SAUTER

SAUTER pressure switches, pressure monitors and pressure limiters DSB, DSF, DSL, DSH

Safety manual

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Original safety manual

Contents

1 Extent of applicability of the safety manual 4

2 Operating range of the devices 6

3 General information 7
- 3.1 Safety instructions 7
- 3.2 Symbols used 7
- 3.3 Other valid documents 8
- 3.4 Abbreviations 8
- 3.5 Technical terms 9
- 3.6 Relevant standards 9

4 Description of the safety requirements and conditions 10
- 4.1 Function 10
- 4.2 Connection as a safety pressure limiter (DSB, DSF) 11
- 4.3 Device behaviour when switched on 11
- 4.4 Device behaviour during normal operation 11
- 4.5 Device behaviour on demand 11
- 4.6 Device behaviour when malfunction occurs 11

5 Engineering and fitting notes 12

6 Parameters for functional safety 13
- 6.1 Specific parameters for functional safety 13

7 Repeat checks 14

8 Repair 16
- 8.1 Contact address 16

9 Certificates and TÜV test marks 17

1 Extent of applicability of the safety manual

The evaluation of functional safety described in this manual is valid for the devices listed below, from product index D onwards.

Where not stated otherwise, only the device variants listed here are suitable for SIL applications. These devices are subject to the internal change process within which the effects of modifications on the functional safety are also evaluated.

The valid devices are:

DSB, DSF, DSL, DSH

TYPE	DSB, DSF	DSL, DSH
Pressure ranges		
Adjustable setpoint	-1...40 bar	-1...40 bar
Area of use		
Pressure monitors	•	
Pressure limiters	*see 4.2*	•

Tab. 1 Overview of pressure monitors and pressure limiters

The safety-oriented pressure monitors and limiters are certified for SIL2 by the TÜV as per EN 61508.

The valid hardware versions for DSB and DSF are:

Type	Setting range in bar
Pressure transducer made of brass for non-aggressive media, for temperatures up to 70 °C	
DSB138F001	0...1.6
DSB140F001	0...2.5
DSB143F001	0...6
DSB146F001	0...10
DSB152F001	6...16
DSB158F001	0...25
DSB170F001	5...40
Pressure transducer made of stainless steel for aggressive media, for temperatures up to 110 °C	
DSF125F001	-1...1.5
DSF127F001	-1...5
DSF135F001	0...0.6
DSF138F001	0...1.6
DSF140F001	0...2.5
DSF143F001	0...6
DSF146F001	0...10
DSF152F001	0...16
DSF158F001	0...25
DSF170F001	15...40

The valid device variants for DSL and DSH are:

Type	Setting range in bar
Locks when the pressure falls (SDBF); pressure transducer made of brass for non-aggressive media, for temperatures up to 70 °C	
DSL 140 F001	0...2.5
DSL 143 F001	0...6
DSL 152 F001	6...16
Locks when the pressure increases (SDB); pressure transducer made of stainless steel for aggressive media, for temperatures up to 110 °C	
DSH 127 F001	-1...5
DSH 143 F001	0.5...6
DSH 146 F001	1...10
DSH 152 F001	2...16
DSH 158 F001	5...25
DSH 170 F001	15...40

Tab. 2 Device variants

WARNING:
Pressure switches not listed in this safety manual do not have SIL2 approval.
This applies to pressure switches of the DSA series, for example.

2 Operating range of the devices

DSB, DSF: Pressure monitors
DSL, DSH: Specially designed pressure limiters

For regulating and monitoring pressure, for liquids, gases and vapours, according to VdTÜV pressure information sheet 100.

The devices are especially suitable for applications in compact installations, for pipe mounting or wall mounting.

These SIL2-approved pressure switches are not suitable for applications in ATEX installations.

ATEX = ATmosphere EXplosive

3 General information

Ensure that you have read and understood this safety manual before commissioning the pressure switches.

Keep this safety manual in an accessible place where it will be available for further use.

The devices may only be installed, used and maintained by authorised persons. These persons must be familiar with this manual and with the valid regulations on work safety and accident prevention.

This manual only applies to pressure switches with SIL2 conformity.

3.1 Safety instructions

To rule out any risks to the operator and their environment, the following instructions must be adhered to:

During the installation, maintenance and cleaning of the devices, the standards for functional safety (IEC 61508) must be adhered to, *see 3.5*, *see 3.6.*

Installation, maintenance and cleaning may only be carried out by trained and authorised personnel.

