Calibration WORLD
03·2007

Traceable and efficient calibrations in the process industry

How often should instruments be calibrated?

An analysis will tell you.

Customer success story

Georgia Power, Plant Yates (USA)

Calibrate for profitability

Dear Calibration Professional, the main articles in this issue of CALIBRATION WORLD deal with traceable and efficient calibrations in the process industry, optimum frequency of calibrations, and improving power plant performance through calibration.

The primary reason for calibration is based on the fact that even the best 'digital' measuring instruments lack in absolute stability, they drift and lose their ability to give accurate measurements. However, there is a wide range of different ways to plan, manage and complete the needed calibration tasks, starting from the most inefficient and prone to error 'pen & paper method', using simple measuring devices. Many times the need of calibration is considered to be motivated only by viewpoints concerning measurement accuracy and/or regulations. Those are real requirements and they must be met, but ultimately the greatest motivation to have a closer look at the entire calibration process should be the fact that, in most cases, calibration on the whole is a very potential source for improving profitability of a business. When done in a smart way, calibration can provide financial benefits.

Finally I would like to encourage you, Dear Reader, to give your feedback and ideas to further develop the Calibration World. We have got a lot of positive feedback about this magazine and I am very proud of the work our team and contributors have done. However, I also believe that nothing is perfect and there is always room for improvement.

Enjoy your reading!

Raimo Ahola

Managing Director, Beamex Group

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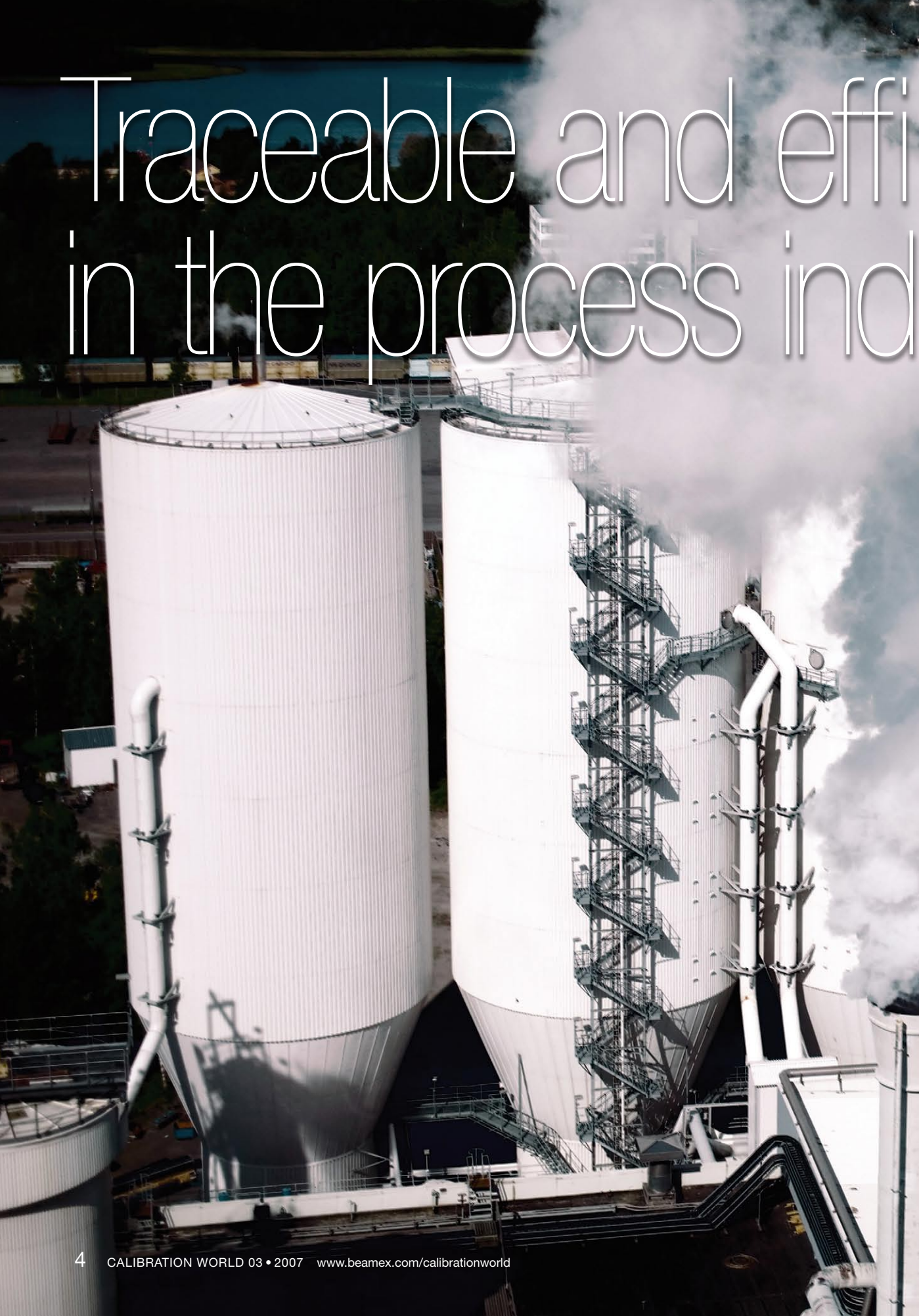

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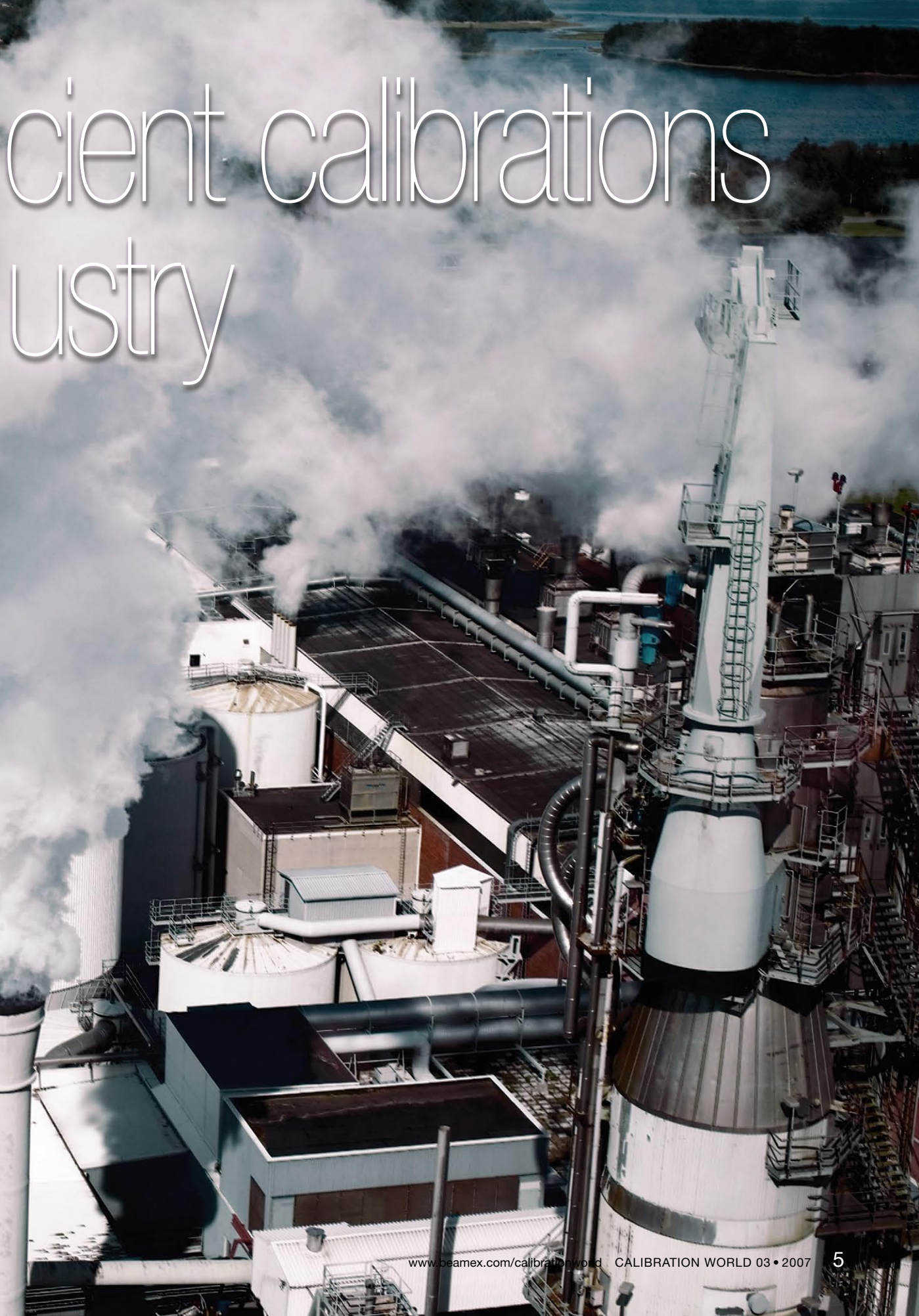


