

INTEGRATED FIRE AND GAS SOLUTION - MAKING PLANTS SAFER AND MORE PRODUCTIVE.

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Whitepaper

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ABSTRACT

For the process industries, the safety of facilities, personnel, production processes and the environment is a crucial concern. Plants must meet their safety needs while optimizing operational and business performance.

Faced with this reality, they are seeking to ensure the lowest risk, and highest value protection, from their Fire & Gas (F&G) systems.

Integration of F&G systems into the overall control system is a very important factor in running modern process plants. Integration of data, sequence of events, alarms, time synchronization and diagnostic messages is mandatory for safe operations.

By implementing a unified fire and gas strategy employing the latest automation technology, plants can meet their critical infrastructure protection requirements while ensuring operational and business readiness at project start-up and during operations

In addition to providing the only truly integrated safety and security solution for the process automation industry, Honeywell's approach improves business performance by reducing the risk of incidents, faults and failures that cost money by disrupting normal operations.

INTRODUCTION

Industrial F&G systems play a critical role in protecting people, processes and the environment. They continuously monitor fire and toxic or combustible gas levels within process plants, and can provide early warning of an abnormal situation before it becomes a significant threat.

Efficient early detection enhances safety by reducing escalation of hazardous events, improves system reliability by reducing spurious activation, and provides financial benefits by optimizing the costs of detectors in the plant lifecycle.

Honeywell's takes an integrated approach to fire and gas solutions for the process industries. Our holistic offerings include fire & gas detection solutions, fire alarm panels for process & non - process buildings, and portable gas detection solutions to protect humans in hazardous situations.

F&G detection systems are key to maintaining the overall safety and operation of industrial facilities. They are commonly employed for offshore petroleum exploration and production, onshore oil & gas facilities, refineries and chemical plants, marine operations, pipelines, power plants, and mining sites.

The safety shutdown system is a prevention safety layer, which takes automatic and independent action to prevent a hazardous incident from occurring, and to protect personnel and plant equipment against potentially serious harm.

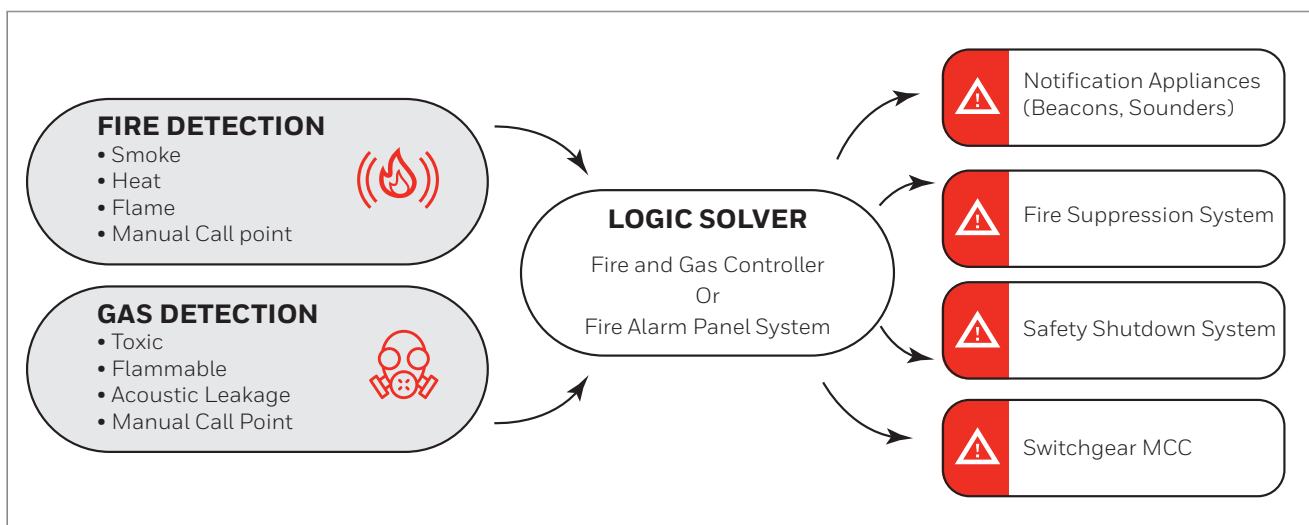
Conversely, the F&G system is a mitigation safety layer tasked with taking action to reduce the consequences of a hazardous event after it has occurred.

