SIL Instructions

Safety-related parameters

Safety Integrity Level		SIL2		
Operating modes: Bx2xxx Bx4xxx Operating modes: BG2xxx BE2xxx		Low demand mode High demand mode		
Architecture		1oo1		
Device type		A		
Hardware fault tolerance	HFT	0		
		BN4xxx BP4xxx	**BE4xxx BR4xxx**	**BE2xxx BG2xxx**
Safe failure fraction	SFF	87.19 %	87.15 %	95.6 %
Failure rate for safe detected failures	λ_S	1.30×10^{-7} 1/h	1.32×10^{-7} 1/h	3.99×10^{-7} 1/h
Failure rate for dangerous detected failures	λ_{DD}	9.14×10^{-8} 1/h	9.76×10^{-8} 1/h	1.14×10^{-7} 1/h
Failure rate for dangerous undetected failures	λ_{DU}	3.25×10^{-8} 1/h	3.39×10^{-8} 1/h	2.37×10^{-8} 1/h
Probability of a dangerous undetected failure on demand Test interval T_1=1 year	PFD	1.43×10^{-4}	1.49×10^{-4}	1.05×10^{-4} 1/h
Probability of a dangerous failure per hour Test interval T_1=1 year	PFH	-	-	2.37×10^{-8} 1/h
Mean time between failures = Mean time to failure	MTBF = MTTF	450 a	433 a	213 a
Mean time to dangerous failure	$MTTF_d$	3512 a	3367 a	4817 a

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 safety function of the device according to IEC/EN 61508 is the switching of the contact.

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.

SIL marking on the unit.

2 Technical data

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

2.1 Accuracy

The accuracy according to the data sheet resp. the order documents also applies during safety operation.

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

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 Fault detection

Fault detection is part of the regular checks, chapter 3.2, and by using a suitable evaluation unit per EN 60947-5-6 (NAMUR).

3 Requirements for the operator

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

3.1 Requirements for safety function

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

Avoid environmental conditions that exceed the data sheet limits.

Operating temperature for SIL-application:

	BN4xxx **BP4xxx** **BE4xxx**	**BR4xxx**	**BE2xxx** **BG2xxx**
Standard- and safety case S3, IP65, without liquid filling	medium/ambient -20...70 °C	medium -20...70 °C ambient -20...60 °C	medium/ambient -20...60 °C
standard case, with liquid filling	medium/ambient -20...70 °C	medium -20...70 °C ambient -20...50 °C	medium/ambient -20...60 °C
Safety case S3, IP66, with liquid filling	medium/ambient -20...40 °C	no safety case	medium/ambient -20...40 °C

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

Pay attention to the specified polarity (+ and -) when connecting circuits to the switching contacts.

Only use evaluation units in compliance with EN 60947-5-6 (NAMUR) to guarantee the safety of the safety circuit in compliance with SIL2. The safe status of the switch contacts for all devices is a high-impedance status (low signal). Applications with an evaluation unit or safety functions, where the safe status is a low-impedance status (high signal), have not been evaluated.

Note the maximum connection values as per the operating instructions and TA_039.

3.2 Regular Inspections

Hazardous undetected faults during operation can be detected with a high level of certainty during regular inspections. The requirements for SIL2 are met in the case of a proof test interval of 12 months.

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 one or more pressure levels - depending on the safety-related pressure range - and check whether the correct value is displayed. It is recommended to check the accuracy at 0%, 50% and 100% of the span as well as at the switching point. If necessary, carry out a zero point correction according to the operating instructions.
- Visual monitoring of damages