Wireless Tutorial:
From Remote Site to Desktop:
SCADA Connectivity with No Wires
By Harry Conrad

Fifteen years ago, even the more advanced automation systems seldom supported telemetry. Systems that did employ telemetry offered very slow data throughput and rarely could provide coverage to every automated location, limiting their usefulness. Today, it's common to have 100 percent communication to all field locations, and to experience data throughput from the field of 19.2 or even 38.4 K baud. High-speed backbone telemetry is now available in the megabits range.

Wireless instrumentation is the latest telemetry trend, supporting analog and digital signals without the constraints of a wired connection. Wireless technology can now be used to communicate to and from pressure or temperature transducers, to control valves remotely, to signal the arrival of switch closures, or to report status changes and contact closures.

The latest of these telemetry advances is the wireless network: A radio system that communicates from the desktop to the RTU (remote terminal unit) or PLC (programmable logic controller), and then to the field instrument (transducer, valve, etc.) without wired connections, on one continuous radio network.

Wireless communications allow users to check the status of controllers and attached instrumentation – plus the health of the telemetry system itself. This diagnostics capability is available throughout an entire SCADA (supervisory control and data acquisition) system, on one continuous network.

Several manufacturers now offer radios capable of retrieving data from remote locations. And although wireless I/O (input/output) has been available, only recently have both capabilities been offered in one communication solution.

Common wisdom used to hold that telemetry could reliably handle the long haul, sending data from a remote site back to the host, but that the local connections to the instruments needed to be hard-wired to ensure reliability. Today, wireless networks have shifted the conventional thinking in automation. Spread spectrum radios now create a robust local area network in the field, which reliably transmits the signals back to the network's backbone.

Networks

Many people think of a network as consisting of Cat 5 cable run through the office. In field automation, there are two more types of networks.

- The first is the field automation counterpart of the WAN (wide area network), which can extend 40 to 100 miles. This network, often referred to as the "backbone" or "skeleton," consists of a series of repeaters connecting the host computer to all the remote locations. Depending on which technology is used, this repeater network can offer high-speed throughput and the ability to bridge many physical obstacles, such as hills, valleys, or buildings. The backbone network can cover distances far greater than any single radio link could alone. By using multiple repeaters, you can rebroadcast data and regain full signal strength at every repeater.
- With telemetry technologies such as spread spectrum radio, the same radio used in the RTUs can act as a slave sending data back to the SCADA host, and also as a repeater to

other field devices or other RTUs. This allows you to expand a network almost limitlessly by using remote sites as a series of repeaters, and using radios in the RTUs to poll the instrumentation. This ability to poll the instrumentation creates the second network: A network of instruments wirelessly reporting back to the RTU. This short-haul network is the equivalent of a LAN (local area network).

Now we have two interlacing networks, the WAN and the LAN working on one radio system, and using a common connection. This common connection is the "slave/master" switchable functionality of the single radio used in the RTU. The radio installed in the RTU is a slave to the SCADA host, and a Master to the wireless I/O.

Economics

Wireless I/O is less expensive than conventional "hard wire" systems, and much easier to install.

- For example, at a "typical" oil and gas well site, the operator will want to transmit measurements from multiple locations back to the RTU. When a contractor (such as an electrician) is hired to install these hard-wired connections, the costs are about $16 per foot, whether the application is direct burial cable or conduit and wire. The break-even point for wireless I/O would be about 50 feet, if we consider only the cost of wire and labor. The cost savings multiply when two or more wire runs are required to two different locations, because the slave/master radio is already installed in the RTU, meaning the only incremental cost is the additional slave radio.
- Time is another factor in calculating true installation costs. Again using the "typical" oil and gas well as our example, a crew would work one full day to install wire and trenching for a well head to retrieve casing pressure, tubing pressure, plunger arrival, and control lines for the valve. The wireless I/O radio can be installed in 20 minutes.

Further complicating this, scheduling conflicts, logistical problems, and unexpected costs frequently result from getting the necessary contractors and end-users on location at the same time. Compare this to the 20-minute installation of a wireless I/O radio, allowing one man to quickly complete the job and move to his next assignment.

Reliability

People often question the reliability of wireless products. As in all technological innovations, "new" takes some getting used to. Radio has proved itself as a reliable data highway for remote data collection. Now with the "new" wireless I/O functionality of radio networks, the reliability question again becomes a possible stumbling block for the advancement of this technology.

Some wireless I/O providers have built safeguards into their networks to help operators address reliability. Examples of this are "link alarms," "command alarms," and "autonomous collection mode."

- Link alarms let an operator know if the signal between an I/O slave and the RTU has been lost. The operator then knows that he is no longer receiving data from the instrument.
- Command alarms warn the operator that while the link is operational, a command to change (such as a command to shut a valve) could not be executed. The reason may be

mechanical or electrical, but in either case the "need to know" is critical – and the wireless I/O can supply this alarm.

- Autonomous mode means that if an RTU loses its radio link to the SCADA software host, the wireless I/O radio and the radio in the RTU will continue communicating. The RTU is programmed to be the control on the location – so if, for example, a tank reaches the high-level mark, the RTU will receive this information from the wireless I/O radio and send (via wireless I/O radio) the command to shut the valve to the tank.

Notification Makes the Difference

No system is completely immune to signal loss. Wired systems are prone to having wires cut during construction or repairs. Rust, corrosion, steam, dirt, dust, and water all can affect a wired instrumentation system. The difference is that wire cannot notify you of a problem – but a radio can.

Author Biography –

Harry Conrad has more than 10 years of direct outside local engineered/technical sales and 14 years of experience as a Regional Manager of sales representatives, channel partners and outside distributors for manufacturers. He recently joined FreeWave as Business Development Executive. Conrad also has 30 years of Industrial and Water/Waste Water Process Instrumentation, Control, and Automation experience.