The F&G system is used for automating emergency actions with a high-integrity safety and control solution to mitigate further escalation. It is also important for recovering from abnormal situations quickly to resume full production.

A typical fire and gas safety system comprises detection, logic control, and alarm and mitigation functions. The logic solver is the central control unit of the overall F&G detection and control system. The controller receives status or analog signals from fire, gas & flame detection devices required for fire and gas detection. It also handles the required actions to initiate alarms and mitigate the hazard .

F&G detection devices have developed greatly over recent years. Using new techniques and adding intelligence to these instruments to reduce the number of spurious alarms has greatly improved detection rates. Correct and proven connection of F&G detectors to plant safety systems is an important factor in reliable performance of the overall system and for establishing the desired safety integrity level (SIL).

In the past, proprietary F&G systems were standalone equipment or a hardwired mimic overview panel via relays. Mitigation of risk would take place via manual activation of fire control measures. These methods are not considered best practice. Today, F&G detection systems are generally programmable electronic system (PES) type with high safety availability and mitigation effectiveness. As modern F&G systems are tightly integrated with the overall process safety strategy, mitigation either takes place via the emergency shutdown (ESD) system or directly from the F&G system itself.



DEMANDS ON INDUSTRIAL MANUFACTURERS

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Now, more than ever, industrial companies are concerned with fire and gas in their production operations. Corporate brand and environmental stewardship are important necessities.

All businesses should comply with relevant industry standards and codes such as NFPA, API and OSHA in the USA, and BS EN in Europe.

Industrial plants need effective solutions for improving a wide range of process-safeguarding practices. This requires a control system architecture allowing engineers to design and build standalone safety applications, as well as distributed plant-wide safety topologies.

Businesses must find ways to improve F&G system effectiveness through optimization of fire & gas detector coverage, system safety availability and mitigation effectiveness, and at the same time, reduce the cost of ownership for safety equipment.

As more operating companies move toward “smart” plants, appropriate integration with other systems will play an important role in increasing safety as well as efficiency. The F&G system will have tight integration with the distributed control system (DCS) addressing fire and gas graphics and alarms for display to the operator; meanwhile, there will be independent displays such human-machine interfaces (HMIs) to draw attention to fire & gas excursions when the DCS HMIs are not available.

The plant F&G system, and the fire system for occupied buildings, should be integrated with the system/site security center for plant evacuation. As part of an overall plant safety strategy, there should also be a unified platform for the command center/fire station for plant evacuation procedures, as well as ESD and F&G systems to provide a single window for operators. End users also require a common tool for engineering and maintenance to drive down operational risk and costs.

UNDERSTANDING SAFETY PERFORMANCE STANDARDS

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Industrial standards play a large role in the development, implementation and installation of F&G systems. The IEC 61511 standard (ANSI/ISA S84.01 in the U.S.) is a major step towards protecting industrial plants.

The overall safety lifecycle model described in the IEC standard lists all the project activities, from the concept (definition) phase to the decommissioning phase, necessary to ensure the functional safety of equipment under control (EUC). These activities can be divided into wide range of categories such as Analysis, Realization and Operation.

Implementation of the IEC 61511 and S84.01 standards is becoming increasingly prevalent for F&G detection systems. An ISA technical report (TR84.00.07-2018) to provide guidance on the evaluation of F&G system effectiveness.

The IEC 61511 standard concerns the determination and development of risk reduction measures (RRMs) required as the outcome of the EUC risk assessment. The basic principle of risk assessment is that all potential risks to the EUC are identified and analyzed. This includes calculating the probability of each potential EUC hazard and determining the risk reduction measures required to achieve an acceptable safety integrity level (SIL).

The potential risk of EUC hazards can be considered as the outcome of the probability that the hazard occurs, and the consequences of the hazard:

Risk = Probability x Consequences

The prescribed reduction measures either decrease the risk probability (e.g., ESD systems), or mitigate their consequences (e.g., F&G systems). The risk of EUC hazards can be reduced by a combination of several RRMs, where each measure takes care of a part of the total required risk reduction factor (RRF).

