PlantWeb University – Wireless 301

Wireless Applications in Process Automation

15 minutes

In this course:

Overview

Recent advances in wireless technologies are making it easier to gain the benefits that wireless offers in process automation – including opportunities to improve labor productivity, better manage inventories, reduce maintenance, and optimize performance.

No single wireless technology delivers all these benefits in every situation. That's because there are so many different potential applications, each with a different requirement and a different "best" solution. The good news is that, with so many potential applications, there are plenty of opportunities to put wireless to work for you.

This course outlines three common types of process-automation applications for wireless technology, including examples and benefits.

"It's in my plant, but too expensive to connect to."

"I can see it, but it's hard to get to."

"I can't see it, but it's critical to my business."

It's important to note that these are only examples. The number of potential applications is almost limitless. Once you understand the potential of wireless technology, you'll begin to see opportunities throughout your operation.

Hint

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

- How can information on remote tank levels reduce delivery costs?
- What new type of data can some Remote Terminal Units now handle?
- What is the relative cost of adding wired and wireless measurement points in a plant?
- Why might you add wireless communications to a device that already has a wired connection to the control system?

In-plant applications

"It's in my plant, but too expensive to connect to."

As we'll see later in this course, some wireless applications involve communication over distances from hundreds of meters to hundreds of kilometers.

But even the much shorter distances inside a plant – or in a single process unit – can sometimes be too difficult or expensive to cover with traditional wired connections.

Wireless technology can help overcome these economic and technical barriers. In fact, the density of potential information sources inside a plant offers a wealth of opportunities.

We don't have room in this course to cover all these opportunities, so we'll look at two of the most common (and rewarding): adding low-cost incremental measurements, and accessing "stranded" diagnostic information.

In-plant applications
Low-cost incremental measurements

Think what you could do with information from additional measurement points.

For example, if you had more real-time data on storage tank levels, steam-line temperatures, or relief-valve status, could you increase process uptime, improve consistency, or detect emissions more quickly? The possibilities are limited mostly by how many ways you can imagine to improve your operations.

Traditionally, however, adding measurements has meant adding wires to bring the data back to the control room – and often the cost of acquiring the information outweighed the potential benefit. Estimates vary, but when you include design, procurement, installation, and startup, as well as the infrastructure needed to support a typical wired analog measurement point, costs can total nearly $10,000 a point.

On the other hand, you can probably install a wireless monitoring point for a fraction of that cost – up to 90% savings on installation. That can dramatically shift the cost-benefit balance in your favor.

The low cost and ease of adding wireless measurement points can also help you justify automating manual data collection – the "clipboard rounds" that can keep operators from doing more productive work. Not only is manual data collection time-consuming, it's subject to human error. And how often have operators simply missed a measurement because they were too busy?

Although some plants have tried different wireless technologies for collecting measurement data, the reliability and robustness of **self-organizing networks** give them the advantage. The concept is simple: each wireless device in the network not only serves as a measurement point, but also acts as a router for communications from neighboring devices. If a message can't get through on a direct communication path, it's automatically re-routed through other devices.

*For more on this application, see the course on **Why Wireless**.*

In-plant applications
Accessing stranded diagnostics

One of the advantages of HART-based field devices is their embedded diagnostics capability. Unfortunately, this diagnostics information often is “stranded” – or goes unused – because many legacy control systems don’t support HART communications.

As a result, plants with hundreds or thousands of HART devices already installed can miss out on opportunities that diagnostics offer for reducing maintenance costs and improving equipment performance.

Wireless technology can help you gain those benefits by providing a separate (but easy and affordable) link to the stranded diagnostics in your HART devices.

The solution involves adding a wireless module to an existing HART device for which you want diagnostic information. The module is electrically connected to the loop wiring without requiring a break in the loop to install, and it accesses the HART data without affecting the analog control signal.

The radios communicate through a self-organizing network to a **gateway** device. Like a wired multiplexer, the gateway brings data from all the devices together into a central location – where you can access the diagnostic information using asset-management software.

For the relatively small incremental cost of wireless radios, gateways, and asset management software, your HART diagnostic data is at your fingertips – and you have the tools to improve process performance and make maintenance decisions without the labor costs of frequent trips to the field.

*For more on this application, see the course on **Accessing Stranded Diagnostics**.*

Near-plant applications

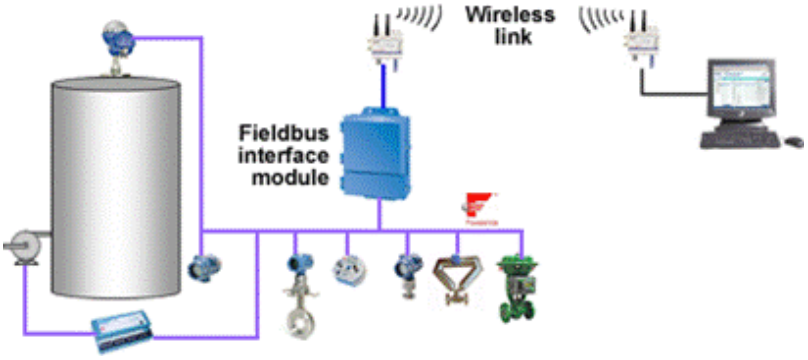
"I can see it, but it's hard to get to."

