

# HART® Transmitter Calibration

## Engineer's Notebook

### Introduction

In today's process plants, most new field instruments are smart digital instruments. Smart implies a microprocessor-based instrument with extra functionality and digital compensation. These instruments generally offer better accuracy, long-term stability, and reliability than conventional analog instruments.

The most common class of smart instruments incorporates the HART protocol, with more than five million instruments in use. HART, an acronym for Highway Addressable Remote Transducer, is an industry standard that defines the communications protocol between smart field devices and a control system that employs traditional 4-20 mA wiring.

Two capabilities are required to properly service HART instruments: precision analog source and measure capability and digital communication capability. Until recently, this required two separate tools, a calibrator and a communicator. Today, the capabilities of those two tools are available in a single HART Documenting Process Calibrator.

### HART calibration is required!

A common misconception is that the accuracy and stability of HART instruments eliminate the need for calibration. Another misconception is that calibration can be accomplished by re-ranging field instruments using only a HART communicator. Still another misconception is that the control system can remotely calibrate smart instruments. These are not true. All instruments drift. Re-ranging with just a communicator is not calibration. A precision calibrator or standard is required. Regular performance verification with a calibrator traceable to national standards is necessary due to:

1. Shifts in performance of electronic instruments over time, due to exposure of the electronics and the primary sensing element to temperature, humidity, vibration, and other field environmental factors.
2. Regulations governing occupational safety, consumer safety, and environmental protection.
3. Quality programs such as ISO 9000 standards for all instruments that impact product quality.
4. Commercial requirements such as weights, measures and custody transfer.

A calibration procedure consists of a verification (As Found) test, adjustment to within acceptable tolerance if necessary, and a final verification (As Left) test if an adjustment has been made. Data from the calibration is collected and used to complete a report of calibration, documenting instrument performance over time.

### How are HART instruments properly calibrated?

To calibrate a HART instrument consistent with its application, it is very helpful to understand the functional structure of a typical HART transmitter. HART instruments consist of three distinct sections (see Figure 1).

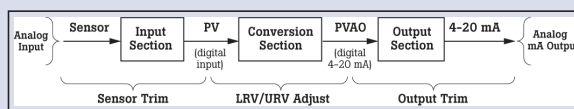


Figure 1

Proper HART calibration may involve either or both sensor trim and output trim. Adjusting range values (LRV and URV) without a calibrator is not calibration.

Sensor trim involves applying a known process variable (temperature or pressure for example) to the input of the transmitter and adjusting the Input Section so the PV agrees with the input applied.

Output trim involves commanding the transmitter to output both a 4 and 20 mA signal. These signals are then measured with a precise mA measurement tool. The Output Section is then adjusted to agree with the measurements.

### New tool speeds calibration

Today, instrument maintenance is moving out of the shop and into the field. This reduces process interruptions and avoids the time and expense of returning instruments to the shop. Portable communicators and calibrators are often used together to complete field calibrations. However, the desire to carry less equipment and to perform maintenance in the field has created a need for a new class of calibration tool.

### Leave the Communicator in the Shop!

The Fluke-744 HART Calibrator requires no external box or communicator for everyday HART field calibration and maintenance. It supports many popular models of HART transmitters, with more device-specific command support than any other HART field calibrator. With the 744, you can:

- Interrogate HART devices to determine type, manufacturer, model, tag-ID, PV, and PVAO
- Perform automated HART sensor trim and output trim for selected devices
- Adjust ranging, damping, and other basic process-configuration settings
- Read and write HART tag and message fields to re-label smart transmitters
- Change sensor configuration on most temperature transmitters
- Clone additional transmitters with basic HART configuration data

Content for this article contributed by Fluke

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