



## FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

***XgardIQ***

manufactured by

***Crowcon Detection Instruments Limited***

Crowcon Detection Instruments Limited  
172 Brook Drive  
Milton Park  
Abingdon  
OX14 4SD  
Oxfordshire  
United Kingdom

have been assessed by Sira Certification Service with reference to the CASS methodologies and found to meet the requirements of

**IEC 61508-2:2010**  
**IEC 61508-3:2010**  
**EN 50402:2017**  
**Routes 1<sub>H</sub> & 1<sub>S</sub>**  
**Systematic Capability (SC2)**

as an element/subsystem suitable for use in safety related systems performing safety functions up to and including

**SIL 2 capable with HFT=0 (1oo1)\***

when used in accordance with the scope and conditions of this certificate.

\* This certificate does not waive the need for further functional safety verification to establish the achieved Safety Integrity Level (SIL) of the safety related system

Certification Decision:

James Lynskey

Initial Certification : 02/09/2019  
This certificate re-issued : 02/09/2019  
Renewal date : 01/09/2024

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Certificate No.: Sira FSP 19007/00  
Form 7016 issue 4  
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## Product description and scope of certification

XgardIQ is a versatile gas detector and transmitter is available fitted with a variety of flammable, toxic or oxygen gas sensors.

Providing analogue 4-20mA and RS-485 Modbus signals as standard, XgardIQ 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.



**Figure 1: Typical Assembly of the XgardIQ**

## Summary of Assessment

As part of the product assessment and supporting evidence of conformity with respect to 'hardware safety integrity' against the requirements of IEC 61508-2; Crowcon have submitted the XgardIQ for FMEA assessment to attain SIL capability. The component failure rates and modes for the XgardIQ have been extracted from or calculated using Quanterion Automated Databook and Item Toolkit. Table 2 summarises the FMEA assessment for the XgardIQ.



**Table 1: FMEA Summary for the XgardIQ in single mode (1001)**

<b>Safety Function:</b>										
The element safety function of the XgardIQ is defined as follows:										
1. Measure the concentration of gas and indicate the measurement by means of a 4-20mA signal. The response of the 4-20mA signal shall follow the calculated gas level with a delay of no more than 1 second.										
If relays are fitted then the following additional safety functions shall be performed:										
2. Indicate if the measured concentration of gas is greater than alarm 1 on-threshold by de-energising the first normally energised alarm relay, with the relay response following the calculated gas level with a delay of no more than 1 second.										
3. Indicate if the measured concentration of gas is greater than alarm 2 on-threshold by de-energising the second normally energised alarm relay, with the relay response following the calculated gas level with a delay of no more than 1 second.										
<b>Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4</b>		<b>Configuration (see table below)</b>								
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	
Safe Failure Fraction (SFF)		<b>91%</b>	<b>93%</b>	<b>91%</b>	<b>94%</b>	<b>90%</b>	<b>93%</b>	<b>91%</b>	<b>93%</b>	
Random hardware failures: [h <sup>-1</sup> ]	$\lambda_{SD}$ $\lambda_{SU}$	0.00E+00 1.78E-07	0.00E+00 9.50E-10	0.00E+00 1.78E-07	0.00E+00 9.50E-10	0.00E+00 1.78E-07	0.00E+00 9.50E-10	0.00E+00 1.78E-07	0.00E+00 9.50E-10	
Random hardware failures: [h <sup>-1</sup> ]	$\lambda_{DD}$ $\lambda_{DU}$	1.19E-06 1.41E-07	1.17E-06 8.14E-08	1.17E-06 1.39E-07	1.15E-06 7.93E-08	1.13E-06 1.43E-07	1.11E-06 8.36E-08	1.15E-06 1.40E-07	1.13E-06 8.01E-08	
Diagnostic coverage (DC)		89%	93%	89%	94%	89%	93%	89%	93%	
PFD @ PTI = 8760 Hrs. MTTR = 8 Hrs.		6.28E-04	3.66E-04	6.18E-04	3.57E-04	6.37E-04	3.76E-04	6.22E-04	3.61E-04	
Probability of Dangerous failure (High Demand - PFD) [h <sup>-1</sup> ]		1.41E-07	8.14E-08	1.39E-07	7.93E-08	1.43E-07	8.36E-08	1.40E-07	8.01E-08	
Architectural constraints & Type of product A/B		<b>Type B</b>								
Hardware safety integrity compliance		R80003491A (This Report)								
Systematic safety integrity compliance		R80003491B								
Systematic Capability (SC1, SC2, SC3, SC4)		SC 2								
Hardware safety integrity achieved		<b>SIL 2</b>								

<b>Config. No.</b>	<b>XgardIQ System Configurations</b>
1	XgardIQ with IR sensor
2	XgardIQ with IR sensor and relay
3	XgardIQ with oxygen sensor
4	XgardIQ with oxygen sensor and relay
5	XgardIQ with toxic sensor
6	XgardIQ with toxic sensor and relay
7	XgardIQ with flammable sensor
8	XgardIQ with flammable sensor and relay

**Element Safety Function**

The element safety function of the XgardIQ is defined as follows:

1. Measure the concentration of gas and indicate the measurement by means of a 4-20mA signal. The response of the 4-20mA signal shall follow the calculated gas level with a delay of no more than 1 second.

