



SAFETY PRESSURE SWITCH DS6

INTRODUCTION

For years Hydropa has been one of the leading specialists for pressure switches. We offer a wide range of different versions for a wide variety of applications. In order to further expand our portfolio, we have now developed something new for you: safety pressure switch DS6

Ds6 is a safety component according to Directive 2006/42/EC (Machinery Directive) and can achieve at least a performance level of "c" according to DIN EN ISO 13849-1. The pressure switch has mechanical positive break contacts according to EN 60947. When the dangerous state is reached, the switch opens positively actuated, which results in an inherently safe separation of the output signals. The switch is available for falling and rising pressure and for pneumatic and hydraulic applications. It offers the possibility of monitoring both minimum and maximum pressures.

CONFIGURATION AND FUNCTION

The hydraulic force resulting from the pressure of the medium acts on one side of the piston. On the other side, the spring force acts resulting from the spring preload. The switching pressure can be adjusted individually by changing the spring preload.

Version „S“

SAs long as the pressure force resulting from the medium pressure is less than the set spring force, the microswitches are not actuated and the safety-related contacts remain closed. The safety-related contacts open only when the pressure to be monitored is exceeded.

Version „F“

As long as the pressure force resulting from the medium pressure is less than the set spring force, the microswitches are not actuated and the safety-related contacts remain closed. The safety-related contacts open only when the pressure to be monitored is exceeded.

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ADDITIONAL INFORMATION

Further information on the correct handling of our pressure switch range is available under "Operating instructions Safety pressure switch series DS6" on our website: www.hydropa.de

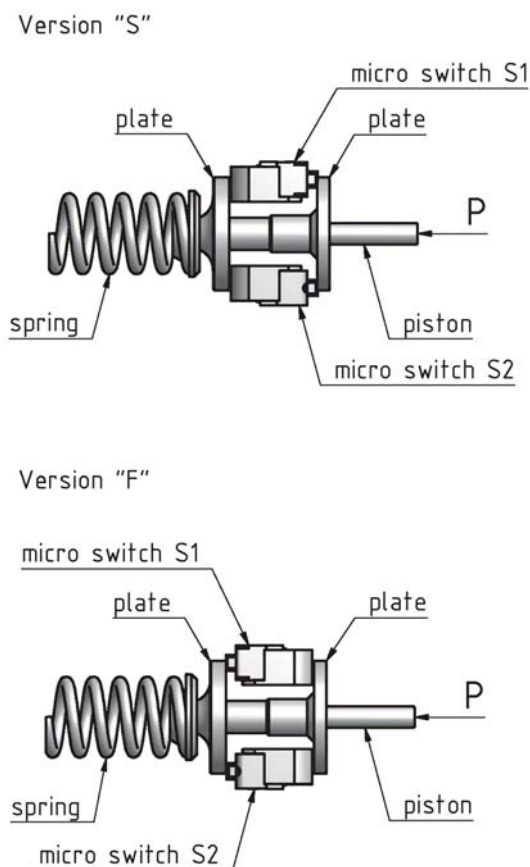
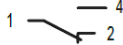



Fig.: 2K-Version

TECHNICAL DATA

General information	
Contact system, electrical symbol	1 change-over contact, form C 
Fluidic symbol	
Installation	arbitrary
Connection	internal thread G 1/4"

Fluidic data				
Pressure range and max. permissible operating pressure	Type	Pressure setting rang p_{Setting} [bar]		p_{max} [bar]
		Version: 1K	Version: 2K	
	5	0,8 - 9,5	1*/2 - 8	40
	10	1 - 15	4 - 12	40
	100	10 - 110	25 - 90	500
	200	20 - 220	60 - 200	500
Approved pressure media	Type	media		
	5 - 10	Compressed air		
	10 - 300	Mineraloil (HL, HLP) according to DIN 51524; viscosity range: 10 - 800 mm ² /s		
	Other pressure media upon request.			
Ambient temperature	- 25 °C to + 80 °C			

Electrical data	
Voltage	24 V _{DC}
Voltage tolerance	-10/+10 %
Switching current	100 - 500 mA
Protection class DIN 60529	IP 65 (higher protection class on request)

Safety		
Reliability parameter B10 _D (for the individual microswitch)	1,5 m switching cycles	
Category and PL (according to EN ISO 13849-1)	Version: 1K	Version: 2K
	Category 1 -> to PL c	Category 3 or 4 -> to PL e
Max. switching frequency	60 switching cycles / minute	

Hysteresis (Reset differential pressure)	
The hysteresis achieved during continuous operation is approx. 7-12 % of the final value at a set pressure of approx. 60-70 % of the max. adjustable switching pressure.	
Example: For a pressure switch DS 6-1K-100-S with a pressure range of 10-110 bar, a hysteresis of approx. 7-13.2 bar results at a setting pressure of 100 bar.	

