Beamex

Calibration White Paper

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The safest way to calibrate fieldbus instruments

beamex
WORLD-CLASS CALIBRATION SOLUTIONS™

The safest way to calibrate fieldbus instruments

Fieldbus is becoming more and more common in today's instrumentation. Fieldbus transmitters must also be calibrated just like conventional instruments. There are also industrial environments where the calibration of fieldbus instruments should not only be made accurately and efficiently, but also safely. When safety becomes a top priority issue in calibration, intrinsically safe fieldbus calibrators enter into the picture. Until now, no practical solutions have existed for calibrating fieldbus instruments in hazardous areas, but now Beamex introduces the safest way to calibrate fieldbus instruments.

Conventional transmitters can deliver only one simultaneous parameter, one way. Each transmitter needs a dedicated pair of cables, and I/O subsystems are required to convert the analog mA signal to a digital format for a control system.

Fieldbus transmitters must be calibrated as well, but how can it be done?

Fieldbus transmitters are able to deliver a huge amount of information via the quick two-way bus. Several transmitters can be connected to the same pair of wires. Conventional I/O systems are no longer needed because segment controllers connect the instrument segments to the quicker, higher-level fieldbus backbone. Being an open standard, instruments from any manufacturer can be connected to the same fieldbus as plug-and-play.

Currently, a large number of fieldbus installations already exist and the number is increasing at a huge rate. A large portion of new projects is currently being carried out using fieldbus. Critical applications and hazardous areas have also begun to adopt fieldbus.

The Foundation Fieldbus and Profibus have begun to clearly dominate the fieldbus markets. Both Foundation Fieldbus and Profibus have reached such a large market share that both buses will most likely remain also in the future.

The development of new fieldbuses has slowed down and it is unlikely that new fieldbus standards will appear in the near future to challenge the position of Foundation Fieldbus or Profibus. Recent co-operation between Foundation Fieldbus and Profibus suppliers will further strengthen the position of these two standards.

Fieldbus benefits for industry

Obviously process plants would not start utilizing fieldbus, if it would not offer them benefits compared to alternative systems. One important reason is the better return on investment. Although fieldbus hardware may cost the same as conventional, or even a little bit more, the total installation costs for a fieldbus factory is far less than conventional. This is caused by many reasons, such as reduction in field wiring, lower installation labour cost, less planning/drawing costs, and no need for conventional I/O subsystems.

Another big advantage is the on-line self-diagnostics that helps in predictive maintenance and eventually reduces the downtime, offering maintenance savings. Remote configuration also helps to support reduced downtime. The improved system performance is important criteria for some plants. There are also other advantages compared to conventional instrumentation.

Fieldbus transmitters must also be calibrated

The main difference between a fieldbus transmitter for pressure or temperature and conventional or HART® transmitters is that the output signal is a fully digital fieldbus signal.

The other parts of a fieldbus transmitter are mainly comparable to conventional or HART® transmitters. Changing the output signal does not change the need for periodic calibration. Although modern fieldbus transmitters have been improved compared to older transmitter models, it does not eliminate the need for calibration. There are also many other reasons, such as quality systems and regulations that make the periodic calibrations compulsory.

Calibrating fieldbus transmitters

The word "calibration" is often misused in the fieldbus terminology when comparing it to the meaning of the

word in metrology. In fieldbus terminology, "calibration" is often used to mean the configuration of a transmitter. In terminology pertaining to metrology, "calibration" means that you compare the transmitter to a traceable measurement standard and document the results. So it is not possible to calibrate a fieldbus transmitter using only a configurator or configuration software. Also, it is not possible to calibrate a fieldbus transmitter remotely.

Fieldbus transmitters are calibrated in very much the same way as conventional transmitters - you need to place a physical input into the transmitter and simultaneously read the transmitter output to see that it is measuring correctly. The input is measured with a traceable calibrator, but you also need to have a way to read the output of the fieldbus transmitter. Reading the digital output is not always an easy thing to do. When fieldbus is up and running, you can have one person in the field to provide and measure the transmitter input while another person is in the control room reading the output. Naturally these two people need to communicate with each other in order to perform and document the calibration.

While your fieldbus and process automation systems are idle, you need to find other ways to read the transmitter's output. In some cases you can use a portable fieldbus communicator or a laptop computer with dedicated software and hardware.

In many cases, calibrating a fieldbus transmitter can be cumbersome, time-consuming and may require an abundance of resources. Until now, no practical way to calibrate fieldbus transmitters has existed.

What is intrinsically safe calibration?

By definition, intrinsic safety (IS) is a protection technique for safely operating electronic equipment in explosive environments. The concept has been developed for safely operating process control instrumentation in hazardous areas. The idea behind intrinsic safety is to make sure that the available electrical and thermal energy in a system is always low enough that ignition of the hazardous atmosphere cannot occur. A hazardous atmosphere is an area that contains elements that may cause an explosion: source of ignition, a flammable substance and oxygen.

Hazardous area classifications in IEC/European countries are:

Zone 0: an explosive gas & air mixture is continuously present or present for a long time.
Zone 1: an explosive gas & air mixture is likely to occur in normal operation.
Zone 2: an explosive gas & air mixture is not likely to occur in normal operation, and if it occurs it will exist only for a short time.

A hazardous atmosphere is an area that contains elements that may cause an explosion.

