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FOR THE FUTURE.

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A wireless signal has no way through obstacles.
It will just bounce around.
At least the smart one will.

Emerson’s Smart Wireless is the secure, robust, self-organizing WirelessHART™ network that’s as easy to use as it is smart. Whether it meets a permanent obstacle or a temporary barrier, the self-organizing network automatically routes the signal around it. Smart Wireless is not just flexible, it’s dependable – proven to deliver greater than 99% data reliability. To find why you should rely on Smart Wireless from Emerson go to EmersonSmartWireless.com

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The BULLET™

WirelessHART™ Adapter

Model No. 1101

**CONNECT 24/7 TO YOUR WIRED HART® DEVICES UP TO 300 METERS AWAY!**

- **BENEFITS**
  - Low-cost method to add additional measurements
    - Access stranded data
    - Access valuable asset management data
    - Implement a predictive maintenance strategy
  - Quickly installs on existing HART devices
  - Loop-powered
    - No need to change batteries
  - Direct power option
    - For use in locations where new wiring is difficult
  - Multi-drop support of up to 6 devices
  - Designed for hazardous location installations
    - Planned / sought approvals: FM, CSA, CE, IECEx, FCC, IC.

**WirelessHART™**

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Measurement and Control Technologies

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The full potential of your smart transmitter has been locked up way too long. Set it free with our HIM Smart HART Loop Interface and Monitor.

Converts HART to 4-20mA
The HIM converts HART digital data to 4-20mA signals that your DCS or PLC control system can handle. A multivariable mass flow transmitter, for example, measures three variables: differential pressure or raw flow, pressure, and temperature. From these non-primary measurements, it calculates mass flow, and sends this on 4-20mA wires back to your control system. The problem is, the non-primary measurements, and the valuable data they provide, never make it out of the field. The solution is the HIM. It “breaks out” non-primary measurements, and sends them as 4-20mA signals to your control system.

Take Full Advantage of In-Place “Legacy” Smart HART Transmitters.
The HIM is your key to leaving trusted (and paid for) smart transmitters in place, yet still take advantage of all the process and diagnostic information they have to offer.

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MOORE INDUSTRIES United States • info@miinet.com
Tel: (618) 694-7111 • FAX: (618) 691-2816
Australias • sales@mooreind.com.au
Tel: (02) 8536-7200 • FAX: (02) 9525-7296

Belgium • info@mooreind.be
Tel: 03/448.10.16 • FAX: 03/440.17.97

The Netherlands • sales@mooreind.nl
Tel: (0)344-617971 • FAX: (0)344-615920

China • sales@mooreind.sh.cn
Tel: 86-21-62491499 • FAX: 86-21-62490635

United Kingdom • sales@mooreind.com
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Today’s challenging global economic environment places even more emphasis on the need for cost-efficient process and asset management improvements to keep process manufacturing facilities relevant, competitive and sustainable. Respond to these challenges by looking at your process control systems and installed assets differently than ever before.

One of your most valuable assets—HART Communication—has vast capabilities that you may have overlooked and underutilized in the past. Now is the time to change that. HART Communication with its new WirelessHART™ capability and other enhanced features will save time and money to help keep your plant competitive.

WirelessHART™ is Here and It’s Ready Now!

With the introduction of WirelessHART™ technology, we have taken the proven field communications, networking and security protocols of HART Communication and integrated them into the first simple, reliable and secure wireless communication standard for process monitoring and control applications.

WirelessHART™ is cost-effective and backward-compatible with currently installed HART devices and is fully supported by the HART-enabled devices, tools and systems used today. It is future-proof—meaning your current and your future devices will work together.

Wired or wireless, HART technology provides the tools and the flexibility you need to better manage your field measurement assets. Whether you need an efficient, cost-effective way to add additional measurements or to access valuable information in an existing HART device, HART Communication and WirelessHART™ will help lower costs, improve operations and optimize your assets. The following articles will help you understand how.

Yes, WirelessHART™ is here. It’s ready now. And many leading automation manufacturers are now developing or already introducing WirelessHART™ products and solutions.

Bottom line: there is no need to wait! HART Communication and WirelessHART™ will save you money now. The technology is complete, the registration process is in place, and major suppliers are ready to support your needs.

So if you’re looking to upgrade your plant for sustainable, global competitive operation...for today and for the future...look to HART Communication—your complete automation solution.