ORDER INFORMATION

DS6 - 1K - 100 - S

1K = Single-channel
2K = Double-channel

Pressure ranges:

	1K	2K	p _{max.}
5 =	0,8 - 9,5 bar	1 ^{*1)} /2 - 8 bar	40 bar ^{*2)}
10 =	1 - 15 bar	4 - 12 bar	40 bar ^{*3)}
100 =	10 - 110 bar	25 - 90 bar	500 bar ^{*4)}
200 =	20 - 220 bar	60 - 200 bar	500 bar ^{*4)}
300 =	30 - 330 bar	70 - 300 bar	500 bar ^{*4)}

*1) 1 bar only by factory adjustment
*2) for pneumatic media exclusively
*3) also for pneumatic media
*4) for hydraulic media exclusively

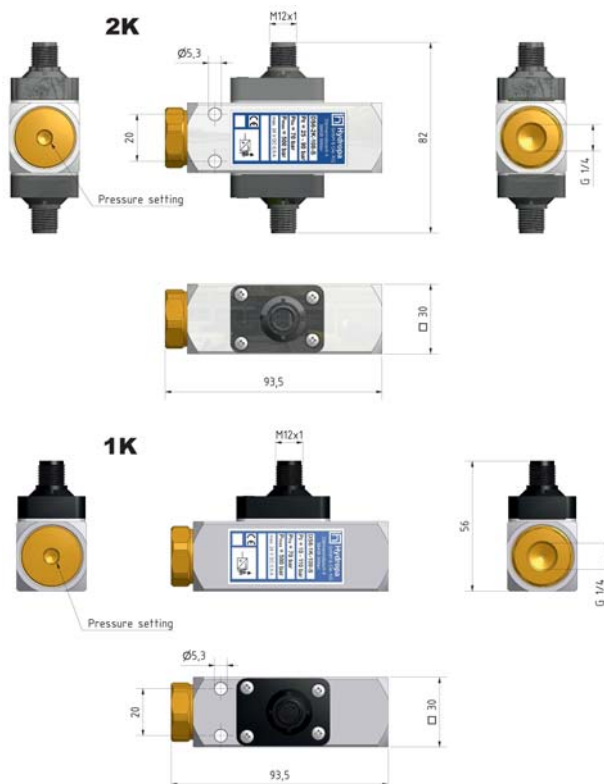
S = Increasing
F = Decreasing

Weight, Dimensions

Weight

0,3 kg

Dimensions (L x W x H)



Terminal assignment

Terminals	Function		<p>The pressure switches are equipped with 4-pole cable connectors of type M12-A (DIN EN 61076-2-101). The cable plug on the machine must be assembled according to the pin assignment.</p>
1 -> 2	Safety-related break contact		
1 -> 4	Signal contact		

SAFETY CHARACTERISTICS

The DS6 pressure switch series is available in a single-channel as well as a dual-channel version.

In addition, the safety-related microswitches have positively actuated contacts in accordance with EN 60947, which enable positive opening of the contacts at a type-dependent pressure level. This enables an inherently safe separation of the safety-related contacts.

Single-channel variant (1K)

The pressure switch version with the type designation "1K" has a safety-related channel consisting of the safety-related microswitch S1. Its safety-related contact pair 1/2 generates a safety-related electrical output signal from the existing pressure signal.

Safety-related block plugging diagram

This pressure switch version has a single-channel architecture which corresponds to category 1 according to EN ISO 13849-1. In this case, the block diagram corresponds to a structure as shown in Fig. (1).

