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How Bluetooth® technology extends the capabilities and connectivity of wired instrumentation

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One day at a refinery, operators call an instrument tech to the control room and point to the screen. “PT-639 is giving us weird readings but everything around it seems normal. Something must be wrong with the transmitter,” said the operator.

The tech knows this pressure instrument is in a Division 1 part of the plant, and consequently puts in a request for a hot work permit. Once granted, the next steps are putting on appropriate personal protective equipment and climbing up to the mezzanine where the instrument is mounted, verifying with the operators that the instrument is no longer controlling a process function, unscrewing the cap and mounting the leads from a HART communicator (**FIG. 1**) to look for error codes.

FIG. 1. Traditional instrument configuration and troubleshooting tasks must often be done at the device, raising safety and other concerns due to extensive time spent in hazardous, and often difficult to access, areas.

This scenario happens every day in countless facilities. It reflects a level of technology where HART-enabled instruments must be accessed directly—usually at the transmitter itself—to retrieve data or change configurations. There is now a much better option that does not require upgrading I/O infrastructure at host systems or making any changes to existing wiring.

Not your everyday Bluetooth technology. Bluetooth technology is a standard for short-range wireless communication between devices such as mobile phones, computers, transmitters and other electronic devices. To cover such a wide range of applications, Bluetooth technology is a family of protocols and profiles under one banner, offering specialized controller and host stacks so developers can optimize performance to match specific use cases.

Options have been selected within the Bluetooth technology offering to make it suitable for industrial environments so it can be applied to field devices mounted in process manufacturing facilities. Using this approach, Bluetooth wireless communication is being added to a growing variety of field devices as a method for easy configuration and viewing of information via proprietary plant asset management software[a]. This type of bidirectional communication empowers technicians to access data and change configurations as needed without a wired connection.

Cybersecurity of these products is of utmost importance, so instruments enabled with Bluetooth wireless technology have been developed with many security features to help a company's information technology (IT) professionals ensure the facility stays cybersecure. Therefore, this Bluetooth communication solution is secure out of the box with encrypted data transfers. These security features are enabled by default and cannot be disabled, either inadvertently or intentionally.

What can Bluetooth technology do in the field? From our hypothetical example, consider a common pressure instrument (**FIG. 2**), which may be monitoring pressure, differential pressure (DP) flow or DP level. In most applications, it is wired to an automation host system using a 4-20 mA with HART loop. The primary variable is sent via the current loop. Ancillary information (e.g., additional variables, diagnostics) is sent to a host system, and in some cases configuration changes are sent to the instrument, via the HART signal.

FIG. 2. Newly capable instrumentation has been in the forefront of technical improvements, and now Bluetooth communication has been added.

If the host system has HART-enabled I/O, supplementary information may be accessible. Otherwise, HART data and configuration access must be performed at the field device. This normally involves opening the housing and exposing transmitter internals to potential environmental contaminants, clipping on leads and proceeding through the list of steps at the sluggish speed of HART. Obtaining hot-work permits complicate the procedure. Moreover, the transmitter might not be readily accessible without a ladder, climbing out on

a catwalk or installing temporary scaffolding. It is also possible to access the HART signal at a marshalling cabinet, but the specific terminals may be difficult to locate.

How does Bluetooth technology, combined with sophisticated instrument transmitter electronics, help? Several examples include:

- Bluetooth communication is much faster than HART, so configuration and data exchange tasks can be completed more quickly.
- All normal functions of the 4-20 mA current loop and HART still work the same. Just as an instrument can be installed without enabling HART, Bluetooth technology will only matter to those who choose to use it.
- Bluetooth technology can duplicate all the point-to-point communication functions of HART, including accessing all process variables, configuration settings and device diagnostics.
- All HART functions can be accessed via Bluetooth communication without the need for a dedicated communicator. Any device—tablet, laptop smartphone—that has Bluetooth communication capability, and the appropriate app can talk to the instrument transmitter.
- There is no need to open the transmitter housing, so transmitter electronics remain protected from potential environmental contaminants and human error.

