

HART monitors extract data from smart instruments

Simple modules expand transmitter usefulness

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According to the HART Communications Foundation (www.hartcomm.org), more than 20 million HART-enabled instruments are installed in chemical and process plants worldwide, and nearly every process transmitter made today has an interface with a HART-enabled device.

A HART-enabled transmitter, valve positioner, flowmeter or other "smart device" imposes a digital signal on its 4-20 mA process signal. The HART digital signal often contains additional process measurements and other variables that may include instrument status, diagnostic data, alarms, calibration values and commands.

Many HART field transmitters are hard at work measuring process parameters, and producing 4-20 mA signals that are used for process control by a DCS, PLC or some other control system. In many cases, HART

instruments were installed simply because they could be configured and diagnosed easily with a handheld HART communicator device.

For a variety of reasons, the rest of the HART data often goes unused. One reason is because of the prohibitive cost of installing a plant-wide HART monitoring system. Another reason is the lack of familiarity with alternatives.

A simple and cost effective solution for gathering HART information is to use a HART interface device only in the specific instances where it is needed most. Fortunately, HART interface devices, available from several manufacturers, make acquiring HART data a fairly simple proposition. This HART data is then made available to the control system via analog signals, discrete outputs or serial communications.

Extracting HART data

A HART interface module can be installed across any

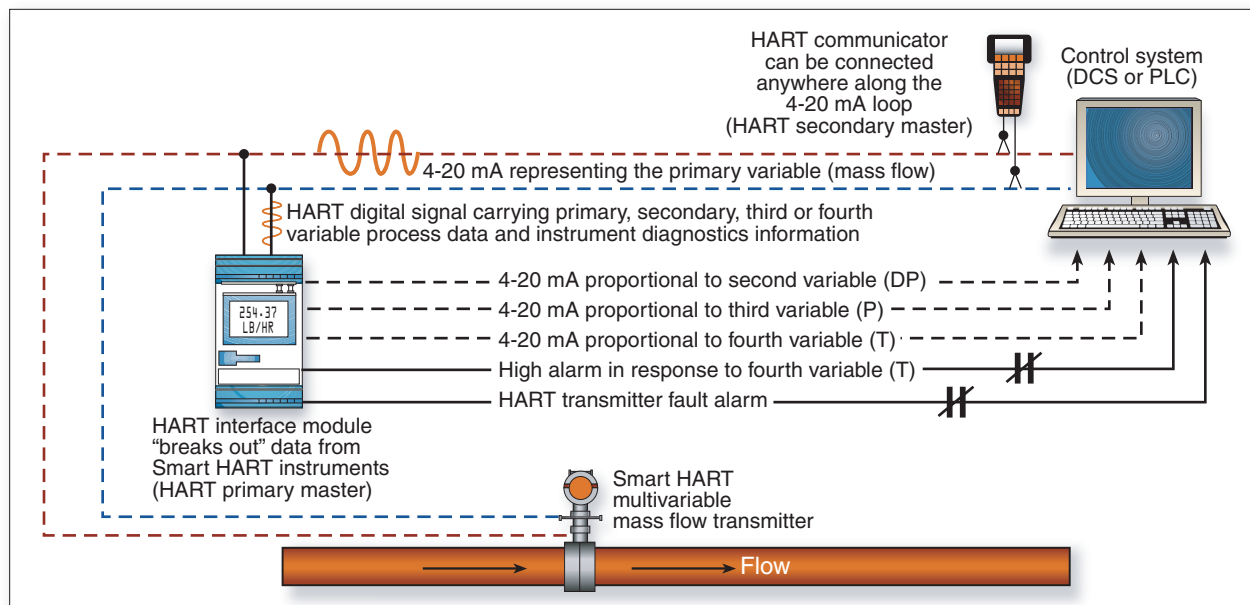


Fig. 1. A HART interface module connected to the 4-20 mA process signal can extract up to four process variables. The 4-20 mA signal containing the primary variable continues to the control system, while the additional process variables and diagnostic information can be sent to the control system as a MODBUS RTU signal or as three 4-20 mA signals and two digital signals.

termination point on a 4-20 mA process loop. The installation does not interfere with the 4-20 mA signal to the control system, nor does it interfere with a handheld HART communicator or a plant wide HART monitoring system if present. It can be used with any HART enabled field device.