Traceable and efficient calibr

1. Introduction

Today's modern process plants, production processes and quality systems, put new and tight requirements on the accuracy of process instruments and on process control.

Quality systems, such as the ISO9000 and ISO14000 series of quality standards, call for systematic and well-documented calibrations, with regard to accuracy, repeatability, uncertainty, confidence levels etc.

Fortunately, modern calibration techniques and calibration systems have made it easier to fulfill the requirements on instrumentation calibration and maintenance in a productive way.

Does this mean that the electricians and instrumentation people should be calibration experts? Not really, but this topic should not be ignored. Fortunately, modern calibration techniques and calibration systems have made it easier to fulfill the requirements on instrumentation calibration and maintenance in a productive way.

However, some understanding of the techniques, terminology and methods involved in calibration must be known and understood in order to perform according to International Quality Systems.

2. What is calibration and why calibrate

Calibration can be briefly described as an activity where the instrument being tested is compared to a known reference value, i.e. calibrator. The keywords here are 'known reference', which means that the calibrator used should have a valid, traceable calibration certificate.

To be able to answer the question why calibrate, we must first determine what measurement is and why measuring is necessary.

WHAT IS MEASUREMENT?

In technical standards terms the word measurement has been defined as:

> *"A set of experimental operations for the purpose of determining the value of a quantity."*

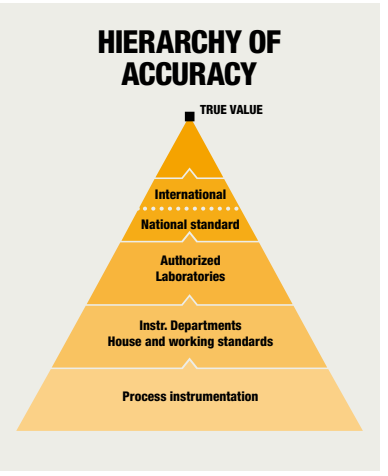
What is then the value of quantity? According to the standards the true value of a quantity is:

> *"The value which characterizes a quantity perfectly defined during the conditions which exist at the moment when the value is observed. Note: the true value of a quantity is an ideal concept and, in general, it cannot be known."*

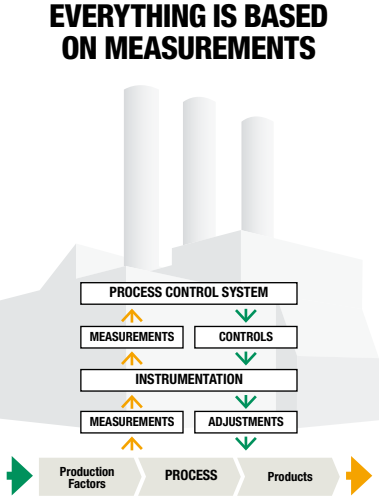
Therefore all instruments display false indications!

3. Why measure?

The purpose of a process plant is to convert raw material, energy, manpower and capital into products in the best possible way. This conversion always involves optimizing, which must be done better than the competitors. In practice, optimization is done by means of process automation. Anyhow, regardless of how advanced the process



automation system is, the control cannot be better than the quality of measurements from the process.



4. Why calibrate

The primary reason for calibrating is based on the fact that even the best measuring instruments lack in absolute stability, in other words, they drift and lose their ability to give accurate measurements. This drift makes recalibration necessary.

Environment conditions, elapsed time and type of application can all affect the stability of an instrument. Even

ations

instruments of the same manufacturer, type and range, can show varying performance. One unit can be found to have good stability, while another performs differently.

Other good reasons for calibration are:

- To maintain the credibility of measurements
- To maintain the quality of process instruments at a good-as-new level
- Safety and environmental regulations
- ISO9000, other quality systems and regulations

The ISO9000 and ISO14000 can assist in guiding regular, systematic calibrations, which produces uniform quality and minimizes the negative impacts on the environment.

5. Traceability

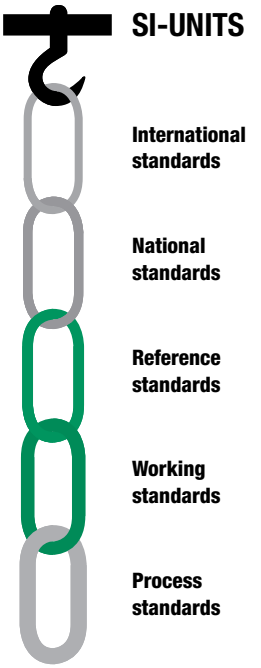
Calibrations must be traceable. Traceability is a declaration stating to which national standard a certain instrument has been compared.

6. Regulatory requirements for calibration

6.1 ISO9001: 2000

The organization determines the monitoring and measurements to be performed, as well as the measuring devices needed to provide evidence of a product's conformity to determined standards.

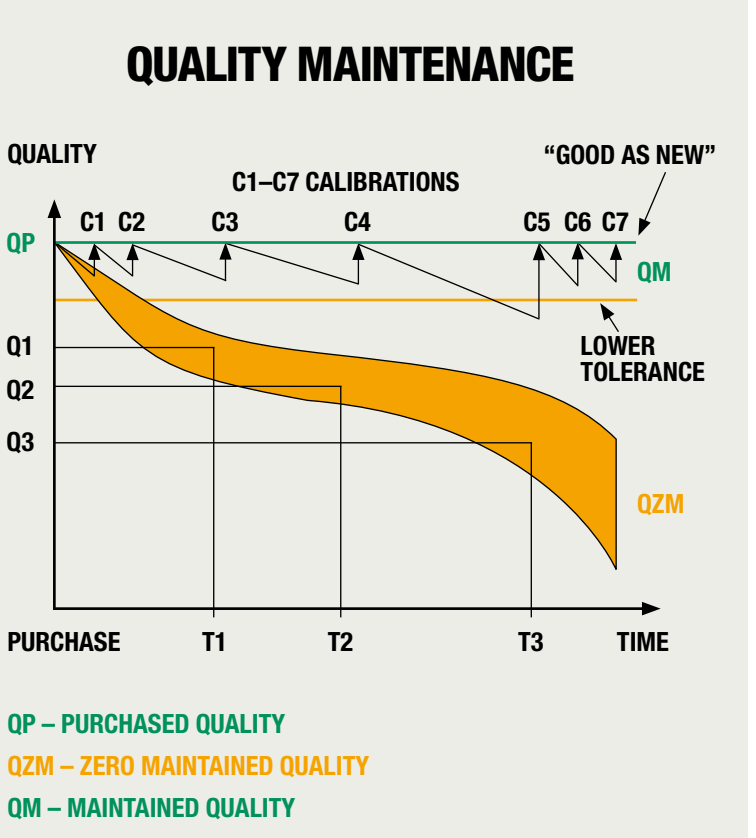
The organization establishes the processes for ensuring that measurements and monitoring are carried out and are carried out in a manner consistent with the monitoring and measurement requirements.



