LIGHTNING-FREE AUTOMATION

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What if you could install lightning-free automation? Well, now you can. Wireless automation has changed the paradigm associated with lightning damage to oilfield automation equipment.

Background

Historically, oil & gas automation has relied heavily on the direct burial of cable for signal communication from remote devices back to a central controller. This cable acts as a copper conductor for power transients (indirect lightning strikes). A majority of all automation damage is caused by indirect lightning strikes. Copper cable buried on a location acts like an antenna picking up all inducted power surges from the surrounding area.

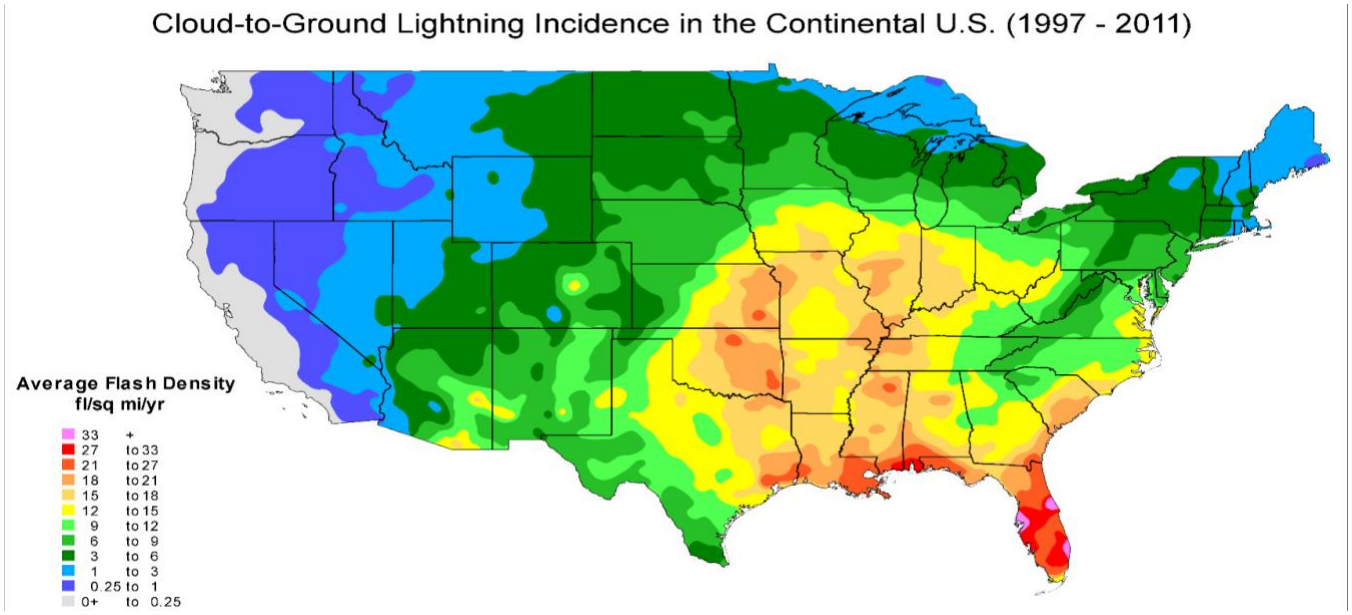

Figure 1: Could to Ground Lightning Incidence 1997-2011 (VAISALA)

According to the National Severe Storms Laboratory (NSSL) at NOAA, there are approximately 25 million ground strikes per year in the U.S. and Lightning can have between 100 million to 1 billion volts and billions of watts of energy. That's a lot of energy out there primed to cause problems with our automation equipment.

Most damage is caused by lightning that strikes long distances away leading to power transients that travel through the ground to the maze of wires buried on a production location. Although the lightning did not directly hit the object on the ground, the electromagnetic field that lightning produced does. The surge induced by lightning travels to any conductive material nearby. According to Faraday's Law, the magnitude of the induced surge will be dependent on the length of the wire available. Due to the low voltages normally used in data transmission cables and the sensitivity of the electronic equipment attached to it, oil & gas automation equipment is extremely susceptible to this kind of induced voltage. Increasing the cable length creates a greater risk for potential damage. With the tremendous expansion of oilfield automation equipment the

potential for damage has grown. It does not take much of an over-voltage to cause arcing between components on printed circuit boards and subsequent damage.

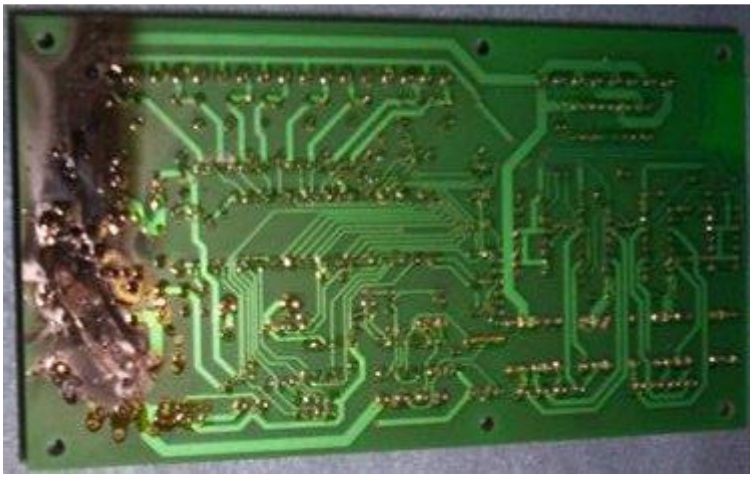

Figure 2: Lightning Damage on Circuit Board

Some damage is immediately apparent such as arc burns. Other damages may be hidden and result in premature failure at a later date. This hidden surge damage can affect operation of the equipment while showing no outward sign of damage. A single strike that seemingly yields no damage often drastically reduces the life expectancy of this sensitive and expensive equipment.

Why Go Wireless?

The answer is simple: when you remove the buried copper cables, you remove the path for induced power surges.

In addition to the preventing premature failure of equipment, this also directly reduces maintenance costs. The direct cost of equipment is easy to quantify, but reducing the intermittent failures associated with lightning damage is a significant soft cost. These intermittent problems are often the most difficult to troubleshoot with both increased production downtime as well as increased labor.

With Wireless I/O, there are no wired paths for the induced electrical energy to pass from one piece of equipment to another. Therefore, when there is a direct strike, the maximum damage can only be losing a piece of wireless instrument and not affecting any other equipment on location.

Safety

Many concerns have been raised about the inherent safety of wireless automation. Typical questions voiced by operators are over their concerns about communication failures from the remote radios. Some manufacturers have added communications to the list of data that each device returns. When you contrast this with a wired solution, it becomes apparent that you have gained the ability to generate alarms early rather than having to wait for catastrophic failure.

Oil & Gas Wireless Applications

- 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
- Flow Back 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

Summary

Wireless oil & gas automation has been gaining acceptance for over 20 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.

While the benefits of wireless are numerous, one of the most compelling benefits is the significant reduction of lightning damage on oil & gas production locations. 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 soldier should never have to fight a battle over the same ground twice” For us in the oil & gas automation industry, it would be fair to paraphrase this and say a technician should never have to automate the same location twice. Interestingly, the geographic areas where the most lightning strikes occur annually are also the areas where we are currently seeing the many new wells being drilled. There is no reason to think that the lightning pattern will soon change. However, there are ample reasons to think that we have the ability to change our practices, and therefore, change the result.