In the case of a mass flow transmitter, the 4-20 mA signal carries the Primary Variable (flow) while the HART digital signal carries up to three additional process variables: typically temperature, pressure, differential pressure, density or raw flow; plus discrete data such as alarms and status (Fig. 1). Some HART instruments can generate a dozen or more variables, all carried by the digital HART signal.

The HART interface module is configured by the user to extract the variables of interest. The module in Figure 1 is configured to extract three process variables, a high alarm and a fault alarm.

Essentially, the HART interface monitor "strips out" the variables of interest from the HART digital signal; converts them to 4-20 mA and discrete signals; and sends the additional data to the process control system or other intelligent devices such as a PC or PLC.

Outputs from a HART interface module can be directly wired into the I/O rack of the control system as analog and digital signals, or they can be sent as a MODBUS RTU signal. The interface module can also be connected to a wireless device, for transmission via RF.

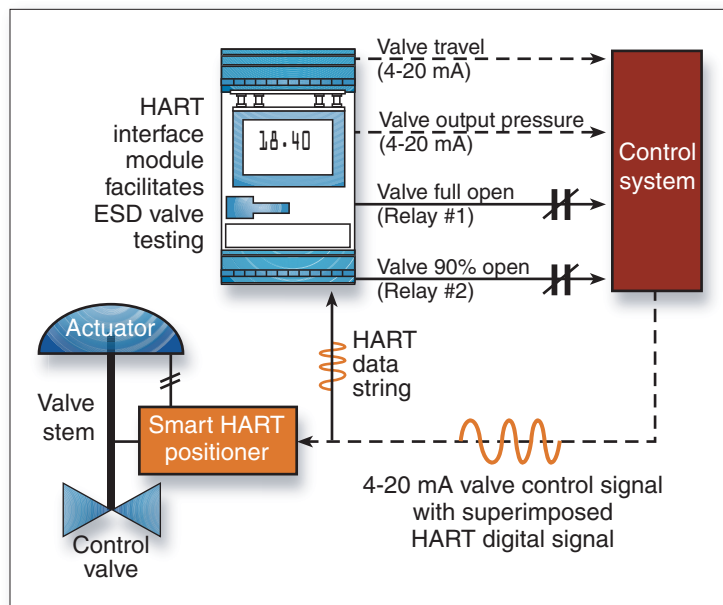


Fig. 2. By using a HART interface monitor, a control system can conduct a partial stroke test on an emergency shutdown valve without the need for limit switches or a technician.

Fig. 5. A HART concentrator system converts a HART digital signal to a serial communication protocol, permitting multiple smart HART-capable transmitters and valves to interface directly with MODBUS-based monitoring and control systems.



Advanced HART applications

The wide variety of HART interface modules on the market today allows engineers to assemble some interesting and useful HART applications. These creative applications include:

- **HART alarms** – HART-enabled instruments almost always have built-in diagnostics; the diagnostic information is contained in the HART digital signal. A HART alarm module can be installed across the 4-20 mA signal to monitor diagnostic data and sound an alarm when process conditions warrant it. A typical HART alarm module continually reads the HART diagnostic data, examines the field device status byte and sends a fault alarm to an annunciator or control system if it detects alarms such as "field device malfunction," "analog output saturated," "variable out of limits," etc.

- **Valve monitoring** – A HART alarm module can be connected to a HART valve positioner to monitor valve performance. Some HART alarm modules have multiple relay outputs that can be tied to specific valve diagnostic and position data. For example, the monitor can provide relay outputs to indicate open or closed valve position, low actuator pressure, positioner temperature or any other value that indicates valve problems. A HART monitor is a simple and effective way to get position feedback from a smart positioner without the expense of running additional signal wires to the positioner in the field.

- **Emergency shutdown valve testing** – Using the capabilities of HART and an appropriate HART monitor, partial stroke testing of emergency shutdown valves can be performed without the need for a technician standing by or the need to install limit switches. Instead, use a HART monitor to extract stem position from the HART data and send it to a PLC or DCS (Fig. 2). The controller then commands the valve to close, monitors data from the HART monitor to determine that the valve is closing and then opens it again, thus verifying that the valve works.