Sometimes even moderate distances or other barriers (such as highways or rivers) can make a wired connection simply too expensive or difficult to install.

That's often the case for hard-to-reach or unstaffed areas on the periphery of plants – including tank farms, loading and unloading stations or docks, and environmental treatment processes. You can probably think of several similar applications in your own operation.

These **near-plant** applications can also benefit from wireless technology. Often the best approach is to combine FOUNDATION fieldbus technology within the remote area with a wireless link back to the central control room.

Besides low installation costs, FOUNDATION fieldbus offers a capability that makes it ideal for these applications: many fieldbus devices can perform control functions independently of a host system. A radio-equipped **fieldbus interface module** can then integrate and wirelessly communicate data from the remote site back to the central control room or wherever else it's needed.



Combining FOUNDATION fieldbus and wireless technology provides a cost-effective way to automate near-plant applications.

This arrangement brings you the benefits of enhanced monitoring and simple control in areas where you couldn't afford it before. But that's not all: the wireless link and fieldbus technology also enables remote diagnostics of smart devices from a central asset-management system, reducing the need for frequent "equipment check" trips to the remote location.

*For more about automating near plant applications using wireless, see the course on **Near-plant Wireless Applications**.*

Remote applications

Wireless technology often makes sense when a hard-wired connection is impractical. That can definitely be the case when the measurement or asset information you need is many kilometers from where you'll use it.

"I can't see it, but it's critical to my business."

Examples in this category include

- remote inventory monitoring
- remote chart recorders
- remote diagnostics in gas & oil fields

Let's look at how wireless technology can help in each of these examples.

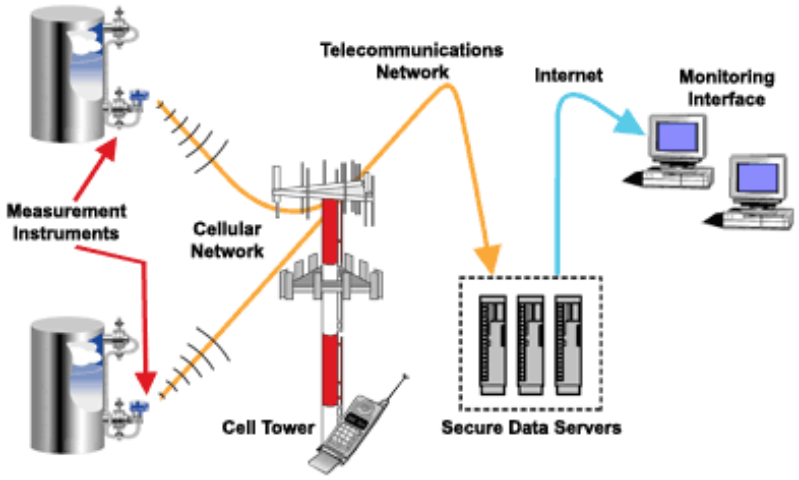
Remote applications
Inventory monitoring

Companies that make cryogenic gases, fuel oils, propane, or specialty chemicals often deliver these products by truck to tanks at geographically dispersed customer sites.

Managing deliveries to make sure tanks always have enough inventory to meet customer needs can be a logistical nightmare, especially if you don’t know how much is in each tank until the truck driver checks it manually on his next visit. Sending a truck too often increases delivery costs and ties up product that might be sold elsewhere. But if you send the truck less frequently, you risk an empty tank and an angry customer – plus the added cost of a rush delivery.

With wireless technology you can **automatically monitor** inventory levels to minimize the risk of tank outages and eliminate unnecessary truck deliveries for partial fills.

For example, a cellular radio at the remote location can transmit tank level measurements wirelessly from a remote tank to the nearest cell phone tower. From there, the information travels over the public telecommunications network to a data server. You can then access the data using a secure web interface – in the same way you would use a PC to access bank account information over the Internet.



Cellular technology helps make accessing remote inventory data easy and affordable.

This application of wireless technology offers several benefits.

Minimize unnecessary delivery trips. When the contents of a tank reach a predetermined level, an automatic alert can tell you it's time to schedule a delivery. You don't have to send a truck before it's really needed, "just to be on the safe side."

Prevent tank outages. The same alerts can tell you when a delivery *is* needed, so you can plan a trip in time to prevent the tank from running dry.

Reduce need for safety stock. You can also program inventory level alerts to notify you when adjustments are needed to minimize the amount of safety stock.

