WHITE PAPER

Minimising Gas Exposure in Hazardous Areas

For those working within hazardous areas, reducing the time exposed to dangers is a crucial way to lessen potential risks. With technological advances in instrumentation in the gas detection industry offering more opportunities to reduce maintenance, and in turn lessen the amount of time operators must spend directly accessing instruments, now is a great time for those in the sector to reassess their gas detection technology portfolio.

This paper reviews the ways those within the sector can minimise exposure to gas in dangerous areas and the various ways advancing developments in gas detection technology are facilitating this process.

CROWCON
Detecting Gas Saving Lives

“A new generation of ‘intelligent’ gas detectors offer ‘bump test’ functions as an alternative to intermediate functional checks or full calibration.”

Gas detector maintenance

Conventional fixed-point gas detectors require routine calibration and maintenance to ensure reliable, long-term operation. Detectors using conventional electrochemical or catalytic bead sensors are typically re-calibrated every three months; or perhaps every six months on lower risk sites. Calibration usually entails zeroing the detector in clean air, followed by application of calibration gas and adjustment of the gas detector transmitter.

A new generation of ‘intelligent’ gas detectors offer ‘bump test’ functions as an alternative to intermediate functional checks or full calibration. The bump test is a quicker procedure and produces a definitive ‘pass/fail’ result that not only enables the engineer to complete the task in less time but also produces an auditable record that the test was conducted and the sensor was fully operational. On higher risk sites, a full calibration could thus be performed every six months, with a simple bump test at the intervening 3-month intervals.

It is becoming far simpler to perform calibration or bump test functions through the introduction of easily readable OLED displays and intuitive user-interface software. The transmitter should guide the operator through the whole process, with manual adjustments being made via an integral keypad (alternatively, some detectors use a magnetically operated reed switch).

Transmitters with keypads are simplest of all and prevent the risk of aborted actions due to the operator not having the correct tool.

This provision of ‘non-intrusive calibration’ eliminates the need to remove the lid or any other part of the transmitter, which would require a hot-work permit and make it time-consuming.

With the aim of helping organisations improve their operational efficiency and safety compliance, the solution provides actionable insight

Sensor replacement

Some widely used sensor types have to be replaced routinely every 2 to 5 years, or more frequently if exposed by extremes of temperature, humidity and gas. Electrochemical sensors used for toxic gas detection tend to require replacement every 18 to 36 months. Oxygen sensors typically need to be exchanged every 2 years, and catalytic bead flammable gas sensors may last many years but are susceptible to 'poisoning' if exposed to contaminants, such as silicone or lead.

Sensor replacement on conventional fixed-point gas detectors often requires physical disassembly of a transmitter and/or sensor housing. Doing this within hazardous areas takes considerable time, especially if personal protective clothing and equipment needs to be worn. This will also require a hot-work permit, which may delay the work by hours or even days.

The inclusion of intrinsically safe (or electrical isolation) protection concepts into the sensor module enables sensor removal in the hazardous area without a hot-work permit. These 'hot-swap' sensors facilitate faster sensor replacement which saves the operator valuable time.

The most intuitive designs enable the sensor module to be removed without any disassembly of the transmitter or sensor housing. This can be done using one hand and simplifies previously timely procedures.

Intelligent hot-swap sensor modules retain vital information including temperature compensation data, sensor ranges, alarm levels and calibration values. So, when a new sensor module is plugged in, it will become fully operational within seconds, without the need for the operator to make adjustments on the transmitter.

Pre-calibrated sensor modules can be supplied which can be simply plugged in without the need to re-calibrate with the transmitter into which they are inserted. This facility provides the option to completely remove in situ sensor calibration practises. Instead, sensors requiring routine calibration can be taken to a work-station in a safe area for calibration. Once calibrated, the sensor module simply needs to be plugged back into the transmitter in the hazardous area with no further action.

Changing sensor types

Hot-swap/intelligent sensors also enable the sensor type to be changed without modification of the transmitter. If, for example, the specific gas risk within an area of a site changes, a different sensor module may be inserted into the same transmitter.

A different type of sensor module may be needed in the case of vulnerable catalytic bead sensors being positioned in a location with high levels of contamination. A more robust infrared (IR) type sensor may then be retro-fitted to eliminate the cost of regular sensor replacement and reduce the number of times an operator needs to visit the detector.

