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Wireless Infrared Gas Detectors Proven Effective on Offshore Platform

By Paul Nesdore

The benefits of wireless gas detection systems for offshore platforms in terms of safety, flexibility and cost were clearly demonstrated on this North Sea platform

While there are many potential applications for wireless gas detection, there is one important application where it could be extremely effective for the oil and gas community—on off-shore platforms. This idea challenged GasSecure, a company established in 2008, to the single goal of developing a truely wireless, infrared gas detector. They knew that a wireless gas detection system would have great cost benefits in addition to contributing to flexibility and safety. Wired systems, on the other hand, greatly limit the ability to install and/or relocate detectors at a reasonable cost. Wired systems also dictate gas detection layout and ultimately the safety of the platform.

Statoil and ConocoPhillips, as the major stakeholders, commissioned GasSecure to develop the best hydrocarbon detector on the market and make it wireless.

The installation took place at Gullfaks C last January. (See Figure 1.) Gullfaks is an oil and gas field in the North Sea operated by Statoil. Gullfaks consists of three platforms, Gullfaks A, B, and C. The Gullfaks C platform was chosen as the test site for many reasons. The platform is an old installation having had many add-ons over its more than 25 year lifetime. It has many obstructions from heavy steel decks, machinery and radio communication that could put the detectors' communication system to the test. Gullfaks C is also situated in an area of the North Sea prone to harsh weather, another test for the system.

Topology

The test installation on the Gullfaks C platform complemented the detection equipment that Statoil already had in place. The location of these detectors influenced the layout or topology of the new wireless system. Figures 2 and 3 show typical topologies for installations.

The Gullfaks C installation includes 3 gateways communicating to 20 detectors. All gateways communicate back to one fire and gas node executing the safety logic and displaying the result on the ABB safety system. The wireless bus, on which the detectors are communicating, is ISA100.11a. It is a standard, 128 bit encrypted, wireless bus developed and supported by the ISA organization (www.isa.org). The wired side of the installation, from the gateway and beyond, uses Profinet. Modbus TCP could have been an option but was not chosen here.

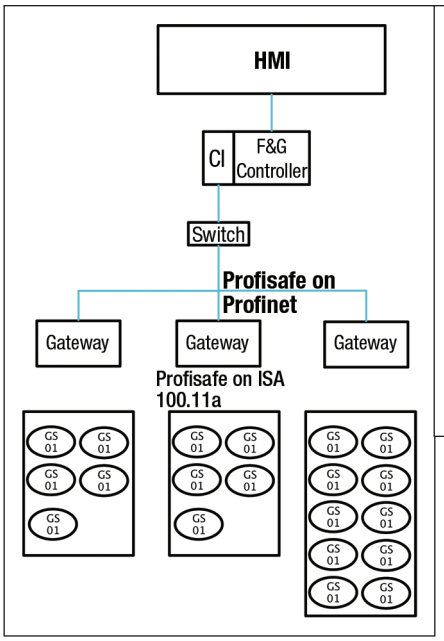
Redundancy

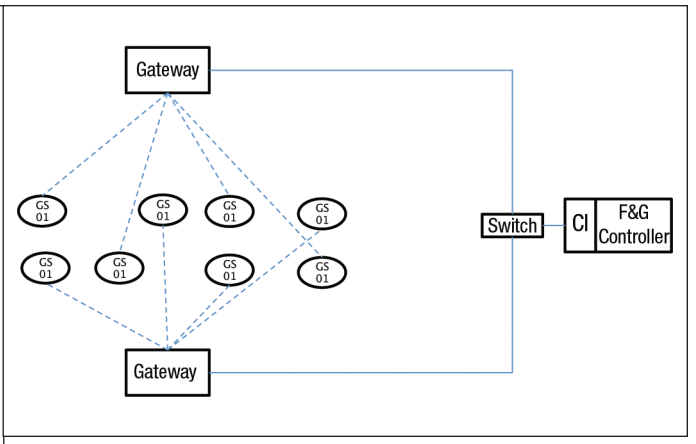
Safety systems are designed to be ready and available and to perform their tasks when required. Systems are therefore designed to avoid single points of failure, and that can be accomplished through several levels of redundancy. All detectors have been paired up with their unique gateway in order to create a tight communication link between the units. The detectors can com-

Figure 1.Gullfaks C Platform

municate directly with the gateway or through one of the other detectors (hopping). All detectors will at any given time maintain two communication routes back to their dedicated gateway and thus secure a redundant communication link.

