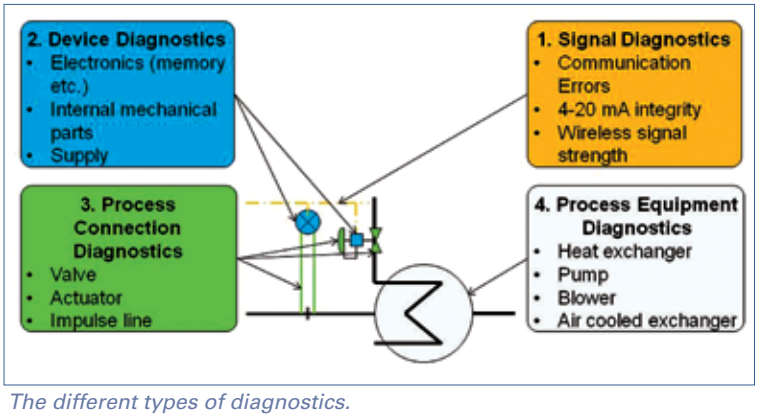
Maintenance with a Hart

The maintenance department loves WirelessHart because along with the valuable asset health information the transmitters provide, adoption requires no special tools beyond those the plant already has. By *Jonas Berge*.

With finite resources, there is often not enough time to manually inspect, clean, and service all the process equipment around the plant to help prevent failures and downtime. The existing primary layer of wired process control for automation, found on the P&ID, is no longer sufficient. Deploying a "second layer" of wireless coverage of missing measurements to automate process equipment inspection, that goes "beyond the P&ID", can help the maintenance department become more effective.

Because managing wireless devices should not become disruptive to the instrument technician's routine, IEC 62591 (WirelessHart) was designed to allow the transmitters to be commissioned and calibrated, etc using the same handheld field communicator as 4-20 mA and fieldbus devices.



The different types of diagnostics.

The impact if process equipment fouls or fails is high. The unit will need to slow down or be shut down until it can be cleaned or repaired. If it is on a main process unit, production is drastically impacted. Moreover, repairs can be costly and can strain maintenance resources.

Reduced energy efficiency increases fuel spending. On the other hand, stopping to clean process equipment unnecessarily early to prevent failure or fouling also causes production downtime, strains manpower, and drives up maintenance cost. To make matters worse, equipment that truly needs service may get neglected if limited resources are instead spent on assets which are in good condition.

Most process units were designed with only the minimal amount of instrumentation, that which is required to safely operate the process. But without visibility into the condition of process equipment it is difficult to effectively schedule maintenance. The majority of these assets are only periodically inspected. This leaves operators and maintenance personnel without sufficient insight into the health of the equipment. Often these assets are maintained under a preventive maintenance program where the asset is "repaired" on a routine basis whether it is required or not.

Wireless proposition

Plants around the world are now adding transmitters to provide the measurements missing from the original design that can help process engineers and the maintenance and reliability departments gain insight into the health of process equipment. And many existing plants are automating their asset management programs through the addition of wireless technology.

Wireless transmitters can be installed with minimal effort and resources, since cable trays and junction boxes need not be opened to install wireless technology, and disruption and risk to personnel safety is greatly reduced thanks to less time in the process area.

The raw data from these instruments is aggregated in essential asset monitoring software with pre-engineered asset health modules for pumps, heat exchangers, air cooled exchangers, cooling towers, blowers, unmonitored compressors, filters & strainers, as well as pipes & vessels. Multiparametric algorithms embedded into the software provide easy-to-understand asset health information.

Similarly, smart instrumentation such as control valve positioners with valve diagnostics and flowmeters with

meter verification, which were not previously digitally integrated through the control system, can now be fitted with wireless adapters to integrate these health diagnostics into intelligent device management software.

For example, it is now possible to perform a sweep of all the control valves while they are in service to determine which of them need overhaul and which ones do not, greatly facilitating turnaround planning and execution.