We wish to dedicate this issue to the memory of Mrs. Betsy Boyes, wife of Control’s editor in chief Walt Boyes, who passed away July 29, 2009.

For more on HART® and WirelessHART™, go to: www.hartcomm.org or www.controlglobal.com.

HART® and WirelessHART™ are trademarks of the HART Communication Foundation.
There are now about 30 million HART smart devices in service in process plants worldwide. This is nearly double the next largest smart device ecosystem in industrial process automation.

How did this come about? Certainly, the HART Protocol was the first for digital data specifically designed for process automation. Certainly, the fact that the HART Protocol was encoded on top of the standard 4-20 mA signal and that no wiring changes needed to be made helped. But that was not the real reason for the continuing growth of HART technology. The HART Protocol is simple, easy to understand and use, yet powerful and reliable. “HART devices always work, and always have,” says Ron Nelson, Executive Director of the HART Communication Foundation (www.hartcomm.org).

The HART ecosystem: Many vendors, one standard

“Customers want plug-and-play solutions,” says ABB vice president Pat Cashwell (www.abb.com). “They don’t have the staff or the time to troubleshoot field problems. Additionally, customers do not want to be locked into a single vendor.”

With over 280 vendors committed to manufacturing devices that meet the HART Communication standard, Cashwell says, “Interoperability is a must.” “It is very important to us as a vendor of HART devices that interchangeability and interoperability requirements are a fundamental part of the technology,” says Endress+Hauser’s Robert Bensberg (www.us.endress.com).

Bob Karschnia, Emerson Process Management’s (www.emersonprocess.com) vice president for wireless, echoes Bensberg. “As a vendor, what interchangeability and interoperability give is a level playing field…no proprietary connection to a host system. Some might argue that this also commoditizes the products, which is true, but only on one dimension: connectivity. We will add value in different ways to differentiate our products.”

HART 7 is more than WirelessHART™

There are many new features in HART 7, in addition to the WirelessHART™ capability. “I believe
THE WIRELESSHART™ ECOSYSTEM

The HART Protocol ecosystem is huge. There over 30 million installed devices and over 280 individual vendors who produce HART-enabled products. The ecosystem is now expanding to include manufacturers of WirelessHART™ products and systems. At this writing, three vendors are producing the firmware and software for WirelessHART™, including Dust Networks (www.dustnetworks.com). “We deliver a complete WirelessHART™ solution to our OEM customers,” says Steve Toteda of Dust Networks. “There may well be over 20 vendors in the WirelessHART™ ecosystem already,” he notes, “and we’ll certainly do our part to make it easy to grow this ecosystem at a rapid pace.”

Major vendors such as ABB, Emerson Process Management, Siemens (www.siemens.com), Pepperl+Fuchs, Endress+Hauser, and Yokogawa (www.yokogawa.com) are producing WirelessHART™ products to complement their wired HART product lines. Smaller companies, such as Moore Industries International, MACTek Corp. and others, are adding WirelessHART™ to their wired HART product lines. New manufacturers such as e-Senza (www.e-senza.de/en/) and others are joining the ecosystem with their WirelessHART™ products. It is estimated that more than 50 manufacturers will be producing HART 7 and WirelessHART™ products by the end of 2010.

“It is not enough to produce a standard,” says Ed Ladd, Director of Technology Programs for the HART Communication Foundation. “You have to have the buy-in from both the vendor and the end-user community. With 30 million installed devices and close to 300 vendors, HART technology has that, and is unmatched by any other field device protocol or standard.”

HOW REGISTRATION BENEFITS DEVICE MANUFACTURERS

Emerson’s Karschnia says, “I don’t think mandatory testing will help with reliability, but it will help with quality. The real goal of this,” Karschnia continues, “is to ensure that a consistent interpretation of the spec is applied by all.”

“If we didn’t have a good boiler plate to follow,” Moore Industries’ Saunders says, “such as the one provided by the foundation, we would spend countless hours troubleshooting our devices in the field when they are installed and expected to communicate with other vendors’ equipment. It is absolutely essential,” Saunders goes on to say, “that HART and any other open communication protocol specification outline how manufacturers implement their firmware to ensure interoperability and interchangeability. While the up-front effort and costs of adhering to such standards may seem burdensome, it is a fraction of the time and dollars that would be spent should we have to troubleshoot devices that reach the field and that did not communicate correctly and efficiently.”

