

SIL Instructions

Safety-related parameters

Safety Integrity Level		SIL2		
Operating modes		Low and continuous demand mode		
Architecture		1oo1		
Device type		A		
Hardware fault tolerance	HFT	0		
		4...20 mA in 2-wire technology	0...20 mA or 0...10 V in 3-wire technology	4...20 mA in 3-wire technology
Safe failure fraction	SFF	75.1 %	61.8 %	78.1%
Failure rate for safe detected failures	λ_{SD}	2.73×10^{-9} 1/h	1.80×10^{-9} 1/h	2.70×10^{-9} 1/h
Failure rate for safe undetected failures	λ_{SU}	7.48×10^{-8} 1/h	7.75×10^{-8} 1/h	7.66×10^{-8} 1/h
Failure rate for dangerous detected failures	λ_{DD}	7.64×10^{-8} 1/h	3.99×10^{-8} 1/h	7.14×10^{-8} 1/h
Failure rate for dangerous undetected failures	λ_{DU}	5.10×10^{-8} 1/h	7.37×10^{-8} 1/h	4.22×10^{-8} 1/h
Probability of a dangerous undetected failure per hour	PFH	5.10×10^{-8} 1/h	7.37×10^{-8} 1/h	4.22×10^{-8} 1/h
Mean time between failures = Mean time to failure	MTBF = MTTF	577 a	592 a	592 a
Mean time to dangerous failure	MTTF _d	2238 a	1549 a	2705 a

Inspection Interval for design in 4...20 mA in 2-wire technology	T ₁	1 year	2 years	3 years	5 years
Probability of a dangerous failure in the event of a request	PFD	2.24x10 ⁻⁴	4.48x10 ⁻⁴	6.71x10 ⁻⁴	1.12x10 ⁻³
Inspection Interval for design in 0...20 mA or 0...10 V in 3-wire technology	T ₁	1 year	2 years	3 years	5 years
Probability of a dangerous failure in the event of a request	PFD	3.24x10 ⁻⁴	6.47x10 ⁻⁴	9.69x10 ⁻⁴	1.61x10 ⁻³
Inspection Interval for design in 4...20 mA in 3-wire technology	T ₁	1 year	2 years	3 years	5 years
Probability of a dangerous failure in the event of a request	PFD	1.86x10 ⁻⁴	3.71x10 ⁻⁴	5.55x10 ⁻⁴	9.25x10 ⁻⁴

for MTTR = MRT = 8 h

1 General information

These SIL Instructions contain information and instructions for using the device as part of a protection system according to IEC/EN 61508. In addition to these instructions, please take all relevant legal requirements, applicable standards as well as the additional technical specifications on the accompanying data sheet into account (see www.labom.com).

1.1 Safety Function

The safe function of the device according to IEC/EN 61508 is the output of the output signal in the respective range (4...20 mA, 0...20 mA, 0...10 V).

1.2 Validity

The safety function can only be guaranteed if the option "Functional safety according to IEC/EN 61508" has been chosen for the device. These devices are marked as shown on the right.

SIL₂

SIL marking on the unit.

2 Technical data

The following technical data applies to the safety function of the device.

2.1 Accuracy

Assured accuracy in safe mode: 1 % of nominal range if the test interval is one year, 2 % of nominal range if the test interval is up to 5 years.

The measuring accuracy is reduced by temperature influences as described in the data sheet.

For devices with diaphragm seal take the error of the diaphragm seal into account as well.

Please note that in hydrogen applications in combination with products with pressure transmission fluid, premature undetected failure (incorrect measured values) is possible due to permeation effects of hydrogen into the pressure transmission fluid. The time until this effect can occur depends on the process conditions. Make sure that the service life determined by our consulting team is not exceeded.

2.2 Reaction times

The response time in the event of a request or a fault detection is 20 ms.

Additional elements in the process connection, such as capillaries or flame arresters, can extend the reaction time in the event of sudden pressure changes in the process.

2.3 Start-up behaviour

After switching on the supply voltage, the output reaches a pressure-proportional value after 20 ms.

3 Requirements for the operator

The operator has to consider the following requirements to ensure that the safety function is not jeopardised.

3.1 Unsafe operating conditions

Avoid the following functions while the device is operating as part of a safety device:

- Zero point correction
- Span adjustment

3.2 Requirements for safety function

Avoid unsafe operating conditions (chapter 3.1).

Ensure compatibility of wetted materials with process media and cleaning agents.

Avoid environmental conditions that exceed the data sheet limits.

Avoid a pressure load that exceeds the permissible pressure limits as per the data sheet.

Avoid an excessive supply voltage above 30 V.

3.3 Regular inspections

Hazardous undetected faults during operation can be detected with a high level of certainty during regular inspections. The operator can define the inspection interval depending on the PFD value required.

Not only the device but the complete measuring chain should be tested during inspection. It is the responsibility of the plant operator to determine an adequate test of the safety function.

The following inspection procedure is recommended for the device to achieve a high fault detection:

- Apply several pressure levels - depending on the safety-related pressure range - and check whether the output corresponds to the applied pressure. Zero point and span must be checked. For further information on the calibration of Labom devices, see HE_107.
- Visual monitoring of damage and contamination. The entire device must be checked. Particular attention is to be paid to
 - the plug for contamination and corrosion.
 - the process connection for contamination and corrosion.
 - if present, the diaphragm for contamination, corrosion and damage.

When evaluating the test, use the accuracy values from the data sheet or the order documents.

When performing the recommended tests, a PTC (Proof Test Coverage) value of 95 % can be assumed following Namur NA106, Section D3.