

# The hidden cost of “low cost” calibrations

## Application Note

The decision to purchase a calibration service is often based on price alone. This price-only approach to purchasing can be a Trojan horse, hiding unexpected costs and a multitude of problems. This overview presents information to help you evaluate your calibration service providers' calibration offerings and why the lowest cost calibration may not offer the best value.

### Manufacturers' recommended calibration procedures

Quality manufacturers of electronic test equipment publish calibration procedures for their instruments. These procedures specify uncertainty levels for calibration sourcing equipment, as well as pre-calibration steps to ensure proper calibration. Most importantly, the procedures specify the calibration points selected by the instrument design engineers. These carefully selected points are required to verify the operation of the instrument throughout its entire operating range.

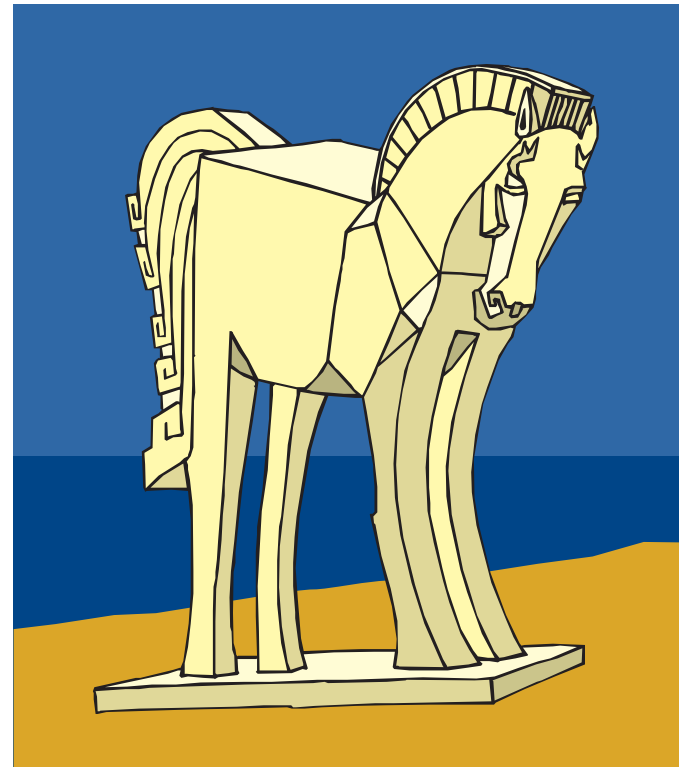
### How do operating points shift within an instrument?

The job of most measuring equipment is to transform some physical parameter such as voltage, resistance, or temperature into a number that corresponds to the value being measured, with a high degree of accuracy. In order to achieve this feat, electronic instruments have a multitude of interdependent circuits that perform various functions, designed to reach an accurate representation of that parameter.

In a perfect world, all electronic components would retain their original value. However, aging components, such as capacitors, analog integrated circuits and resistors all have the capacity to change with age, heat and contamination. Humidity on PC boards inside the instrument can cause subtle-to-significant circuit malfunctions throughout an instrument's analog operating range, which is why all manufacturers specify a humidity operating range. Humidity can carry with it contaminants that can remain on the PC board long after the humid condition recedes. Often, these contaminants can create errant signals that may appear as a non-linearity or slight oscillations somewhere within the instrument's signal measuring or sourcing range.

### What is included (and not included) in a low cost calibration?

Like many businesses, calibration houses operate and compete on margin. Investment in high quality calibrators and quality personnel are not often high on the list of a “low cost” calibration lab. The less



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time they spend calibrating an instrument, the less they need to charge and the more competitive they appear to be, at least to the casual observer.

One cost saving method used in a “low cost” calibration is to calibrate using “face specs,” or specifications found on an instrument's data sheet or label. Data sheets usually offer only high and low values, enough to enable consumers to evaluate an instrument's range and performance while making a purchasing decision. The

calibration procedures in the service manual for this same instrument are much more comprehensive and include the entire scope of calibration points selected by the design engineers. While there is currently, no regulation preventing the issuance of a calibration certificate using “face specs,” metrology professionals recognized that doing so breaches the trust of what customers expect to receive in a certificate of calibration.

Low cost calibration facilities may also reduce calibration time and increase margins by “short cutting” manufacturers’ procedures. The most tempting procedure to bypass is warm-up time. Some manufacturers’ procedures call for warm-up times of one hour or more before performing calibration. Reducing this wait time to 10 minutes saves time but as you might guess, the calibration integrity suffers.

To show an example of the potential shortfalls for the customer in a “low cost” calibration, let us look at a calibration of a Fluke 744 Documenting Process Calibrator. The Fluke 744 calibrator is a field documenting process calibrator with multiple parameters and ranges for both sourcing and measuring. A complete factory-recommended calibration requires 150 separate measurements to verify proper operation of this field calibrator. If an adjustment is needed during the calibration, the 150 points must be rechecked before the calibration can be concluded and a certificate issued.

A “low cost” calibration may simply skip the factory recommended calibration procedure, certifying this instrument as calibrated with as little as 10 “improvised” calibration points.

If this example Fluke 744 had a problem caused by some of the component value shift issues mentioned earlier, the chances are high that the non-linearity would not have been caught during calibration, but you would still have received a certificate of calibration from your provider and placed your calibrator back into service at your company.

### The real costs

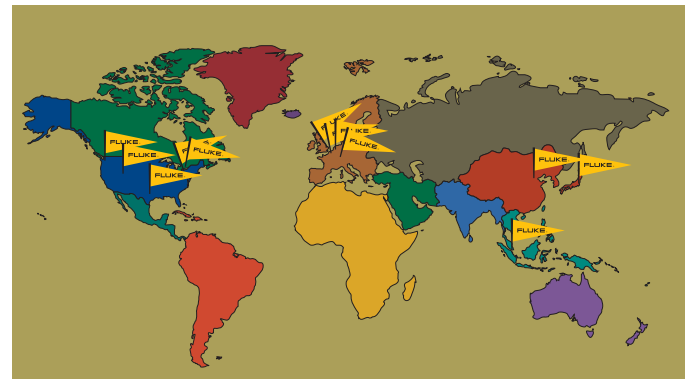
Because the Fluke 744 in this example is itself a calibrator, these errors will perpetuate throughout your facility and may well affect the quality of your product with resulting costs that could range from unfortunate to astronomical. The effects may lead to poor market image, full product recall or even litigation—all stemming from a poorly calibrated instrument. Yet you received a “calibration sticker” on your Fluke 744 from a “qualified lab.” Were they doing something illegal or wrong? No, they were just giving you what you paid for, a “low cost” calibration.

As the person responsible for your company’s measurement quality, you need to know your calibration provider’s philosophy on minimum point calibrations.

### How do you know if you are getting a quality calibration?

Talk to your calibration supplier. Ask if they measure all manufacturers’ recommended calibration points and follow manufacturer’s recommended calibration procedures. Ask to see a copy of the manufacturer’s calibration instructions for the instrument you intend to have calibrated. Ask if

they have their own in-house quality assurance program. If you want or need to have written backup for the calibration, ask for a “calibration with data,” which is a common method of providing all measured data taken during the calibration. If that information is not available, you may want to reconsider the value they are providing for the price and decide if the potential hidden costs are worth it to your company.



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