

CALIBRATION

of Process Instrumentation

What is Calibration?

There are many definitions of calibration, most more complicated than the process itself. In its simplest form calibration is: *The process of comparing an instrument's accuracy to known standards and adjusting it to meet those standards.* Typically, calibration of an instrument is checked at several points throughout its calibration range. The calibration range is the region between limits within which a quantity is measured, received or transmitted. The limits are defined by zero and span values specific to that instrument.

Why Calibrate?

Newly installed instruments are calibrated, to be certain that the instrument is providing accurate response, indication or output signal. Over time, instrument error can occur due to: sensor drift, vibration, moisture, temperature changes, power fluctuations, power surges, process changes, and degradation of electronic components. The process in which the instruments are operating is dependent upon accurate, reliable inputs and outputs within the control system. Without accurate information the system performance will suffer; *garbage-in = garbage-out.*

Calibration Procedure:

There are two general categories of calibration in the world of process controls:

Loop calibration: Loop calibration is performed by disconnecting the transmitter and connecting a known standardized signal into the loop. All instruments in the loop are recorded and compared to the transmitted value for error and adjusted as necessary to within the specified tolerance.

Individual instrument calibration: Individual instrument calibration is performed on a single instrument, removed from the loop. The input and output are disconnected, a known standardized signal or source is applied to the input and the output is measured at various data points throughout the calibration range. If necessary, the unit is adjusted to meet the specified tolerance.

Accuracy and Tolerance:

Accuracy is defined as: The ratio of error to the reading or the full scale output, expressed in percent of reading or percent of full scale. For example; if the manufacturer's stated accuracy is 1% *of full scale*, then a 0-100psi pressure transmitter could have an error of 1psi at any point over its entire range. However, if the manufacturer's stated accuracy is 1% *of the reading*, the same pressure transmitter could have an error of 1psi at 100% output, a .5psi error at 50% output and a .01psi error at 1% output.

Tolerance is defined as: The permissible deviation from a specific value, expressed in measurement units, percent span or percent of reading.

Calibration Maintenance:

A program of routine calibration is important to ensure proper performance of the process control system. Each instrument should be documented including: manufacturer, model number, serial number, specified accuracy, acceptable tolerance, date of installation, startup, calibration frequency, last calibration, calibration procedures, standards used, etc. A calibration report should be used when performing calibrations and should remain on file for future reference. Above all, the control system technician, performing the calibration must understand the process, pay great attention to detail when following calibration procedures and in preparing accurate concise documentation.