Flowmeters can be assessed while they are in use to find out which ones need to be calibrated. This way, valves that need repair and flowmeters that need calibration can be serviced during the turnaround, avoiding the need to pull them while the plant is in operation, thus ensuring longer "time on pipe", i.e. time in service on the pipe or vessel as opposed to on the bench in the workshop.

Wireless sensors help reduce operator rounds for test and inspection. By adopting a "check the software first" mindset, the maintenance team can implement data-driven desktop maintenance planning to better schedule daily maintenance by using the asset health information delivered via the wireless sensors, making it possible for plants to reduce unplanned slowdowns and process shutdowns, save energy and reduce maintenance costs.

Technicians can confirm the health of an asset, such as a pump, from their desk, which saves them the trouble of going to the field to inspect or for planning turnaround reducing the duration of the outage.

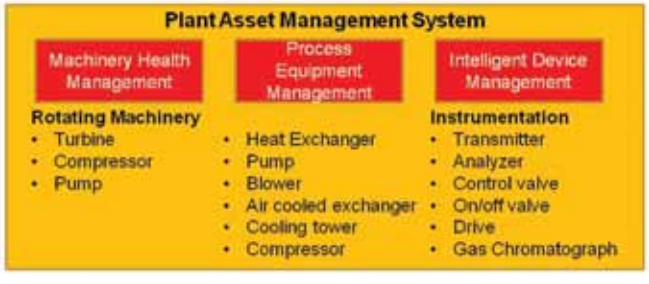
Moreover, in case of failure, the maintenance technician can Google the process equipment before heading out to maintain them, thus knowing what the problem is and what to do about it.

Managing more sensors

A common trend in plants across all industries is to install more wireless sensors on process equipment to provide measurements that were not included in the original design or even for revamps.

In addition to improving long-term asset reliability and reducing operator clipboard rounds, wireless also provides measurements for Energy Conservation Measures (ECM), and Health, Safety and Environmental (HS&E) such as monitoring of safety showers and eye wash stations.

More sensors dramatically increases the number of devices in the plant, making the use of 4-20 mA and on/off signals with associated wiring and I/O cards impractical. Plants instead use digital communication networks from the "first meter", deploying digital everywhere, and wireless is the easiest way to deploy a digital sensor network in an existing plant.



Intelligent device management and process equipment management are both part of asset management.

Deployment issues

Using gateways, WirelessHart can be integrated into any system supporting Modbus/RTU, Modbus/TCP, EtherNet/IP, or OPC. That is, no system is too old to integrate WirelessHart. There is no need to replace or upgrade the control system to use WirelessHart. The wireless gateway doesn't even have to come from the system supplier.

Modernisation for wireless networks can be done incrementally or site-wide as part of an overall modernisation project beginning with an audit of the existing site, followed by definition of scope, detail design, installation, and commissioning.

For plant-wide modernisation, the original EPC for the plant can be well positioned to support large-scale upgrading because the original isometric pipe drawings, 3D models, and other documentation can reduce the mechanical engineering for the sensors.

However, some sensors such as vibration, temperature, and acoustics simply clamp on and need minimal mechanical work. During periods when few new plants are built, EPCs can instead direct their resources to plant modernisation.

The beauty of digital sensor networks in general, but wireless networks in particular, is that expansion is very easy since individual wires or I/O channels are not required for each sensor added.

Integrated wireless transmitters for pressure, flow, level, valve position, pH, conductivity, on/off contact, vibration, temperature, multi-temperature, and acoustic as well as level switches, on/off valve actuator and wireless adapters for wired devices are available.

All of these devices can share the same wireless network and be set with update periods to meet diverse application needs and maximize battery life. Multiple temperature input transmitters are ideal for heat exchanger and boiler tube monitoring as the number of transmitters can also be reduced; a good example of a device which is possible with digital communication but not with 4-20 mA.

Making it easy

WirelessHart transmitters are very helpful to the maintenance department. But there is another reason why the technicians have accepted WirelessHart transmitters so quickly: the devices themselves are easy to use.

