Beamex

Calibration White Paper

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November 2007

How often should instruments be calibrated?

beamex
WORLD-CLASS CALIBRATION SOLUTIONS™

How often should instruments be calibrated? An analysis will tell.

Plants can improve their efficiency and reduce costs by performing calibration history trend analysis. By doing it, a plant is able to define which instruments can be calibrated less frequently and which should be calibrated more frequently. Calibration history trend analysis is only possible with calibration software that provides this functionality.

Using Calibration History Trend Analysis to Adjust Calibration Intervals of Plant Instrumentation

Manufacturing plants need to be absolutely confident that their instrumentation products – temperature sensors, pressure transducers, flow meters and the like – are performing and measuring to specified tolerances. If sensors drift out of their specification range, the consequences can be disastrous for a plant, resulting in costly production downtime, safety issues or possibly leading to batches of inferior quality goods being produced, which then have to be scrapped.

Most process manufacturing plants will have some sort of maintenance plan or schedule in place, which ensures that all instruments used across the site are calibrated at the appropriate times. However, with increasing demands and cost issues being placed on manufacturers these days, the time and resources required to carry out these calibration checks are often scarce. This can sometimes lead to instruments being prioritised for calibration, with those deemed critical enough receiving the required regular checks, but for other sensors that are deemed less critical to production, being calibrated less frequently or not at all.

But plants can improve their efficiencies and reduce costs by using calibration 'History Trend Analysis', a function available within Beamex® CMX Calibration Software. With this function, the plant can analyze whether it should increase or decrease the calibration frequency for all its instruments.

Cost savings can be achieved in several ways. First, by calibrating less frequently where instruments appear to be highly stable according to their calibration history. Second, by calibrating instruments more often when they are located in critical areas of the plant, ensuring that instruments are checked and corrected before they drift out of tolerance. This type of practise is common in companies that employ an effective 'Preventive Maintenance' regime. The analyses of historical trends and how a pressure sensor, for example, drifts in and out of tolerance over a given time period, is only possible with calibration software that provides this type of functionality.

Plants can improve their efficiencies and reduce costs by using calibration 'History Trend Analysis', a function available within Beamex® CMX Calibration Software.

Current Practices in Process Plants

But in reality, how often do process plants actually calibrate their instruments and how does a maintenance manager or an engineer know how often to calibrate a particular sensor?

In July 2007, Beamex conducted a survey that asked process manufacturing companies how many instruments in their plant required calibrating and the frequency with which these instruments had to be calibrated. The survey covered all industry sectors, including pharmaceuticals, chemicals, food and beverage, oil and gas, paper and pulp.

Interestingly, the survey showed that from all industry sectors, 50 % of the respondents said they calibrated their instruments no more than once a year.

However, in the pharmaceuticals sector, 42% said they calibrated once a year and 42% said they calibrated twice a year.

Perhaps unsurprisingly, due to it being a highly regulated industry, the study proved also that the pharmaceuticals sector typically possesses a significantly higher number of instruments per plant that require calibrating. In addition, these plants also calibrate their instruments more frequently than other industry sectors.

The Benefits of Analyzing Calibration History Trends

But regardless of the industry sector, by analysing an instrument's drift over time (ie. the history trend) companies can reduce costs and improve their efficiencies. Pertti Mäki

is Area Sales Manager at Beamex in Finland. He specialises in selling the Beamex® CMX to different customers across all industry sectors. He comments: "The largest savings from using the History Trend Option are in the pharmaceuticals sector, without doubt, but all industry sectors can benefit from using the software tool, which helps companies identify the optimal calibration intervals for instruments."

The trick, says Mäki, is determining which sensors should be re-calibrated after a few days, weeks, or even years of operation and which can be left for longer periods, without of course sacrificing the quality of the product or process or the safety of the plant and its employees. Doing this, he says, enables maintenance staff to concentrate their efforts only where they are needed, therefore eliminating unnecessary calibration effort and time.

But there are other, perhaps less obvious benefits of looking at the historical drift over time of a particular sensor or set of measuring instruments. As Mäki explains: "When an engineer buys a particular sensor, the supplier provides a technical specification that includes details on what the maximum drift of that sensor should be over a given time period. With CMX's History Trend Option, the engineer can now verify that the sensor he or she has purchased, actually performed within the specified tolerance over a certain time period. If it hasn't, the engineer now has data to present to the supplier to support his findings."

But that's not all. The History Trend function also means that a plant can now compare the quality or performance of different sensors from multiple manufacturers in a given location or set of process conditions. This makes it an invaluable tool for maintenance or quality personnel who, in setting up a new process line for example, can use the functionality to compare different sensor types to see which one best suits the new process.

Sensors that are found to be highly stable need not be re-calibrated as often as sensors that tend to drift.

Calibration software such as CMX can also help with the planning of calibration operations. Calibration schedules take into account the accuracy required for a particular sensor and the length of time during which it has previously been able to maintain that degree of accuracy. Sensors that are found to be highly stable need not be re-calibrated as often as sensors that tend to drift.