The transmitter may be able to 'auto-configure' to a new type of sensor module. Where appropriate, the transmitter can also recognise a different sensor type, prompt the operator for acknowledgement and then automatically upload the appropriate configuration for the new sensor: full-scale range, units, alarm levels, etc. This saves the significant time it may take for the operator to manually adjust such parameters on the transmitter.

Of course, the transmitter must be designed to prevent accidental or unauthorised removal/insertion of sensors. User/operator permissions may be set within the transmitter limiting access to functions. The transmitter may also provide options to 'inhibit' the analogue output/fault relay to enable planned and authorised sensor swap-out without causing system faults.

Minimise time with the right equipment

As explored above, minimising gas exposure in hazardous areas is key to lessen the risks involved with work in these spaces. Equipping yourself and your team with the correct equipment that can achieve this time reduction is imperative.

Crowcon's new XgardIQ is the most intelligent fixed gas detector in our portfolio, as it has intelligent technology that can increase safety by minimising the time operators must spend in hazardous areas.

The versatile transmitter and gas detector has a range of features that protect engineers and support facilities managers of oil, gas, chemical & petrochemical plants and many more. It can be fitted with a variety of sensors for flammable, toxic, oxygen gases; a high temperature H2S

Sensor is also available. XgardIQ is 3rd party certified to the Functional Safety standards IEC61508 and EN50402 (SIL-2).

The sensor provides analogue 4-20mA and RS-485 Modbus signals as standard, and is optionally available with Alarm and Fault relays and HART communications. The 316 stainless steel is available with three M20 or 1/2"NPT cable entries.

With a focus on being safe and easy to use, the unit comes with a bright, clear OLED display which shows gas levels and detector status even in dark locations where visibility is poor. The sensor also offers non-intrusive calibration where zero and calibration functions are performed via the display and keypad. This means there is no need for a hot-work permit or any special tools.

With proof of safe operation at a glance, operators do not have to waste precious time in hazardous areas ensuring their unit is in working order before they can complete their work. The event log function stores all alarm, fault and maintenance events and provides easy visibility of the usage and history of the detector. A remote sensor option enables the transmitter/ display to be located in an inaccessible area.

The sensor is also simple to install and maintain, which again adds to its overall ease of use within dangerous areas which require smooth processes to ensure the safety of those involved. The universal transmitter is utilised for Crowcon's full range of sensor technologies and is the ideal choice for those looking for solutions for use in hazardous locations. An intelligent auto-sense function automatically detects whether a 4-20mA control system is being configured as current sink or source, and sets itself appropriately, eliminating the risk of being incorrectly set.

Alongside auto-sense functionality the sensor comprises an auto-configure function which detects when a sensor module is plugged-in and uploads the appropriate gas type, range, units and alarm levels.

With a focus on reliability the sensor's smart bump and speedy bump test functions minimises lengthy processes by enabling sensor health responses are visible and verified quickly and easily using test gas. In this vein, the entire process is automated and a reminder when a bump test is due is provided for the operator.

The XgardIQ display reminds users when calibration is due to ensure that sensors remain operational and accurate at all times. Users can also adjust the full-scale measuring range of the sensor via the display menu according to site or specific location requirements.

By streamlining data availability and accessibility you can avoid time consuming inventory management manual processes, as well as reduce lengthy report compilation that would previously have taken an exhausting amount of effort. Therefore your time can be spent analysing and exploring the insights that matter, as opposed to sifting through endless data in an attempt to bring it into one place.

"The ground-breaking design deployed in the XgardIQ high temperature H_2S sensor enables long life in environments up to 70°"

Reliable High Temperature H_2S Detection

Providing a reliable, long-life sensor for H_2S detection in hot environments was a primary focus for the design and creation of Crowon's XgardIQ gas detector. Sustained high temperatures cause the electrolyte on conventional electrochemical sensors to dry out, leading to premature sensor failure. The ground-breaking design deployed in the XgardIQ high temperature H_2S sensor enables long life in environments up to 70°, with the reliable performance electrochemical sensor technology provides.

This means the high temperature H_2S sensor delivers a reliable and safe solution for the harsh conditions of the Middle East.

The sensor can come with a remote sensor assembly, which can be installed where gas leaks are most likely to be detected earliest, in areas such as air ducts, tanks, channels and storage locations. Meanwhile the transmitter, with display screen and push-button controls, can be located for easy and safe access, up to 15metres away.