HOW REGISTRATION BENEFITS DEVICE USERS

“From a customer perspective, the newly upgraded HART test procedures ensure end users that the products they buy meet the high standards of the HART Communication Foundation,” ABB’s Cashwell says. “ABB supports the HART test system as a method to provide feedback and validation of the quality of our products and designs.”

Moore Industries’ Saunders notes, “Users want freedom of choice when choosing instruments. As such, back-end communication protocols like HART are only as good as their requirement and test specifications that are offered to manufacturers.”

MACTek’s Holmes says, “The registration process helps both suppliers and users by providing an independent audit trail to confirm compliance to the specifications. This lowers the risk for the user by supplying a HART registered device that will work according to their specifications.”

Holmes goes on to give the other side’s view. “From the supplier standpoint, the registration process helps us to deliver devices that will be truly interoperable and interchangeable.”
that all the features of HART 7 are important, including WirelessHART™,” says Tom Holmes, CEO of MacTek Corp (www.mactekcorp.com). “We typically include all the features of a major revision that are applicable to our product line, in order to produce the most flexible product possible. For example, with our Bullet WirelessHART™ adapter, we provide the option to use either loop power or direct power, and the option to multi-drop up to six devices in accordance with the HART Standard.”

“We are looking to implement two new features that are part of the HART 7 standard,” says Scott Saunders, vice president at Moore Industries International (www.miint.com), “even before implementing any wireless capabilities in our transmitters. The first is exception-based reporting, and the second is multiple-message support. Exception-based reporting is critical to diagnostic monitoring systems that our customers have been asking us for, especially since all plants are running with fewer and fewer personnel. Multiple-message support will help eliminate one of the obstacles to multi-dropping HART devices at the relatively slow 1200 bps data rate that many hosts and asset systems still support.”

THE HART COMMUNICATION FOUNDATION HOLDS IT ALL TOGETHER

Founded in 1993, the Foundation is the technology owner, standards-setting body and central authority on the HART Protocol and provides global support for application of the HART technology. The Foundation establishes and controls the HART Communication standards, including new developments and technology enhancements that benefit and support the needs of the industry. “At Moore Industries,” says Saunders, “we don’t sell or manufacture a full-blown control system. Open communication standards like HART are the best solution for us and our customers.”

“Unfettered interoperability is our goal for all devices implementing the HART Protocol,” says Ed Ladd, Director of Technology Programs for the HART Communication Foundation. “Therefore, the Protocol specifications and Quality Assurance and Device Registration Procedures are all written to ensure the interoperability of HART-enabled products.”

Since 1993, vendors have been permitted to develop testing procedures on their own and submit the test results to the Foundation. In 2008, the Foundation’s board of directors mandated independent verification testing be required to register HART devices, whether wired or wireless.
4-20mA Representing the Primary Variable (Mass Flow)

HIM Smart HART Loop Monitor
“Breaks Out” Data from Smart HART Instruments

4-20mA Proportional to 2nd Variable (DP)

4-20mA Proportional to 3rd Variable (P)

4-20mA Proportional to 4th Variable (T)

HART Transmitter Diagnostics Fault Alarm or Additional Process Alarm

HART Communicator can be connected anywhere along the 4-20mA loop

Unlock Your Smart HART® Multivariable Transmitter's Hidden Secrets
The full potential of your smart transmitter has been locked up way too long. Set it free with our HIM Smart HART Loop Interface and Monitor.

Converts HART to 4-20mA Signals
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**THE KEYS TO HART**

**HOW A HART DEVICE IS TESTED**

Regardless of whether the device is a HART or WirelessHART™ device, the testing process is the same. Here’s an example of the testing procedure for a WirelessHART™ device:

1. Manufacturer tests the device

<table>
<thead>
<tr>
<th>Wireless Tests Case Category</th>
<th>Defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Token-Passing-Data-Link Layer - FSK</td>
<td>52</td>
</tr>
<tr>
<td>FSK Physical Layer</td>
<td>8</td>
</tr>
<tr>
<td>Universal Command (FSK)</td>
<td>16</td>
</tr>
<tr>
<td>Common Practice CAL (FSK)</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
</tr>
</tbody>
</table>

2. Manufacturer submits test data for completeness review prior to submission
3. Manufacturer sends complete test data, device and setup information to the Foundation
4. The Foundation performs 100% verification of device comparing the manufacturer’s data to verification test data from the test at HCF.
5. The last test to be performed is a stress test that sends 2 million messages to the device. The device can miss no more than 20 messages out of 2,000,000, a failure rate of not more than 0.001%.
6. Once the device is verified, a certificate is issued, the website is updated and the device can carry the “HART Registered” mark.

