OILFIELD AUTOMATION
MAXIMIZE YOUR EXISTING INVESTMENTS
API 682 FAVORS CONTINUOUS MEASUREMENT
OVERCOME TRANSFER PUMP PROBLEMS
TRADE SHOW PREVIEW: LAGCOE & SPE
Wireless automation has changed the paradigm associated with lightning damage to oilfield automation. Historically, oil and gas automation has relied heavily on the direct burial of copper cable for signal communication from remote devices back to a central controller. This cable acts as a copper conductor for power transients, such as indirect lightning strikes. Most automation damage is caused by these indirect lightning strikes. Copper cable buried on a location acts like an antenna picking up inducted power surges from the surrounding area.

Most damage is caused by distant lightning that strikes, leading to power transients that travel through the ground to the maze of wires buried on a production location. Although the lightning does not directly hit the object on the ground, the electromagnetic field that lightning produces does affect the object. The magnetic power surge induced by lightning travels through any conductive material nearby.

According to Faraday’s Law, the magnitude of the induced surge will depend on the available length of wire. Because of the low voltages normally used in data transmission cables and the sensitivity of the electronic equipment attached to these communication cables, oil and gas automation equipment is extremely susceptible to this kind of induced voltage. The longer the cable, the greater the potential for damage.

With the tremendous expansion of oilfield automation and electronic surveillance equipment, the potential for damage has become a major concern. Even a small amount of overvoltage can cause arcing between components on printed circuit boards and subsequent damage. Some types of damage, such as arc burns, are immediately apparent. The equipment may have catastrophic failure immediately. Other damage may be hidden and result in premature failure in the future.

A single strike that seemingly yields no damage often drastically reduces the life expectancy of sensitive and expensive equipment. Mitigating transient damage from inducted power surges is crucial to operations and to the economics of oil and gas automation.

Wireless Automation Offers Lightning Protection for Oilfield Equipment

By JIM GARDNER / OleumTech

Wireless automation offers lightning protection for oilfield equipment. Each wireless gauge is battery powered and has its own radio and antenna talking back to a single data hub. (Images and graphics courtesy of OleumTech)
Why Wireless?
Removing the buried copper cables eliminates the path for induced power surges from indirect lightning strikes. Few automation problems are associated with direct strikes. A direct strike will destroy wireless transmitter and whatever process equipment it was attached to, but these incidents are extremely rare.

Even when a direct strike occurs, there is no path for the electrical energy to pass from one piece of equipment to another because nothing is connected with wire, so losses are dramatically reduced. Each wireless gauge is battery powered and has its own radio and antenna talking back to a single data hub. Even if one piece of wireless equipment is brought offline or damaged, no other equipment at the location will be affected.

Protocol and Classification
Most wireless transmitters designed for oil and gas operations use Modbus protocol and are easily integrated into common oil and gas controller devices such as remote terminal units (RTU) or programmable logic controllers (PLC). Almost all are designed to be class one, division one (C1D1) devices that can be safely installed in hazardous environments.

Safety
Many professionals have raised concerns about the inherent safety of wireless automation. Operators often voice concerns about communication failures from the remote radios. Manufacturers have worked to address these concerns in several ways. Some manufacturers have added communications to the list of Modbus addresses that each device returns. This means that an operator can set two or more alarm values for the remotes. One alarm can be set to activate if the signal strength of the remote radio drops below a preset threshold and a second can be set for loss of communication after a preset interval, such as 30 seconds. These thresholds are user selectable and can be set to greater or lesser intervals depending on the critical nature of each...
piece of equipment. This allows users to generate alarms early rather than having to wait for catastrophic failure as they need to with wired solutions.

**Security**

Each manufacturer of wireless oil and gas automation devices has addressed security concerns in their own way. Many address security concerns with the use of security keys, which resemble passwords for each device. Another common technique is the use of spread spectrum radios which “hop” between frequencies 100 times per second, making it extremely difficult to continuously monitor the data delivery. Also, many manufacturers continue to use serial communications that only allow data transfer between two points. There are no IP addresses so there is no way to tunnel through the system. Additionally, many wireless devices are transmit-only rather than transmit and receive. It is not possible to send signals to a remote device that is built to only transmit.

**Battery Life**

Each manufacturer has designed their devices to maximize battery life. Some are more successful than others, but the single biggest factor in determining battery life is the duty cycle of the individual instrument. Since many manufacturers use a “push” technology rather than a “poll and response” technology, each instrument has a different battery life depending on how often it is programmed to push data back to the central data hub. For example, if the operator wants a tubing pressure measurement every second, the battery life may be less than six months. If they set the duty cycle on a tank battery to 15 minutes, the battery life may be as great as 10 years. The operator can match the duty cycle to best fit their individual needs for each remote device.

**Oil & Gas Wireless Applications**

Applications for wireless technology in the oil and gas industry include:
- tank level
- high-level alarms
- casing pressure
- tubing pressure
- valve control
- plunger lift optimization
- flow monitoring and totalization
- separator level
- separator temperature
- compressor monitoring
- chemical tank monitoring
- sump level monitoring
- flowback tank monitoring
- fuel tank monitoring during fracking
- sand filter levels
- RTU/EFM I/O extensions
- ESD
- pipeline cathodic protection
- rectifier voltage monitoring
- gas flow measurement
- pipeline pressure and valve monitoring
- raw material tank levels
- flare temperature monitoring
- pressure relief and shut-off valves
- steam trap monitoring
- flow meter monitoring
- rail car high level alarm monitoring
- safety showers

**Conclusion**

Wireless oil and gas automation has been gaining acceptance for more than 10 years. In that time, manufacturers have increased the breadth of the product offered to include every aspect of process control in an upstream oil and gas production facility or a multi-well production pad.

The benefits of wireless automation are numerous, but the most compelling is the elimination of lightning damage on oil and gas production locations. With lower commodity prices come smaller crews, and everyone is extremely busy in the field. Near real-time data retrieval has become a mandate in many companies. Production optimization, theft prevention, gas allocations and production balances are considered critical.

General George Patton is credited with saying “A solider should never have to fight a battle over the same ground twice.” Those in the oil and gas automation industry could say a technician should never have to automate the same location twice. Effectively eliminating the damage caused by lightning, power surges and ground-based power transients can help accomplish this goal. Interestingly, the geographic areas where the most lightning strikes occur annually are also the areas where many new wells are being drilled. The threat of lightning will not decrease any time soon, but we can change our practices to operate better in these environments.

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