Pros and Cons of Wireless Architectures

The days of being tethered by wires to a single location for data access are long gone. Today, organizations have many options, including Bluetooth® wireless, cellular monitoring, wireless monitoring, satellite and remote monitoring. But not all of these technologies have the same capabilities, and it is these differences that make one a better choice than the others for your application. Here is a brief rundown on some of the top new technologies for data acquisition and data logging.

UWBT-PH
pH transmitter.

UWBT-RH
Relative humidity
(includes probe).

UWBT-RTD-TB
RTD with terminal
block connection.

UWBT-TC-M12
Thermocouple
with M12 connection.

UWBT-TC-UST
Thermocouple with
universal TC connector.

Bluetooth® WIRELESS

Bluetooth is a global standard for wirelessly connecting devices. Dr. Jaap Haartsen invented the Bluetooth standard in 1994 when he was an employee at Ericsson.

Originally, the idea was to replace RS232 cables with Bluetooth wireless. Later, Ericsson, Nokia, Intel, IBM and Toshiba formed the Bluetooth Special Interest Group to further the use of the technology.

Bluetooth uses radio waves to transmit data over short distances, up to 328 feet or 100 meters, although most devices have a more limited range closer to 30 feet due to interference. Bluetooth technology transmits in the 2.4 to 2.485 GHz range. It is a spread spectrum, frequency hopping full-duplex signal.

Bluetooth wireless requires a chip to transmit the radio signal and software to enable connections. It has a uniform standard for connection that has contributed to the proliferation of Bluetooth, and as a result, it is in a vast array of devices, from mobile phones to cars to medical devices and fitness monitors. Bluetooth is widely expected to play a key role in the evolving Internet of Things (IoT).

PROS OF Bluetooth WIRELESS

- Low power so it works well in battery driven devices
- Inexpensive so it can be deployed in low cost devices
- Manages voice and data transmissions simultaneously
- Low latency
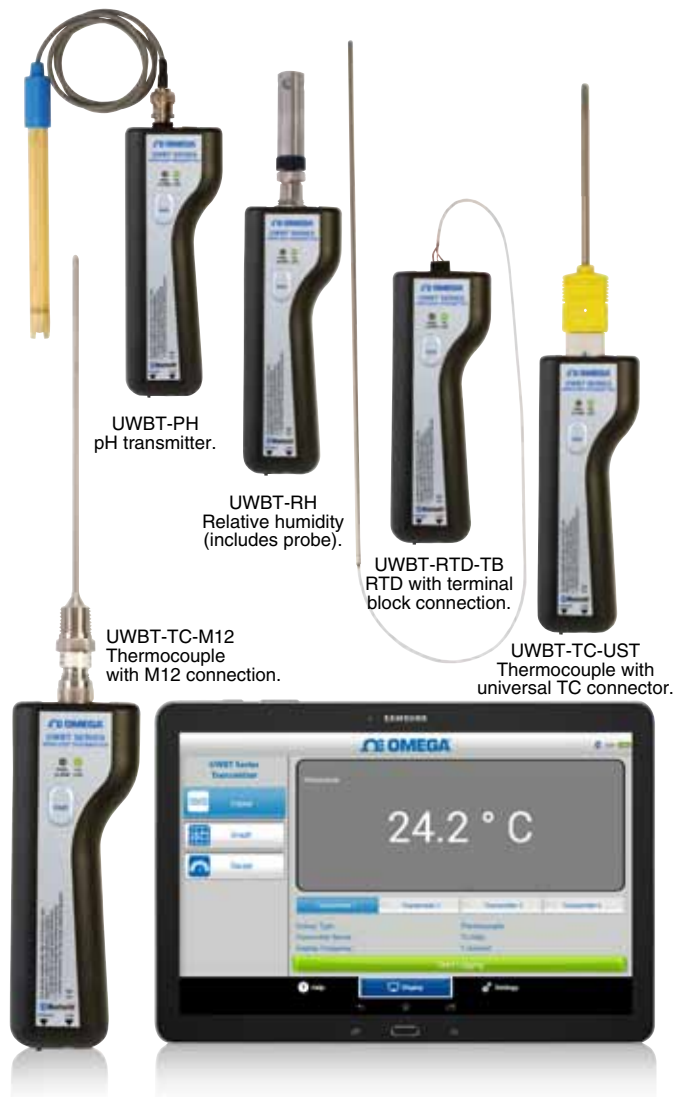
CONS OF Bluetooth WIRELESS

- Limited range in most devices
- Data transfer rate (24 Mbits/s)
- Incompatible pairing protocols between devices
- Requires local data logging to ensure uninterrupted data availability

Conclusion: Bluetooth wireless is an excellent method for transmitting voice or data between two devices in near proximity.

CELLULAR MONITORING

Cellular monitoring uses the same technology as wireless phones and mobile devices, which is essentially a radio. The technology uses varying frequency ranges and technologies to expand the number of devices that can access the band or cell simultaneously. The cellular network enables more traffic within each frequency by breaking the coverage area into cells that function almost as separate networks. The result is fast, reliable communication in most parts of the world.