If relays are fitted then the following additional safety functions shall be performed:

2. Indicate if the measured concentration of gas is greater than alarm 1 on-threshold by de-energising the first normally energised alarm relay, with the relay response following the calculated gas level with a delay of no more than 1 second.
3. Indicate if the measured concentration of gas is greater than alarm 2 on-threshold by de-energising the second normally energised alarm relay, with the relay response following the calculated gas level with a delay of no more than 1 second.



## Certified Data in support of use in safety functions

The assessment has been carried out with reference to the *Conformity Assessment of Safety-related Systems* (CASS) methodology using the Route 1<sub>H</sub> approach.

**Table 2:** Base information for the XgardIQ

1	Product identification:	XgardIQ
2	Functional specification:	<p><i>The element safety function of the XgardIQ is defined as follows:</i></p> <ol style="list-style-type: none"> <li>1. <i>Measure the concentration of gas and indicate the measurement by means of a 4-20mA signal. The response of the 4-20mA signal shall follow the calculated gas level with a delay of no more than 1 second.</i></li> <li><i>If relays are fitted then the following additional safety functions shall be performed:</i></li> <li>2. <i>Indicate if the measured concentration of gas is greater than alarm 1 on-threshold by de-energising the first normally energised alarm relay, with the relay response following the calculated gas level with a delay of no more than 1 second.</i></li> <li>3. <i>Indicate if the measured concentration of gas is greater than alarm 2 on-threshold by de-energising the second normally energised alarm relay, with the relay response following the calculated gas level with a delay of no more than 1 second.</i></li> </ol>
3-5	Random hardware failure rates:	Refer to table 1 of this certificate.
6	Environment limits:	<ul style="list-style-type: none"> <li>• Transmitter: -40°C to +75°C</li> <li>• Sensors: <ul style="list-style-type: none"> <li>○ Oxygen: -20°C to +50°C</li> <li>○ Toxic: -40°C to +50°C</li> <li>○ Pellister: -40°C to 75°C</li> <li>○ Infra-red: +20°C to +55°C</li> <li>○ High Temperature H<sub>2</sub>S: -40°C to 70°C</li> </ul> </li> </ul>
7	Lifetime/replacement limits:	25 years
8	Proof Test requirements:	Refer to safety manual - M070030
9	Maintenance requirements:	Refer to safety manual - M070030
10	Diagnostic coverage:	See table 1.
11	Diagnostic test interval:	Refer to safety manual - M070030
12	Repair constraints:	Refer to safety manual - M070030
13	Safe Failure Fraction:	See table 1.
14	Hardware fault tolerance (HFT):	HFT = 0
15	Highest SIL (architecture/type A/B):	Type B, SIL2.
16	Systematic failure constraints:	The hardware safety integrity assessment was based on a proof test interval of 1 year.
17	Evidence of similar conditions in previous use:	Not applicable.
18	Evidence supporting the application under different conditions of use:	Not applicable.
19	Evidence of period of operational use:	Not applicable.
20	Statement of restrictions on functionality:	See systematic report R80003491B.
21	Systematic capability (SC1, SC2, SC3)	SC2 - See systematic report R80003491B.
22	Systematic fault avoidance measures:	Compliance with techniques and measures from IEC 61508-2 Annex B to SIL 2 - See systematic report R80003491B.
23	Systematic fault tolerance measures:	Compliance with techniques and measures from IEC 61508-2 Annex A to support the SFF achieved – see hardware safety integrity report R80003491A.
24	Validation records:	All documents that have been used in support of the hardware have been documented in section 5.24 of report



	R80003491A; this includes the FMEA document and insertion tests.
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### Management of functional safety

The assessment has demonstrated that the product is supported by an appropriate functional safety management system that meets the relevant requirements of IEC 61508-1:2010 clause 6, see report R80003491B.

### Software lifecycle assessment

The assessment of the software development process and results has shown, based upon the audit conducted as described in section 2.3 of R80003491C, that the XgardIQ software can be certified to IEC 61508-3:2010 up to and including SC 2.