COMPONENTS OF A GOOD FIRE & GAS SYSTEM

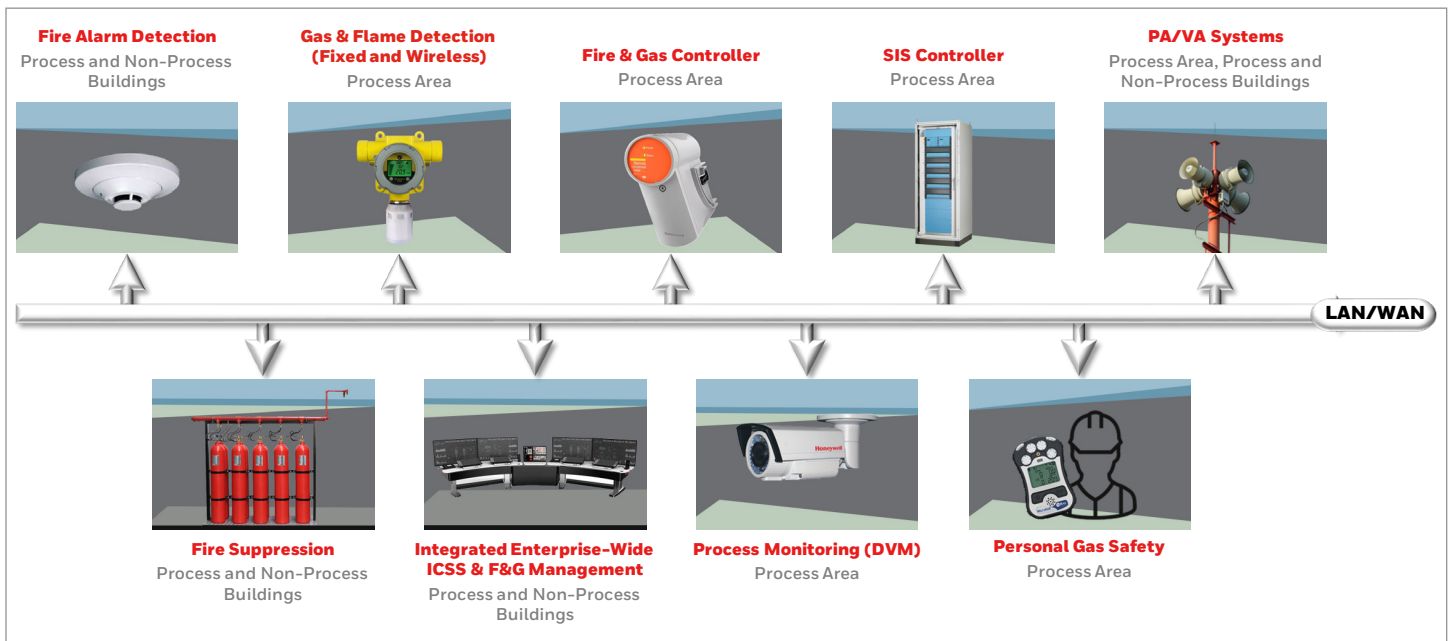
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A reliable F&G system combines innovative fire and gas detectors, conventional and analog addressable fire panels, clean agent and inert gas fire suppression systems, and a SIL 3-certified fire and gas logic solver into a consistently designed and executed solution.

It also provides common tools, operating interface and networking, resulting in a common platform with independent systems.

Honeywell's state-of-the-art F&G systems can detect early warnings of explosive and health hazards, including combustible and toxic gas releases, thermal radiation from fires and minute traces of smoke in sensitive equipment enclosures. Audio and visual alarms are generated to alert plant operators and fire-fighting personnel.

Overall, SIS technology integrates safety measures dispersed throughout a plant to reduce risk to employees, assets and the environment.