Where necessary, to ensure valid results, measuring equipment is calibrated or verified with measurement standards traceable to national or international standards at specified intervals. If no such standards exist, the basis used for calibration or verification is recorded; adjusted or re-adjusted as necessary; identified for the determining of the calibration status; safeguarded against adjustments that would invalidate the measurement result; protected from damage and deterioration during handling, maintenance and storage.

In addition, the organization assesses and records the validity of the previous measuring results when the equipment is found not to conform to requirements. The organization then takes appropriate action on the equipment and any product affected. Records of the calibration and verification results are then maintained.

When used in the monitoring and



measurement of specified requirements, the ability of computer software to satisfy the intended application is confirmed. This is done prior to initial use and reconfirmed as necessary.

NOTE: See ISO 10012 for further information.

6.2 PHARMACEUTICAL (FDA, U.S. Food and Drug Administration)

Any pharmaceutical company that sells their products in the USA must comply with FDA regulations regardless where the products are manufactured.

- Calibration records must be maintained.
- Calibrations must be done according to written, approved procedures.
- Each instrument should have a master history record.
- All instrumentation should have a unique ID; all product, process and safety instruments should be physically tagged.
- A calibration period and error limits should be defined for each instrument.
- Standards should be traceable to national and international standards.
- Standards must be more accurate than the required accuracy of the equipment being calibrated.
- All instruments used must be fit for purpose.
- There must be documented evidence that personnel involved in the calibration process have been trained and are competent.
- Documented change management system must be in place.

- All electronic systems must comply with FDA's regulation 21 CFR Part 11.
- All of the above should be implemented in conjunction with following regulations:
  – 21 CFR Part 211: "Current Good Manufacturing Practice for Finished Pharmaceuticals"
  – 21 CFR Part 11: "Electronic Records; Electronic Signatures"

Software systems need features such as Electronic Signature, Audit Trail, User Management, and Security System to be

able to comply with these regulations.

In such a system, the Electronic Signature is considered equivalent to a hand-written signature. Users must understand their responsibilities once they give an electronic signature. The Audit Trail is required for change management. It must be a tool that records all modifications, which add, edit, or delete data from an electronic record.

7. Definitions of metrological terms

Some metrological terms in association with the concept of calibration are described in this section.

Quite a few of the following terms are also used on specification sheets for calibrators. Please note that the definitions listed here are simplified.

Calibration

An unknown measured signal is compared to a known reference signal.

Validation

Validation of measurement and test methods (procedures) is generally necessary to prove that the methods are suitable for the intended use.

Non-linearity

Non-linearity is the maximum deviation of a transducer's output from a defined straight line.
Non-linearity is specified by the Terminal Based method or the Best Fit Straight Line method.

Resolution

Resolution is the smallest interval that can be read between two readings.

Sensitivity

Sensitivity is the smallest variation in input, which can be detected as an output. Good resolution is required in order to detect sensitivity.

Hysteresis

The deviation in output at any point within the instrument's sensing range, when first approaching this point with increasing values, and then with decreasing values.

Repeatability

Repeatability is the capability of an instrument to give the same output among repeated inputs of the same value over a period of time. Repeatability is often expressed in the form of standard deviation.

Temperature coefficient

The change in a calibrator's accuracy caused by changes in ambient temperature (deviation from reference conditions). The temperature coefficient is usually expressed as % F.S. / °C or % of RDG/ °C.

Stability

Often referred to as drift, stability is expressed as the change in percentage in the calibrated output of an instrument over a specified period, usually 90 days to 12 months, under normal operating conditions. Drift is usually given as a typical value.

Accuracy

Generally accuracy figures state the closeness of a measured value to a known reference value. The accuracy of the reference value is generally not included in the figures. It must also be checked if errors like non-linearity, hysteresis, temperature effects etc. are included in the accuracy figures provided.

Accuracy is usually expressed % F.S. or % of RDG + adder.

The difference between these two expressions is great.

The only way to compare accuracy presented in different ways is to calculate the total error at certain points.

Uncertainty

Uncertainty is an estimate of the limits, at a given cover factor (or confidence level), which contain the true value.

Uncertainty is evaluated according to either a "Type A" or a "Type B" method. Type A involves the statistical analysis of a series of measurements. In this case, uncertainty is calculated using Type A uncertainties, i.e. the effects of these components include measurement errors, which can vary in magnitude and in sign, in an unpredictable manner. The other group of components, Type B, could be said to be of a systematic nature. Systematic errors or effects remain constant during the measurement. Examples of systematic effects include errors in reference value, set-up of the measuring, ambient conditions, etc. Type B uncertainty is used when the uncertainty of a single measurement is expressed.

It should be noted that, in general, errors due to observer fallibility cannot be accommodated within the calculation of uncertainty. Examples of such errors include: errors in recording data, errors in calculation, or the use of inappropriate technology.

Type A uncertainty

The type A method of calculation can be applied when several independent measurements have been made under the same conditions. If there is sufficient resolution in the measurement, there will be an observable difference in the values measured.

The standard deviation, often called the "root-mean-square repeatability error", for a series of measurements under the same conditions, is used for

calculation. Standard deviation is used as a measure of the dispersion of values.

Type B uncertainty

Type B evaluation of uncertainty involves the use of other means to calculate uncertainty, rather than applying statistical analysis of a series of measurements.

It involves the evaluation of uncertainty using scientific judgement based on all available information concerning the possible variables. Values belonging to this category may be derived from:

- Experience with or general knowledge of the behavior and properties of relevant materials and instruments
- Ambient temperature
- Humidity
- Local gravity
- Atmospheric pressure
- Uncertainty of the calibration standard
- Calibration procedures
- Method used to register calibration results
- Method to process calibration results

The proper use of the available information calls for insight based on experience and general knowledge. It is a skill that can be learnt with practice. A well-based Type B evaluation of uncertainty can be as reliable as a Type A evaluation of uncertainty, especially in a measurement situation where a Type A evaluation is based only on a comparatively small number of statistically independent measurements.

Expanded uncertainty

The EA has decided that calibration laboratories accredited by members of the EA shall state an expanded uncertainty of measurement obtained by multiplying the uncertainty by a coverage factor k. In cases where normal (Gaussian) distribution can be assumed, the standard coverage factor, k=2, should be used. The expanded uncertainty corresponds to a coverage probability (or confidence level) of approximately 95%.

For uncertainty specifications, there must be a clear statement of cover probability or confidence level. Usually one of the following confidence levels are used:

1 s = 68 %
2 s = 95 %
3 s = 99 %

8. Calibration management

Many companies do not pay enough attention to calibration management although it is a requirement e.g. in ISO9001: 2000. The maintenance management system may alert when calibration is needed and then opens up a work order. Once the job has been done, the work order will close and the maintenance system will be satisfied.

Unfortunately, what happens between opening and closing of the work order is not documented very often. If something is documented, it is usually in the form of a hand-written sheet that is then archived. If the calibration results need to be examined at a later time, finding the sheets requires a lot of effort.

Choosing professional tools for maintaining calibration records and doing the calibrations can save a lot of time, effort and money. An efficient calibration management system consists of calibration management software and documenting calibrators.

Modern calibration management software can be a tool that automates and simplifies calibration work at all levels. It automatically creates a list of instruments waiting to be calibrated in the near future. If the software is able to interface with other systems the scheduling of calibrations can be done in the maintenance system from which the work orders can be automatically loaded into the calibration management software.

When the technician is about to calibrate an instrument, (s)he simply downloads the instrument details from the calibration management software into the memory of a documenting calibrator; no printed notes, etc. are needed. The "As Found" and "As Left" are saved in the calibrator's memory, and there is no need to write down anything with pen.

