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
Oxfordshire, OX14 4SD
United Kingdom

have been assessed by CSA Group Testing UK Limited with reference to the CASS methodologies and found to meet the requirements of

IEC 61508-2:2010
IEC 61508-3:2010
EN 50402:2017
EN 50271:2018 **
Routes 1_H & 1_S
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
**Additional optional EN 50271:2018 SIL 1 clauses have not been explicitly assessed (but IEC 61508 SIL 2 capability has been assessed)

Certification Decision:
David Kilshaw

Initial Certification : 02 Sep 2019
This certificate re-issued : 10 Jul 2025
Renewal date : 01 Sep 2029

UKAS PRODUCT CERTIFICATION
0011

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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.

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Table 1: FMEA Summary for the XgardIQ in single mode (1oo1)

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.

Summary of IEC 61508-2 Clauses 7.4.2 and 7.4.4		**Configuration (see table below)**							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Safe Failure Fraction (SFF)		**91%**	**93%**	**91%**	**94%**	**90%**	**93%**	**91%**	**93%**
Random hardware failures: [h^{-1}]	λ_{SD} λ_{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^{-1}]	λ_{DD} λ_{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 - PFH) [h^{-1}]		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		**Type B**							
Hardware safety integrity compliance		R80003491A							
Systematic safety integrity compliance		R80003491B							
Systematic Capability (SC1, SC2, SC3, SC4)		SC 2							
Hardware safety integrity achieved		**SIL 2**							

Config. No.	XgardIQ System Configurations
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.

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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_H approach.

Table 2: Base information for the XgardIQ

1	Product identification:	XgardIQ
2	Functional specification:	*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.*
3-5	Random hardware failure rates:	Refer to table 1 of this certificate.
6	Environment limits:	• Transmitter: -40°C to +75°C • Sensors: ○ Oxygen: -20°C to +50°C ○ Toxic: -40°C to +50°C ○ Pellistor: -40°C to 75°C ○ Infra-red: -20°C to +55°C ○ High Temperature H_2S: -40°C to 70°C Note Crowcon recommends that for high temperature operation with a Pellistor sensor, a remote cable is used and the transmitter is located within an environment at less than 70°C (see XGardIQSIL SupplementManualOct2021).
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.

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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.

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/s	Checksum
IQ-Main	V1 i1.08 (for 256A3U microprocessor)	0x7e16
	V2 i1.09 (alternative for 192D3-MH microprocessor)	0x2004
IQ-Sensor	V1 i1.07 (for 64A4U microprocessor)	0x593e
	V2 i1.08 (alternative for 192D3-MH microprocessor)	0x9347
IQ-Display	V1 i1.05 (for 64A4U microprocessor)	0x8a13
	V2 i1.06 (alternative for 192D3-MH microprocessor)	0x9ec5

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 2018	Main Board

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Document no.	Pages	Rev	Date	Document description
ECAD-000028-PL	1 of 1	12	18 Jan 2018	Main Board Parts List
ECAD-000240-CD	2 of 2	2	06 Dec 2022	Alternative XGARD IQ MAIN BOARD (with 192D3 microprocessor, see ECN-41) *Note version number differences for testing and FMEA are justified in ENG-001454 v2*
ECAD-000240-PL	1 of 1	2	06 Dec 2022	Parts List for alternative XGARD IQ MAIN BOARD (with 192D3 microprocessor, see ECN-41) *Note version number differences for testing and FMEA are justified in ENG-001454 v2*
ECAD-000030-CD	1 of 1	6	21 Jan 2015	Relay Module
ECAD-000030-PL	1	9	21 Jan 2015	Relay Module Parts List
ECAD-000030-CD	1 of 1	9	13 May 2022	Alternative Relay Module (with alternative regulator in parts list issue 10 see ECN-192)
ECAD-000030-PL	1	10	13 May 2022	Alternative Relay Module Parts List (with alternative regulator in parts list issue 10 see ECN-192)
ECAD-000060-CD	1 of 1	9	23 Dec 2019	IQ OLED Module
ECAD-000060-PL	1 of 1	9	23 Dec 2019	IQ OLED Module Parts List
ECAD-000060-CD	1 of 1	11	31 Jan 2023	IQ OLED Module (with alternative diodes in parts list issue 11) See ECN-157
ECAD-000060-PL	1 of 1	11	31 Jan 2023	IQ OLED Module Parts List (with alternative diodes in parts list issue 11) See ECN-157
ECAD-000064-CD	1 of 1	6	10 Apr 17	Oxygen Sensor
ECAD-000064-CD	1 of 1	6	10 Apr 17	Oxygen Sensor Parts List
ECAD-000237-CD	1 of 1	1	19 May 22	Alternative Oxygen Sensor Board (with 192D3 microprocessor). See ECN-50
ECAD-000237-PL	1 of 1	1	19 May 22	Parts list for alternative Oxygen Sensor Board (with 192D3 microprocessor). See ECN-50
ECAD-000076-CD	1 of 1	11	06 Nov 20	Toxic Sensor
ECAD-000076-PL	1 to 4	11	09 Nov 2020	Toxic Sensor Parts List *Note: version number update is justified in ENG-001454 v2*
ECAD-000236-CD	1 of 1	1	08 Nov 22	Alternative Toxic Sensor Board (with 192D3 microprocessor). See ECN-48.