Wired detectors located in the same area would normally be routed via separate junction boxes and cable trays back to the safety controller. The same setup can be achieved with a wireless solution by logically exchanging the junction box with a gateway. Loss of one gateway will decrease the density between detectors until the lost gateway has been fixed or replaced. However, detection will still be available through the gateways still operating.





Figures 2 and 3. Typical topologies

Safe Wireless Transmission

For safe communication at SIL2,[1] four error handling mechanisms must be supported: sequence numbering, timeout in the absence of response, device code name, and data consistency checking. The purpose of these mechanisms is to detect failures of the safety device in terms of packet loss, unacceptable network delay, bit errors, replay attacks, etc.

A safety controller will send a packet equipped with the four above-mentioned mechanisms. The safety device needs to respond to that packet within the process safety time. If the device does not respond before the safety time elapses, the device is marked as unavailable in the control system. It is fundamental to the operation of all safety systems that the exchange of safe packets is initiated by the controller and that there is a one-to-one correspondence between the packet sent and the packet received. Once the controller receives a response, a new request can be issued. Several options exist for implementing the four required safety features. One approach, chosen by GasSecure, is to base the product on a certified implementation of an open safety protocol. GasSecure has chosen ProfiSAFE over Profinet and ISA 100, due to the widespread use of the former in process control applications. Other safety protocols may be implemented following the same principles of operation.

Wireless Coverage

One of the most common questions related to wireless instrumentation is the communication availability. Can we trust the wires that are not there? Industrial wireless solutions like ISA100 and Wireless HART have been around for some years. Data from the thousands of installations that use wireless communication clearly shows that the concerns about data losses are much greater than the actual data losses experienced. If you match the stability of communication with the redundant communication routes always available for each detector, you will have a robust installation with very high reliability.

Since it is difficult to be completely certain as to where radio waves can be transmitted, you will always have some challenges on specific installation sites. However, as experienced on the Gullfaks C installation, radio transmission was actually aided by all the metal structures giving the radio waves the possibility to bounce their way between detectors and gateways.

The Detector

A normal wired detector on the market today uses 3-6 W in operation. The GS01 detector from GasSecure, used in the Gullfaks C test, uses 5 mW. This power reduction of one thousandth is the real difference between existing infrared detectors and the infrared GS01. The solution is patented by GasSecure and is an enabler of a wireless, battery operated detector with intrinsically safe design. The low power usage gives the battery a lifetime of about 2 years and the intrinsically safe design of both detector and battery enable the detector to be installed, and the battery to be changed, in hazardous areas without any "hot" work or special safety permits.

Results

The GS01 from GasSecure went through extensive testing by Statoil, DNV and GasSecure to see how it performs in different environments. The offshore installation at Gullfaks C is Statoil's last verification of the system before it will be promoted on all Statoil installations.

Ten of the detectors at Gullfaks C have been installed shoulder-to-shoulder with Statoil's legacy wired gas detector to compare responses. The tests showed that the response time is essentially equal for both detectors; however the digital design of the GS01 gives a quicker reading on the correct level of gas (LEL reading).

All readings of the GS01 are 100% stand- alone and no filtering has to be applied as is the case for regular detectors.

Why Wireless?

The real driver for wireless solutions has been cost. The costs related to cable, cable trays, junction boxes, installation, engineering and documentation alone is a substantial part of the cost for wired systems. An estimated 70-90% overall cost reduction can be documented for wireless installations. Added to this you will have the savings in weight of cables and equipment which can be very significant for offshore installations. A third and very important benefit is flexibility. When a site needs more detection capability either through expansion or modification, one can add detectors without disturbing the running of the operation. This can be done by adding onto an existing wireless installation or to a site employing conventional wired detection. G&I

Reference

1. SIL2 or Safety Integrity Level 2 is a way of classifying equipment according to performance required from the equipment. Key performance aspects are Probability of Failure on Demand (PFD) and Risk Reduction Factor (RRF).

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