The instrument's measurement ranges and error limits are defined in the software and also downloaded to the calibrator. Thus the calibrator is able to detect if the calibration was passed or failed immediately after the last calibration point was recorded. There is no need to make tricky calculations manually in the field.

All this saves an extensive amount of time and prevents the user from making mistakes. The increase in work productivity allows for more calibrations to be carried out within the same period of time as before. Depending on what process variable is calibrated and how many calibration points are recorded, using automated tools can be 5 to 10 times faster compared to manual recording.

While the calibration results are uploaded onto the database, the software automatically detects the calibrator that was used, and the traceability chain is documented without requiring any further actions from the user.

Calibration records, including the full calibration history of an instrument, are kept in the database; therefore accessing previous results is also possible in just a few seconds. When an instrument has been calibrated several times, software displays the "History Trend", which assists in determining whether or not the calibration period should be changed.

One of today's trends is to move towards to a paperless office. If the calibration management software includes the right tools, it is possible to manage calibration records on computer

without producing any papers. If paper copies of certificates are preferred, printing them must, of course, be possible. When all calibration related data is located in a single database the software is obviously able to create calibration related reports and documents.

Today's documenting calibrators are capable of calibrating many process signals. It is not very uncommon to have a calibrator that calibrates pressure, temperature and electrical signals including frequency and pulses. In addition to the conventional mA output of a transmitter, modern calibrators can also read HART, Foundation Fieldbus or Profibus output of the transmitters, and they can be even used for configuring these "smart" transmitters.

Implementing a modern calibration management system benefits everybody who has anything to do with instrumentation. For instance the maintenance manager can use it as a calibration planning and decision-making tool for tracking and managing all calibration related activities.

When an auditor comes for a visit, QA will find a calibration management system useful. The requested calibration records can be viewed on screen with a couple mouse clicks. If a calibrator drifts out of its specifications, it is possible to use a "reverse traceability report" to get a list of instruments that have been calibrated with that calibrator.

Good calibration tools help technicians work more efficiently and accurately. If the system manufacturer has paid attention usability, the system is easy to learn and use. When many tasks are automated, the users can concentrate on their primary job.

Transferring to a new calibration system may sound like a huge task and it can be a huge task. There are probably thousands of instruments that need to be entered into the database and all the details must be checked and verified before the system is up and running. Although there is a lot of data involved, it does not mean the job is an enormous one.

Nowadays most companies have instrumentation data in some type of electronic format: as Excel spreadsheets, Maintenance databases, etc. The vendor of the calibration system is most likely able to import most of the existing data to the calibration database saving months of work.

Conclusion

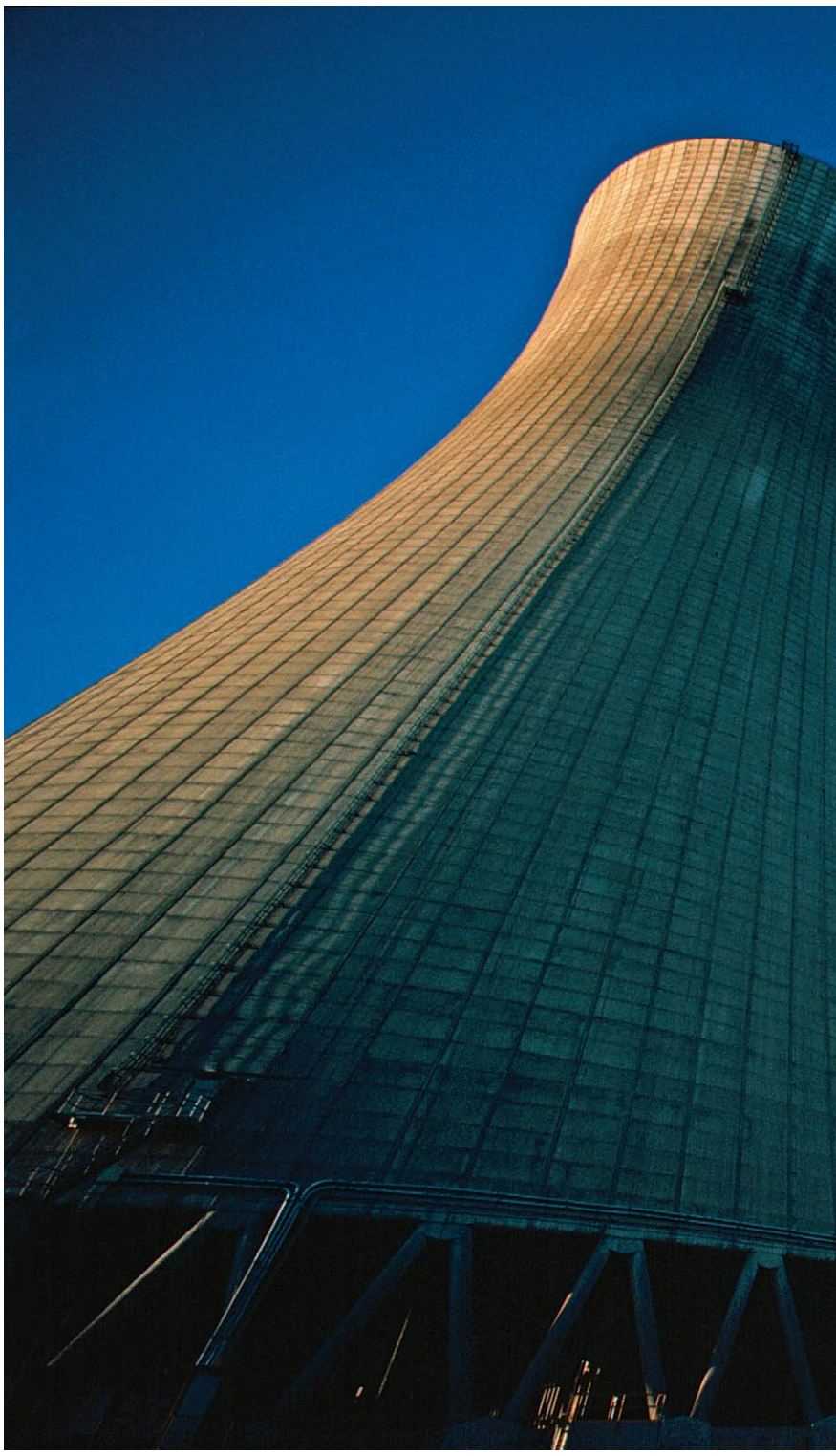
■ A good, automated calibration system reduces workload because it carries out tasks faster, more accurately and with better results than what could be reached with a manual system. It assists in documenting, scheduling, planning, analyzing and finally optimizing the calibration work.

References

[1] ISO9001: 2000 "Quality Management Systems. Requirements"
[2] 21 CFR Part 11: "Electronic Records; Electronic Signatures"
[3] 21 CFR Part 211: "Current Good Manufacturing Practice for Finished Pharmaceuticals"

Improving power plant perfor

Calibration helps a power plant in maintaining or even improving safety, as well as in meeting national and international standards. However, calibration is also a matter of profitability. By using high-accuracy calibration equipment, the accuracy of vital measurements can be maintained at required levels and plants can increase their annual power production capability.



Power and Energy Operations

Electric, natural gas, oil, and other energy meters directly influence revenue. Because of rising energy costs, power and energy operations carefully scrutinize these devices to ensure that they accurately account for their energy

"Uncertainty need is also one of the most important issues when specifying the calibration period."

and bill correctly. Calibration issues that arise in the power and energy industries are also similar to those faced in power and energy consumer industries. Although not directly billable, internal energy consumption and its allocation can make or break a seemingly viable product. Proper instrument calibration helps ensure that these measurements are performed accurately, especially because annual billing can exceed 1 billion US dollars in many plants.

Instrumentation is used to measure energy flow within power and energy operations in order to monitor and improve operations. While these

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mance through calibration

instruments are not directly used for billing purposes, their proper operation is often key to identifying and preventing energy losses that can have large economic consequences. Failure to properly calibrate these instruments can lead to significant economic consequences.