Modifying the device or the connections will lead to the forfeiture of the functional safety and the guarantee.

SAUTER must be informed immediately about defective devices. Defective devices must be returned to SAUTER for a technical inspection and, if applicable, for repair.

It is the responsibility of the user to check whether the selected device model is suitable for the intended use and the given environmental conditions. SAUTER is not liable for an incorrect selection and its consequences.

The technical data is to be found in product data sheets 23.760 (DSB, DSF) and 23.770 (DSL, DSH).

3.2 Symbols used

Symbol	Meaning
	Information about other applicable, important documents
	Attention! Note and adhere to the following information. SAUTER will not accept any liability for damage occurring due to non-adherence to these instructions.
	Note on important information

3.3 Other valid documents

This safety manual is only valid in combination with the following product-specific documents.

Document number	Designation
P100014216 C	Fitting instructions for pressure switches and pressure limiters
23.760	Product data sheet for DSB and DSF: Pressure monitors and pressure switches
23.770	Product data sheet for DSL and DSH: Specially designed pressure limiters

3.4 Abbreviations

Abbreviation	English	German
SIL	Safety integrity level	Sicherheits-Integritätslevel. International standard IEC 61508 defines four safety integrity levels (SIL 1 to SIL 4). These four levels specify the requirements for the safety integrity of the safety functions. Safety integrity level 4 is the highest degree of safety integrity. Safety integrity level 1 is the lowest degree of safety integrity.
HFT	Hardware fault tolerance	Hardware Fehlertoleranz.
λ_{SD}		Lambda safe detected
λ_{SU}		Lambda safe undetected
λ_{DD}		Lambda dangerous detected
λ_{DU}		Lambda dangerous undetected
$\lambda_S + \lambda_D$		Total error rate
PFD_{avg}	Average probability of failure on demand	Mittlere Wahrscheinlichkeit eines Ausfalls bei Anforderung.
T_i	Test interval	Prüfintervall
n_{op}		Assumed demand rate
PFDspec		Probability of failure on demand
DC		Diagnostic degree
1-α		Confidence level
PTC		Diagnostic degree of cover for repeat check

3.5 Technical terms

Term	Explanation
Dangerous failure	Failure with the potential of putting the safety-related system into a dangerous or inoperative state.
Non-dangerous failure, malfunction	Failure without the potential of putting the safety-related system into a dangerous or inoperative state.
Safety-related system	A safety-related system performs the safety functions that are required to achieve or maintain a safe state, e.g. in an installation.
Safety function	Defined function that is executed by a safety-related system. The objective of this function is, while considering a defined, dangerous incident, to achieve or maintain a safe state, e.g. in an installation. Example: pressure limit monitoring
Functional safety	The functional safety refers to the portion of the overall safety of a system that depends on the correct operation of the safety-related systems and external facilities for reducing risks.
Low demand	Operating mode with a low demand rate for the safety system. The safety system must not be required more than once a year.
High demand	Operating mode with a high demand rate or continuous demand for the safety system. The safety system works continuously or is required more than once a year.

3.6 Relevant standards

SIL certification

Standard	English	German
IEC 61508	Functional safety of electrical/ electronic/programmable electronic safety-related systems	Funktionale Sicherheit sicherheitsbezogener elektrischer/elektronischer/programmierbarer elektronischer Systeme

CE conformity as per the following standards

Low-voltage Directive 2014/35/EU	EN 60730-1/ EN 60730-2-6
EMC Directive 2014/30/EU	EN 61000-6-1/ EN 61000-6-2 EN 61000-6-3/ EN 61000-6-4
PED 2014/68/EU, Cat. IV	VdTÜV pressure information sheet 100 EN 12952-11 EN 12953-9

4 Description of the safety requirements and conditions

4.1 Function

The functions of the pressure switches are:

- Minimum pressure limiting (DSL)
- Maximum pressure limiting (DSH)
- Pressure monitors for falling or increasing pressure (DSB, DSF)

Minimum pressure limiting (DSL)

When the pressure drops below the lower change-over point (adjustable setpoint Xs), the pressure limiter locks mechanically and switches the contact from 1-3 to 1-2. If the pressure rises by at least the amount of pressure increase Xsd above the lower change-over point, the contact can be switched back from 1-2 to 1-3 by pulling the reset button using a screwdriver.

Maximum pressure limiting (DSH)

When the pressure rises above the upper change-over point (adjustable setpoint Xs), the pressure limiter locks mechanically and switches the contact from 1-2 to 1-3. If the pressure drops below the upper switching point by at least the amount of pressure reduction Xsd, the contact can be switched back from 1-3 to 1-2 by pulling the reset button using a screwdriver.

