Beamex

Calibration White Paper

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Automated calibration planning lowers costs

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Calibration is an essential element of any instrumentation maintenance program. However, sometimes calibration operations can be long and time-consuming. By planning the process and adding the right tools, efficiency can be improved and costs lowered substantially.

Accumulated wear and random variations in a sensor's environment will inevitably reduce its accuracy over time, so periodic testing is required to guarantee that the measurements being reported actually match the conditions being monitored. Otherwise, any computerized monitoring or control systems, to which the sensor is interfaced, will be unable to detect off-spec conditions and the quality of the product being manufactured will suffer.

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Unfortunately, calibration operations can be long and tedious, even with the aid of an electronic calibrator that automates the tests. The sheer volume of data that must be collected and analyzed can be overwhelming when there are hundreds of sensors to be checked and multiple data points to be recorded for each.

For instance...

The experience of Croda Chemicals Europe (Nr. Goole, East Yorkshire, UK) is typical. They use pressurized vessels to purify lanolin for health care and beauty products. Each vessel needs to be certified at least once every two years to demonstrate that it is safe and structurally sound. That includes a functionality check on all of the pressure instrumentation, as well as on the sensors that monitor the incoming chemical additives and the outgoing effluent.

Senior Instrument Technician, David Wright, remembers what it was like to perform all of those calibration operations with paper and pencil during their regularly scheduled maintenance shut-downs. "It took us a week to perform the calibrations and a month to put together the paperwork."

Today, Croda uses the CMX calibration management software system from Beamex to coordinate the data collection operations and archive the results. "It's faster, easier, and more accurate than our old paper-based procedures," says Wright. "It's saving us around 80 man-hours per maintenance period and should pay for itself in less than three years."

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CMX runs under the Windows operating system and connects directly to several kinds of calibrators. It is capable of tracking pre-defined, customized process instruments and calibration standards such as pressure, temperature, electrical, indicator, recorders, and mass. Multidimensional plant hierarchy with uninstalled, installed, and spare equipment can have multiple functions, multiple procedures, and work orders, including equipment classification.

Once a calibration task has been performed, CMX records the calibration history together with timestamps, electronic signatures, record status, and a complete audit trail. These functions are especially necessary in regulated industry, such as the pharmaceutical industry, where routine calibration operations are required to show that quality-critical instruments continue to perform within the defined tolerances. The records that are produced must be stored and be retrievable upon demand to demonstrate to an auditor that the plant is being maintained to an acceptable level. CMX complies with the new legislation, concerning electronic records and signatures, defined in the regulations set forth by the FDA in 21 CFR Part 11.

Calibration planning

Calibration software like 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 trick is determining which sensors should be re-calibrated after a few hours, weeks, or years of operation and which can be left as-is for longer periods without sacrificing quality or safety. Doing so allows maintenance personnel to concentrate their efforts only where needed, thereby eliminating unnecessary calibration work.

The calibration schedule at Croda is determined by three criteria. They must first comply with all governmental and insurance regulations that mandate protection for the plant, its personnel, and its environment. These are Croda's top priorities and in some ways the most expensive, not so much for the direct costs of complying with the mandated calibration operations, but for the potential cost of failing to comply. In the UK, as well as in the EU and the US, government agencies can shut down a plant completely for violating health and safety regulations, including those for calibration.

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Croda also enforces its own in-house safety and quality standards that require certain sensors to be checked every week, every time an area of the plant shuts down for maintenance, or every year. The most frequent calibrations are reserved for critical sensors such as the pH meters that measure the acidity of the effluent discharged to the river.

Wright describes Croda's third criteria for calibration planning as "experience of practice". Management analyzes the history of previous calibration operations and determines the optimal interval between calibrations for sensors that do not require regular checks. This analysis can be performed automatically with calibration software like CMX, thereby improving the efficiency of creating a calibration schedule and relieving maintenance personnel of the need to remember when a particular sensor is due for calibration work.

And by maintaining calibration schedules for all of the sensors in the plant in one electronic database, calibration software can reduce the administrative headaches of maintaining individual schedules for individual machines, processes, and operational zones. Automatic archiving functions also eliminate the transcription errors common to hand-written calibration reports and work schedules, saving not only the time required to fill out a paper report, but the time required to do it again when mistakes are discovered.

The bottom line

The ROI afforded by an automated calibration planning system will depend not only on the cost of acquiring it, but on the savings it provides. Net returns will be greatest under the following conditions...

- When the plant is highly regulated.
- When current calibration procedures are highly labor-intensive due to a large number of instruments, a large variety of instruments, a particularly complicated set of calibration procedures, or a particularly cumbersome set of paper-based reporting procedures.
- When a large percentage of instruments have discretionary calibration intervals (that is, when most instruments do need to be calibrated at fixed intervals for regulatory, safety, or quality reasons or because access is limited to specific maintenance periods).
- When the instruments to be calibrated must meet a wide variety of tolerance, safety, and quality requirements, especially when some requirements are stricter than others.
- When a large number of plant personnel must coordinate their efforts either to perform calibration work or to review the results.