Best Practices for Reducing Transmitter Life Cycle Costs

RESULTS

- Eliminate on-site calibration and lower total installed costs by purchasing calibrated transmitters
- Eliminate unnecessary calibration and minimize maintenance costs through extended calibration frequencies
- Properly maintain calibration records to prove device stability

OVERVIEW

Pressure and temperature instrumentation users understand the importance of an accurate, repeatable measurement; thus they often scrutinize reference accuracy and installed performance as the basis for purchasing decisions. But what happens to the performance of the device after day one? Long term stability, a measure of transmitter drift over time, is another critical factor to consider.

While long term stability specifications for pressure and temperature instrumentation have steadily improved over the years, device users have been challenged on how to take full advantage of these performance improvements. Plant instrument calibration intervals typically occur more frequently than the manufacturer's minimum recommendation. These calibration intervals were set long ago and were based on considerably less-stable devices. Establishing new best practices for purchasing and maintaining pressure and temperature instrumentation allows users to take advantage of stability improvements and significantly reduce transmitter life cycle costs.

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BEST PRACTICE #1: PURCHASE CERTIFIED FACTORY CALIBRATED TRANSMITTERS TO ELIMINATE ON-SITE CALIBRATION

A common practice for users within the process industry is to purchase pressure and temperature transmitters and recalibrate them out of the box with their own equipment. Transmitters on the market today have accuracies of 0.04% for pressure and 0.1°C for temperature, or better. To ensure the accuracy of the device, equipment for calibration must meet the following requirements:

- Pressure source/temperature source is calibrated and traceable to a known standard (e.g. NIST).
- Pressure source/temperature source is at least 4:1 higher performance than the device being calibrated (which follows the ANSI Z540 requirements).
- All equipment used (multimeter, pressure/temperature source and load resistor) is calibrated to known standards and is on regular calibration intervals.

Finding a pressure or temperature source which is four times more accurate than the device being calibrated is extremely difficult and expensive. Most plants do not have equipment of this caliber. Thus, calibrations performed on-site often result in device performance degradation. Alternatively, users may choose to send devices out to be calibrated, which is costly and, often times, inconvenient.

Emerson Process Management calibrates 100% of its pressure and temperature devices prior to shipment. In addition, Emerson Process Management also offers a calibration certificate (option Q4) to accompany the transmitter. This calibration certificate documents that the transmitter meets its published accuracy specification. Emerson Process Management also offers a calibration certificate and tamper evident seal (option QP). After calibration is complete, the transmitter is placed in a box and tamper evident tape is placed around the box, “gift-wrap” style, prior to shipment. This tamper evident tape is proof that the package has not been opened and that the device has not been altered in any way. The user can store the device secure in the box until installation. In most cases, there is no need to recalibrate the device. However, for pressure devices, the user should verify functionality at the minimum, maximum, and mid-point of the desired output range. A zero trim is recommended immediately after installation to compensate for mounting position or static line pressure effects.

Purchasing calibrated devices from Emerson Process Management with either the Q4 or QP option is a best practice and will reduce total installed costs by eliminating costly on-site calibration.

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BEST PRACTICE #2: EXTEND CALIBRATION FREQUENCY TO MINIMIZE MAINTENANCE COSTS

Transmitters on the market today have up to 10-year stability guarantees to extend the frequency of calibration without sacrificing measurement accuracy and repeatability. There are two different methods that can be used to take advantage of these stability specifications, calculated and proven extensions.

Method #1: Calculated Extensions

One method used to extend calibration frequencies is to calculate the installed performance of the device and compare it against measurement performance requirements. The accepted method of determining installed performance is to perform a root-sum-square calculation of the environmental effects on the transmitter. For pressure, this includes the device's reference accuracy, ambient temperature effect, static line pressure effect, and stability. For temperature, this includes reference accuracy, ambient temperature effect, sensor effects, and stability. After installed performance is calculated, the user can compare this value to the acceptable performance level to determine how frequently the device needs to be calibrated. The graphs below show high performing transmitters, such as the Rosemount 3051S Pressure Transmitter and Rosemount 3144P Temperature Transmitter vs. typical smart transmitters on the market today. As illustrated below, the typical smart transmitter requires multiple calibrations over a 10-year period for pressure and over a 5-year period for temperature, while the 3051S and 3144P require just one calibration.

