide the user step by step.



During the session the names of the persons who witnessed the session and any comments can be registered.



The Session Manager guides the engineer and optional witnesses through the verification of the complete meter run / system

## Validation methods

**CALSYS® for Metering** supports the following validation methods:

### Reference sample method

A predefined reference sample is supplied to the instrument and one or more readings are taken and compared with the reference value(s).

### Line sample method

A sample is taken from the process (very near to the instrument) and at the same time the instrument reading is recorded. The line sample is analysed in the lab and afterwards compared with the measured value.

### Reference measurement method

Typically used for transmitters and PT100 temperature elements, in which a portable calibration device is temporarily lined up in series with the on-line instrument, and the reading of the instrument is compared with the reading of the calibration device.

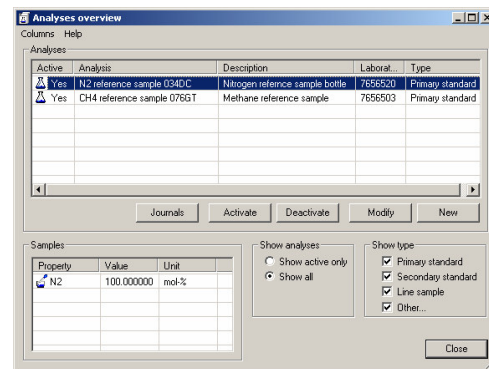
Besides of these standard methods CALSYS® for Metering supports custom-made validation methods as well.

At the end of a validation session the software evaluates whether or not the overall metering system (or meter run) is within the required uncertainty limit.

An important feature of **CALSYS® for Metering** is the option to **calculate** the overall uncertainty of the complete metering run / system based on the latest validation results.

## Reference and line samples

**CALSYS® for Metering** manages the reference and line samples that are used for and obtained from the instrument validations.



References and samples are managed by the software.

Optionally an automatic interface can be established with a Management Information System

## Validation sessions

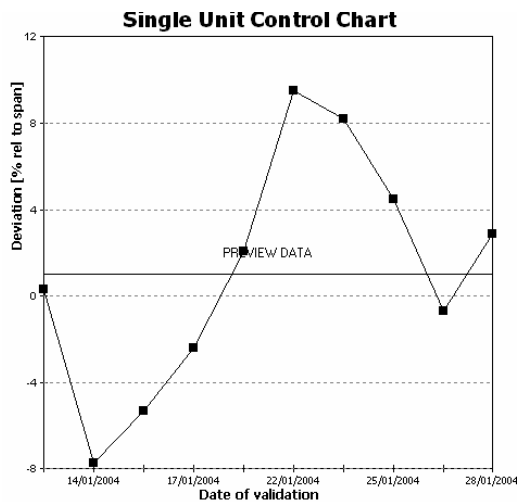
An important feature of **CALSYS® for Metering** is the *Session Manager*, which organises individual validations in so-called *validation sessions*. A validation session is a pre-defined set of validation procedures that are required to verify a complete metering system. The *Session Manager* assists the operators such that the procedures are executed in a pre-defined order and within a limited period of time.

Both reference and line samples may be subjected to a limited lifetime. A validation procedure will be aborted if the reference sample used for the validation has passed its 'end of life'.

## Statistical Control and Evaluation

The most straightforward way to check the performance of an instrument is to check if the actual deviation in measurement, as found during the latest validation, is within the required limit.

A more sophisticated verification method is to use *Control Charts* in combination with *Decision Rules*. This will not only consider the latest result but also the previous results in order to detect a non-random behaviour of the measurement, like a trend, an oscillation and a systematic offset.



Furthermore **CALSYS® for Metering** can provide a number of statistical tests to verify the behaviour of the instrument over a longer period of time to detect if there is an external factor that negatively influences the measurement, e.g. if the instrument is sensible to seasonal influences.

## Features

- Automates instrument validation to the highest extent
- Objective, reproducible and traceable validation and calibration results
- Standard procedures and reports for all common flow meters, analysers and instrumentation
- Session Manager to organize the verification of complete meter runs and systems
- Closely integrates with the Metering System
- User-based system security
- Test and calibration equipment is logged from a predefined set of equipment.
- Statistical process control and evaluation on the validation results
- Checks and calculates the overall metering uncertainty
- Allows for easy integration (based on SQL Server and OPC)
- Option for graphical operator screens, real-time and historical trends and alarm managements

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