Just like 4-20 mA transmitters with Hart and Foundation fieldbus, wireless transmitters need setup/configuration, calibration, and troubleshooting/diagnostics etc. Wireless transmitters also require "provisioning" to prepare them for joining the wireless network securely.

That is, the tasks performed on a wireless transmitter are largely the same as for 4-20 mA or Foundation fieldbus transmitters. Therefore the same tools should be used for wireless transmitters and 4-20 mA and Foundation fieldbus devices, making the learning of WirelessHart easy.

Wireless transmitters are configured with a network ID and a security join key before they join the wireless network, a process known as "provisioning". Because it should be secret for security reasons, provisioning is not done wirelessly. Once the provisioning has been done, the wireless transmitter has the necessary security credentials to commence secure wireless communication.

For WirelessHart, the join key can be automatically generated by the system, so that the user need not do it manually, and it doesn't get seen. The join key can be the same (shared) by all transmitters on the network, or each transmitter can have a unique join key, a security scheme known as an Access Control List (ACL).

Once the WirelessHart transmitter joins the network, the system will automatically detect the transmitter based on its tag. There is no hassle of transferring any "provisioning files" to the gateway. If the network ID is changed in the WirelessHart gateway, the gateway will automatically update all the transmitters in the

Handheld field communicators for 4-20 mA and Foundation fieldbus also work for WirelessHart.

network. There is no need to provision the transmitters again.

Therefore, all WirelessHart transmitters have a standard maintenance port where the same familiar handheld field communicators and laptop software used in plants for commissioning, configuration/setup, calibration, and diagnostics/troubleshooting of 4-20 mA and Foundation fieldbus devices can be connected.

The same tools can also be used for all WirelessHart transmitters regardless of manufacturer, so technicians need not adopt new unfamiliar tools or software. Special infrared tools for each manufacturer are not required for WirelessHart and technicians do not have to lug a heavy laptop when working in the field, but can use a lighter handheld field communicator instead.

A handheld also has the advantage that it can be operated by one hand and has longer battery life. Even the same documenting calibrator used for 4-20 mA and Foundation fieldbus devices can also be used for WirelessHart devices.

Another benefit of using the same tools for WirelessHart transmitters is that WirelessHart transmitters are setup/configured, calibrated, and diagnosed the same way as 4-20 mA and Foundation fieldbus devices. Plants already have the tools, and technicians are already familiar with the procedures to use them.

4-20 mA, Foundation fieldbus, and WirelessHart all use the Electronic Device Description Language (EDDL). Thanks to EDDL (www.eddl.org), 4-20 mA, Foundation fieldbus, and WirelessHart have user interfaces which are very similar. This makes it easy to manage a mix of devices even though they using different signaling.

The steps for downloading EDDL files onto the system to keep it up to date with the latest types and version of devices is the same for WirelessHart as for 4-20 mA and fieldbus devices.

4-20 mA (HART)

FOUNDATION fieldbus

WirelessHART

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Justified investment

Installing sensors using 4-20 mA or on/off signals in an existing plant is disruptive and carries a risk of damage to the plant. Wireless is therefore a good alternative to conventional hardwiring as a second layer of automation for applications beyond the P&ID. WirelessHart enables accelerated deployment, making it possible and low risk to deploy this second layer of automation during a short turnaround or even while the plant is running. This modernization of maintenance does not affect process control, alarming, or safety – it is a second layer of automation that goes beyond the P&ID.

The maintenance department loves the asset health information assembled from WirelessHart transmitters because it eliminates unnecessary maintenance work, and also because WirelessHart transmitters are easy for plants to adopt because they require no special tools beyond those the plant already has for 4-20 mA and fieldbus devices.

Start a side-wide modernisation program by justifying the investment in the additional automation to the plant management. A consultant can help develop the justification. Follow with an audit of the plant assets and the operation & maintenance procedures to enable definition of the scope to fill the gaps.

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