The Benefits of Analyzing Calibration History Trends

The 'History Trend Option', which is available as standard in CMX Enterprise and as an add-on option within CMX Professional, is basically a utility for viewing calibration history data. It is easy-to-use and is available both for Positions and Devices. The data is displayed graphically and is also available in numeric format in a table.

The function enables users to plan the optimal calibration intervals for their instruments. Once implemented, maintenance personnel, for example, can analyze an instrument's drift over a certain time period. History Trend displays numerically and graphically the instrument's drift over a given period. Based on this information, it is then possible to make decisions and conclusions regarding the optimal calibration interval and the quality of the instruments with respect to measurement performance.

The function enables users to plan the optimal calibration intervals for their instruments.

Users already familiar with CMX may confuse this function with the standard 'Calibration Results' window, but the 'History Trend' window enables users to view key figures of several calibration events simultaneously, allowing to evaluate the calibrations of a Position or a Device for a longer time period compared to the normal calibration result view.

For example, the user can get an overview of how a particular device drifts between calibrations and also whether the drift increases with time. Also, the engineer can analyze how different devices are suited for use in a particular area of the plant or process.

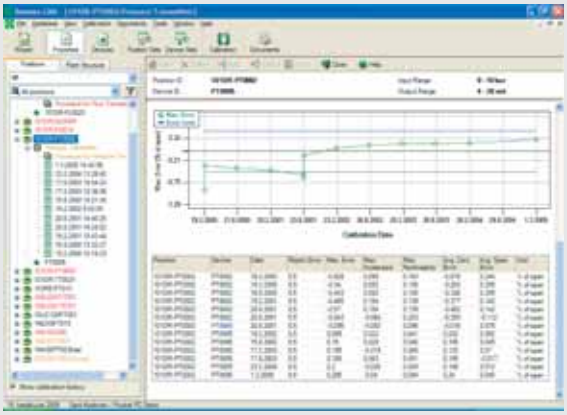
Reporting is straightforward and the user can even tailor the reports to suit his or her individual needs, using the 'Report Design' tool.

CALIBRATION HISTORY TREND ANALYSIS

The History Trend Option of Beamex® CMX calibration software allows you to analyze the instrument's drift over a certain time period.

- The Beamex® CMX stores every calibration event into the database; the history trend is made automatically without any extra manual work.
- The Beamex® CMX also indicates when new devices have been installed and calibrated. This helps in comparing differences between devices.
- The graphical display of the history trend helps in visualizing and optimizing the calibration interval for the instruments.

HISTORY TREND USER-INTERFACE



HISTORY TREND REPORT

View the results on a history trend report that includes your company logo.

SUMMARY

The benefits of calibration history trend analysis.

- Analyzing and determining the optimal calibration interval for instruments
- Conclusions can be made regarding the quality of a particular measuring instrument
- Time savings: faster analyses is possible when compared to traditional, manual methods
- Enables engineers to check that the instruments they have purchased for the plant are performing to their technical specifications and are not drifting out of tolerance regularly
- Supplier evaluation: the performance and quality of different sensors from different manufacturers can be compared quickly and easily.

When calibration frequency can be decreased:

- If the instrument has performed to specification and the drift has been insignificant compared to its specified tolerance
- If the instrument is deemed to be non-critical or in a low priority location

When calibration frequency should be increased:

- If the sensor has drifted outside of its specified tolerances during a given time period
- If the sensor is located in a critical process or area of the plant and has drifted significantly compared to its specified tolerance over a given time period
- When measuring a sensor that is located in an area of the plant that has high economic importance for the plant
- Where costly production downtime may occur as a result of a 'faulty' sensor
- Where a false measurement from a sensor could lead to inferior quality batches or a safety issue

ISO 9001:2000 quality management requirements

7.6 Control of monitoring and measuring devices

The organization shall determine the monitoring and measurement to be undertaken and the monitoring and measuring devices needed to provide evidence of conformity of product to determined requirements.

The organization shall establish processes to ensure that monitoring and measurement can be carried out and are carried out in a manner that is consistent with the monitoring and measurement requirements.

Where necessary to ensure valid results, measuring equipment shall

a) be calibrated or verified at specified intervals, or prior to use, against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification shall be recorded;
b) be adjusted or re-adjusted as necessary;
c) be identified to enable the calibration status to be determined;
d) be safeguarded from adjustments that would invalidate the measurement result;
e) be protected from damage and deterioration during handling, maintenance and storage.

In addition, the organization shall assess and record the validity of the previous measuring results when the equipment is found not to conform to requirements.

The organization shall take appropriate action on the equipment and any product affected.

Records of the results of calibration and verification shall be maintained (see 4.2.4).

When used in the monitoring and measurement of specified requirements, the ability of computer software to satisfy the intended application shall be confirmed. This shall be undertaken prior to initial use and reconfirmed as necessary.