ENGINEERING SAFETY CONSULTANTS
The Global Provider of Functional Safety Expertise and Technical Consultancy

Random Hardware Reliability Assessment Certificate

Functional Safety of Safety-Related Programmable Electronic Systems

The **Digital Linear Heat Detection Cable (LHDC) Locator Module (LDM-519-DDL/Z/G) by Patol Ltd** (OEM for the unit), has been assessed and is considered capable for use in a low demand Safety Function up to (and including) SIL 2 with regards to random hardware failures and architectural constraints.

The function of the LDM-519-DDLZ/G is to monitor a length of LHDC for both fire condition and fault statuses (open circuit). The unit can be configured to operate in a two-wire mode that emulates the operation of conventional heat detectors and can therefore be directly interfaced with fire control panels by connection to fire zone trigger circuits or addressable interfaces.

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

- **Engineering Safety Consultants Ltd Report: F004_FM001 rev. 5;**
- **Renewal Letter from Patol Ltd, signed by Mark Lewis, Product Development Engineer, Dated 4th July 2022.**

The system was assessed against the following failure mode:

- **A fault causing a failure of the fire detection unit to identify a genuine high temperature alarm.**

The system assessed comprises the following modules:

- LDM-519-DDL Module (Part No. 700-451 and 700-452);
- Digital Linear Heat Detecting Cables:
  - Standard
    - 700-070 Digital LHDC. Alarm temperature 70°C, max ambient 45°C;
    - 700-090 Digital LHDC. Alarm temperature 90°C, max ambient 70°C;
    - 700-140 Digital LHDC. Alarm temperature 140°C, max ambient 110°C;
    - 700-180 Digital LHDC. Alarm temperature 180°C, max ambient 150°C;
  - Stainless Steel over-braid (Armoured)
    - 700-071 Digital LHDC. Alarm temperature 70°C, max ambient 45°C;
    - 700-091 Digital LHDC. Alarm temperature 90°C, max ambient 70°C;
    - 700-141 Digital LHDC. Alarm temperature 140°C, max ambient 110°C;
    - 700-181 Digital LHDC. Alarm temperature 180°C, max ambient 150°C.
  - Low Smoke Zero Halogen (LS0H) Version
    - 700-070LS0H Digital LHDC. Alarm temperature 70°C, max ambient 45°C;
    - 700-090LS0H Digital LHDC. Alarm temperature 90°C, max ambient 70°C.
  - LS0H Stainless Steel over-braid (Armoured)
    - 700-071LS0H Digital LHDC. Alarm temperature 70°C, max ambient 45°C;
    - 700-091LS0H Digital LHDC. Alarm temperature 90°C, max ambient 70°C.

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It should be noted also that this certificate is applicable to the LDM-519-DDL-Z and LDM-519-DDL-G, with the letter prefix at the end indicating that these devices are to be used to monitor a hazardous environment from a safe area via zener barrier or a galvanic barrier.

This FMEA analysis has been conducted on the listed device manufactured by Patol Ltd and not on any external equipment (i.e. the zener / galvanic barriers). Therefore, it is recommended that any external equipment to be used with the Patol Ltd LDM-519-DDL/Z/G for hazardous areas must be assessed with regards to its suitability for use as a Safety Function with these devices.

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

- Random Hardware Failures (Predicted PFD as shown in Table below) with a Mean Down Time (MDT) of 168 hours, a Proof Test Interval (PTI) of 1 year (8760 hours), as Proof Test Coverage (PTC) of 100% or 95% and an Overhaul Interval of 10 years (87600 hours);
- Random Hardware Failure with Achieved PFH = 2.7E-08
- Random Hardware Failure with Achieved λ_{DD} = 1.4E-07 (/hr)
- Random Hardware Failure with Achieved λ_{DU} = 2.7E-08 (/hr)
- Architectural Constraint (Type B, SFF 90%-99%).

The assessment results are as follows:

Description	Proof Test Interval (hrs)	Proof Test Coverage (PTC)	Estimated PFD	Max Allowable SIL (Architectural Constraints)	Overall Achieved SIL
LDM-519-DDL/Z/G	8760	95%	1.9E-04	2	2
		100%	1.3E-04	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.

Managing Director: Simon Burwood
Member of IEC 61508 (MT61808-1-2) & IEC 61511 (MT61511) Maintenance Committees
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