

Wireless Diagnostics for Steam Traps

Chris Gibbs

Armstrong International, Inc.

Steam traps have been around for a hundred years or so, and for the most part, nothing revolutionary has come forward to change the basic way a trap functions. Any operation that uses steam to produce a high-quality, consistent product depends on a multitude of these ingenious devices to do their job day in and day out. Yet, who watches over these steam traps, which may number in the thousands, to ensure that they perform without fail? Who conducts the weekly, monthly and annual inspections recommended by the U.S. Department of Energy to make sure these traps function as they should?

Let's face it, maintenance staffs have been cut back, and even though just one blown trap can cost a plant more than \$6,000 a year, "best practices" fall by the wayside when it comes to the time-consuming task of inspections. For those who do conduct trap surveys, valuable hours can be spent on manual inspections that may show a trap performing as it should one day, but failing the next. Worse yet, these surveys put workers at risk by exposing them to high elevations or hazardous plant areas.

While traps may not have changed much in the last hundred years, the technology to diagnose and monitor their performance has. Wireless, radio-frequency (RF) based tools are now available to not only take the guesswork out of monitoring steam-trap performance, but also enable plant managers, utility managers and maintenance supervisors to capture wasted energy costs and better deploy labor.

How harnessing new technology in steam trap monitoring can curb energy costs, reduce labor and make your operation safer

Trap testing goes high tech

Historically, the primary method of steam trap testing has been a visual inspection, aided by the use of temperature monitoring and listening devices such as ultrasonic stethoscopes (Figure 1).

Although these traditional methods are better than the alternative of not testing, their diagnosis is often inconsistent. They still require intervention by trained personnel to listen to each and every steam trap to determine if it's blowing through, leaking or functioning properly. Today, these devices have given way to more reliable, less labor-intensive high-tech alternatives.

Wireless monitoring systems such as those using RF transmitters (Figure 2) have been around since the 1980s. However, their adoption has lagged, due in part, to historically low-energy costs and a lack of compatibility with a cross section of multiple steam-trap brands.

The chemical process industries (CPI) have been experimenting with wireless solutions over the past five years. Because of rising energy costs, a reduced labor force and the availability of a wider range of options, wireless technologies are now gaining widespread interest and demand. People are looking for measurement-economics, safety and security; and although the adoption of wireless technology is relatively slow today, industry experts predict a sharp adoption curve



FIGURE 1. Traditionally, visual inspection has been the primary method of steam-trap testing. Manual inspections are aided by the use of temperature-monitoring and listening devices, such as the ultrasonic stethoscope shown here

within the next five to six years.

Wireless monitoring systems vary widely and are based on a number of data-transmission technologies, including RF, microwave, infrared, satellite and cell phone. Each technology has its own benefits and drawbacks, and some technologies are better suited to certain end-use applications than others. For example, satellite technology is very reliable and provides 100% coverage, but such systems are very expensive. On the other hand, transmission by cell-phone is less expensive than satellite transmission, but it's also much less reliable. For purposes of this discussion, we'll focus on RF technology and its application in high-pressure, critical-processing environments, such as the production of chemicals.

How RF technology works

In its simplest form, RF technology consists of a transmitter and receiver that exchange data, much as a handheld, two-way radio functions. When this technology is applied to steam traps, the transmitter is typically mounted externally to the trap. The RF transmitter monitors the operation of the trap, identifying fluctuations in flow and deviation in temperature. These indicators are used to determine if the steam trap has failed, is open or is closed. The transmitter then relays the signal to a receiver, which translates and stores the data in a

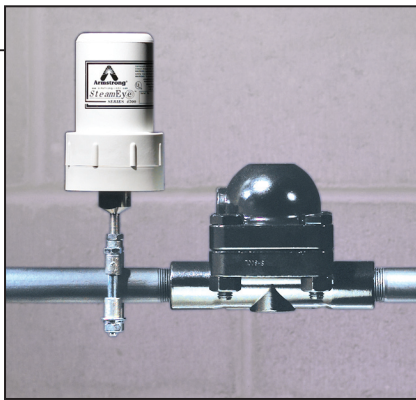


FIGURE 2. Radio frequency (RF) wireless monitoring systems are becoming more popular because of their reliability and 24/7 monitoring capability

readable format. Users can access the data from any network computer or from any offsite location with a Web-enabled device. A typical setup for a facility is shown in Figure 3.

RF communication uses a narrow-band frequency spectrum (typically 902–928 MHz) and often, does not require an FCC license for operation. The typical transmission signal range is 1,200 ft in outdoor applications where the transmitter is located within the receiver's line of sight. In facilities where the signal has to travel through walls or floors, the range will vary. In these situations, repeaters (stations that pick up and carry the signal from a transmitter to a receiver) may be necessary.

The 24/7 watchdog

RF steam-trap-monitoring devices act much like a plant's security or surveillance system. They keep a close watch over the steam traps being monitored and will alert operators of any breach. While RF monitors can't prevent a trap from failing, they can provide immediate alerts about traps that need attention.

Whereas manual trap inspections offer only a point-in-time evaluation, wireless RF trap monitoring systems enable a plant to continuously monitor thousands of steam traps 24 hours per day, 7 days per week (24/7). When a trap fails, a maintenance team can be sent promptly to fix or replace it. This helps a plant maintain the integrity of its end product, as well as reduce overall operating costs.