Reducing the measurement uncertainty (with high-accuracy calibrators) in a nuclear power plant can potentially increase electrical production up to nearly 2 percent.

Instruments typically calibrated in power plants include transmitters, switches, gauges, transducers, frequency devices and pulse counters to ensure proper operation and safety. Failure to properly calibrate these devices can significantly affect process operation. Calibrating instruments properly in a timely manner is an important aspect of ensuring the environmental integrity of the process that can reduce the number and severity of environmental issues.

Calibration Requirements for Increasing Plant Productivity and Safety

Accurate measurements can allow increased energy production. Therefore, high-accuracy calibrators such as the Beamex® MC5 Multifunction Calibrator, have a significant role in improving plant productivity. For instance, reducing the measurement uncertainty in a nuclear power plant can potentially increase electrical production up to nearly 2 percent (see CNA case story).

The economic consequence of this seemingly small power increase typically increases revenues by many millions of dollars because the total value of power and energy flows can easily be over a billion dollars per year. Therefore, seemingly small measurement errors caused by poor calibration techniques can potentially result in major revenue losses. With these improved measurements comes the additional requirement of maintaining calibration equipment and techniques that are comparable with the improved instrument performance with traceability to national and international standards, such as NIST, ISO 9001 and ISO 17025.

Safety is based upon never exceeding established operating limits such as reactor power and cooling capacity. A byproduct of improved calibration is an improvement in safety and fewer problems because instruments periodically calibrated to more accurate standards reduce the risk associated with these measurements. In addition, improved calibration standards can be used to detect instrument degradation sooner.

Power and Energy Industry Calibration

Field calibration allows the in-situ calibration of instruments that measure electrical parameters such as voltage, current and power – some of which may be used for billing purposes in a power plant. The performance of natural gas and oil flow measurement systems can also influence billing. In particular, the calibration of flowmeters used to check the custody transfer flowmeters is important. Small variations between these flowmeters can result in large billing differences and could indicate a problem with the custody transfer flowmeter. Field calibrators allow these calibrations to be performed accurately and more efficiently, especially when the instrument is installed with poor personnel access.

Many electricity, steam, cogeneration, ethanol, bio-diesel, refinery and other types of energy plants use these measurements to develop process heat and material balances that describe their processes. Heat and material balances can be instrumental in locating opportunities that can save millions of dollars of energy. For example, increased steam flow to a heat exchanger indicates that either the steam trap on the heat exchanger leaks (wasting steam), or that the process changed (wasting steam) and needs to be investigated to reduce steam consumption. Field calibrators help ensure that these instruments operate properly and accurately, quantifying energy savings. In addition, instruments that are regularly and accurately

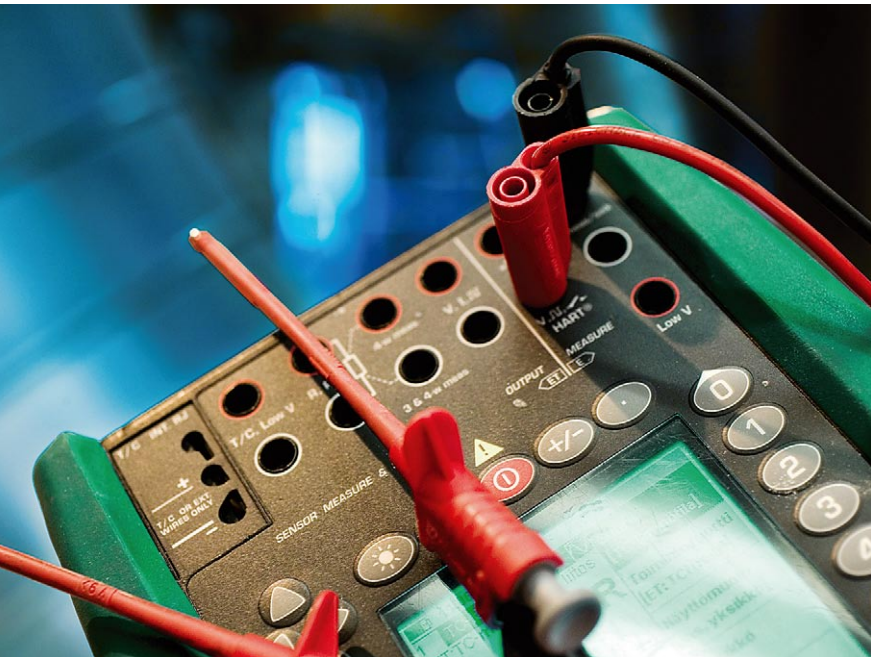
Case: Increasing Annual Production with High-Accuracy Calibrators

Central Nuclear de Almaraz (CNA), Spain

Enhanced calibration equipment performance makes it possible to perform calibration operations with better uncertainty levels, with which it is possible to improve production results. This is achieved by using the high-accuracy Beamex® MC5 multifunction calibrators for calibration in the power plant.

By improving the measurement of the parameters **from 2% to 0.4%** (parameters associated with the determination of reactor power), enabled the power in each unit to be **increased by 1.6%.** This has a very significant effect on the annual production.

Read the case story at: www.beamex.com/success



calibrated often tend to improve plant safety and reduce the probability of equipment damage.

Further, automated portable calibrators can improve the calibration process by automating the generation of the transmitter inputs and the recording of the transmitter measurements. This makes the calibration process much less time-consuming and improves the accuracy with which data is collected by reducing the probability of human error.

Expensive qualification requirements often preclude the opening of transmitters in nuclear power plants. In these applications, the calibration process can be performed faster and more accurately with an automated calibrator as compared to using existing manual calibration techniques.

The Beamex® MC5 Multifunction Calibrators and the Beamex® CMX calibration software form an integrated, automated calibration system. Calibrations performed using automated field calibrators and calibration software with electronic documentation, result in more uniform calibrations that are less prone to human error. This automated calibration process is faster and more complete than the manual process. Aside from being more accurate, it also frees up significant amounts of time for the technician to perform other work. The integrated system with communicating calibrators and calibration software allow also easy upload of calibrations to a PC and produce easy-to-read calibration certificates showing the accuracy of the instrument. It also allows the ability to search for instruments that are due for calibration.

DID YOU KNOW?

that the Beamex® MC5 is a high-accuracy, multifunctional calibrator that replaces many individual measurement devices. It meets perfectly the requirements of calibration in a power plant. For more information or a quotation, complete the request form at www.beamex.com/request

Summary:
Improving Power Plant Performance through Calibration

■ An optimal calibration plan executed well can improve both safety and productivity of the plant.

Calibration improves safety

Calibration is carried out to compare the quality and reliability of the measurements by means of traceability through national and international standards (e.g. NIST, ISO 9001, ISO 17025).
Plan safety is based on never exceeding the established operating parameters (e.g. reactor power, cooling capacity).

Calibration improves efficiency

Enhanced calibration equipment performance results in better uncertainty levels, with which it is possible to improve annual production levels.

With an integrated calibration solution, such as the Beamex® calibrators and calibration software, plant can reduce the amount of paperwork and equipment that has to be taken out in the field.

How often should instruments

An analysis will tell you.

Plants can improve their efficiency and reduce costs by performing calibration history trend analysis. The analysis enables a plant to determine 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.

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

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.

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.

be calibrated?

The Benefits of Analyzing Calibration History Trends

But regardless of the industry sector, by analysing an instrument's drift over time (ie. the historical 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."

