

ISA100 Wireless Webinar Safety Integrated Systems (SIS) with Wireless Gas Detection

05th of November 2019 Jorgen Svare Head of Operations, GasSecure/Dräger **Table of Contents**



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GS01 Wireless Gas Detector Features and Benefits





GS01 Device Alternatives





GS01 (standard) Fixed 2 dBi antenna

Installed with two 8mm bolts antenna pointing up or down



GS01-EA Extended 6 dBi antenna 5, 10 or 20m cable Improves flexibility in areas with weak radio coverage

Standard infrared gas detector setup





Focused areas for MEMS

1) Filtering & focusing light on the detection side

2) Light source

Principal optical design of traditional infrared point detectors

MEMS, Micro Electromechanical System





GasSecure optical bench replaces conventional infrared components with MEMS.

Single Beam, triple wavelength





Lifelong zero point stability

Expanding the wireless SIL2 portfolio



Dräger

Polytron 6100 EC WL



- Supports all DrägerSensors (EC, 140 gases)
- ISA 100.11a communication
- SIL 2 capable
- No cable
- Battery Lifetime >24 month (battery pack, soldered)
- Bluetooth interface for easy maintenance
- Hand Held as GUI (Windows 10, Polysoft)
- Intrinsically safe (no hassle with declassifications)
- Extended antenna (5, 10 & 20m)
- Performance certification
- Dust approval
- Local power possible
- Option without sensor compartment as repeater



System Architecture





Wireless Network Range & Size





Dense pipework, machinery, structures; eg. offshore platform, pipe racks, etc.

GS01 SIL2 Certification

The SIL2 assessment included

- GS01 Hardware
- GS01 Software
- Wireless communication (PROFIsafe)

Key SIL parameters

- $\lambda_{\rm DU}$ = 1.08E-07 h⁻¹
- SFF = 91 % (for HFT = 0)
- PFD_{AVG} = 1.61E-03 (for T_P = 2 years)

Note

- PFD_{AVG} is well within the allowed range for SIL2 (< 0.01)</p>
- PFD_{AVG} is claiming less than 35% of this range (< 3.50E-03)







Safety function

The detection of potentially explosive gas concentrations in %LEL. The gas concentration is converted into a digital measured value and provided as a PROFIsafe message to a safety controller.

Failsafe values and safe state

- Internal diagnostic functions provide Failsafe Values (NaN*) for gas concentration.
- Communication issues result in a PROFIsafe safe state to flag unavailability of field devices.

Timeout

 Unavailability is flagged within predefined time limits (process safety time typically 60 sec in hydrocarbon gas detection).

* NaN = (0x7FC00000) per float definition in IEEE754



Based on the ISA100 Wireless[™] Standard

ISA100 Wireless Strengths

- "Tunnelling" of foreign protocols through the network facilitates the integration of safety protocols.
- Contract based communication (uplink and downlink) guarantees Quality of Service through limits for bandwidth, latency, and priority.
- Superior coexistence with WiFi
- Device interoperability supports communication of devices from multiple vendors on one network.



Suitable for fast and low-power safety communication





SafeWireless is a communication concept to combine low power with short response time developed by GasSecure.

Principle

- Different response time in the presence and absence of hydrocarbon gas
 - Short publish rate (all timeslots used) when GAS Default = 2 sec
 - Longer publish rate (not all timeslots used) when NO GAS Default = 12 sec
- SafeWireless supports cyclic communication, as required for SIS
 - Request from controller must be answered within "process safety time"
 - Detector "armed" with safe downlink packet
 - Response delayed, but instantly when gas detected



SafeWireless[™] - Cyclic Communication



Legend

- Uplink slots
- → Downlink slots
- → Comm. w/o gas
- \rightarrow Comm. with gas
- --> Non-SIL com





PROFIsafe

- Protocol developed by PROFIBUS and PROFINET International (PI)
- An additional layer on top of PROFINET
- Certified for up to SIL3 use

Black channel principle means

- PROFIsafe is independent of the communication method.
- Covering the entire communication path from the sensor over the controller to the actuator on one channel.
- Protection for all eventual failures in communication.







Redundancy improves availability and on-time.

Availability requirements are the driver to select redundant devices.

Redundancy does have no impact on the detector safety function.

The SIL rating determines the required average probability of failure on demand.

SIL2: PFD_{AVG} at least 1.0E-02

GS01: $PFD_{AVG} = 1.61E-03$ (for TP = 2 years) / 1.22E-03 (for TP = 1 year)

The SIL rating does not determine the availability.

Fault-tolerant Wireless Network Design



Redundancy implemented at all levels (GS01, AP, GW) GS01 Primary link GS01 Secondary link Design without any "single point of failure"





Flexibility due to simple mounting (two 8mm bolts)

- Freedom for optimal detector placement
- Deployable in hard-to-wire areas (turrets, cranes, confined spaces)
- Easy to rearrange detectors (upgrades, revamps)
- Simple to extend coverage with additional detectors (extensions)



From SIL-capable Detector to Safety Integrated System Risk Analysis (described in IEC 61508 / 61511)







Client / Country	Equinor Refining / Denmark (formerly Statoil)
Project / Facility	Fire & Gas Extension / Kalundborg Refinery
Process / Plant / Application	Fill-in detectors for 3 process areas after risk assessment determined inadequate coverage by current system
Equipment / Infrastructure	114 units GS01 / 8 units GS01-EA / Other detectors 3 Gateways / 18 Access Points / Siemens S7
Design	SIL certified detectors and controller, gateway with PROFINET / PROFIsafe, client assessments & verifications \rightarrow SIL2 capable
Challenges	Large, congested plant area. Enclosed spaces.
Key Notes	Significant cost reductions with wireless.

GS01 Case Study Aerial View





Area covered with wireless gas detection (about 75.000 sqm)

Project was split into 3 phases (3 geographical areas)

Placement of access points was based on existing knowledge for wireless on this site



GS01 Case Study Site Layout

<u>Phase 1 Block 1</u> <u>Detector locations</u> Green = GS01 Purple = Other



Block 1 area has wireless challenges due to heavy machinery blocking communication.

Detectors with extended antenna were chosen to overcome this challenge.

GS01 Case Study Site pictures





Elevated dual access points for good radio coverage



GS01-EA, detector with extended antenna



- Planning of wireless infrastructure placement can largely be done by visual inspection.
- Recommended to have some extra infrastructure and instruments ready for use in case challenges occur during commissioning.
- Wireless technology increases the flexibility in placing and moving of equipment.
- Expanding wireless installations is very easy.
- Using wireless for safety is a step change for any organization. Local competence of wireless has to be developed.
- We would definitely choose wireless again



Thank you for your attention.

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