Fewer errors. With manual monitoring of tank inventories, human error is inevitable. Automation minimizes the potential for mistakes.

*To learn more about wireless web-based monitoring solutions, see the course on **Reducing Remote Inventory Logistics Costs**.*

Remote applications
Chart recorders

Paper-chart recorders are often used to track pressure, level, or temperature measurements in remote areas. With this traditional technology, periodic trips to the remote site are required – maybe weekly or monthly – to collect the paper chart, interpret the data, and install a new paper wheel.

More important, the only time current data is accessible is during these periodic site visits. And if the recorder happens to malfunction, it won't be detected until the next site visit – which could be weeks away.

Wireless technology can help eliminate these drawbacks. For example, a cellular-radio-equipped

measurement device at the remote location can automatically transmit the data for improved information gathering and analysis. You get the information you need – in a timely manner – and nobody has to drive out to replace the paper chart.

*For more on this topic, see the course on **Automated Pressure Chart Recorders**.*

Remote applications
Diagnostics in oil & gas fields

Wireless technology already plays a role in the oil and gas industry, where production and distribution systems can span hundreds of kilometers. In North America, Supervisory Control and Data Acquisition (SCADA) systems have long used high-powered 900 MHz wireless technology to communicate with Remote Terminal Units (RTUs) at wellheads, pipelines, and other remote sites.

Maintaining equipment across such vast areas can be difficult and labor-intensive – a task that would be easier with easily accessible, up-to-date information on equipment health and status. Unfortunately, traditional SCADA systems typically don't provide such valuable information, relying on the operator or engineer to notice when process-measurement anomalies imply a possible equipment problem.

More recently, however, advancements in wireless technology and improved-performance RTUs have made it possible to transmit diagnostics data from HART-based field devices into a central asset management system. This information makes it easier to detect and diagnose potential problems, often before they cause equipment failures or even shut down your remote operation.

*For more on this application – and other ways wireless technology can help in oil and gas, see the course on **Wireless in oil & gas fields**.*

Wireless and the mobile worker

Wireless technologies can increase the productivity of workers – especially those who spend much of their time away from the control room as they work on tasks throughout the plant.

As we mentioned earlier in the course, for example, in most plants operators collect data from hundreds of stand-alone measurement points manually while making "clipboard rounds" to check gauges, sight glasses, chart recorders, or other indicators once per hour, shift, day, or week. Now imagine using wireless technology instead of clipboards to bring that data back to the control room. The lower cost for adding wireless devices makes it feasible to do so for many of those hundreds or thousands of measurement points.

Because the wireless devices can collect and transmit the information automatically at frequent intervals, you'll get a more accurate, more up-to-date picture of what's happening in the plant – while your operators reduce their exposure to hazardous conditions and get more time for higher-value work.

Wireless technologies can extend mobile workers' access to critical process information, historical data, graphics and other key functions. For example, operators in the field can use wireless-equipped tablet PCs to communicate with systems or applications on the plant control network – without returning to the control room.

Wireless technology can also provide much of the information that maintenance technicians now have to collect manually – or can't access at all. For example, maintenance technicians often have to go into the field to check on devices whose readings aren't what operators expect. Often such trips reveal that there is nothing wrong, or the problem is elsewhere in the loop.

With wireless access to HART data, however, the maintenance team can quickly and easily check device status or perform diagnostics without leaving the control room or maintenance shop. Devices with advanced diagnostics can even enable you to detect potential problems before they occur – so you can take corrective action before operations are affected.

Wireless and control applications

Most of the wireless applications we've covered in this course have involved monitoring and diagnostics. That's because the greatest value in wireless technology today is its ability to provide additional information to help you make the most of your operation.

What about control?

As you'll learn in the course on **Wireless Control Applications**, there are unique considerations for doing wireless control. Especially for fast or critical control loops, you'll need to determine if the technology is a good match for the requirements of each specific application.

Before you apply it to your most difficult process control problem, it's a good idea to first gain experience on monitoring and non-critical control applications such as open-loop control and latency-tolerant, non-critical control.

Most in-plant wireless solutions utilizing self-organizing networks are robust enough for control while maintaining a cost-effective architecture that's optimized for monitoring. A good flexible network design will allow you to meet all your application needs cost-effectively.

Summary

Wireless technology is creating exciting opportunities in process and asset management – including leveraging information that was previously out of economic or technical reach. These include

- Monitoring remote inventory levels to reduce logistics costs
- Automating remote chart recorders to get more timely data while reducing labor costs and manual errors
- Accessing diagnostic data from equipment in distant oil and gas fields
- Automating near-plant operations where wired connections aren't practical
- Gaining process insights from incremental in-plant measurements
- Taking advantage of "stranded" diagnostics in HART devices throughout your plant

These are only a few examples based on the kinds of benefits wireless users are getting today. You're likely to discover many more potential applications in your own operation.