Beamex

Calibration White Paper

www.beamex.com
info@beamex.com

Getting the most from the HART handheld device

beamex
WORLD-CLASS CALIBRATION SOLUTIONS™

Getting the most from the HART handheld device

A device like the Beamex MC6 offers the highest functionality and automation for configuration and calibration of wired or wireless HART transmitters.

A HART handheld is an essential tool in plants deploying HART instrumentation. But what is a HART handheld? What are the differences between various handheld brands and what are the practical considerations that should be taken into account when selecting one? Finally, how does one get the most from the HART handheld?

The difference between calibration and configuration

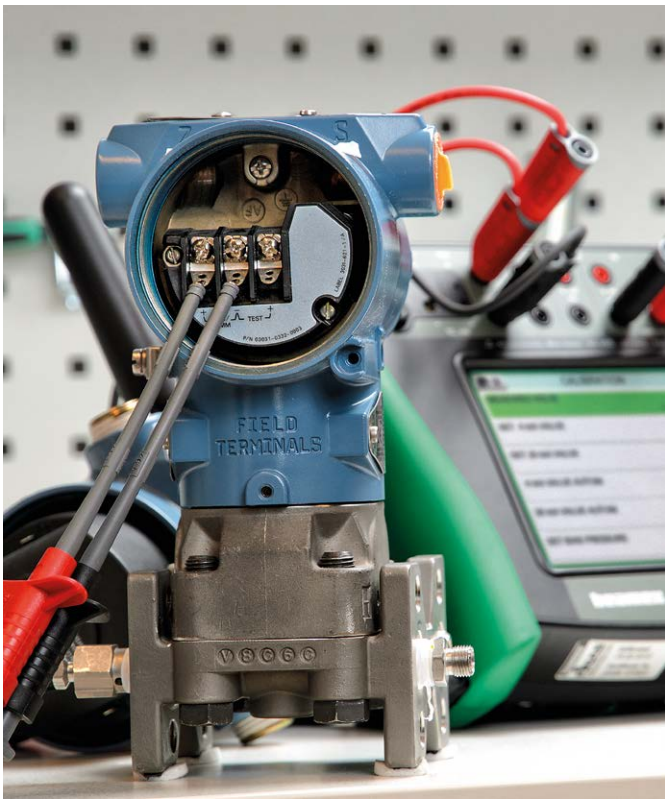
Before beginning a discussion on HART handhelds, it is important to take a short look into a terminology issue that often causes confusion – that is the meaning of and difference between *configuration* and *calibration*.

According to international standards; *calibration* is a comparison of the device under test against a traceable reference instrument (calibrator) and documentation of this comparison. Although, formally, the calibration does not include any adjustments, in practice the possible adjustment is often included in the process of calibration. So, in order to do a calibration of a HART device, a traceable metrological reference device (calibrator) is needed.

Configuration means using the digital communication protocol to change settings inside the field device. Configuration can be done with a configuration software or handheld communicator. It is important to remember that a communicator alone cannot be used for metrological calibration to check the accuracy of a field device. Configuring parameters of a HART transmitter with a communicator is not metrological calibration and it does not assure accuracy. For a real metrological calibration, a traceable reference standard (calibrator) is always needed. Configuration is not the same as calibration.

HART integration into a plant

There are different ways and levels of integrating the HART protocol into a plant. The simplest integration would be to continue using the standard analog control system and use HART instrumentation that is configurable via HART communication (a handheld device or "communicator"). Another way would be to use an analog control system, but have another digital asset management system that uses the HART protocol to gather diagnostic and other valuable information from field instruments. The highest level of integration would be to use a fully HART enabled ecosystem from the field devices to the control system via all-digital signals with no analog mA signals.



For a real metrological calibration, a traceable reference standard (calibrator) is always needed.

How to calibrate a HART transmitter

It is good to remember that a HART transmitter has different outputs that can be used and calibrated; that is, the analog mA output and the digital HART output(s). In most cases, the analog output is still being used among end users.

In order to calibrate the analog output, the transmitter input signal needs to be generated or measured while simultaneously measuring the transmitter output. For example, generate a pressure input, measure that accurately with a calibrator and at the same time measure the analog mA output with a meter.

If calibrating the digital HART output, the calibration process alters slightly. The generation/measurement of the transmitter input in the same way as for an analog transmitter using a calibrator is still needed.

However, to be able to see what the transmitter digital HART output is, some kind of HART communicator showing the digital HART signal is required.

In the case of analog or digital output, one would go through the range of the transmitter at a few intervals and record the input and output signals to document the calibration. If there are too many errors found during the calibration, the transmitter is trimmed via HART protocol and a new calibration performed.

Practical considerations for the HART handheld

For the configuration of HART transmitters, it is possible to use a PC with a HART modem and related software, but it is often more practical to use a mobile handheld HART communicator. This article will focus on the handhelds.

If one wants to work with a HART transmitter that is not connected to field supply voltage, some kind of power supply to power up the transmitter is needed. Some HART handhelds do not have a built-in loop supply, so there should be an external loop supply with required impedance (nominally 250 ohms) for the HART communication to work. However, some handhelds do have a built-in loop power supply as well as built-in impedance, meaning that no additional equipment to communicate is required. If configuration or calibration of transmitters occurs before installation in the field, power is taken from the DCS (distributed control system).