Ladd continues, “Products undergo many levels of testing, and the test specifications that are outlined in the HART Test Program standardize and eliminate the need for each manufacturer to develop its own test to validate Protocol compliance.”

Manufacturers still test their devices, but they use new standardized tests and procedures. Ladd goes on, "Manufacturers must confirm the test results through the Foundation’s Quality Assurance and Device Registration Procedure. Manufacturers must perform the tests and certify the results. Then they send a device along with complete documentation to the Foundation for verification. Through independent testing the Foundation performs 100% verification and validates that the device and its test results have achieved the Protocol requirements.”

**INTEROPERABILITY AND INTERCHANGEABILITY — THE KEY TO HART**

“With over 30 million HART-enabled products in the field, HART-enabled solutions must be able to interoperate no matter what revision the device or protocol,” says Ladd. “As the number of HART products continue to grow, it has become increasingly important that all manufacturers ensure their devices are compliant to the HART Protocol Standard, passing all conformance tests and registering products with the Foundation.”

“It has always been a requirement,” says Helson, “that any HART-enabled device must be able to replace any other similar device, regardless of manufacturer. That means that any new HART 7 device, wired or WirelessHART™, is backward-compatible with the entire globally installed base of HART instruments. It also means that HART-enabled devices have a very low risk of failure or bad application, and the cost of ownership is lower because you can reduce inventory. One device can be configured for multiple applications.”

“As a vendor of HART multiplexers,” says Pepperl+Fuchs’ (www.pepperl-fuchs.com) Thomas Klatt, “we have ‘only’ to ensure that the HART commands will be transferred correctly from the host to the instruments and back.” Before P+F began manufacturing WirelessHART™ devices, Klatt noted, “Interoperability was a very important point to us, because the HART multiplexer is almost always located between different DCS systems and different field instruments.”
Designing and Specifying a HART-Based Project
How to use the new features of HART 7 and WirelessHART™ in your project.

Since 1989, the HART Protocol has focused on simplicity, reliability and utility. One of the keys to the success of HART technology has been the insistence on interoperability and interchangeability. Another has been the insistence of the HART Communication Foundation on backward-compatibility. Each revision of the HART Protocol (the current version is HART 7) has been designed from the beginning to be backward-compatible with every other HART version before it.

While many of the features added in HART 7 are to enable WirelessHART™, some of those features, such as “time or condition based alerts,” or “report by exception,” or the PV trending functions, synchronized sampling and time-stamped data are new and important features that designers and end users can take advantage of, in either a wired HART 7 or WirelessHART™ network, or both.

It is a significant and unique feature of HART 7 that the same commands, recommended practices, and programming and configuration procedures work for both wired and wireless networks. The knowledge base of end users and designers for working with HART is large and varied, and easily translates to working with WirelessHART™ as well. No other wireless field device protocol has this integration with wired field sensor networks.

**ADDING HART 7 AND WIRELESSHART™ TO AN EXISTING CONTROL SYSTEM**

Because of the interoperability, interchangeability and backward-compatibility features of the HART Protocol, engineers and operators may simply add HART 7-enabled wired transmitters to their sensor networks as they have always done, either using the traditional current loop configuration, or the multi-drop digital configuration.