INTEGRATED APPROACH IMPROVES PLANT SAFETY

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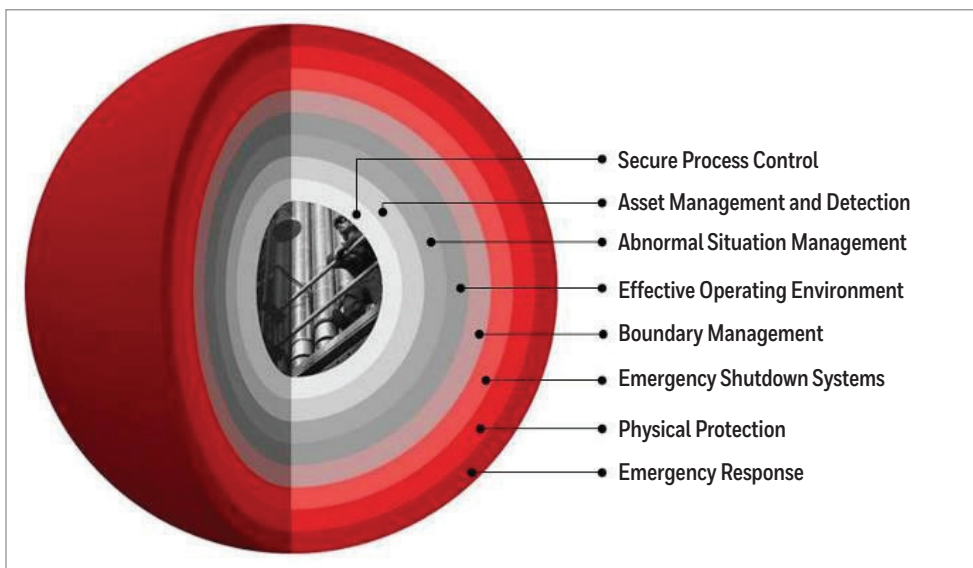
Industrial operations benefit from a holistic approach to safety that supports a secure process control network to the perimeter of the plant to protect people, assets and profitability.

A layered safety strategy encompasses process and system technology – and the people who interact with that technology – to help plants achieve their safety objectives .

A layered safety strategy unifies all plant protection layers (i.e., basic control, prevention and mitigation as outlined in IEC 61511 standard) required for achieving optimum functional safety. Plus, it provides the required functional safety with a high SIL. This includes superior visualization and logging facilities enabling optimal operator response and accurate evaluations. By integrating basic control, prevention and mitigation components, overall project costs and ongoing maintenance expenses can be vastly reduced.

A truly integrated safety system delivers:

- Integrated operational interface
- Integrated emergency shut down system
- Integrated peer control
- Integrated diagnostics
- Integrated failure or incident analysis
- Integrated fire and gas system
- Integrated tool for modifications
- Integrated tool for simulation and optimization



Operational integration allows plant personnel to have a seamless interface to the process control system, as well as third-party systems like compressor controls, machine monitoring systems, and ESD and F&G systems. From an operational perspective, it makes no difference where the application is running. All required information is available to the operator in a single window.

Plants implementing an integrated control and safety system (ICSS) platform for F&G, ESD and DCS systems can significantly lower their project implementation, operation and maintenance costs. Seamless integration with the ESD and DCS via a common network protocol also provides a safe landing in case of emergencies and eliminates the need for additional equipment or engineering. Integration of fire detection and security systems for off-sites and utilities with the plant automation infrastructure further improves operator efficiency through single-window access for alarm visualization, diagnostics, and events/historians.

At the core of a layered safety strategy is process design – the embodiment of the business, safety, and production considerations necessary for effective operations. At the next layer, this approach implements tools and procedures for managing abnormal situations and reducing incidents. When an abnormal situation occurs, alarm management, early event detection, and Abnormal Situation Management (ASM™)-designed displays ensure operators have the information available in the context they need it. This enables faster reaction to hazardous situations, thereby avoiding safety incidents.

Next, properly designed emergency shutdown systems and automated procedures can move a plant to a safe state in the event an incident escalates beyond the inner sphere of protection. Should an incident occur, F&G detection solutions, coupled with rapid location of individuals and a carefully designed emergency response procedure, will help contain the impact.

Finally, a layered approach to safety protects the perimeter of the plant using physical security that safeguards access to structures and monitors traffic approaching the facility.

Industrial facilities can leverage the benefits of their fire and gas strategy by employing an integrated main automation contractor (IMAC) to help them meet critical asset protection needs – and ensure operational and business readiness at project startup.