XgardIQ sensor modules are able to be quickly and simply 'hot swapped' without a hot-work permit, either for replacement with a new pre-calibrated module, or for temporary removal to a safe area for calibration. Designed with site safety and reducing time spent conducting routine maintenance at the fore, this high temperature sensor tackles the challenge of minimising gas exposure within areas where heat could potentially impair sensor functionality and reliability.

"Gas detectors, such as XgardIQ, are designed to make installation and commissioning as quick and simple as possible.

Commissioning

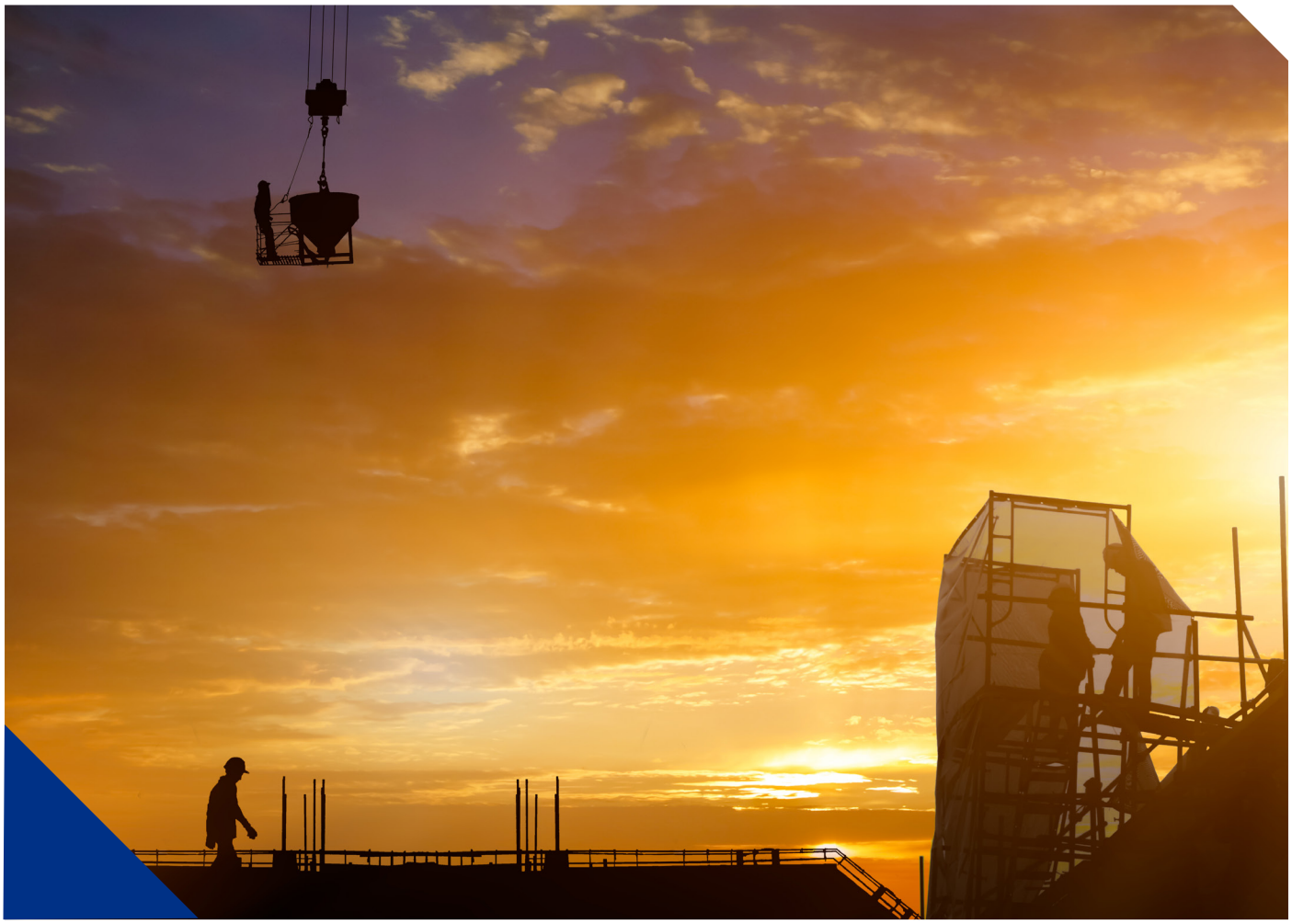
On new-build sites, gas detectors may be commissioned in environments where hazardous gases are not yet present. Detectors can therefore be commissioned with minimum risk to personnel. On operational sites however, detector commissioning may place engineers in a potentially hazardous environment for extended periods.