One of the significant changes with HART 7 is the rush by nearly all of the major control system vendors to provide native HART 7 access to their DCS and PLC control systems. This means that all of the features shown in Figure 1 for HART 7 are going to be enabled in nearly every control system. This is a significant enabler alone. Matching this with the other half of the HART 7 release, WirelessHART™ gives the designer and end user unparalleled ability to monitor process variables and other important information.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Protocol Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Loop Check</td>
<td>7</td>
</tr>
<tr>
<td>Broadcast messaging</td>
<td>6</td>
</tr>
<tr>
<td>Device Calibration</td>
<td>5</td>
</tr>
<tr>
<td>Device Configuration</td>
<td>7</td>
</tr>
<tr>
<td>Device Status</td>
<td>6</td>
</tr>
<tr>
<td>Multi-Variable Reads</td>
<td>5</td>
</tr>
<tr>
<td>PV with status</td>
<td>7</td>
</tr>
<tr>
<td>32 Character Tag</td>
<td>6</td>
</tr>
<tr>
<td>All variables with status</td>
<td>5</td>
</tr>
<tr>
<td>Digital Loop Check</td>
<td>7</td>
</tr>
<tr>
<td>Enhanced Multi-variable support</td>
<td>6</td>
</tr>
<tr>
<td>Local Interface Lock</td>
<td>5</td>
</tr>
<tr>
<td>Manual ID of device by host</td>
<td>7</td>
</tr>
<tr>
<td>Peer to peer messages</td>
<td>6</td>
</tr>
<tr>
<td>Visual ID of Device</td>
<td>5</td>
</tr>
<tr>
<td>Time or Condition based Alerts</td>
<td>7</td>
</tr>
<tr>
<td>Report by Exception</td>
<td>6</td>
</tr>
<tr>
<td>Synchronized Sampling</td>
<td>5</td>
</tr>
<tr>
<td>Time stamp</td>
<td>7</td>
</tr>
<tr>
<td>Trends</td>
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</tr>
<tr>
<td>Wireless Co-existence</td>
<td>5</td>
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<tr>
<td>Wireless diagnostics</td>
<td>7</td>
</tr>
<tr>
<td>Wireless mesh &amp; star topologies</td>
<td>6</td>
</tr>
<tr>
<td>Wireless message routing</td>
<td>5</td>
</tr>
<tr>
<td>Wireless Security</td>
<td>7</td>
</tr>
</tbody>
</table>

**MAKING A MESH OF THINGS**

While the technology of installing and using wired HART transmitters and control valves is reasonably
well-known, and well-understood, the nuts and bolts of using WirelessHART™ devices is considerably less well-understood.

The first part of planning a wireless project is to determine the project scope, just as it is when planning a wired sensor network. There are differences, though.

First, you need to determine what a Process Unit is so that you can organize the Wireless Field Devices (WFD) and their network. This maintains existing workflows, data flows and operator responsibilities, and provides for scalability in the future. Determining a Process Unit also sets expectations for the range of the wireless network (at this point, typically less than approximately 250 m).

Most WFD are going to be mounted below the normal obstruction height. That's generally the airspace above the process vessels and tankage, where LOS (line of sight) is located. LOS is defined as “obstruction height + 2 m.” Mounting network gateways and repeaters at LOS height will produce maximum range.

FORGET THE SURVEYS

You don’t need a traditional radio survey, whether you are on a brownfield or greenfield site. Get yourself a scale drawing or an aerial photograph. Printing out images from Google Earth or other aerial mapping programs can be quite effective. You can use scale drawings for P&ID, ILP and asset management for this purpose too.

From experience, we already know that a minimum of five WFD should be used to create a network. The more WFD you have, the stronger the network becomes, because the WirelessHART™ network is a self-healing, self-organizing mesh. The more sensors, the more paths the signal can go to reach the gateway, and from the gateway to the control system. On your scale drawing or photograph, place the WFDs as if they were standard wired transmitters and final control elements.

In greenfield applications, you can plan to install them as if they were wired—just leave the wires off the drawings. Each field device should have at least three neighbors. If the congestion of tankage and other obstructions is heavy, locate your transmitters within 30 m of their neighbors. For medium obstructions, use 75 m, and for light obstruction, light environmental density, you can go as far as 150 m.

Mount the antennas at least 0.5 m away from any vertical surface, and at least 1.5 m off the ground.

One of the uses of the WirelessHART™ adapters being supplied by at least five vendors is to permit inexpensive remote location of the wireless antenna, since the adapter can be located anywhere along the HART-enabled current loop. Thus, you do not have to run expensive antenna cable—just run a standard current loop out of the transmitter and use a WirelessHART™ adapter.

A Process Unit with at least 25 WFD provides saturation coverage of the unit, with minimal need for design recommendations. Locate the gateway in the center of the initial network, or in the center of the Process Unit, with its antenna at LOS height (obstruction height + 2 m), and with direct wireless connection to at least 25% of the WFD in the network. To fortify a network, add more WFDs. WFDs can be used as repeaters. That’s a quick fix for fortifying the network during design, or after installation.

Your existing network, once formed, is the foundation for scalability, whether you add WFDs to the perimeter of the network, or to the interior of the existing network. Don’t forget that this is a mesh network. Devices do not need to be within the range of the gateway, they just need to be close to another wireless instrument.