An intrinsically safe calibrator is therefore designed to be incapable of causing ignition in the surrounding environment with flammable materials, such as gases, mists, vapors or combustible dust. Intrinsically safe calibrators are also often referred to being "Ex calibrators", "calibrators for Ex Areas", or "IS calibrators". An Ex Area also refers to an explosive environment and an Ex calibrator is a device designed for use in the type of environment in question.

Where is intrinsically safe calibration required?

Many industries require intrinsically safe calibration equipment. Intrinsically safe calibrators are designed for potentially explosive environments, such as oil refineries, rigs and processing plants, gas pipelines and distribution centres, petrochemical and chemical plants, as well as pharmaceutical plants. Basically, any potentially explosive industrial environment can benefit from using intrinsically safe calibrators.

What are the benefits of using intrinsically safe calibrators?

There are clear benefits in using intrinsically safe calibration equipment. First of all, it is the safest possible technique. Secondly, the calibrators provide performance and functionality.

Safest possible technique. Intrinsically safe calibrators are safe for employees, as they can be safely used in environments where the risk of an explosion exists. In addition, intrinsically safe calibrators are the only technique permitted for Zone 0 environments (explosive gas and air

mixture is continuously present or present for a long time).

Performance and functionality. Multifunctional intrinsically safe calibrators provide the functionality and performance of regular industrial calibration devices, but in a safe way. They can be used for calibration of pressure, temperature and electrical signals. A documenting intrinsically safe calibrator, such as the Beamex® MC5-IS, provides additional efficiency improvements with its seamless communication with calibration software. This eliminates the need of manual recording of calibration data and improves the quality and productivity of the entire calibration process.

Are intrinsically safe calibrators technically different from regular industrial calibrators?

Intrinsically safe calibrators are different from other industrial calibrators in both design and technical features. In view of safety, there are also some guidelines and constraints for how to use them in hazardous areas. Every intrinsically safe calibrator is delivered with a product safety note, which should be read carefully before using the device. The product safety note lists all the "do's and don'ts" for safe calibration.

The differences in design and technical features were made with one purpose in mind–to ensure that the device is safe to use and is unable to cause an ignition. The surface of the device is made of conductive material. The battery of an intrinsically safe calibrator is usually slower to charge and it discharges quicker. Many times intrinsically safe equipment operate only with dry batteries, but the Beamex® intrinsically safe calibrators operate with chargeable batteries. When charging the battery, it must be done in a non-Ex area. External pressure modules can be used with IS-calibrators, but they must also be intrinsically safe. There are also usually small differences with electrical ranges compared to regular industrial calibrators (e.g. maximum is lower).

Making a calibrator safe and unable to cause ignition – typical technical differences:

- Surface made of conductive material
- Constraints in using the device (listed in Product Safety Note)
- Small differences with electrical ranges (e.g. maximum is lower)
- Battery slower to charge, quicker to discharge
- Battery must be charged in a non-Ex area
- When using external pressure modules, they must be IS-versions

What are ATEX and IECEx?

ATEX ("ATmosphères EXplosibles", explosive atmospheres in French) is a standard set in the European Union for explosion protection in the industry. ATEX 95 equipment directive 94/9/EC concerns equipment intended for use in potentially explosive areas. Companies in the EU where the risk of explosion is evident must also use the ATEX guidelines for protecting the employees. In addition, the ATEX rules are obligatory for electronic and electrical equipment that will be used in potentially explosive atmospheres sold in the EU as of July 1, 2003.

IEC (International Electrotechnical Commission) is a nonprofit international standards organization that prepares and publishes International Standards for electrical technologies. The IEC TC/31 technical committee deals with the standards related to equipment for explosive atmospheres. IECEx is an international scheme for certifying procedures for equipment designed for use in explosive atmospheres. 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.

As Beamex® MC5-IS Intrinsically Safe Multifunction Calibrator is certified according to ATEX and the IECEx Scheme, it ensures the calibrator is fit for its intended purpose and that sufficient information is supplied with it to ensure that it can be used safely.

Is service different for intrinsically safe calibrators?

There are certain aspects that need special attention when doing service or repair on an intrinsically safe calibrator. The most important thing to remember is that an intrinsically safe calibrator must maintain its intrinsic safety after the service or repair. The best way to do this is to send it to the manufacturer or to an authorized service company for repair. Recalibration can be done by calibration laboratories (still preferably with ISO/IEC 17025 accreditation).

A hazardous atmosphere is an area that contains elements that may cause an explosion.

Safe fieldbus calibration with the Beamex® MC5-IS Intrinsically Safe Multifunction Calibrator

The Beamex® MC5-IS Intrinsically Safe Multifunction Calibrator is a high accuracy, all-in-one calibrator for extreme environments. Being an all-in-one calibrator, the MC5-IS replaces many individual measurement devices and calibrators. The MC5-IS is also ATEX and IECEx certified. The MC5-IS has calibration capabilities for pressure, temperature, electrical and frequency signals. It is a documenting calibrator, which means that it communicates seamlessly with calibration software. Using documenting calibrators with calibration software can remarkably improve the efficiency and quality of the entire calibration process. The MC5-IS also has HART® communication. The MC5-IS can also be used for calibrating Foundation Fieldbus H1 or Profibus PA transmitters.

Beamex® MC5-IS offers the safest possible technique for calibrating fieldbus transmitters.

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