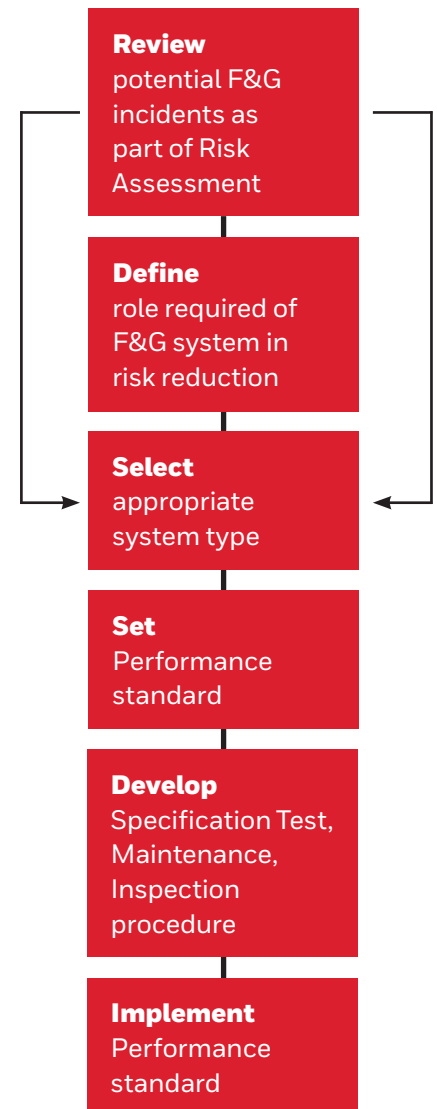
With the IMAC approach, plant management has a single point of contact throughout the entire system lifecycle. This results in optimized risk reduction and operational performance, better compliance with safety standards, and increased lifecycle sustainability.

End users should select a main automation contractor who brings together all necessary expertise in fire and gas detection for a complete, integrated solution. Certified device connections to the fire and gas safety system improve reliable performance of the overall mitigation function and establish the desired SIL. The chosen supplier should have global capabilities with consistent local support and implementation, as well as consistent engineering tools and processes for each project phase.

An effective project strategy starts with an assessment of future or existing fire and gas performance according to functional safety standards. Based on this assessment, end users have a detailed roadmap for installing new equipment or updating obsolete infrastructure to an optimal level of safety. The main automation contractor can help to identify fire and gas hazard points and possible risks, and develop basic design packages and related acceptance test criterions to meet safety requirements .

By partnering with a knowledgeable, experienced automation contractor, industrial plants can develop an IEC 61511/ISA S84-compliant fire and gas detection and suppression capability, as well as solutions meeting desired international standards such as NFPA or EN. Supplier assistance can extend to implementing SIS solutions; live hot cutover, implementation and execution of revamps; and installation, commissioning and safety validation.

To sustain the end user's F&G system performance, leading automation contractors also provide lifecycle support services that include periodic proof testing; system maintenance; training programs on safety, code and standard compliance; and spare parts management.



TYPICAL PROCESS INDUSTRY APPLICATION

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Like other process industry operations, Petroleum refineries present difficult challenges for automation and safety technology. Tank farms, storage areas, and processing units all require F&G and safety systems to protect personnel, assets and the environment. The consequences of incidents at petroleum refineries can be enormous.

In petroleum refining applications, operators need an integrated fire and life safety system allowing proactive response to alarms and events and a single, real-time view to any potential threat. Industrial plants have procedures and safety systems designed to bring operations to a safe state in the event of equipment malfunctions and other operational problems. In the case of a significant security incident, an integrated system can activate these same procedures and systems. It also leads to less expensive implementation and maintenance because all the pieces work together.

An integrated fire and life safety solution for petroleum refineries typically incorporates the latest technology gas/vapor detectors, integrated with the overfill shutdown system, to detect incidents before they escalate. The system will mitigate safety incidents by ensuring all personnel are informed of hazardous situations in a clear and unambiguous manner, and providing fast and efficient response to associated risks.

An effective petroleum refinery automation and safety/security solution will also integrate security access control, personnel mustering systems and video monitoring to reduce the possibility of unauthorized access or intrusion. Integration of technologies such as security biometrics and wireless mesh networks enhance the operation and the lower cost of implementation of these systems.

CONCLUSION

Today's industrial organizations face a host of operational challenges. Ensuring the safety of personnel, equipment, and the environment are priorities for every facility. At the same time, plants must find ways to optimize process performance, availability, and throughput – and thus improve their overall business performance.

Experience has shown Integrated fire and gas safety systems enable operating companies to minimize intervention and shutdowns and recover more easily from process upsets, while providing critical functions such as warning and mitigating a possible hazard.

A holistic approach to plant operation and safety also helps in improving efficiencies and managing capital expenditures. This approach drives greater agility, enabling operators to adapt to business conditions quickly and cost effectively, to help ensure profitability in uncertain times.

For More Information

Learn more about Honeywell Integrated Fire and Gas Solutions, visit www.honeywellprocess.com or contact your Honeywell account manager.

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