



ENGINEERING SAFETY CONSULTANTS

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Random Hardware Reliability and Systematic Assessment Certificate

Functional Safety of Safety-Related Programmable Electronic Systems

Manufacturer: Tyco Fire & Security GmbH (TFSG), Victor Von Bruns-Strasse 21 ,8212 Neuhausen am Rheinfall, Schaffhausen, Switzerland

The **TFSG, FV421i Intrinsically Safe (IS) Flame Detector** has been assessed and is considered capable for use in a low demand Safety Function up to (and including) SIL 2 capability, with regards to random hardware failures, architectural constraints and systematic capability.

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

- **Engineering Safety Consultants Ltd Report: SIL Random Hardware Capability Assessment Report: H076_FM001 rev.4;**
- **Failure Modes, Effects and Diagnostics Analysis (FMEDA) Spreadsheet: H076_FV421i_FMEDA rev.1.xlsx;**
- **Engineering Safety Consultants Ltd Report: (IEC 61508 Part 1) Assessment Report: H076_SM001 rev.4;**
- **Engineering Safety Consultants Ltd Report: (IEC 61508 Part 2) Assessment Report: H076_SM002 rev.4;**
- **Engineering Safety Consultants Ltd Report: (IEC 61508 Part 3) Assessment Report: H076_SM003 rev.4;**
- **Renewal letter from TFSG, signed by T.A. James, Special Hazards Team Leader, dated: 17/10/2022.**

The product was assessed against the following failure mode:

- **Detector not detecting a detectable flame and signal an appropriate alarm to the control system.**

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

- SIL 2 with a HFT = 0 via Route 1H;
- Architectural Constraint (Type B, SFF 90% - 99%);
- Systematic SIL 2 capability against IEC 61508 (2010 Edition) Parts 1, 2 and 3.

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The assessment results are as follows based on the different field interfaces:

Device	Field Interface	λ NSR (/hr)	λ_s (/hr)	λ DU (/hr)	λ DD (/hr)	SFF	Estimated SIL Capability
FV421i IS Flame Detector	Conventional	3.1E-06	5.8E-07	1.2E-07	7.0E-07	91%	SIL 2
	MX	2.8E-06	6.3E-07	1.3E-07	9.3E-07	93%	SIL 2
	4-20mA	3.1E-06	5.2E-07	9.0E-08	7.9E-07	94%	SIL 2
	HART	3.0E-06	5.2E-07	9.2E-08	8.2E-07	94%	SIL 2
	Modbus	3.1E-06	5.4E-07	9.3E-08	7.9E-07	94%	SIL 2

Note: The PFD or PFH of a complete SIF (inclusive of sensor, logic solver and final element subsystems) must be determined, considering any redundancy, Proof Test Interval (PTI), Proof Test Coverage (PTC), Mission Time and Mean Time To Restoration (MTTR) for all elements. Each subsystem should be verified to ensure compliance with the minimum HFT requirements.

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.



Managing Director: Simon Burwood
 Assessment Date: September 2018
 Renewal Date: October 2022, valid to October 2024
 Certificate: H076_CT001 rev. 4