SPECIFYING WIRELESSHART™ INSTRUMENTATION IS EASY

WirelessHART™ devices are all basically the same when it comes to their wireless characteristics. All you have to do is to make sure the device is registered with the HART Communication Foundation. This is the indicator of a good wireless design, which has been tested for interoperability
Optimize your production, logistics and maintenance processes with automation solutions from Endress+Hauser. The perfect combination of high-quality instruments with our expertise in project management, fieldbus engineering, system integration, third-party supply, service and training enables you to increase productivity and lower costs. Our best-in-class solutions are always customized to your needs, so you’re assured of having every piece of the puzzle in place. www.us.endress.com/automation
with other vendors’ products. Some devices may offer antenna options that will alter the distance assumptions you may make using a standard WirelessHART™ antenna. If you are trying to “push” a signal from a very remote WFD at the very edge of the mesh, for example, you might want to consider a higher gain antenna than standard.

The other thing you need to decide is whether you want the devices preconfigured with the network ID and join key entered by your supplier, if it is offered. There are reasons both for and against this. Some end users may wish to enter their own network ID and join key information at commissioning time.

**COMMISSIONING WIRELESS FIELD DEVICES**

As with wired HART, a HART handheld or PC tool will allow you to join WirelessHART™ devices to the network. You start with the gateway. Install and apply power to the gateway, and then install the devices one by one, beginning with the device closest to the gateway. To do that, you install or activate the device’s power source (whether it is line power or battery) and enter the network ID and the network Join Key. Then set the refresh (update) rate and verify that the device has joined the network either by using a handheld or PC field tool, or at the gateway.

Next, verify the device operation by checking tags, engineering units, PV update rate and if the unit is battery-powered, the battery life. One of the unique features of the WirelessHART™ specification is that the battery life variable is required to be reported as “net time remaining” rather than a simple voltage or numeric value with no context.

Verify the gateway, checking for a minimum of 5 direct connections, and in large networks, make sure that at least 25% of the devices connect directly to the gateway.

**SECURE WIRELESSHART™ NETWORKS**

WirelessHART™ is designed to be highly secure from the beginning, but there are some recommended best practices to help you make the network even more secure. The fundamental security precaution is “key management.” Segment the networks using different network IDs for different process units. Provide a global join key for all devices or an individual join key for each device. The join key can be fixed or rotating (controlled by the network manager software), and assignment can be made either at the factory with the order or on the bench in the instrument shop.

The use of “white lists” which only permit approved devices to join the network is another recommended practice for increasing the security of your WirelessHART™ network.
Connecting HART to the Rest of the Plant

Many plants are using HART technology only once or twice a year. You can no longer afford to do this.

There are well over 30 million installed HART devices in the world. Roughly 15% to 20% of them are connected digitally through direct connection to the control system. The rest of the HART population is being used simply as a single PV transmitter or valve positioner over a conventional 4-20mA current loop. The HART smart capability of the device is only used for setup and calibration of the instrument. Using HART technology in this way limits its usefulness in the plant to just twice a year.

Automation professionals no longer can afford to do this. There is so much valuable information in HART-enabled devices that the use of that information can seriously affect the profitability of the enterprise. And now, with HART 7 and WirelessHART™, there are simple and easy ways to get that information out of the device and into the hands of the engineers, operators and maintenance and operations personnel who need it.

TRAPPED INSIDE

The vast majority of HART-enabled devices have only one output connected to the control system—the PV (process variable) that reports on the 4-20 mA loop. Depending on the manufacturer, there is a lot more intelligent information within the device that can be accessed. (See Figure 1.)

Much of that information, such as the other seven cyclically reported process and dynamic device variables, trending information and device status, is useful to the process control system. The broadcast messaging feature, report by exception and time- or condition-based alerts are also important to the process control system and eliminate the need to poll the device for information, as in previous versions of the Protocol.

Other information items stranded inside the transmitter are device configuration, device calibration, the 32-character device tag, loop check data and much more system and process diagnostic information. Some of this is useful to the process control system, but much of it is even more useful for the quality and asset management systems.

Here are some examples of the really useful data that can be found in various types of field devices and final control elements.