A potential drawback with this method is that the user will need to make multiple calculations as performance requirements may vary, depending on the application.

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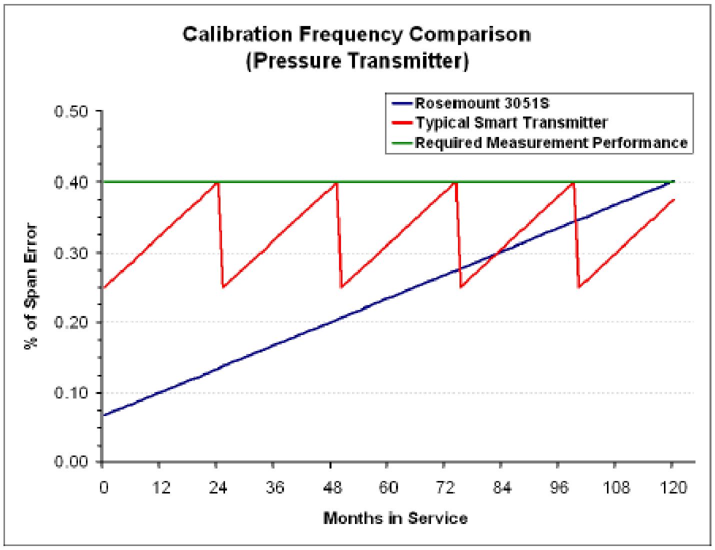

