FLUID COMPONENTS INTERNATIONAL LLC
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Supplemental Manual

ST100A Series Safety Instrumented System (SIS) Requirements

Table of Contents

List of Tables

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ST100A Series Safety Instrumented System (SIS) Requirements

Introduction

This document describes how to configure the ST100A Series for IEC 61508 compliance in a Safety Instrumented System (SIS) application. The safety-critical output of the ST100A Series is provided through the Channel #1 4-20 mA analog output.

Compliance Through FMEDA (Failure Modes, Effects and Diagnostic Analysis)

Safety Integrity Level, Hardware Fault Tolerance:

- SIL 1, HFT = 0
- SIL 2, HFT = 1

Subsystem Type:

- B

ST100A Safety Identification

Verify that the ST100A Series is using firmware version 2.04L or higher. The firmware version can be identified via the HMI (models with Display), the ST100A configuration software or by contacting FCI directly to cross reference the unit's serial number with its firmware version as shipped. The information in this document relates to all ST100A Series flow meter configurations.

Installation in SIS Applications

Installations are to be performed by qualified personnel. No special installation is required in addition to the standard installation practices outlined in the ST100A Series IO&M (Document No. 06EN003480). Environmental and operational limits are listed in the manual's Technical Specification section.

Configuring the Instrument for SIS Application

For all safety-related applications, configure the ST100A Series flow meter in a fail-safe alarm configuration as listed below.

- Verify that materials are compatible with process conditions.
- Configure the device for fault indication per NAMUR NE43 OR the logic solver is configured to interpret 4 mA as a fault condition.
  - Low Alarm current is ≤ 3.6 mA
  - High Alarm current is ≥ 21.0 mA
  - Channel #1 4-20 mA analog output is configured for Flow
- The safety accuracy of the ST100A Series mass flow output is ±0.75% of reading and ±0.5% of full scale. Base accuracy is dependent on the process gas composition, pressure and temperature. These parameters can be found in the appropriate calibration certificate. Contact FCI if you would like to obtain a copy referenced by the unit's serial number.
- Use the password protection feature of the ST100A firmware to prevent accidental or deliberate change of process parameters and configuration data during normal operation.
- HART protocol is only used for setup, calibration, and diagnostic purposes; not for safety critical operation.

Proof Test

Use the recommended proof test described below to identify Dangerous Undetected faults in the ST100A Series thermal mass flow meter. This test consists of cycling the power, setting the output to minimum and maximum values, and performing a calibration check. It is recommended that the proof test be performed annually at a minimum.

Recommended Proof Test

1. Bypass the safety function and take appropriate action to avoid a false trip.
2. Use digital communications (HART) or software configuration to retrieve any diagnostics and take appropriate action.
3. Cycle the power to the transmitter. This executes initialization checks on RAM and ROM and clears any soft errors.
4. Send a HART command to the transmitter to go to the high alarm current output and verify that the analog current reaches that value[1].
5. Send a HART command to the transmitter to go to the low alarm current output and verify that the analog current reaches that value[2].
6. Inspect the transmitter for any leaks, visible damage, or contamination.
7. Perform a two-point calibration[3] of the transmitter over the full working range.
8. Remove the bypass and otherwise restore normal operation.

Notes:
1. This tests for compliance voltage problems such as a low loop power supply or increased wiring resistance. This also tests for other possible failures.
2. This tests for possible quiescent current related failures.
3. If the two-point calibration is performed with electrical instrumentation, this proof test will not detect any failures of the sensor.

Product Repair

The ST100A Series is repairable by major component replacement. All product repair and part replacement is to be performed by qualified personnel only.

ST100A Series Safety Instrumented System (SIS) Reference

The ST100A Series must be operated in accordance with the functional and performance specifications listed in the IO&M (Document No. 06EN003480) Technical Specification section.

Failure Rate Data

The FMEDA report includes failure rates and common cause Beta factor estimates (contact FCI for a copy of the report). Table 1 below summarizes the failure rate data (Good Maintenance Assumptions in FIT @ SSI = 2).

Table 1 – Failure Rates According to IEC 61508-1

Device	λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}	#	SFF
Single Probe AC	0	806	1479	632	2098	78.3 %
Single Probe DC	0	757	1237	604	2105	76.8 %
Dual Probe AC	0	821	1909	610	1739	81.7 %
Dual Probe DC	0	773	1668	582	1747	80.7 %

Where:

λ_{SD} = Fail Safe Detected

λ_{SU} = Fail Safe Undetected

λ_{DD} = Fail Dangerous Detected

λ_{DU} = Fail Dangerous Undetected

= No Effect Failures

SFF = Safe Failure Fraction

FIT= Failure rate in 10^{-9}/hour

Proof Test Coverage

The Proof Test Coverage for the various product configurations is given in Table 2.

Table 2 – Proof Test Coverage — Static Applications ST100A Series

Device	$\lambda_{DU}PT$ (FIT)	Proof Test Coverage
Single Probe AC	196	69%
Single Probe DC	195	68%
Dual Probe AC	211	66%
Dual Probe DC	210	64%

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