<table>
<thead>
<tr>
<th>HART Feature Summary</th>
<th>Revision</th>
</tr>
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<tbody>
<tr>
<td>PV with Status</td>
<td>✓</td>
</tr>
<tr>
<td>Device Status</td>
<td>✓</td>
</tr>
<tr>
<td>Broadcast Messaging</td>
<td>✓</td>
</tr>
<tr>
<td>Device Configuration</td>
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</tr>
<tr>
<td>4-20 mA Analog Loop Check</td>
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</tr>
<tr>
<td>Multi-Variable Reads</td>
<td>✓</td>
</tr>
<tr>
<td>PV with Status</td>
<td>✓</td>
</tr>
<tr>
<td>32 Character Tag</td>
<td>✓</td>
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<tr>
<td>All Variables with Status</td>
<td>✓</td>
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<tr>
<td>Digital Loop Check</td>
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</tr>
<tr>
<td>Enhanced Multi-Variable Support</td>
<td>✓</td>
</tr>
<tr>
<td>Local Interface Lock</td>
<td>✓</td>
</tr>
<tr>
<td>Manual ID of Device by Host</td>
<td>✓</td>
</tr>
<tr>
<td>Peer-to-Peer Messages</td>
<td>✓</td>
</tr>
<tr>
<td>Visual ID of Device</td>
<td>✓</td>
</tr>
<tr>
<td>Report by Exception</td>
<td>✓</td>
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<tr>
<td>Synchronized Sampling</td>
<td>✓</td>
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<tr>
<td>Time or Condition based Alerts</td>
<td>✓</td>
</tr>
<tr>
<td>Time Stamp</td>
<td>✓</td>
</tr>
<tr>
<td>PV Trends</td>
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</tr>
<tr>
<td>Wireless Co-Existence</td>
<td>✓</td>
</tr>
<tr>
<td>Wireless Diagnostics</td>
<td>✓</td>
</tr>
<tr>
<td>Wireless Mesh &amp; Star Topologies</td>
<td>✓</td>
</tr>
<tr>
<td>Wireless Message Routing</td>
<td>✓</td>
</tr>
<tr>
<td>Wireless Security</td>
<td>✓</td>
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</tbody>
</table>

MAGNETIC FLOWMETERS

- Flow
- Raw Flow
CONNECTING HART

- Volumetric Flow
- Smoothed Flow
- Positive Total
- Negative Total
- Net Total
- Process and Diagnostic Alarms

ULTRASONIC FLOWMETERS
- Flow
- Sound Velocity
- Positive Total
- Negative Total
- Process and Diagnostic Alarms

VORTEX FLOWMETERS
- Mass Flow
- Volumetric Flow
- Velocity
- Total Flow
- Process Temperature
- Vortex Frequency
- Process and Diagnostic Alarms

HYDROSTATIC LEVEL METERS
- Level
- Volume
- Pressure
- Differential Pressure
- Sensor Pressure
- Process Temperature
- Sensor Temperature
- Process and Diagnostic Alarms

PRESSURE TRANSMITTERS
- Pressure
- Differential Pressure
- Percent Range
- Electronics Temperature
- Sensor Temperature
- Process and Diagnostic Alarms

PH (AND OTHER WET CHEMISTRY) TRANSMITTERS
- pH
- Process Temperature
- Electrode Performance
- Process and Diagnostic Alarms

VALVE POSITIONERS AND DAMPER OPERATORS
- Stem Position Percentage
- Input
- Supply Pressure

GETTING THE DATA UN-STRANDED
So why has this data typically remained stranded? For many years, even though it was available, DCSs and PLC-based control systems were not able to take the data in directly. Companies such as Pepperl+Fuchs (www.pepperl_fuchs.com) and Moore Industries International (www.miint.com) have made up for this by producing HART interface modules. (See Figure 2).

These interface modules typically have taken the HART data, stripped it off the 4-20mA loop and presented it to the control system in the form of Modbus, Modbus TCP serial digital information or additional 4-20mA input signals.

Many control system manufacturers now have HART-enabled I/O, allowing native HART data directly into the DCS, and most of the major vendors are expected to release this feature for HART 7 devices (backward-compatible to earlier HART Protocol versions) in the next 12 months.

The multi-drop, all-digital network configuration of HART-enabled field devices is also available for this purpose.