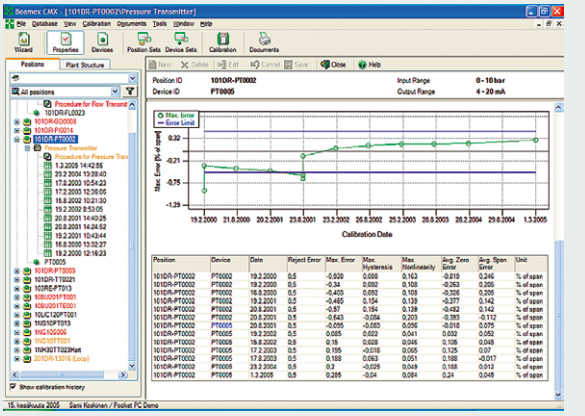
The trick, says Mäki, is determining which sensors should be re-calibrated after a few days, weeks, or even years

History Trend

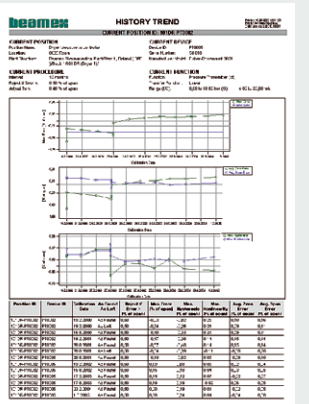
The History Trend Option of Beamex® CMX Calibration Software allows you to analyze the instrument's drift over a certain time period.

- 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 IN BEAMEX® CMX



HISTORY TREND REPORT



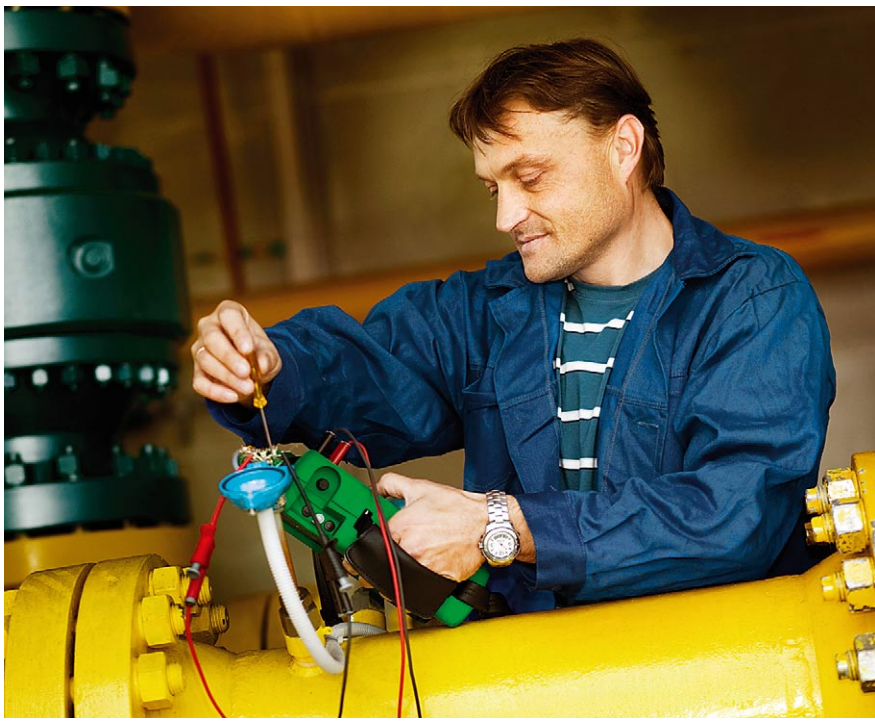
View the results on a History Trend report that includes your company logo.

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."

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

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.



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 'History Trend' Function within CMX

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.

DID YOU KNOW?

that 90% of Beamex® CMX calibration software customers state that using Beamex products has improved the efficiency of their calibration procedures.*

*Beamex Customer Survey 2006

Summary:

The benefits of calibration history trend

- 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.

Georgia Power, Plant Yates (

Calibrating for plant performance

Southern Company is a super-regional energy company with nearly 39,000 megawatts of electric generating capacity in the southeast United States. It is one of the largest producers of electricity in the United States. Southern Company supplies energy to a 120,000 square-mile service territory spanning most of Georgia and Alabama, southeastern Mississippi, and the panhandle region of Florida. FORTUNE magazine has named Southern Company "the most admired" electric and gas utility in America for the last three years. Southern Company is currently ranked number 178 on the latest FORTUNE 500 listing of the largest U. S. corporations. Southern Company reported earnings of $1.47 billion in 2003. The company has approximately 26,000 employees.

Southern Company, the parent firm of Georgia Power, is one of the largest producers of electricity in the United States.

Southern Company is the parent firm of Georgia Power. One of the generating plants is Georgia Power's Plant Yates. Units 1 through 5 at Plant Yates are some of Georgia Power's oldest fossil-fuel power plants. The plant has seven generating units, with a total capacity of 1,250 megawatts. When Yates was completed in 1952, it was the largest steam generating plant in Georgia. Over the years, Plant Yates has been maintained to increase reliability, sustain efficiency and keep its operations compatible with increasingly strict environmental standards.

The situation

The Instruments and Controls department is responsible for maintaining and calibrating all instrumentation at Plant Yates, including transmitters and switches. Jeff Cason is a Senior Instruments and Controls Technician at Georgia Power's Plant Yates.

Calibration of process instruments is considered essential at Plant Yates. "Proper calibration ensures the best possible plant performance, increases efficiency, and reduces risk of problems", Jeff Cason states. "It provides safety from potential hazards due to undesirable operating conditions", Jeff continues.

The main objectives achieved through calibration are increased performance, reliability, efficiency, and safety. Transmitters, switches, gauges, transducers, frequency devices and pulse counters, among other things, are calibrated at Plant Yates.

The solution and main benefits

"We calibrate control instrumentation on a yearly basis, and indication instruments every eighteen to twenty-four months" Jeff Cason explains.

At Plant Yates, they utilize Beamex® MC5 Multifunction Calibrators, vacuum calibration pumps, both high and low-pressure calibration pumps and Beamex® calibration software; the results have been very satisfying. "Beamex equipment was chosen because the MC5 offered the most options as far as module ranges, devices that could be calibrated and put into the database, HART® communications, and database functionality", Jeff Cason reveals.

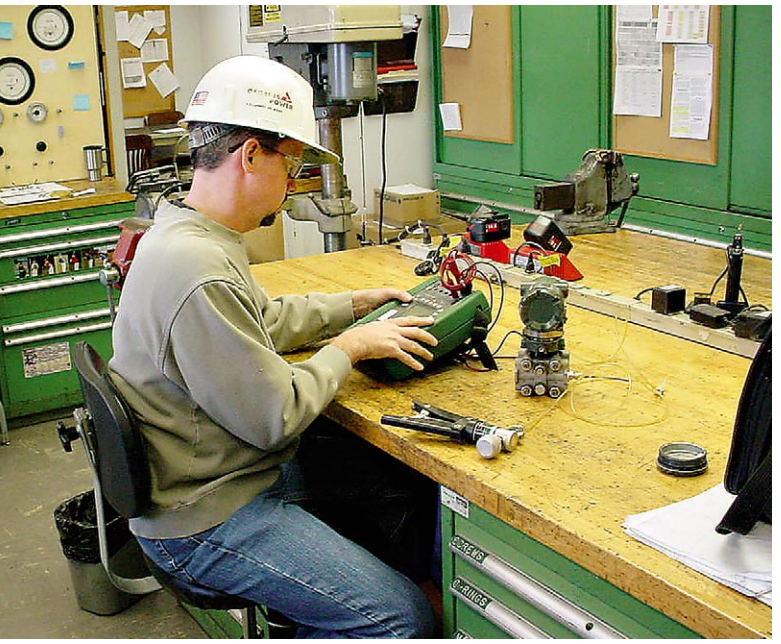
"The Beamex® MC5 is very versatile, powerful, and compact. All-in-one functionality means no need to carry several different gauges, manometers, and ammeter into the field", Jeff Cason describes. "Also, the accuracy of the MC5 modules is very good", Jeff continues. In addition, the calibration software has proven to be very efficient. "The software makes it easy to send a list of instruments to be calibrated to the MC5 and then to work from that list, without needing to do paperwork out in the field", Jeff Cason points out.