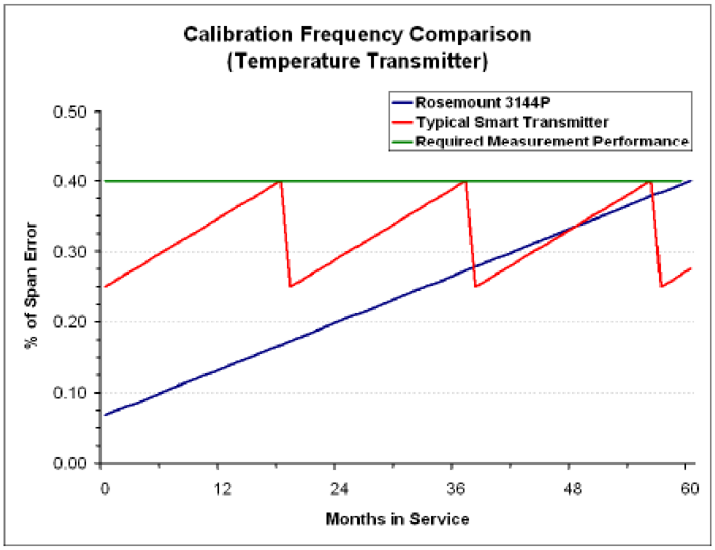

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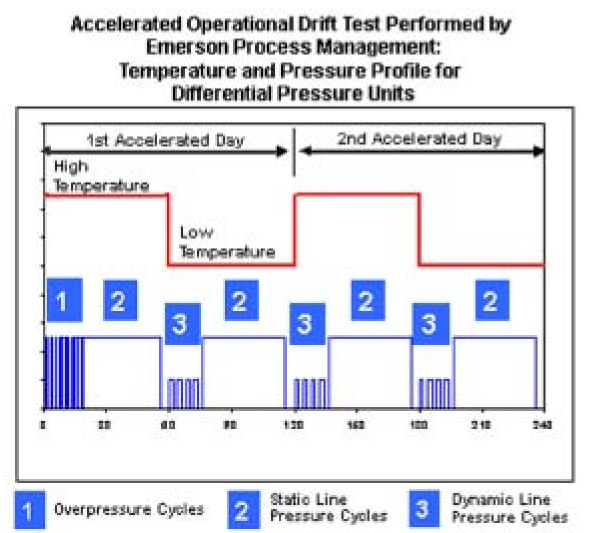
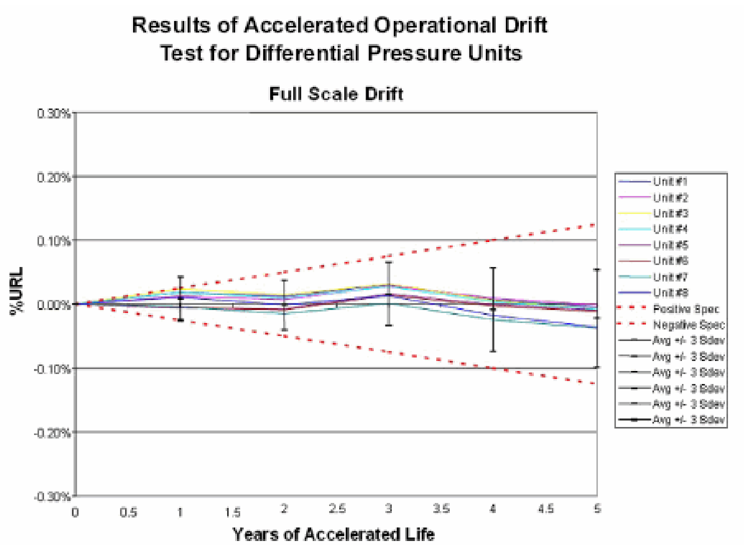
Method # 2: Proven Extensions

A second method for extending calibration frequencies is to use the instrumentation supplier's stability testing records, accompanied by plant calibration/verification records to "prove" that the device does not require calibration. Using the supplier's stability testing records as basis alone for extending calibration frequencies should be done with caution. Most instrument suppliers today perform stability testing in accordance with IEC 770, which defines transmitter stability as the transmitter's change in output given a fixed input as a function of time. Typical testing per IEC 770 is as follows:

- The output of the device is monitored for 30 days with a steady input signal corresponding to 90% of span, where practical.
- Zero and span are measured and recorded immediately before and after the 30-day test period to determine error.
- Testing is performed at constant temperature and pressure.

Because IEC 770 testing is not representative of "real-world" conditions, Emerson Process Management expanded the standard IEC 770 testing to include the effects of process conditions, ultimately developing an accelerated operational drift test. During the test, units experience temperature, pressure, and power cycling typically seen in plant environments. Unit aging is accelerated by elevating the test temperature 60°F and increasing pressure and power cycle frequency, simulating five years of outdoor service in approximately five months of testing. The following graphics are examples of accelerated pressure tests and results. Temperature tests use the same basic principles to obtain its accelerated drift analysis. This method for stability verification includes "real-world" conditions and provides a solid foundation for considering extended calibration frequencies.





