



## Management Summary

This report summarizes the results of the hardware assessment in the form of a Failure Modes, Effects, and Diagnostic Analysis (FMEDA) of the ST51A/ST75A/ST75AV Mass Flow Meter, hardware and software revision per Section 2.5.1. A Failure Modes, Effects, and Diagnostic Analysis is one of the steps to be taken to achieve functional safety certification per IEC 61508 of a device. From the FMEDA, failure rates are determined. The FMEDA that is described in this report concerns only the hardware of the ST51A/ST75A/ST75AV. For full functional safety certification purposes all requirements of IEC 61508 must be considered.

The ST51A and ST75A/ST75AV Series are thermal dispersion, industrial process grade air/gas flow meters. They are suitable for all air and gas flow measurement applications. ST51A units range in line sizes from 51 to 610 mm and ST75A units 6 mm to 51 mm]. The instrument provides direct mass flow measuring and measures flow rate, totalized flow and temperature. The measurements are made available to the user through 4-20 mA analog output channels, a separate source and sink channel (pulse output) and optional HART. The optional graphics display provides real-time process variable values, flow range and process description information.

Table 1 gives an overview of the different versions that were considered in the FMEDA of the ST51A/ST75A/ST75AV.

Table 1 Version Overview

AC CH1	100-240V AC Power, 4-20mA CH#1 is safety output
DC CH1	24V DC Power, 4-20mA CH#1 is safety output
AC HART	100-240V AC Power, 4-20mA value of HART output is safety output
DC HART	24V DC Power, 4-20mA value of HART output is safety output

The ST51A/ST75A/ST75AV is classified as a Type B<sup>1</sup> element according to IEC 61508, having a hardware fault tolerance of 0.

The analysis shows that the ST51A/ST75A/ST75AV has a Safe Failure Fraction between 60% and 90% (assuming that the logic solver is programmed to detect over-scale and under-scale currents) and therefore meets hardware architectural constraints for up to SIL 1 as a single device.

Based on the assumptions listed in 4.3, the failure rates for the ST51A/ST75A/ST75AV are listed in section 4.5.

These failure rates are valid for the useful lifetime of the product, see Appendix A.

Failure rates listed in this report do not include failures due to wear-out of any components. They reflect random failures and include failures due to external events, such as unexpected use, see section 4.2.

A user of the ST51A/ST75A/ST75AV can utilize these failure rates in a probabilistic model of a safety instrumented function (SIF) to determine suitability in part for safety instrumented system (SIS) usage in a particular safety integrity level (SIL).

<sup>1</sup> Type B element: "Complex" element (using micro controllers or programmable logic); for details see 7.4.4.1.3 of IEC 61508-2, ed2, 2010.