The average cost of steam is now over \$10 per 1,000 pounds. A single leaky trap with a 7/64-in. orifice and average pressure of 250 psig will cost \$6,10/yr. Multiply that by an average trap malfunction rate of 15%

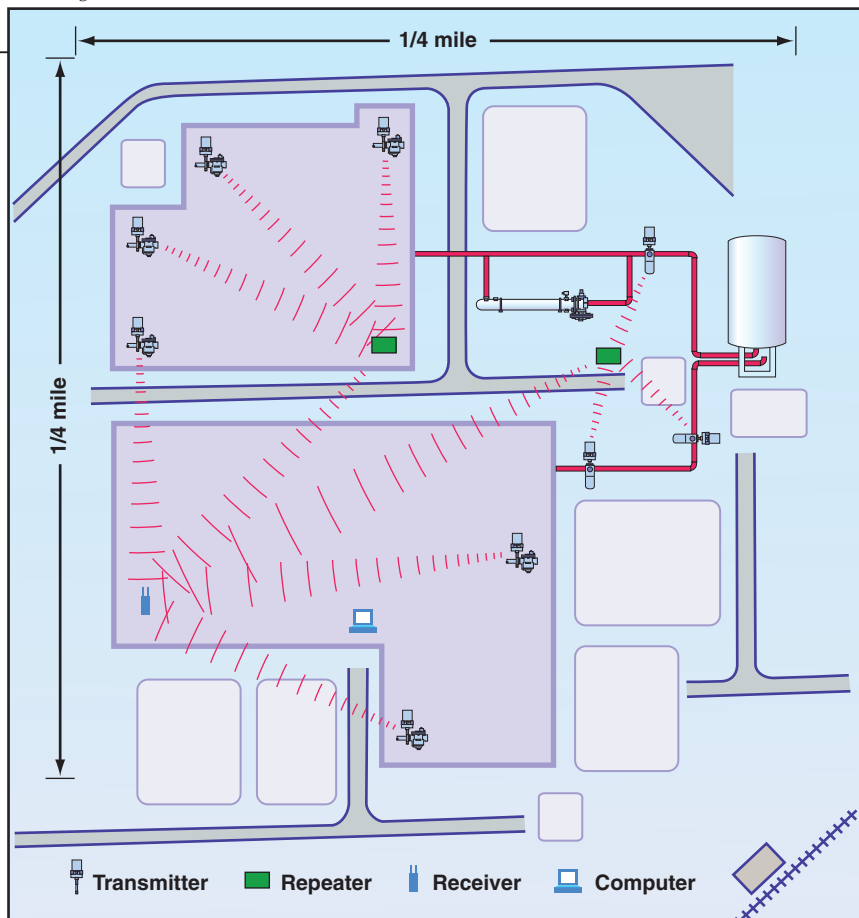


FIGURE 3. A typical facility layout using an RF-monitoring system consists of transmitters, repeaters and a receiver

across 1,000 traps, and the cost runs \$915,000 annually. At this rate, installing an RF steam-trap-monitoring system can offer a very attractive payback. For example, a typical RF monitoring-system installation will focus on high pressure steam traps in the first phase of commissioning because these traps cause the greatest losses. For this type of installation, the average payback period is less than 12 months. Following this initial payback period, what was considered dollar losses, can now be counted as cost avoidance, because users can now respond immediately whenever a trap fails to mitigate losses.

The economics of purchasing a system become even more attractive when calculating associated costs, such as labor, that would arise under a manual inspection program.

Worker safety is also something you can't put a price tag on. Having personnel check steam traps in elevated piping areas is a common occurrence that can be minimized using a wireless trap-monitoring system. Wireless trap-monitoring systems not only make economic sense, but they should be part of any company's safety initiative.

In addition to 24/7 monitoring to maintain end-product integrity, reduced energy costs and enhanced worker safety, RF trap-monitoring devices can also provide a benchmark for comparing energy use and efficiency from many operating sites.

Some RF-monitoring devices use a Web-enabled platform, allowing an organization to measure and compare energy savings from one location with that of other sites around the world. This allows corporate energy managers to support and carry out their company's operating goals and strategies to achieve greater efficiencies and add profits to the bottom line.

End users looking for RF trap-monitoring solutions can turn to a variety of manufacturers and products — each with their own inherent features and benefits. Some manufacturers have invested their resources to bring wireless technology to market and provide an infrastructure to integrate or host a variety of wireless solutions. Other companies have concentrated their resources in developing point-specific solutions such as RF steam trap diagnostic tools. The best approach

to get started may be to begin with a small system that's scalable, allowing additional receivers to be installed as needs evolve and requirements change.

'Wired' for wireless

Making the move to wireless steam trap monitoring requires not only a capital investment, but also thoughtful planning. Engineering considerations must be made, including the integration of wireless devices with other wired and wireless networks.

Critical process applications, such as chemical and pharmaceutical manufacturing, require ongoing monitoring and immediate identification of closed or failed traps to ensure that the integrity of the end product is not compromised.

When making the move to wireless systems, such as RF-trap monitoring, end users need to evaluate not only which applications are best suited for the technology, but also their current engineering and communications infrastructure.

The decision to invest in a wireless steam-trap monitoring system should be evaluated in the context of other alternatives and variables, including the cost of installing wired systems, the need for ongoing labor for manual inspections and wasted energy from blown or leaking traps that go undetected. Most RF systems require a relatively small investment, and some manufacturers even offer their solution as part of a monthly or annual operating-maintenance agreement. Critical areas, such as high-pressure steam, should be considered first. Other less-critical areas can then be added later. ■

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Author



Chris Gibbs is an account manager at Armstrong International, Inc. (816 Maple Street, Three Rivers, Mich. 49093. Phone: 269-273-1415; Fax: 269-278-6555; Email: chris@armstronginternational.com) where she has worked for over 10 years. Her experience includes steam-

and condensate-system optimization and troubleshooting, steam-system measurement and validation, and development of best-practice steam-trap management programs. Gibbs has a bachelors degree in business administration from Western Michigan University.