With the Beamex MC6, you can generate/measure the HART transmitter's input at the same time as the analog or digital output is read.

In a case where a transmitter is connected in the field to the power supply coming from DCS, no additional power supply device is needed. However, it is important to remember that the loop supply coming from the DCS does not always include the required impedance for the HART communication to work, especially if the control system is made for analog signals. If the handheld operates according to the HART standard specification, its communication signal level must not be too low (due to excessively low impedance), as that could be noise instead of a real, reliable signal. In that case, additional impedance to the loop may need to be added. While connected to the transmitter in the field, physical connection at the transmitter is not needed. The connection can be anywhere in the loop of the transmitter.

Functionality of a HART handheld

There are two important aspects of a Device Description (DD) published by HART Communication Foundation (HCF) and the available commands of a HART handheld. Some handhelds only support a limited amount of HART devices and commands, while others support all of the HART devices and full command structure of the DD file, including Methods. The support for all of the device-specific advanced features requires support for the entire DD structure. Therefore, it is important to ensure that the chosen handheld supports the installed and future HART device base.

The availability and pricing for the future updates of the DDs for new transmitters vary. If restricted only to the Universal Commands, limited support is offered. Differences also exist between handhelds in the support for the HART methods. These methods are like small "wizards" built in the DD file making it easier to do several configuration steps.

Measuring mA signal

As the HART transmitter is most often used with the analog mA signal, a device for measuring the mA signal is required. If the handheld does not have mA measurement functionality, another device for the mA measurement needs to be used. Some handhelds offer accurate mA measurements, but many of them do not. The mA measurement is also something that needs to be measured if a calibration of the transmitter's mA output is desired.

When HART transmitters are calibrated, it is good to remember that output should be measured, whether it is an analog mA signal or digital variable. It is also important to remember that in order to calibrate, a traceable reference standard (calibrator) is required to measure or source the transmitter's input. If the handheld does not offer this functionality, an additional calibrator device for the calibration will be needed.

Advanced HART handhelds

A few advanced handhelds even offer a fully multifunctional process calibrator in the same device as the HART handheld. These devices can be used not only for configuring but also for calibrating and trimming of HART devices, such as temperature and pressure transmitters. The typical procedure with these devices is that if there is a need for trimming after the first "As Found" calibration is done, the HART trim methods are run. After trimming the transmitter, a second calibration, "As Left", is performed.

Some handheld devices are documenting devices, so they can save the calibration results into memory and later upload results to PC software. Furthermore, some handhelds can also read and document the configurations from the HART device and upload this into a PC for archiving or printing.

Usability and the user interface are important features to consider when choosing a handheld, as there are differences in

the ease of use. Some devices are larger and some are smaller; some have a small display and some have a bigger. A touch screen user interface with color display is available in the most modern handhelds, such as in the Beamex MC6.

*Wireless*HART

The *Wireless*HART standard is the latest offer from HART. Although a *Wireless*HART instrument transmits wirelessly, it does have screw terminals and configuration and calibration is done via the screw terminals. Therefore, a handheld for *Wireless*HART transmitters does not need to be wireless. The handheld must, however, be able to support the HART 7 standard that the *Wireless*HART uses, and obviously the handheld must have the DD files to support the *Wireless*HART transmitter models that are used.

Durability and support

As the handheld is often used in field environments, the robustness and water/dust protection should be taken into account. While some handhelds seem to be simply based on standard Pocket PC's (made for office use), others are made for use in industrial applications and have good ratings for water and dust protection (IP or NEMA classification). Some handhelds are suitable for use in hazardous (Ex) areas – the Beamex MC5-IS is one of them.

Pocket PC-based handhelds are not necessarily suitable for industrial/factory field environments and they often do not have built-in HART modem; an external modem solution needs to be used. Typically they will not offer built-in loop supply/impedance either, so one may end up carrying several devices.

A handful of the most modern handhelds, the Beamex MC6 among others, have a multifunctional process calibrator and HART communicator in the same device, and offer field communication for FOUNDATION Fieldbus and/or Profibus devices as well.

After-sales support is a final element to take into account when comparing handhelds. All in all, there are many types of HART handhelds available on the market. Be sure to review the features and suitability for current and future needs.

Beamex MC6 advanced calibrator and field communicator

The new Beamex MC6 is a device combining a field communicator and a very accurate multifunctional process calibrator with documentation.

With the Beamex MC6, you can generate/measure the HART transmitter's input at the same time as the analog or digital output is read. Both can be done simultaneously and the results can be automatically stored into the MC6 memory for later reference or uploaded to calibration software.

For configuration of smart transmitters, the MC6 includes a field communicator for HART, *Wireless*HART, FOUNDATION Fieldbus H1 and Profibus PA protocols. All required electronics are built-in, including modems, power supply and required impedances for the protocols.

The Beamex MC6 can be used both as a communicator for configuration and as a calibrator for calibration of smart instruments with the supported protocols.

While a normal HART communicator can be used to configure and read the HART digital output, it alone cannot be used for calibration or trimming of the transmitter; an additional calibrator would be needed. This means that one ends up with two separate devices without any automatic calibration procedure or documentation. Therefore, a device like the Beamex MC6 offers the highest functionality and automation for configuration and calibration of wired or wireless HART transmitters.

To watch video demonstrations of a HART handheld, visit: http://www.youtube.com/beamexcalibration.