

## Buses 201

# Introduction to HART

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## Overview

### **HART® protocol has been around for a long time. Is it still a good choice?**

HART is one of several different communications protocols used in plant automation. Each has its strengths, but HART is the best overall solution for obtaining value-added device and diagnostic information in digital form while retaining compatibility with legacy 4-20 mA automation architectures.

This course gives a brief overview of the HART communication protocol. The two courses that follow describe how HART communication works, and when it makes sense to use this protocol in a project.

*Hint: As you go through the topics in this course, watch for answers to these questions:*

- *Why is HART called a "hybrid" protocol?*
- *What are three benefits of HART?*

## What is HART?

HART ("Highway Addressable Remote Transducer") is a communication protocol designed for industrial process measurement and control applications.

It's called a **hybrid** protocol because it combines analog and digital communication. It can communicate a single variable using a 4-20 ma analog signal, while also communicating added information on a digital signal. The digital information is carried by a low-level modulation superimposed on the standard 4-to-20 mA current loop.

The digital signal does not affect the analog reading because it's removed from the analog signal by standard filtering techniques.

The ability to carry this added digital information is the basis for HART's key benefits.

## Two-way communication

Using an analog signal, information is sent only one way, either from the device to the host (inputs) or from the host to the device (outputs).

Digital information, on the other hand, can travel in both directions using the HART digital communications signal.

This opens the way for an instrument that traditionally only receives control-signal information from a host — a valve controller, for example — to also send the host information about what's happening at the valve.

Similarly, a transmitter that traditionally only sends a process variable to the host can now also receive information such as configuration settings.

## New types of information

Traditional analog and discrete devices communicate only a single process variable — and you typically have no easy way to tell if the information they're sending is valid.

With HART, you still get the process variable — but other types of information, too.

As many as 35-40 information items are standard in every HART device. Examples include

- Device Status & Diagnostic Alerts
- Process Variables & Units
- Loop Current & % Range
- Basic Configuration Parameters
- Manufacturer & Device Tag

With additional information like this, HART devices that are digitally polled by a host can tell you if they're correctly configured and operating correctly. This eliminates the need for most routine checks — and helps you detect failure conditions before they cause a major process problem.

## Multivariable instruments

In digital mode, a single pair of wires can handle multiple variables. For example, one transmitter could handle inputs from multiple sensors.

For host systems that cannot use the HART digital information, information from multivariable instruments is often handled first by a device (called a tri-loop) that converts the digital information into multiple 4-20 mA signals that are then independently wired into the host.

## Vendor independence

With HART, there's no danger of getting locked into limited vendor-specific or regional "standards."

That's because HART technology isn't owned by an individual company, nor regulated by a single nation or standards body. Instead, the technology is managed by the independent, not-for-profit HART Communications Foundation.

## The PlantWeb advantage

HART is a prime example of Emerson's longstanding support for open, non-proprietary standards.



We developed the HART protocol in the late 1980s, then donated it to the industry so other companies could use it — and even more users could benefit.

## Breadth of supply

HART is currently the world's most broadly supported protocol for the process industry. Almost 600 HART-based products are available from different vendors.

This breadth of available products means there's likely to be a HART product for almost any process application — often more than one, from a choice of vendors.

## Interoperability

Interoperability simply means that HART-compliant devices and host systems, regardless of vendor, can work together.

Some host systems use universal and common-practice commands to work with HART devices. Others go a step farther by also using Device Descriptions to understand all HART messages.

Even hosts that aren't designed to handle the digital information from a HART device can still have control interoperability through the 4-20 mA analog signal.