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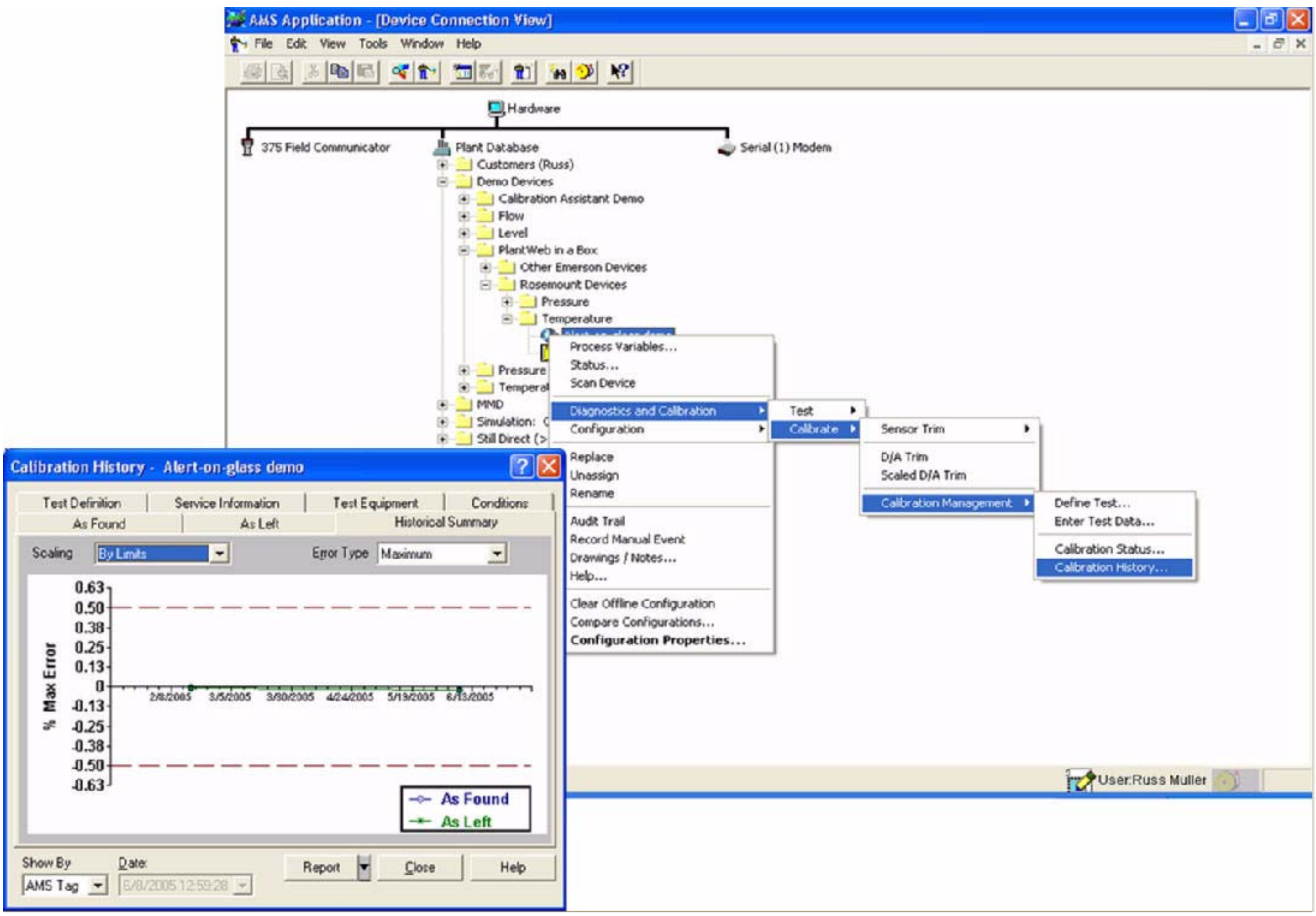
BEST PRACTICE #3: PROPERLY MAINTAIN CALIBRATION RECORDS TO PROVE DEVICE STABILITY

For certain plants, documentation of testing completed at the supplier's manufacturing facility provides sufficient evidence to move out calibration frequencies. Other plants follow a plant standard for calibration intervals, such as every six months, or they are under strict jurisdiction by regulatory agencies, such as the U.S. Food and Drug Administration (FDA). These plants require significant justification to extend calibration intervals. In these cases, plant calibration records can be used to "prove" the stability of any given device.

Emerson Process Management provides AMS™ Suite: Intelligent Device Manager software to help users easily obtain and maintain calibration data.

Plant calibration records typically containing "As Found" or "As Left" data, can be analyzed to determine when the device was calibrated and if it is still within specification. Unfortunately, this can be an overwhelming and costly task. Emerson Process Management provides AMS™ Suite: Intelligent Device Manager software to help users easily obtain and maintain this important calibration data, as shown below.



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By taking advantage of the improvements in transmitter stability, users can implement best practices to reduce transmitter life cycle costs.

The next step is to present these findings, which form the basis for extending calibration intervals, to other cross-functional groups and management. It is up to the user to determine which areas adopt the new calibration intervals given there may be non-critical, critical, and safety areas.

By taking advantage of the improvements in device stability, users can implement best practices to reduce transmitter life cycle costs:

- Purchase certified factory calibrated pressure and temperature transmitters to eliminate on-site calibration and lower total installed costs.
- Extend calibration frequencies to eliminate unnecessary calibration and minimize maintenance costs.
- Obtain plant calibration data with AMS™ Suite: Intelligent Device Manager software to better maintain calibration records and avoid unnecessary recalibrations.

Implementation of these best practices will lead to significant savings in installation and maintenance costs each year.

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