This certificate is applicable to modules with the installed software shown below:

Module	Software Version	Checksum
IQ-Main	V1 i1.05	0x54cb
IQ-Sensor	V1 i1.06	0xace4
IQ-Display	V1 i1.04	0x1206

### Identification of certified equipment

The certified equipment and its safe use is defined in the manufacturer's documentation listed in Table 3 below.

**Table 3:** Certified documents

Document no.	Pages	Rev	Date	Document description
ECAD-000028-CD	1 to 2	12	17 Jan 18	Main Board
ECAD-000030-CD	1 of 1	6	21 Jan 15	Relay Module
ECAD-000060-CD	1 of 1	8	27 Jan 15	IQ OLED Module
ECAD-000064-CD	1 of 1	6	10 Apr 17	Oxygen Sensor
ECAD-000076-CD	1 of 1	10	12 Oct 18	Toxic Sensor
ECAD-000081-CD	1 to 2	10	06 Jun 17	Flammable Sensor Internal Board
ECAD-000082-CD	1 of 1	13	10 Apr 17	Flammable Sensor External Board
ECAD-000093-CD	1 to 2	20	27 Nov 18	Terminal Board
ECAD-000094-CD	1 of 1	3	08 Oct 14	Sensor Internal EXIA Board
ECAD-000098-CD	1 to 2	13	27 Jul 16	Display Board
ECAD-000104-CD	1 of 1	3	09 Oct 14	Sensor Internal Connect EXD Board
ECAD-000155-CD	1 of 1	4	26 Feb 15	Sensor Pod PCB
ECAD-000176-CD	1 of 1	1	19 Feb 16	Sensor Internal Connect IR Board
ECAD-000077-CD	1 of 1	5	10 Apr 17	IR Micro PCB
ECAD-000101-CD	1 of 1	4	27 Oct 17	IR Amp PCB

### Conditions of Certification

The validity of the certified base data is conditional on the manufacturer complying with the following conditions:

1. The manufacturer shall analyse failure data from returned products on an on-going basis. Sira Certification Service shall be informed in the event of any indication that the actual failure rates are



worse than the certified failure rates. (A process to rate the validity of field data should be used. To this end, the manufacturer should co-operate with users to operate a formal field-experience feedback programme).

2. Sira shall be notified in advance (with an impact analysis report) before any modifications to the certified equipment or the functional safety information in the user documentation is carried out. Sira may need to perform a re-assessment if modifications are judged to affect the product's functional safety certified herein.
3. On-going lifecycle activities associated with this product (e.g., modifications, corrective actions, field failure analysis) shall be subject to surveillance by Sira in accordance with 'Regulations Applicable to the Holders of Sira Certificates'.

### **Conditions of Safe Use**

The validity of the certified base data in any specific user application is conditional on the user complying with the following conditions:

1. The user shall comply with the requirements given in the manufacturer's user documentation in regard to all relevant functional safety aspects such as application of use, installation, operation, maintenance, proof tests, maximum ratings, environmental conditions, and repair.
2. Selection of this product for use in safety function and the installation, configuration, overall validation, maintenance and repair shall only be carried out by competent personnel, observing all the manufacturer's conditions and recommendations in the user documentation.
3. All information associated with any field failures of this product should be collected under a dependability management process (e.g., IEC 60300-3-2) and reported to the manufacturer.
4. The safety device is to have an independent power supply, it must not share the same power supply as non-safety devices that may cause a fault to the safety device.
5. To maintain the safety integrity level detailed within this certificate, the product must undergo a full proof test (following the procedure outlined in the product safety manual) at least once per year.

### **General Conditions and Notes**

1. This certificate is based upon a functional safety assessment of the product described in Sira Test & Certification Assessment Report R80003491A and any further reports referenced (R80003491B, R80003491C).
2. If the certified product or system is found not to comply, Sira Certification Service should be notified immediately at the address shown on this certificate.
3. The use of this Certificate and the Sira Certification Mark that can be applied to the product or used in publicity material are subject to the 'Regulations Applicable to the Holders of Sira Certificates' and 'Supplementary Regulations Specific to Functional Safety Certification'.
4. This document remains the property of Sira and shall be returned when requested by the issuer.
5. No part of the Functional safety related aspects stated in the instruction manual shall be changed without approval of the certification body.
6. This certificate will remain valid subject to completion of two surveillance audits within the five year certification cycle, and upon receipt of acceptable response to any findings raised during this period. This certificate can be withdrawn if the manufacturer no longer satisfies scheme requirements.



## Certificate History

Issue	Date	Report no.	Comment
0	02/09/2019	R80003491A R80003491B R80003491C	The release of prime certificate.