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Document no.	Pages	Rev	Date	Document description
				Note version number differences from testing and FMEA are justified in ENG-001454 v2
ECAD-000236-PL	1 of 1	1	08 Nov 22	Parts List for Alternative Toxic Sensor Board (with 192D3 microprocessor). See ECN-48. *Note version number differences from testing and FMEA are justified in ENG-001454 v2*
ECAD-000081-CD	1 to 2	10	06 Jun 17	Flammable Sensor Internal Board
ECAD-000081-PL	1 of 1	10	05 Jun 17	Flammable Sensor Internal Board
ECAD-000081-CD	1 of 1	11	23 May 19	Updated Flammable Sensor Internal Board. See ECN-82
ECAD-000081-PL	1 of 1	11	23 May 19	Updated Flammable Sensor Internal Board Parts List*** . See ECN-82
ECAD-000081-PL	1 of 1	12	10 Nov 22	Updated Flammable Sensor Internal Board Parts List***. See OBS4
ECAD-000082-CD	1 of 1	13	10 Apr 17	Flammable Sensor External Board
ECAD-000082-PL	1 of 1	13	10 Apr 17	Flammable Sensor External Board
ECAD-000082-CD	1 of 1	14	04 May 2019	Flammable Sensor External Board – See ECN-82
ECAD-000082-PL	1 of 1	14	04 May 2019	Flammable Sensor External Board Parts List – See ECN-82
ECAD-000238-CD	1 of 1	1	08 Apr 25	Flammable Sensor External Board. See ECN 59
ECAD-000238-PL	1 of 1	1	08 Apr 25	Updated Flammable Sensor External Board Parts List. See ECN 59
ECAD-000093-CD	1 to 2	20	27 Nov 18	Terminal Board
ECAD-000093-PL	1 of 1	20	18 Jan 2019	Terminal Board Parts List
ECAD-000243-CD	1 of 1	1	27 Jan 2023	Alternative Terminal Board – See ECN-172
ECAD-000243-PL	1 of 1	1	27 Jan 2023	Parts List for Alternative Terminal Board – See ECN 172
ECAD-000094-CD	1 of 1	3	08 Oct 14	Sensor Internal EXIA Board
ECAD-000094-PL	1 of 1	3	08 Oct 14	Sensor Internal EXIA Board Parts List
ECAD-000094-CD	1 of 1	4	09 Nov 2022	Updated Sensor Internal EXIA Board (ECN 283)
ECAD-000094-PL	1 of 1	4	09 Nov 2022	Updated Sensor Internal EXIA Board Parts List (ECN - 283)
ECAD-000098-CD	1 to 2	13	27 Jul 16	Display Board