"Beamex equipment was chosen because the MC5 offered the most options as far as module ranges, devices that could be calibrated and put into the database, HART® communications, and database functionality", Jeff Cason reveals.

Using Beamex's calibration equipment has provided many benefits such as smooth, effortless calibrations. "Easy upload of calibrations to a PC and easy-to-read calibration certificates show the accuracy of the instrument", Jeff Cason explains the benefits of the Beamex calibration system. "It also allows the ability to search for instruments that are due for calibration", Jeff adds.

"Utilizing the Beamex calibration system has reduced the amount of equipment and paperwork that has to be taken out in the field", Jeff Cason concludes.

USA)



Case story in brief

Customer profile

Georgia Power, Plant Yates
USA

Business Situation

Southern Company, the parent firm of Georgia Power, is one of the largest producers of electricity in the United States. The plant has seven generating units, with a total capacity of 1,250 megawatts. When Yates was completed in 1952, it was the largest steam generating plant in Georgia. Over the years, Plant Yates has been maintained to increase reliability, sustain efficiency and keep its operations compatible with increasingly strict environmental standards. Calibration of process instruments is considered essential at Plant Yates. Proper calibration ensures the best possible plant performance, increases efficiency, and reduces risk of problems.

Solution description

- Beamex® MC5 Multifunction Calibrators
- Beamex® Calibration Software
- Beamex® PGV, PGM and PGXH calibration pumps

Main benefits

- Accuracy of Beamex calibrators
- Beamex calibration system has reduced the amount of equipment and paperwork that has to be taken out in the field
- Easy upload of calibrations to a PC and easy-to-read calibration certificates show the accuracy of the instrument
- Proper calibration ensures the best possible plant performance, increases efficiency, and reduces risk of problems

News

Using the Beamex® MC5 Fieldbus Calibrator with Emerson's AMS™ Suite

■ The AMS Device Manager fully supports the Beamex® MC5 Fieldbus Calibrator. The calibration procedure is simple. First you select the fieldbus instrument(s) to be calibrated in AMS Device Manager and set up in a route. Then you check out the route in AMS Device Manager to the MC5. Once this is done, you must select the instrument in MC5 and press 'Edit' to edit the instrument. After this, select the 'Instrument Output' page in the MC5 and edit the 'Output Method' from 'Keyed' to 'FOUNDATION H1'. Save the instrument's data and begin calibrating as you normally would. After the calibration is completed and results are saved into MC5, results can be uploaded to AMS Device Manager by checking in the route. Quick and simple!

For more information about the MC5 and AMS communication option, contact info@beamex.com

Free demo for Beamex® CMX Light calibration software!

■ Does your plant already utilize calibration software for managing all calibration information and assets? Now you can take the first step by downloading and installing the Beamex® CMX Light software demo. The Beamex® CMX Light is easy-to-use calibration software for a single workstation. It is the calibration solution for all large and mid-sized companies that wish for advanced, yet simple to use, calibration software. If you need more advanced features, you can go for the CMX Professional or the CMX Enterprise.

"Before purchasing Beamex® CMX Light we would have to record calibration results on paper first, and then in a document on our network. Using CMX Light to directly download the results to a computer, enables us to save time (and money) by eliminating double recording of calibration results."

– Peter Vandenberg,
Senior Technical Officer
Instrumentation & Controls,
AGL Torrens Island Pty Ltd, Australia

To download the free Beamex® CMX Light software demo, as well as a user guide and installation instructions, go to www.beamex.com/calibrationsolution

The Beamex® MC5-IS Calibrator gets updated certification

■ The Beamex® MC5-IS Intrinsically Safe Multifunction Calibrator's Ex certification has been updated in June 2007. The main benefit of the updated certificate is that the new IECEx certificate for the MC5-IS is officially approved in many new countries. The ATEX certification of the MC5-IS has also been updated.

IECEx member countries include 26 countries, such as Australia, Canada, China, UK and USA. The complete list of IECEx member countries can be found at: http://www.iecex.com/countries.htm. The MC5-IS certification body (VTT) has received a status as an Approved Certification Body in the IECEx scheme program. The objective of the IECEx Scheme is to facilitate international trade in equipment and services for use in explosive atmospheres, while maintaining the required level of safety. More information on IECEx can be found at www.iecex.com.

The new certification is valid for all Beamex® MC5-IS calibrators that are delivered after mid-June 2007.

Beamex® MC5-IS Intrinsically Safe Multifunction Calibrator is a high-accuracy calibrator that can replace several individual measurement devices due to its all-in-one functionality. It is designed for use in potentially explosive environments such as offshore platforms, oil refineries, chemical and petrochemical plants where inflammable gases may be present.

Beamex provides a new corporate-wide calibration system for Scottish and Southern Energy

■ Beamex Limited (UK) made recently a major contract to provide a new corporate-wide software-based calibration system for Scottish and Southern Energy. The contract includes several Beamex® CMX Professional Calibration Software licenses. The new system will be used at 11 Scottish and Southern Energy sites in the UK.

Installing and utilizing this new system will provide Scottish and Southern Energy quality and efficiency improvements due to the possibility to have a fully networked calibration software solution that can be rolled out across multiple geographically dispersed sites. In addition to the network capability, other reasons for choosing Beamex® CMX Calibration Software were that the software can communicate seamlessly with documenting calibrators and that it can be integrated with a maintenance management system.

Scottish and Southern Energy is one of the largest energy companies in the UK. The company is involved in the generation, transmission, distribution and supply of electricity; energy trading; the storage, distribution and supply of gas; electrical and utility contracting; and telecoms.

John Adeimy appointed as president of Beamex, Inc.

■ John Adeimy has been appointed as President of Beamex, Inc. (USA). He started with Beamex on the 2nd of July, 2007.

John holds a key position within the Beamex Group as President of the Beamex's US subsidiary, as USA is one of the biggest markets for Beamex and a key focus area for the company.

John has an extensive background from managing sales and marketing operations in the automation industry. Before joining Beamex, he was VP of Sales and Marketing at Voith Automation. Other companies he has worked for include Honeywell, ABB and Monsanto Company.

"We are very pleased for the experience and competence John brings to the Beamex team. Our operations in USA is expanding and John has a key position in bringing it to the next level", explains Raimo Ahola, Managing Director of Beamex Group.

John Adeimy, President
Beamex, Inc.
Tel. (office): 770-951-1927
Email: john.adeimy@beamex.com
Internet: www.beamex.com

Beamex® Integrated

Software-based calibration management

- Create, manage and store calibration data efficiently
- Automate calibration work from start to finish
- Share database with other plants worldwide
- Integration into MMS (e.g. SAP®, Maximo®)
- Paperless calibration data management
- Regulatory compliance (e.g. ISO 17025, ISO 9001, FDA)
- Seamless communication with documenting calibrators
- Manual entry, Pocket PC interface and weighing in

