

The importance of calibration

Why is the calibration of instruments needed? How often? Where should it be carried out? And what can we expect in the future? **Rachael Morling** finds out

Measurement is a crucial factor in an infinite number of industrial process applications, explains Calibration Dynamics. However, instruments used for test and measurement are susceptible to performance related factors due to such issues as variations in temperature and mechanical stress, and over time they are therefore likely to output incorrect readings. This 'instrument drift' can result in serious repercussions, among which are a decline or inconsistency in product quality.

Frank Alandt, market development manager support EMEA, Agilent Technologies, adds: "When drift happens, the testing done by a customer on his products becomes untrustworthy and both design and production quality suffers." This can mean products are thought to be good when they are actually faulty; or that products are detected as faulty when in fact they aren't.

Instrumentation determines the way a process operates, says Mike Shelton, product manager calibration at GE Measurement & Control. It determines the efficiency of the process, the quality of the product and even the safety of the system. "For example, it may be necessary to heat a product to a specific temperature to sterilise it, cook it, or to separate petroleum products in a refinery," he adds. "If the temperature deviates by a few degrees the product will not be sterilised, will be burnt or not distilled, so the job of the instrumentation in these examples is to control the temperature to the specific value required. But how do we know the desired value is actually being measured correctly by the instrumentation?"

Calibration is therefore an essential process for instrumentation, as Alandt explains: "Calibration provides assurance that a piece of measuring equipment produces valid data and that the readings of the instrument give us confidence in making decisions."

According to Stephen Oxborough of AMECaL, calibration is a requirement for many trades, professions and quality management systems the company may be adhering to – for example, 16th/17th Edition Equipment should be calibrated to fulfil both the manufacturer's guidance and the requirements of BS EN 61557 (which normally means an annual calibration).

The process

So how is calibration carried out?

Calibration Dynamics explains it involves the comparison of a test/measurement/control device against a known reference standard. It could be described as a validation process which ensures acceptable data results are achieved from instruments.

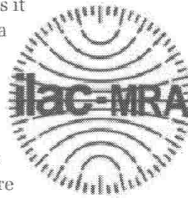
Shelton adds: "Calibration compares the value measured or set by the instrumentation with that of a known standard, and in this way the accuracy of the instrumentation can be determined."

"Accuracy in this case only defines the error of the instrumentation with respect to the standard and unless we know the error of the standard we cannot define the absolute error of the instrumentation. For the accuracy to have any real meaning the performance of the standard also has to be evaluated and defined, therefore the standard itself has to have traceability to a nationally or internationally recognised reference instrument."

Ensuring accuracy of instruments means that calibration is becoming an even more important process. This can be down to a number of factors, explains Alandt, including increasing responsibility, meaning that products need to be tested correctly during design and production. From a cost effectiveness standpoint it is also important that the supplier is using calibrated instruments.

Shelton also believes that it is becoming more important, explaining that regulations, standards, health and safety, and environmental are legal requirements, and failure to comply can result in large fines and the need to stop production. "Compliance gets harder year on year as the regulations become broader and more restrictive," he says. "Calibration plays an important role in demonstrating compliance, providing safety, reducing emissions, etc."

The importance of calibrating and adjusting process instruments is calculated by a number of key factors that vary from one process application to another, says Calibration Dynamics, and a re-calibration programme should be implemented into a quality assurance system in order to establish regular calibration intervals suited to each application. These intervals are formulated depending on the accuracy of the test instrument, manufacturer re-calibration guidelines and criticality of the production output media.



AMECaL is the only Calibration Laboratory with UK accreditation for gloss measurement

The company cites an example: "A process involving the measurement of water into a tank vessel would generally require a fairly low-cost, low-accuracy level measurement device which in turn would specify a recommended re-calibration cycle of 12 months. This moderately lengthy period between calibrations is due to the low-criticality of the media, water in this case, under test. On the other hand, if an application involved controlling the gas-flow into a turbine system, the user will require a much higher accuracy instrument and shorter re-calibration intervals due to the much higher criticality of the test media."

Shelton says: "Historically, calibrations used to be made say once a year during a plant shutdown. Some instruments would pass and some would fail, but by the end of the outage everything was back within specification and ready for the next 12 months, after which the whole process was repeated. The problem with this approach is that for those instruments that drift out of specification there is a potential decline in process efficiency or quality and this could start anywhere in the 12 month period."

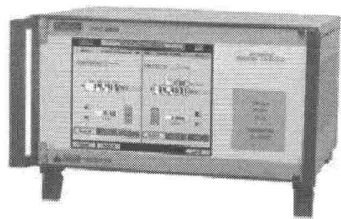
"One solution was to calibrate those instruments more regularly, but how regularly was a question of the cost of additional resource v benefit. Intelligent software (4Sight) is now able to analyse the calibration data that has already been collected and determine the optimal calibration period for each instrument based on a set of programmable operating scenarios and safety margins. Calibrating critical instruments more often, keeping them within tight operating limits, can have a very beneficial effect on quality and efficiency, but the software can also show where calibration periods can be extended without the instrument going out of specification. Calibration activity can be reduced by up to 40%, quality and efficiency are improved and there are fewer alarms and alerts to attend to."