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Document no.	Pages	Rev	Date	Document description
ECAD-000098-PL	1 of 1	14	15 Nov 2017	Display Board Parts List *Note Crowcon has explained that this parts list incorrectly refers to ECAD-000098-CD v14 instead of V13 and that this had been noted in the PDM system*
ECAD-000241-CD	1 to 2	2	24 Jan 2023	Alternative Display Board (with 192D3 microprocessor). See ECN-64 *Note version number differences from testing justified in ENG-001454 v2*
ECAD-000241-PL	1	2	24 Jan 2023	Parts List for Alternative Display Board (with 192D3 microprocessor). See ECN-64
ECAD-000104-CD	1 of 1	3	09 Oct 2014	Sensor Internal Connect EXD Board
ECAD-000104-PL	1 of 1	3	09 Oct 2014	Sensor Internal Connect EXD Board Parts List
ECAD-000155-CD	1 of 1	4	26 Feb 15	Sensor Pod PCB
ECAD-000155-PL	1 of 1	4	26 Feb 2015	Sensor Pod PCB Parts List
ECAD-000176-CD	1 of 1	1	19 Feb 2016	Sensor Internal Connect IR Board
ECAD-000176-PL	1 of 1	1	19 Feb 2016	Sensor Internal Connect IR Board Parts List
ECAD-000077-CD	1 of 1	5	10 Apr 2017	IR Micro PCB
ECAD-000077-PL	1 of 1	5	10 Apr 2017	IR Micro PCB Parts List
ECAD-0000239-CD	1 of 1	1	19 May 2022	Alternative IR Micro PCB (based on ECN-49 and ENG-001371)
ECAD-0000239-PL	1 of 1	1	19 May 2022	Alternative IR Micro PCB Parts List (based on ECN-49 and ENG-001371)
ECAD-000101-CD	1 of 1	4	27 Oct 2017	IR Amp PCB
ECAD-000101-PL	1 of 1	6	27 Oct 2017	IR Amp PCB Parts List
ECAD-000101-CD	1 of 1	5	30 May 2023	Alternative IR Amp PCB (based on ECN-352 and ENG-001371)
ECAD-000101-PL	1 of 1	7	10 Nov 2022	Alternative IR Amp PCB Parts List (based on ECN-352 and ENG-001371)
ECAD-000096-CD	1 of 1	1	21 Oct 2013	Terminal to Display Harness Schematic Drawing
ECAD-000096-PL	1 of 1	1	21 Oct 2013	Terminal to Display Harness Parts List
ECAD-000110-CD	1 of 1	1	25 July 2013	Display to Sensor Harness Schematic Drawing

UKAS PRODUCT CERTIFICATION 0011

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Document no.	Pages	Rev	Date	Document description
ECAD-000110-PL	1 of 1	1	25 July 2013	Display to Sensor Harness Parts List

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. CSA Group Testing UK Limited 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. CSA Group Testing UK Limited 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. CSA 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 CSA Group Testing UK Limited in accordance with 'Regulations Applicable to the Holders of CSA Group Testing UK Limited 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 CSA Group Testing UK Limited Assessment Report R80003491A and any further reports referenced (R80003491B, R80003491C, R80086540, R80124592).
2. If the certified product or system is found not to comply, CSA Group Testing UK Limited should be notified immediately at the address shown on this certificate.

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3. The use of this Certificate and the CSA Group Testing UK Limited that can be applied to the product or used in publicity material are subject to the 'Regulations Applicable to the Holders of CSA Group Testing UK Limited Certificates' and 'Supplementary Regulations Specific to Functional Safety Certification'.
4. This document remains the property of CSA Group Testing UK Limited 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.

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Certificate History

Issue	Date	Report no.	Comment
0	02/09/2019	R80003491A R80003491B R80003491C	The release of prime certificate.
1	13/10/2020	R80003491A R80003491B R80003491C	Update to certificate to include latest version of IQ-Display.
2	04/11/2021	R80003491A R80003491B R80003491C R80086540	Update of certificate to cover changes ECN-145, ECN-175 and ECN-180
3	30 May 2023	R80003491A v2.0 R80124592 v1.2	Update of certificate to cover changes ECN-157, ECN-172, ECN-192, ECN-250, ECN-269 and ECN-272, ECN-41 (IQ-Main), ECN-48 (IQ-Sensor with Toxic Sensor), and ECN-64 (IQ-Display)
4	13 Sep 2023	R80003491A v3.0 R80124592 v2.0	Update of certificate to cover changes ECN-49, and ENG-001371 v7, and ECN 352.
5	19 Sep 2024	R80226832A	Re-issued certificate, following successful recertification audit.
6	10 Jul 2025	R80003491A v4.0 R80124592 v3.0	Update of certificate to cover changes ECN-50, ECN-59, and ECN-82. IQ-Sensor software version V2 i1.08 also certified with pellistor and oxygen sensors. EN50271:2018 (except additional optional SIL 1 clauses) IR sensor lower temperature corrected (-20 not +20 degrees C)

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