But what happens if you have a control system that doesn’t accept HART data or you don’t have room in your marshalling cabinets to install HART Interface Modules? What happens if it just plain costs too much money, and you can’t make the justify the project, even though you know you will save time, save money, and provide better per-
formance to the plant—but you just can’t prove it in advance?
And what happens if some of the measurements you need aren’t from traditional process sensors at all—say from alarm switches on safety showers or gas detectors that would never have been interfaced with the DCS or other control system?

Connecting HART

The HART Communication Foundation realized that there was a need for more than one way to connect data from HART devices to control and operations systems. So as an integral part of the HART 7 release, it created WirelessHART™. WirelessHART™ is the only wireless communication protocol that is designed to work seamlessly and completely integrate with an industrial wired protocol.

So when do you use WirelessHART™? WirelessHART™ is useful for hard-to-reach locations. It is great for doing process efficiency calculations, not just process monitoring and control. You certainly can use WirelessHART™ sensors for control applications. Control columnist and Emerson Process Management consultant Greg McMillan wrote recently, “With the wireless PID algorithm, a comprehensive battery life management approach, exception reporting and a secure, reliable self-organizing and optimizing network, wireless process control is ready for all but the fastest processes, provided the transmitter resolution settings are right for the application. Use of wired devices will be relegated to processes requiring scan and PID execution times much faster than once per second, such as compressor surge and pressure control.”

WirelessHART™ can allow process operations personnel to place transmitters where they could never afford to place a wired device before. They can now use WirelessHART™ devices to monitor secondary variables that can help optimize the process but that previously were impossible to measure in a cost-effective way. Maintenance personnel can monitor rotating machinery where it was not feasible without wireless sensors. Environmental monitoring personnel can measure health and safety tools, such as safety showers and gas detectors...even gas detectors carried on the person. Steam traps, water discharge, stack emissions, relief valve fugitive emissions and many other parameters and devices can be monitored in an extremely cost-effective way, using WirelessHART™ sensors and devices.

This is why it is such a valuable feature of the HART 7 Protocol that the same information and the same programming and the same types of devices are available—wired or wireless.

For those who have wired devices and don’t have the ability to put in HART multiplexers or interface modules because of cost or space constraints, WirelessHART™ adapters provide a simple, easy and cost-effective way to get the stranded data out of existing HART devices and into the control and information systems of the plant.

Entering WirelessHART™

Another major advantage of using HART 7 and WirelessHART™ is the large number of industry standard protocols the HART Protocol is designed to interface directly with: Ethernet (IP-based networks), Pepperl & Fuchs HART Multiplexers

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The HART data can be converted by industry-standard OPC server technology and imported into any OPC-compliant control system, data historian or database.

In addition, the Wireless Cooperation Team, formed of delegates from the Fieldbus Foundation and the Profinet Technical Organization, has been working for more than a year now to produce an interface specification for a gateway between WirelessHART™ and FOUNDATION fieldbus communication technologies; an interface specification for a gateway between WirelessHART™ and Profinet communication technologies; and a common set of compliance guidelines for incorporation into the respective product registration procedures. This will mean that end users will have the ability to use any of the three most commonly found communication protocols without worrying about compatibility or interoperability issues.

**AFFORDABLE DD BASED CONFIGURATION USING YOUR PC**

ProComSol, Ltd designs and manufactures both the hardware and software needed to perform complete HART device configuration and monitoring using your PC. DevCom2000 software uses the registered DDs from the HART Foundation, allowing full access to all device parameters, including Methods. The HM-USB HART modem and the HM-BT-BAT Bluetooth HART modem offer significant cost savings and productivity benefits. Units meet industry standards for USB, Bluetooth and HART connectivity. Order this affordable solution online using our secure website.

**CONNECTING HART**

![Diagram of HART connectivity](image)

**IMPROVE THE BOTTOM LINE**

Plant optimization, advanced process control and predictive and prescriptive maintenance programs have been shown for years to contribute directly to the bottom line. Yet it has been expensive, in some cases prohibitively so, to instrument the process well enough to apply those techniques in the plant. HART 7 and WirelessHART™ have broken that barrier and liberated all the data in the plant.
With the emerging ABB WirelessHART™ range of products, you will be able to release the trapped information within existing HART instruments. This information is then available to operations and maintenance teams to improve plant availability and performance. In addition, ABB offers on-site service support that provides you a low risk entry point into the wireless world.

Allow ABB to be your guide as you take your first wireless steps. www.abb.com/instrumentation

The first interoperable wireless communication standard for the process industries

www.hartcomm.org

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