CORPORATE-LEVEL

CALIBRATION MANAGEMENT

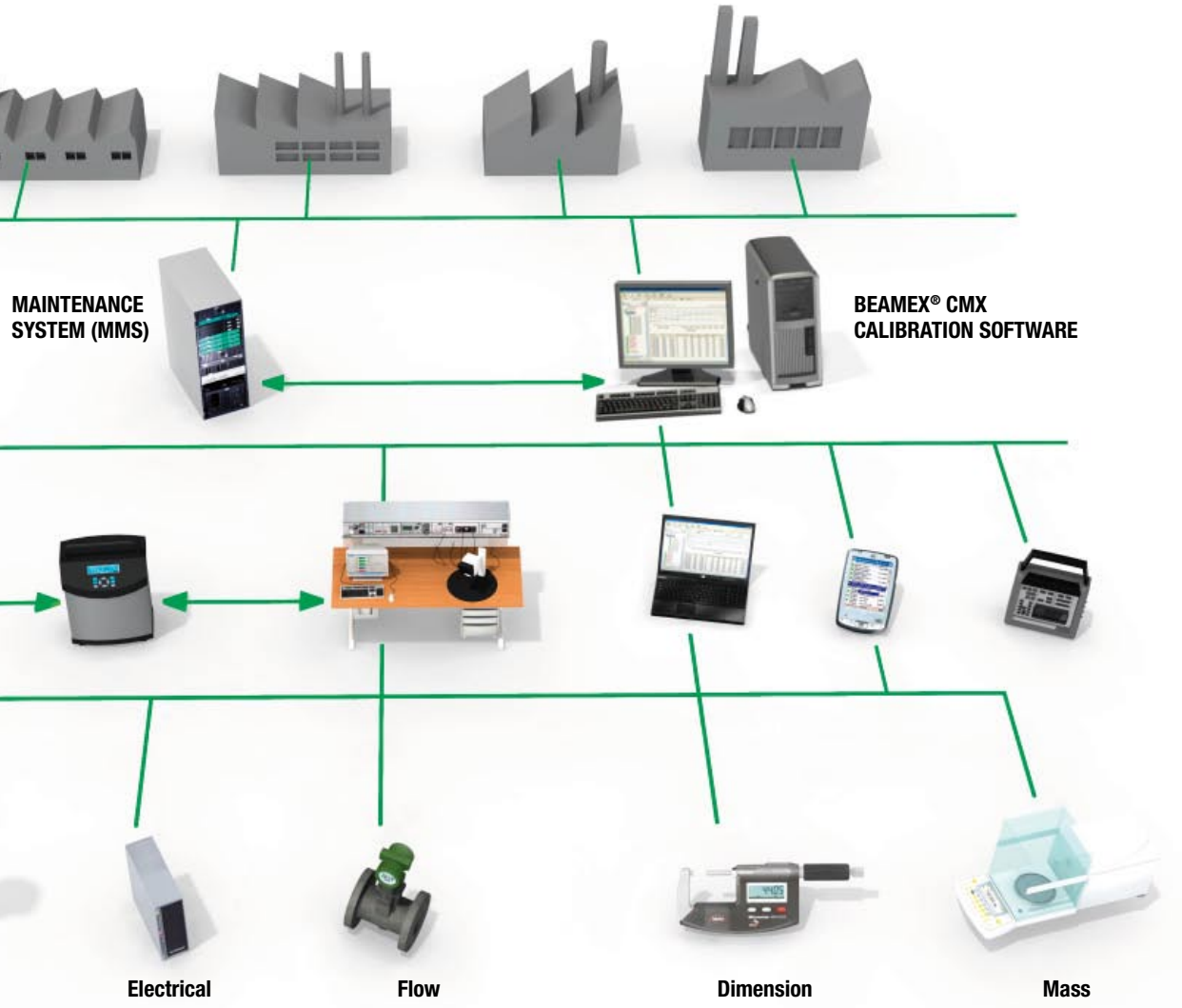
CALIBRATION AND DOCUMENTING TOOLS
- **Beamex® MC5 Calibrator**
- **Temperature bath / Pressure controller**
- **Beamex® MCS100 Workstation**
- **Manual entry in Beamex® CMX**
- **Pocket PC interface for Beamex® CMX**
- **3rd party calibrator support**

INSTRUMENTS:
- **Conventional**
- **HART**
- **Profibus PA**
- **Foundation Fieldbus H1**

Calibration Solution

Accurate and efficient calibration

- High accuracy portable calibrators and workstations
- Replace several individual devices and cut recalibration costs with Beamex® multifunctional calibrators
- Automated calibrations, documenting capability and automatic error calculations
- Reliable and robust calibrators, Ex-version available
- Seamless communication with calibration software
- Support for many different instruments and protocols, such as HART®, Profibus and Foundation Fieldbus



News

Beamex provides an integrated calibration solution to the world's largest straw fired power station

■ Beamex has recently been contracted by EPR to supply their world-class integrated calibration solution for Elean Power Station – the world's largest straw burning power station creating 38MW from burning 200,000 tons of cereal straw every year.

Beamex is proud to be part of this fantastic project helping to create power for the UK from a renewable source.

The integrated solution includes the well-respected combination of Beamex® MC multifunction documenting calibrators and Beamex® CMX Professional Calibration Software allowing the seamless and electronic flow of calibration data from calibration software to calibrator and back.

The seamless and electronic flow of data minimizes the error-prone requirement for hand-written data entry and accelerates the whole process leading to savings in time and cost. The system also documents automatically all calibration results.

In addition to the time and cost savings, other reasons for choosing Beamex® MC calibrators and Beamex® CMX Calibration Software are the capability to communicate with and calibrate HART® and Foundation Fieldbus transmitters, operate within a paperless environment, and be able to share the calibration results across a corporate network.

EPR (Energy Power Resources) is at the forefront of the renewable energy market with one of the largest and most diverse portfolios of plant in the UK, generating some 10% of the UK's renewable electricity.

The managing director of Beamex appointed as chairman of Finnish Metrology Advisory Commission

Managing Director of Beamex Group, Raimo Ahola.

■ Managing Director of Beamex Group, Raimo Ahola, has been appointed as the chairman of Finnish Metrology Advisory Commission for the upcoming 3-year period. The Metrology Advisory Commission assists the Finnish Ministry of Trade and Industry, Centre for Metrology and Accreditation (MIKES) and Safety Technology Authority (TUKES) in matters concerning metrology business, education and science. In addition to Raimo Ahola, the Metrology Advisory Commission has 17 other members covering different fields of metrology. Being the chairman of Metrology Advisory Commission means having a key position in developing and shaping the entire field of metrology in Finland.

Beamex in brief

Beamex is a leading worldwide provider of calibration solutions that meet even the most demanding requirements of process instrumentation. Beamex offers a comprehensive range of products and services — from portable calibrators to workstations, calibration accessories, calibration software, industry-specific solutions and professional services. Through Beamex's partner network, their products and services are available in more than 60 countries.

Learn more about Beamex products and services:
www.beamex.com

Brochures, product demonstrations and quotations
info@beamex.com
www.beamex.com/request (online request form)

Software support
support@beamex.com

Re-calibration and service
service@beamex.com

Find your local Beamex sales office at:
www.beamex.com/contacts

Interested in submitting an article to CALIBRATION WORLD?
Contact: villy.lindfelt@beamex.com

If you would like to remove your name from our mailing list:
please visit www.beamex.com or send an e-mail to info@beamex.com

Beamex products and services

Portable calibrators
Beamex's range of portable MC calibrators for field calibration is known for their accuracy, versatility and also for meeting both high and uncompromised quality standards.
- MC5 Multifunction Calibrator
- MC5-IS Intrinsically Safe Multifunction Calibrator
- MC2 Series

Workstations
A workstation can be considered ideal when most of maintenance and calibration tasks are performed in the workshop.
- MCS100 Workstation
- MC5P Calibration Host Module

Accessories
Beamex's calibration accessories complete your investment into calibration equipment.
- External pressure modules
- Calibration hand-pumps
- Spare parts

Calibration software
Plan, manage and document all your calibrations efficiently and safely using Beamex's calibration software.
- CMX Light
- CMX Professional
- CMX Enterprise

Professional services
An essential part of a total calibration solution is Professional Services — service and re-calibration, installation and training, software support, validation services and integration services.
- Re-calibration and service
- Installation and training
- Software Service Agreement (SSA)
- Validation services (pharmaceutical industry)
- Integration services



Learn step-by-step how the most integrated, automated calibration system works.

Register for a FREE multimedia CD-ROM at www.beamex.com/cdrom

The CD-ROM contains:

- Animated video
- Beamex® CMX Light Calibration Software demo
- Brochures for calibrators and calibration software
- Customer case stories
- Calibration White Papers
- User guides

Register for the FREE CD-ROM at: www.beamex.com/cdrom

beamex
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Portable calibrators
Workstations
Calibration software
Professional services
Industry solutions

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