- **Monitoring multiple instruments** – HART instruments can be set up either individually – where a single HART transmit-

ter connects via a twisted wire pair to a control system; or in a multi-drop HART network – where up to 16 HART instruments communicate digitally over a single wire pair. For a multi-drop system, a HART “concentrator” can extract HART digital data from any or all 16 of the field instruments, and transmit the data to a control system via a MODBUS RTU connection (Fig. 3). This allows the control system to treat the 16 instruments almost like a field-bus system. Specifically, it can obtain primary process variables from the instruments on one wire pair and status, diagnostic and additional process variable data from the instruments on a field-bus-like “segment.”

• Protecting process signals

– Sometimes 4-20 mA HART signals are subject to problems from voltage surges, spikes, transients and grounding problems. Although 90% of HART instruments are isolated, problems still occur. Also, 10% are not isolated; a simple ground loop can cause problems.

A HART isolator breaks

the common galvanic path that can pass dangerous overloads from a DCS or PLC to a transmitter, or vice versa.

• **Sharing HART signals** – In some cases, it is desirable to share the output of a HART transmitter with two different systems. For example, a refinery may want to share signals from transmitters with a DCS and an Emergency Shutdown System. A simple HART isolator (Fig. 4) makes this possible. An isolator also protects one system from the other: both 4-20 mA process signals are fully isolated.

A HART monitor really is a simple solution to expand the usefulness of a HART-enabled transmitter, save on wiring costs and maximize the availability of data needed by the control system to operate efficiently without adding new transmitters.

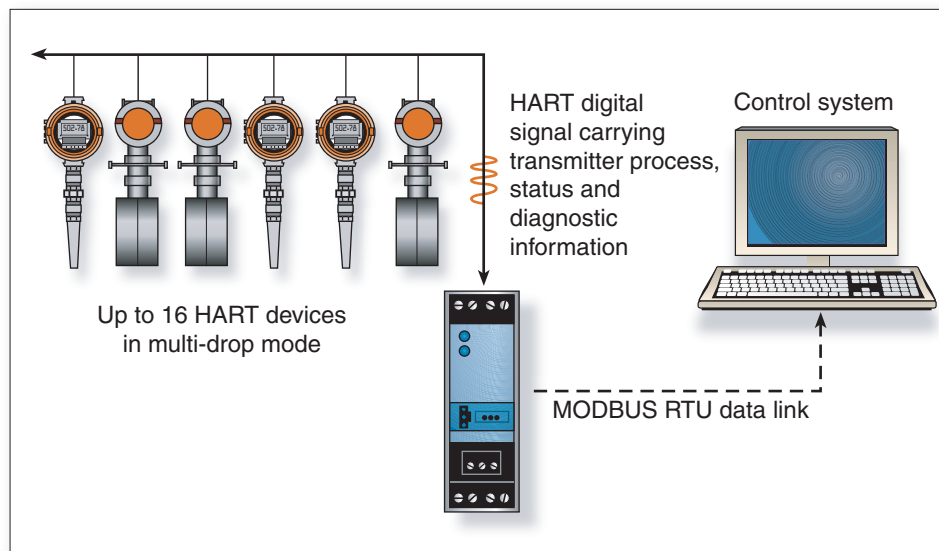


Fig. 3. Data from up to 16 HART instruments can be extracted by a single HART “Concentrator” module and transmitted to the control system via MODBUS RTU.



As wireless HART gains greater acceptance, the use of handheld devices continues to grow as well.

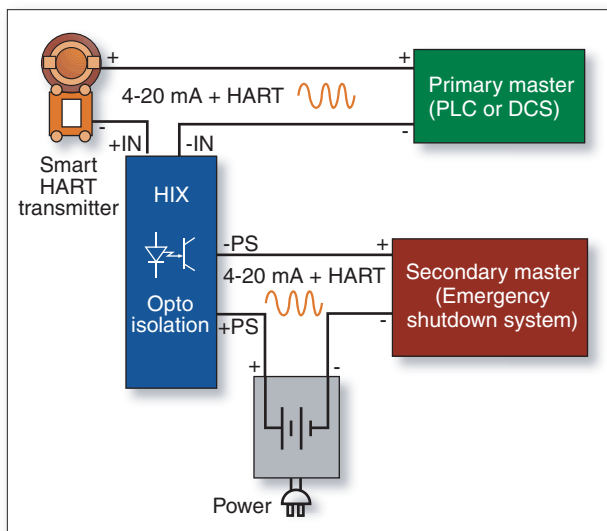


Fig. 4. A HART isolator makes it possible to share the same 4-20 mA process signal with two systems, such as a DCS and an Emergency Shutdown System.

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