



ENGINEERING SAFETY CONSULTANTS

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Certificate of Conformity to IEC 61508 Safety Integrity Level (SIL) 2

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 SIL 2 capability with regards to systematic, random failure rates and architectural constraints.

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

- **ESC Ltd SIL Random Hardware Capability Assessment Report: H076_FM001 rev.3;**
- **Failure Modes, Effects and Diagnostics Analysis (FMEDA) Spreadsheet: H076_FV421i_FMEDA rev.1.xlsx;**
- **ESC Ltd Systematic Capability (IEC 61508 Part 1) Assessment Report: H076_SM001 rev.3;**
- **ESC Ltd Systematic Capability (IEC 61508 Part 2) Assessment Report: H076_SM002 rev.3;**
- **ESC Ltd Systematic Capability (IEC 61508 Part 3) Assessment Report: H076_SM003 rev.3;**
- **Renewal letter from TFSG, signed by T.A. James, Special Hazards Team Leader, dated: 19/10/2020.**

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:

- Random Hardware Failures (20% of SIL 2 range) (refer to Table below);
- Architectural Constraint (Type B, SFF >90%, <99%), HFT = 0;
- Systematic SIL 2 capability against IEC 61508 (2010 Edition) Parts 1, 2 and 3.

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 | Achieved PFD |
|--------------------------|-----------------|---------------------|-------------------|--------------------|--------------------|--------|--------------|
| FV421i IS Flame Detector | Conventional | 3.07E-06 | 5.81E-07 | 1.23E-07 | 6.99E-07 | 91.24% | 5.55E-04 |
| | MX | 2.79E-06 | 6.26E-07 | 1.25E-07 | 9.30E-07 | 92.55% | 5.71E-04 |
| | 4-20mA | 3.10E-06 | 5.21E-07 | 8.99E-08 | 7.90E-07 | 93.58% | 4.13E-04 |
| | Modbus | 3.05E-06 | 5.41E-07 | 9.27E-08 | 7.94E-07 | 93.50% | 4.25E-04 |

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.

Chairman: Kenneth G L Simpson
Member of the IEC 61508 committee
Assessment Date: October 2020, October 2022
Certificate: H076_CT001 rev. 3

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