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

Safety manual
D100237466 B

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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	
DSB 138 F001	0...1.6
DSB 140 F001	10...2.5
DSB 143 F001	0...6
DSB 146 F001	0...10
DSB 152 F001	6...16
DSB 158 F001	0...25
DSB 170 F001	5...40
Pressure transducer made of stainless steel for aggressive media, for temperatures up to 110 °C	
DSF 125 F001	-1...1.5
DSF 127 F001	-1...5
DSF 135 F001	0...0.6
DSF 138 F001	0...1.6
DSF 140 F001	0...2.5
DSF 143 F001	0...6
DSF 146 F001	0...10
DSF 152 F001	0...16
DSF 158 F001	0...25
DSF 170 F001	15...40

Extent of applicability of the safety manual

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 his environment, the following instructions must be adhered to:



During the installation, maintenance and cleaning of the devices, the standards for functional safety (IEC 61508, IEC 61511) 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).


General information

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	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	Explanation
SIL	Safety integrity level. 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.
MTBF	Mean time between failures
MTBF _D	Mean time between two dangerous failures
MTTF _d	Mean time to dangerous failure
HFT	Hardware fault tolerance
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
SFF	Safe failure fraction
PFD _{avg}	Average probability of failure on demand
T _i	Test interval
f _{np}	Assumed demand rate
PFDspec	Specific probability of failure on demand
DC	Diagnostic degree
1- α	Confidence level

Abbreviation Explanation

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 Explanation**

IEC 61508 IEC 61511	Functional safety of electrical/electronic/programmable electronic safety-related systems
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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 12963-9

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 falls below the lower change-over point (adjustable setpoint X_s), the pressure limiter locks mechanically and switches the contacts from 1-3 to 1-2. When the pressure exceeds the lower change-over point by at least the amount of the pressure increase X_{sd} , the contacts can be reset from 1-2 to 1-3 by levering out the reset button using a screwdriver.

Maximum pressure limiting (DSH)

When the pressure exceeds the upper change-over point (adjustable setpoint X_s), the pressure limiter locks mechanically and switches the contacts from 1-2 to 1-3. When the pressure falls below the upper change-over point by at least the amount of the pressure decrease X_{sd} , the contacts can be reset from 1-3 to 1-2 by levering out the reset button using a screwdriver.

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

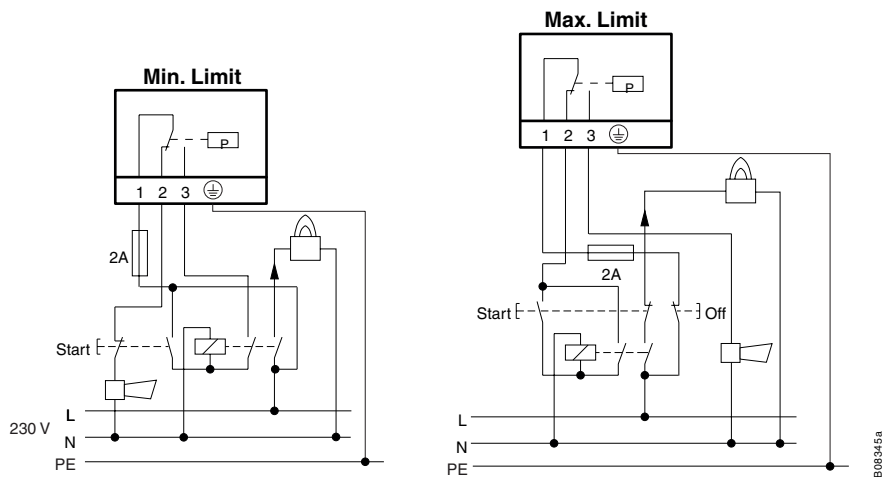
When the pressure falls below the lower change-over point (adjustable setpoint X_s), the contacts switch from 1-3 to 1-2. When the pressure exceeds the lower change-over point by the amount of the switching difference X_{sd} , the contacts switch from 1-2 to 1-3.

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.

Description of the safety requirements and conditions

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

5 Engineering and fitting notes

DSB, DSF, DSL, DSH: The devices conform to the European Directive on pressure equipment 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 is used (See 4.2) 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	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 table shows the specific parameters for functional safety.

	DSB	DSF	DSL	DSH
SIL	SIL 2	SIL 2	SIL 2	SIL 2
HFT	0	0	0	0
Type of sub-system	Type A	Type A	Type A	Type A
Operating mode	Low demand	Low demand	Low demand	Low demand
SFF	63.3%	66%	67.5%	70.3%
PFD _{avg} T1 = 1 year	1.56×10^{-5}	1.56×10^{-5}	1.56×10^{-5}	1.56×10^{-5}
Possible selection circuits (MooN)	1001	1001	1001	1001
MTTF _d	32,000 a	32,000 a	32,000 a	32,000 a

 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 ten times per year.

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 declarations loses its validity and the guarantee lapses.

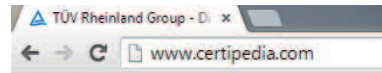
8.1 Contact address

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Fax +41 61 - 695 55 10
www.sauter-controls.com
info@sauter-controls.com

9 Certificates and TÜV test marks

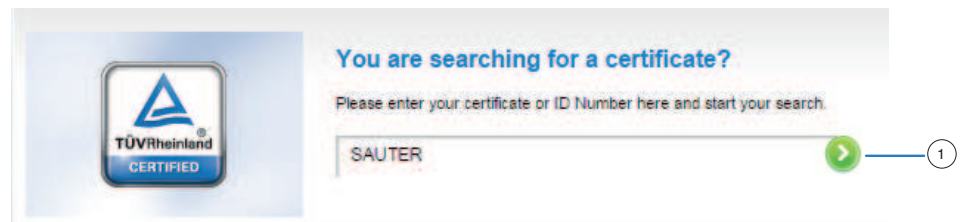
@ The certificates can be downloaded under www.certipedia.com.

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.



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