Cellular networks work well for broadcast messages or for alerts. Cellular monitoring has been used in home and building security systems, plant and equipment status monitoring,

OM-SQ2010 data logger shown smaller than actual size.

zED-TC-LCD-DC-H2 shown smaller than actual size.

environmental monitoring such as temperature or humidity, and data transfer between computers.

Cellular monitoring typically uses the GSM protocol. The main advantage of cellular monitoring is that it is easier and less expensive to implement than hard-wired monitoring systems. As long as there is a nearby cell tower supporting the right frequency range, it is reliable and reasonably secure. In addition, many cellular devices work even during a power failure. Cellular is an ideal solution for data logging information that can be updated periodically in a batch. It is not a good choice for continuous monitoring and communication requirements.

PROS OF CELLULAR MONITORING

- Reliable
- Readily available, as long as there is coverage in the area
- Inexpensive for data logging and batch transfers
- Ideal for monitoring remote locations like storage tank levels

CONS OF CELLULAR MONITORING

- Bandwidth limitations and availability in congested areas
- Requires local data logging to ensure uninterrupted data availability

Conclusion: Cellular monitoring is ideal for applications and data logging where updated information is not required in real time, as long as there is reliable cell coverage in the area.

WIRELESS MONITORING

Wireless monitoring uses the same Wi-Fi technology as home or business networks. It is very fast. Wi-Fi signals can be

made to cover large areas through the use of repeaters and boosters, so it is an ideal solution for large installations. Without boosters, wireless has a range of about 1,000 meters if there is no interference.

Wi-Fi signals are easily intercepted, so it's important to have appropriate safeguards such as firewalls in place. Wireless monitoring is less expensive to set-up than wired solutions in existing installations, since there is little or no cabling required. Wi-Fi can connect a diverse variety of devices from PCs on desktops to PLCs on equipment, along with mobile devices and VoIP phone systems.

The fastest wireless networks run on a standard called 802.11n, which has a maximum transmission rate of 600 Megabits per second with multiple antennas and no competition from other devices. Wireless runs on 2.4 GHz and 5 GHz bands.

IEEE 802.15.4 standard at 2.4 GHz is another wireless protocol that is ideal for conditions where battery life considerations are important, such as remote locations or dangerous environments. IEEE 802.15.4 is good for low to moderate volumes for data acquisition and logging and provides the added advantage of simple connectivity. The 2.4 GHz band is open for private use throughout the world, making it popular for industrial solutions. This standard allows for both point-to-point and point-to-multi-point configurations, so it works well in both simple and complex networks and remote monitoring solutions.

Zigbee builds off the IEEE 802.15.4 protocol and adds additional capabilities such as more robust routing and networking. Zigbee is ideal for situations where data must be relayed from point-to-point but some radios are located outside the typical wireless range. The Zigbee mesh networking forwards data between nodes until it reaches the desired node.

PROS OF WIRELESS MONITORING

- Fast transmission speeds

- Inexpensive installation in existing locations

- Flexible connections

- Handshaking ensures accurate data transmission even if data must be resent

- Ideal for monitoring remote locations like storage tank levels

- Multiple protocols enable a wide range of solutions to allow usage in widespread or congested environments

CONS OF WIRELESS MONITORING

- Susceptible to interference

- Requires strong security

Conclusion: Wireless monitoring is a versatile and inexpensive solution for a variety of applications in locations with no interference.

REMOTE MONITORING

By allowing people to see status data from anywhere, remote monitoring is ideal for situations with harsh or dangerous environmental conditions or where a single individual or team must monitor results from multiple locations or sources. Typically, the user accesses the information using a browser and the Internet, so it is inexpensive and easy to set-up. Remote monitoring may be combined with cellular or wireless monitoring to trigger alerts when conditions at the remote site warrant review or action. Remote monitoring often includes remote diagnostic capability, which allows the team to diagnose issues and often take corrective action remotely.

PROS OF REMOTE MONITORING

- Accessible from any location with Internet access

- Provides safe monitoring in dangerous environments

- Flexible—manages voice and data

- Alerts for out of range conditions

CONS OF REMOTE MONITORING

- Susceptible to power failures

- May require personnel to go on-site to reset or repair equipment when out of range conditions occur

iTHX-SD-5D shown smaller than actual size with SD card and DB9-Y cable for dual probe (included).

Conclusion: Remote monitoring is ideal for applications in dangerous or harsh environments where conditions are relatively stable and adjustment to equipment parameters can be made remotely.

Cloud connectivity is ideal for any of these wireless solutions, because it provides secure data access and upload, while allowing remote monitoring and maintenance over dashboards or cloud applications. Cloud also allows for simple, highly accessible data storage, which simplifies analytics and reduces the need for on-site storage or other technology requirements.