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## Random Hardware Reliability and Systematic Assessment Certificate

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### ***Functional Safety of Safety-Related Programmable Electronic Systems***

The **Michell Instruments UK Ltd, XTP601 Process Oxygen Analyser & XTC601 Binary Gas Analyser** have been assessed and are considered capable for use in a low demand Safety Function up to (and including) SIL 2 capability with regards to systematic, random hardware failures and architectural constraints.

The assessment was based on the assumptions, data provided, and recommendations given in:

- **Engineering Safety Consultants Ltd Report: H215\_FM001 rev. 4.**

The products were assessed against the following failure modes:

- **XTP601: Ability to detect oxygen presence within another gas stream and generate a 4-20mA output;**
- **XTC601: Ability to detect target gas in another gas stream and generate a 4-20mA output.**

The assessment was carried out to determine compliance with IEC 61508 (2010 Edition) with regards to:

- Random Hardware Failure (Predicted PFD as shown in Table below) with a Mean Down Time (MDT) of 168 hours, a Proof Test Interval (PTI) of one year (8760 hours), a Proof Test Coverage of 95% or 90% and an Overhaul Interval of 10 years (87600 hours);
- Random Hardware Failure with Achieved PFH:
  - XTP601 = 5.4E-08
  - XTC601 = 3.9E-08
- Random Hardware Failure with Achieved  $\lambda_{DD}$ :
  - XTP601 = 7.4E-07
  - XTC601 = 7.0E-07
- Random Hardware Failure with Achieved  $\lambda_{DU}$ :
  - XTP601 = 5.4E-08
  - XTC601 = 3.9E-08
- Architectural Constraint (Type B, SFF >90%, <99%), HFT = 0;
- Systematic SIL 2 capability against IEC 61508 (2010 Edition) Parts 1, 2 and 3.



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Device	Proof Test Coverage (PTC)	PFD Target (20% of SIL 2 band)	PFD Achieved	Estimated Achieved PFD	SFF	Type	Estimated Achieved SIL (Arch)	Estimated Overall SIL Capability
XTP601	95%	2.0E-03	4.1E-04	2	94%	B	2	2
	90%		5.1E-04	2			2	2
XTC601	95%	2.0E-03	3.1E-04	2	96%	B	2	2
	90%		3.8E-04	2			2	2

**IMPORTANT:** It should be noted that this assessment does not include confirmation of the response time of the device. For response times (along with any relevant assumptions) reference should be made to the Safety Manual of each device and the total SIF response time **MUST** be compared against the process safety time for the specific application.

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