A walk-through of a Bluetooth-enabled plant. The idea of a Bluetooth-enabled plant is a bit misleading since it is not necessary to make any modifications to the plant or its I/O. Installing Bluetooth-enabled instruments is the only requirement, so the change can be incremental.

When an operator carries a laptop, smartphone or tablet equipped with the appropriate app (**FIG. 3**), it will discover all Bluetooth enabled instruments within a radius of approximately 15 m (50 ft). These instruments "broadcast" their presence continuously, waiting for a technician to request a connection through the app. Since the instrument's radio power consumption is very low, it operates using normal loop power.

FIG. 3. Bluetooth-enabled instruments broadcast their signal, waiting for a technician with the app and proper credentials to make a connection. Once credentials are verified and connectivity is

established, techs can gather information and make configuration changes.

Simply by walking around with the app, the technician can see all the instruments within range listed on the screen. All instruments that have established a prior secure connection display their process variable, engineering units and operational status, much like the transmitters' local displays. Any that are showing a process alarm or diagnostic advisory will so indicate. This information can be seen without having to connect to an individual transmitter.

If an individual instrument requires attention, the technician connects via the app, using the correct password. It is now possible to see all variables, including those related to the process, but also diagnostic information. If necessary, the technician can also make configuration changes, which are written to the transmitter and logged. Calibration actions and history are also logged in the transmitter and accessible via Bluetooth. To protect such information, companies should apply normal password practices for all users when deploying Bluetooth instruments.

For day-to-day instrumentation maintenance, there is no longer any need to access an instrument directly using wires, so there is no reason to obtain a hot-work permit, open the housing, climb up a ladder or physically connect test leads. If the instrument is within approximately 50-ft, horizontally or vertically, a wireless connection can be made.

If the technician needs additional documentation to carry out a specific task, it may be possible to access it for that specific transmitter directly from the Bluetooth app with an internet connection via the plant's Wi-Fi network, avoiding the need to go back to the control room or maintenance shop. These timesavers can expedite any required actions, allowing technicians to spend far less time in the plant environment.

The ability to communicate wirelessly over a specific distance has additional safety benefits. For example, a technician may be able to access an instrument in a Division 1 location from a safe distance outside of the hazardous zone. Whatever the case, normal safety protocols for the facility must be observed, including restrictions for any devices carried by technicians.

Bluetooth communication compliments HART. The latest Bluetooth-enabled instruments retain all the usual HART capabilities, so now there are two options for configuration. HART still works as it always has, and the new configuration app designed for Bluetooth technology (**FIG. 4**) uses the same interface as HART communication, so trained technicians do not need to learn new steps or menus.

FIG. 4. New configuration tools designed for Bluetooth technology use the same interface as HART communication, so experienced technicians will find them very familiar.

However, Bluetooth communication is up to 10-times faster than HART, which speeds up configurations and data downloads. This is particularly useful where work must be carried out in a hazardous area and technicians would benefit from spending less time in these locations. It also increases productivity by reducing the amount of time required to complete each specific task. In cases where an operation has been halted due to an instrument issue, any time savings is very significant.

For instrumentation, Bluetooth connectivity offers distinct advantages over traditional methods of communicating with devices in the field. Technicians can make plant rounds and check the status of Bluetooth-enabled devices without needing to be at grade, interfering with any operation or removing housing covers. Any changes can be made very quickly, increasing productivity and potentially reducing downtime.

For facilities with legacy I/O that does not use HART, adding Bluetooth technology is a major step forward since it avoids the need to make a physical connection to an instrument. Even if host systems do support HART, there are often instances where it is beneficial to be in the field near the instrument, and Bluetooth communication helps in these situations. When in the plant, technicians can work much more quickly, easily and safely, with the ability to check the status of any Bluetooth instrument in seconds. This is a critical tool that should be considered for any instrument upgrades or new installations. **HP**

NOTE

[a] Emerson's AMS Device Configurator

MEGAN WIENS is a Global Pressure Product Engineer for Emerson. She is responsible for new product introductions and advanced diagnostic capabilities across the Rosemount pressure portfolio. In this role, she works to implement product solutions that improve plant

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