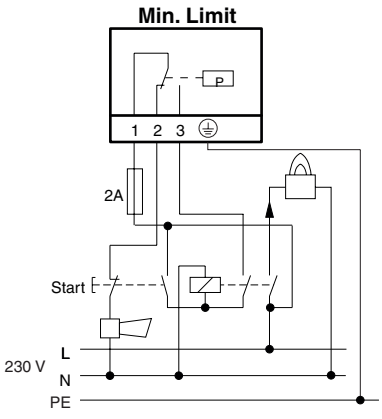
Pressure monitors for falling or increasing pressure (DSB, DSF)

When the pressure falls below the lower change-over point (adjustable setpoint Xs), the contact switches from 1-3 to 1-2. When the pressure exceeds the lower change-over point by the amount of the switching difference Xsd, the contact switches from 1-2 to 1-3.

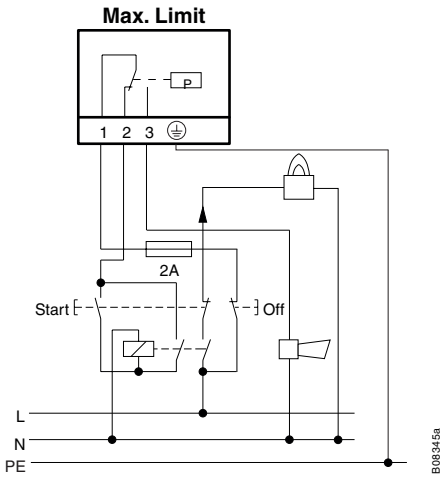
The switching difference can be set from outside using a grub screw: One revolution changes the switching difference by approx. 20% of the total switching difference range.

4.2 Connection as a safety pressure limiter (DSB, DSF)

The devices can be used as safety pressure limiters (SDBFS) for falling or increasing pressure. The prerequisite for this is that an electrical interlock circuit is used (see application examples) and the requirements of DIN 57116 and VDE 0116 are fulfilled. The electrical plant devices must adhere to VDE 0660 or VDE 0435.



Pressure monitor as safety pressure limiter for falling pressure



Pressure monitor as safety pressure limiter for increasing pressure

4.3 Device behaviour when switched on

The devices are immediately ready for use.

4.4 Device behaviour during normal operation

During normal operation, the switching contacts are in the idle state - see the label on the device. The switching contacts switch immediately when the pressure switches measure abnormal pressure.

4.5 Device behaviour on demand

Devices	Function on demand
DSB / DSF	Reliable switching
DSH / DSL	Reliable switching, and switch position is held

4.6 Device behaviour when malfunction occurs

The device diagnostic degree is 0, which means that the pressure switch does not have an integrated monitoring mechanism.

It is the responsibility of the end user to achieve a relevant degree of diagnosis using suitable diagnostic measures.

5 Engineering and fitting notes

DSB, DSF, DSL, DSH: The devices conform to the European Pressure Equipment Directive 2014/68/EU and belong to device category IV as safety components. The devices also conform to Low-Voltage Directive 2014/35/EU and EMC Directive 2014/30/EU. The devices are suitable for use in installations based on TRD604, sheet 1 and sheet 2.

DSB, DSF: The devices can be used as safety pressure limiters (SDBFS) for falling or increasing pressure when an electrical interlock circuit (*see 4.2*) is used and the requirements of DIN 57116 and VDE 0116 are fulfilled. The electrical plant devices must adhere to VDE 0660 or VDE 0435.

The following documentation must be available for fitting the devices.

Document number	Designation
P100014216 C	Fitting instructions for pressure switches and pressure limiters

The information, conditions and limit values contained in the fitting instructions must be noted and adhered to when installing and operating the devices.

The safe operation of the devices requires that they be fitted, wired and commissioned correctly.

It is the responsibility of the operator of the installation that the fitting, wiring and commissioning of the devices is carried out by authorised, qualified personnel.

The operator of the installation is obliged to replace the devices before the period of use of 5 years has elapsed.

The operator of the installation is obliged to consider national and regional laws, regulations and standards. These apply in addition to the product documentation.

Installers or users of the pressure switches are obliged to contact the manufacturer if they have problems understanding the product documentation.

6 Parameters for functional safety

6.1 Specific parameters for functional safety

The tables show the specific parameters for functional safety.