Where to calibrate

So having established the frequency in which calibration needs to be carried out, where should the instruments be calibrated?

Calibration Dynamics explains that there are two main methods. The first is to send the instruments to a recognised calibration house for traceable or accredited calibration. A calibration certificate will be provided detailing the 'as found' readings of the instrument and any adjustments made, as well as the date of calibration and the standard used. This type of service is typically suited to those who have a relatively low quantity of instruments which

> 16



The MENSOR CPC6000 automated pressure calibrator from Calibration Dynamics

require calibration, where process downtime is not a primary issue.

The second method, the company adds, applies to those who use a large number of test/measurement/control instruments. In this scenario engineers may prefer to purchase a handheld calibrator which covers calibration of all desired parameters. Calibration Service Kits can cover multiple parameters – such as pressure, temperature and electronics – and offer a fast calibration solution for on-site instruments. Here, the instrument under test is simply isolated from the process application circuit and is calibrated and adjusted on the spot. Data can be logged on the calibrator and then transferred via communication (RS-232 Communication) to a PC in order to produce a traceable calibration certificate. Taking this approach means the hand held calibrator is the only instrument which requires an off-site calibration. This procedure significantly reduces the process application downtime and also saves the cost of sending multiple instruments off-site for re-calibration.

Shelton adds that it is significantly quicker and less costly to calibrate in-situ, and calibrating in the instruments' working location is a better measure of how it works in the local environment conditions. It also means the whole loop back to the control system can be tested at the same time.

"Some argue that a true calibration cannot be performed away from the calibration laboratory because the effects of temperature etc., cannot be controlled, and historically calibration equipment could not be relied upon outside of a controlled environment. However, calibrator manufacturers

have responded to this by providing equipment with a one year specified uncertainty over a broad range of environmental conditions," he continues.

Alandt explains that performing calibration in-house brings the benefits of reduced downtime, however it does require additional testing equipment to allow the calibrations to be performed. Some OEMs offer calibration services that are delivered on-site at the customer facility. This brings the benefits of fast Turn Around Time (TAT) to a couple of hours instead of days or weeks, and the same quality of calibration service that would be provided at the OEMs service centre.

Oxborough argues that calibration in-house can be a false economy: "Carrying out any operations which are not part of the company's core competency is often costly and prone to errors (as well as distracting) but calibration is particularly specialised and therefore prone to these problems. As well as the more visible costs of buying expensive reference standards, managing the calibrations and employing the technicians involved, there are additional hidden costs."

He adds: "The best way of minimising problems is to hand your equipment to a calibration specialist, but even external calibration results can only be truly valued if they are carried out by an organisation accredited to BS EN ISO 17025 – such as through UKAS (in the UK). This accreditation is government backed and independent – a calibration laboratory accredited by UKAS is regularly assessed by its auditors against internationally recognised standards and the technicians have demonstrated their competence, impartiality and performance capability. In other words, they are professional and proficient in what they do – which is calibrate and repair equipment."

The future

So what can be expect for the future of calibration? Alandt says: "In the near future we will see that calibration

cycles of instruments will become longer. Today most instruments have a 12 month calibration cycle. For newer instruments this is already 24 or 36 months. Also, future instruments will have more service technology on-board to do internal verification or a minor calibration. With the complexity of the newer instruments a manual calibration is not possible anymore and can only be performed with an automatic calibration system."


Paul Crowhurst, managing director at Calibration Dynamics, added: "It is clear that while calibration as a process is a necessary requirement for high quality process performance, the criticality levels, impacts on downtime and therefore restrictions on process availability are all issues. Rapid progress in automated calibration technology means that we can provide solutions that improve calibration quality, data protection integrity and reduce downtime."

As technology develops, improves and becomes more complex, there will, however, be an increasing number of instruments to be calibrated, measuring an ever-widening array of properties, comments Oxborough. Calibration laboratories will have to constantly strive to develop processes and procedures to cater for this technological expansion.

He concludes: "Calibration can only be valued and relied upon if it is provided by an accredited source. To many this is simply a more expensive option, but this doesn't need to be the case. Accreditation is the only way to guarantee calibration is carried out professionally and accurately – and if this is demanded by industry, the price will inevitably come down without compromising on quality."

- Calibration Dynamics**
www.calibrationdynamics.com Enter 678
- Agilent Technologies**
www.agilent.com Enter 679
- GE Measurement & Control**
www.ge-mcs.com Enter 680
- AMECaL**
www.amecal.com Enter 681

INTELLIGENT TRANSMITTERS




HygroFlex5, for humidity, moisture and temperature measurement

If you need precise and stable humidity, moisture and temperature data, you need the HygroFlex5-series from ROTRONIC. Interchangeable digital probes simplify maintenance and calibration as well as providing the optimum mechanical solution for any application. Self-diagnostics, integrated data backup and product configuration are standard features of both analogue and digital output versions.

Visit www.rotronic.co.uk for more information.

ROTRONIC Instruments (UK) Ltd, Crompton Fields, Crompton Way, Crawley, West Sussex, RH10 9EE
T: 01293 571000, F: 01293 571008, E: instruments@rotronic.co.uk



LEADING IN HUMIDITY MEASUREMENT