Gas detectors, such as XgardIQ, are designed to make installation and commissioning as quick and simple as possible. Minimising the need for transmitter set-up and adjustments is key. Gas detectors should be pre-configured to exactly meet each specific location requirement with the appropriate gas type, range and alarm levels prior to installation.

Commissioning issues can occur with gas detectors with analogue signal outputs (i.e. 4-20mA) that match the current sink/source assignment with the associated control system. Often loop-powered, current sink only gas detectors are purchased and connected to PLCs which only accept a current source signal. The only solution in such instances is to replace the detectors, or install expensive signal conditioners that convert the current sink signal to current source.

Even where gas detectors can be configured as either current sink or current source, there is the potential for them to be ordered or supplied incorrectly set, so the system would not function when first powered up. This scenario requires fault finding, which again extends the time the commissioning engineer spends in the hazardous area.

A new and unique innovation eradicates this risk; as mentioned the XgardIQ detector monitors the analogue signal when powered up and automatically configures itself to current sink or current source, as appropriate, to the control system to which it is connected.



Remote access to data

Gas detectors equipped with Modbus or HART communications protocols may be interrogated remotely for operating status or fault diagnosis. Whereas the 4-20mA analogue signal may still be used to perform the safety function, operators can communicate with detectors to obtain detailed information on its current 'health'. If any faults or issues are indicated, corrective actions can be properly planned before sending the engineer into the area.

For example, a fault signal may be indicated by a gas detector by means of a 1-2mA signal on a control system. On a conventional system without communications, an engineer would need to visit the detector to investigate the cause of the fault. If, for example, the fault was due to a failed sensor, the engineer would need to leave the area to obtain a replacement sensor, then return to the area at a later date to fit and commission the new sensor.

A Modbus or HART enabled detector allows the user to identify the cause of the fault remotely. In the example above, a replacement sensor could then be prepared beforehand, and the engineer would be able to rectify the fault in a single visit to the hazardous area.

Finding Fault

Intelligent gas detectors now offer local displays with comprehensive diagnostic messages and enhanced information, such as the applied supply voltage, analogue output signal current and even the optical obscuration level on IR detector mirrors and windows.

This wealth of information greatly reduces the amount of time required to identify faults, on the rare occasions they occur. All parameters within the gas sensor and transmitter are constantly monitored, and where an issue that could affect operation or safety is identified, the transmitter will display an appropriate message. This informs the engineer of the issue and may even prescribe the solution.

The provision of an 'event logging' function on an instrument further enhances fault-finding capabilities by recording events, such as alarms and faults, along with the date and time that they occurred. Thus, an engineer can determine the performance of the detector over a long period of time and easily identify any transient faults or alarms.

Maintenance actions, such as sensor calibrations, bump-tests and even sensor module replacement, are also logged as events, and thus a gas detector's entire history can be easily viewed at any time. This information can be used for preventive maintenance; for example the age of the sensor can be determined, enabling a replacement sensor module to be fitted before the original fails. In this way, down-time on the detector, and a potential period of time whereby an area is unprotected, is prevented.

XgardIQ incorporates a novel ‘Sensitivity’ function that enables the user to monitor sensor performance and proactively plan sensor replacement.

Sensor life prediction

When an electrochemical or pellistor gas sensor is first calibrated during manufacture, the amount of amplifier gain that is applied is measured and stored in the sensor module. On every subsequent routine calibration the gain required to achieve calibration is compared to the original data-point, and any increase (required due to reduction in sensor sensitivity over time) is extrapolated as a percentage reduction in performance.

Hence the instrument will display a Sensitivity of 100% for a new sensor, and this figure will reduce proportionally over the life of the sensor as its performance degrades. Attempted re-calibration will fail if the Sensitivity value of the sensor drops below 10%.

The user can track the trend over time via the display, or remotely via HART or Modbus protocols to make an informed judgement of remaining sensor life assuming environmental influences remain the same. This innovation enables sensor life to be maximised and replacement costs to be kept to a minimum, based on actual (not estimated) sensor response data.

Final Thoughts

To ensure yourself and those within your team remain safe and minimise the time they spend within hazardous environments, choosing the best equipment that can facilitate this is key.

For more information about Crowcon's innovative XgardIQ detector and the ways in which the technology employed can safeguard those within your team, get in touch today.

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