	DSB, DSF, DSL, DSH
SIL	SIL 2
HFT	0
Type of sub-system	Type A
Operating mode	Low demand
Possible selection circuits (MooN)	1oo1 / 1oo2

DSB / DSF / DSL / DSH

Safety function	λ_{DU}		**PFD**$_{avg,1oo1}$	**PFD**$_{avg,1oo2}$
Safe closing and opening of an electrical contact	5.30 E-08 / h	53 FIT	2.36 E-04	2.37 E-05
Compliance with external tightness	2.70 E-08 / h	27 FIT	1.20 E-04	1.20 E-05
Maximum switching point shift of ± 2 % of the setting range + 1 % of the end value	1.45 E-07 / h	145 FIT	6.46 E-04	6.50 E-05

The serviceable life of the electric switching contacts is 6,000 cycles.

7 Repeat checks

To check that the pressure switches are functioning correctly, SAUTER recommends carrying out repeat checks. The check must be carried out at least once a year and may be carried out a maximum of twelve times per year.

Visual inspection
Check
- the pressure switches for damage, contamination, corrosion, water damage
- the labelling of the pressure switches: SIL and TÜV labels must be present and legible
- the connector plug for correct fastening and the electrical cables for damage
- the seal for damage and the correctness of the setpoint
- the position of maintenance valves
- the correct fitting position and installation point as per the fitting instructions
- the compliance with operating temperatures
- whether it is ensured that the pressure transducer is only in contact with fluids of group I with a hazard potential of categories IV or V as per Article 13 of Pressure Equipment Directive 2014/68/EU, or with fluids of group II.

Additionally, the extents of applicability of the TÜV certifications and the standards they contain must be considered. The user must check the compatibility of the fluids used with the materials of the pressure sensor.

Mechanical check
- For DSL/DSH pressure limiters, check in the non-locked state that the reset plunger can be moved easily.
- Lightly tap the pressure switch housing and check whether the contact triggers. In this case the contact must not trigger.
- Carefully test whether the switch head cannot be moved against the pressure transducer. If the switch head can be turned in the anti-clockwise direction, the pressure limiter is defective and must be replaced immediately.

Prepare a maintenance plan for the system and plan periodic inspections of the safety devices.

Use system downtimes to check the safety functions of the pressure switches and perform any required recalibrations.

Keep a system log.

Do not repair defective devices. All faults must be reported to Fr. Sauter AG. Please contact SAUTER customer service.

All checks and check intervals described here are the minimum requirements of the manufacturer for safe operation. **If the regionally responsible supervisory authorities demand shorter check intervals, a higher number of checks, checks of a wider scope or other, stricter conditions, this must be complied with in all cases!**

8 Repair

If it is necessary to repair an “SIL device”, the device must be returned to SAUTER for repair.

If this regulation is not adhered to, the SIL conformity declaration loses its validity and the guarantee lapses.

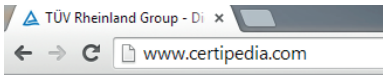
8.1 Contact address

Fr. Sauter AG
Im Surinam 55
CH-4058 Basel
Tel. +41 61 - 695 55 55
Fax +41 61 - 695 55 10
www.sauter-controls.com
info@sauter-controls.com

9 Certificates and TÜV test marks

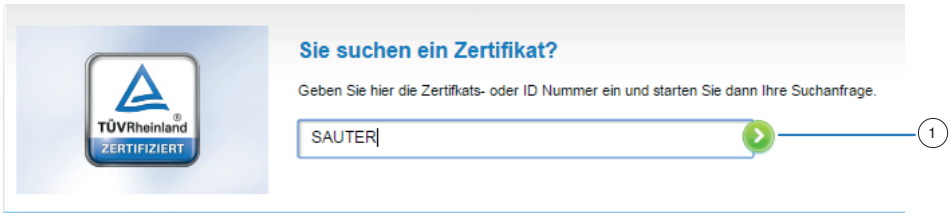
The certificates can be downloaded under www.certipedia.com.

1. Enter www.certipedia.com in the URL input window.



➲ The website of TÜV Rheinland opens.

2. Enter SAUTER in the search window.



3. Press button (1).

➲ All the SAUTER products certified by TÜV Rheinland are listed.

4. Select the certificates you require and download them by clicking the certificate number.

Im Surinam 55
CH-4058 Basel
Tel. +41 61 - 695 55 55
Fax +41 61 - 695 55 10
www.sauter-controls.com
info@sauter-controls.com

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