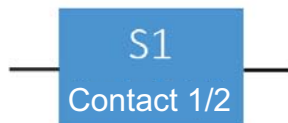


Fig. (1): Block plugging diagram of the "Sensor system" subsystem - single-channel version

Performance Level (PL) of the subsystems

Due to their architecture, subsystems consisting of only one pressure switch of this version can achieve a maximum performance level of "c" according to DIN EN ISO 13849-1.

The achievable performance level results from the calculated $MTTF_d$ value for the safety-related contact pair 1/2 of the microswitch S1.

For the calculation of the performance level we recommend the use of the SISTEMA software tool, which is provided free of charge by the German Institute for Occupational Safety IFA.

$MTTF_d$ value of the subsystem

The $MTTF_d$ value of the subsystem depends on the average annual actuation frequency n_{op} of the safety-related contact pair 1/2 of the microswitch S1 and must be determined by the control unit or machine manufacturer within the framework of PL verification. For this purpose, the principles of EN ISO 13849-1 must be observed.

Calculation example

The calculation was based on the following values:

Reliability parameter B_{10D} (for the individual microswitch)	1.5 m switching cycles
Actuation frequency n_{op}	2.880 cycles / year

Calculation result for the subsystem:

MTTF _D value (subsystem)	100 years
PFH _D (subsystem)	$1,1 \cdot 10^{-6}$ 1/h
PL (subsystem)	c

Dual-channel version (2K)

The pressure switch version with type designation "2K" has two (redundant) safety-related channels which are each capable of generating a safety-related electrical output signal from the existing pressure signal. For this purpose this pressure switch variant has two microswitches S1 and S2. Its safety-related contact pair 1/2 generates an independent safety-related electrical output signal each from the existing pressure signal.

Safety-related block plugging diagram

This pressure switch version has a dual-channel (redundant) architecture which corresponds to category 3 or 4 according to EN ISO 13849-1. Thus, the prerequisite for single error safety is given. In this case, the block diagram corresponds to a structure as shown in Fig. (2).

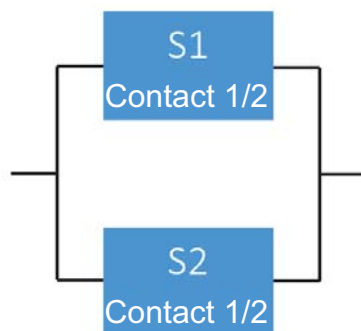


Fig. (2): Block plugging diagram of the "Sensor system" subsystem - dual-channel version

Performance Level (PL) of the subsystem

Due to their architecture, subsystems consisting of only one pressure switch of this version can achieve, as rule, a maximum performance level of "d" according to DIN EN ISO 13849-1.

The achievable performance level results from the symmetrized MTTF_d value and the average diagnostic coverage DC_{avg} of the subsystem.

For the calculation of the performance level we recommend the use of the SISTEMA software tool, which is provided free of charge by the German Institute for Occupational Safety IFA.

Symmetrized MTTF_d value of the subsystem

The symmetrized MTTF_d value of the subsystem depends on the average annual actuation frequency n_{op} of the safety-related contact pair 1/2 of the microswitches S1 and S2 and must be determined by the control unit and/or machine manufacturer within the framework of PL verification. For this purpose, the principles of EN ISO 13849-1 must be observed.

Average diagnostic coverage DC_{avg} of the subsystem

The average diagnostic coverage DC_{avg} depends on the measures applied to detect faults that can lead to a safety-critical failure of the safety-related contact 1/2 of the microswitches S1 or S2. The measures for fault detection must be defined by the control and/or machine manufacturer. For this purpose, the principles of EN ISO 13849-1 must be observed.

As a component manufacturer, we recommend cross comparison of redundant output signals to detect errors. The signal status of the output signals must be compared in the logic of the control. The pressure switches always show no error, if the signal status of both output signals is identical, or if the output signals change (from HIGH to LOW and vice versa), the output signals show the same status again within a predefined period of time (e.g. 500 ms).

Calculation example

The calculation was based on the following values:

Reliability parameter $B10_D$ (for the individual microswitch)	1.5 m switching cycles
Diagnostic coverage DC_{avg} (for the individual microswitch)	99% (cross comparison of the output signals in logics)
Actuation frequency n_{op}	2,880 cycles / year

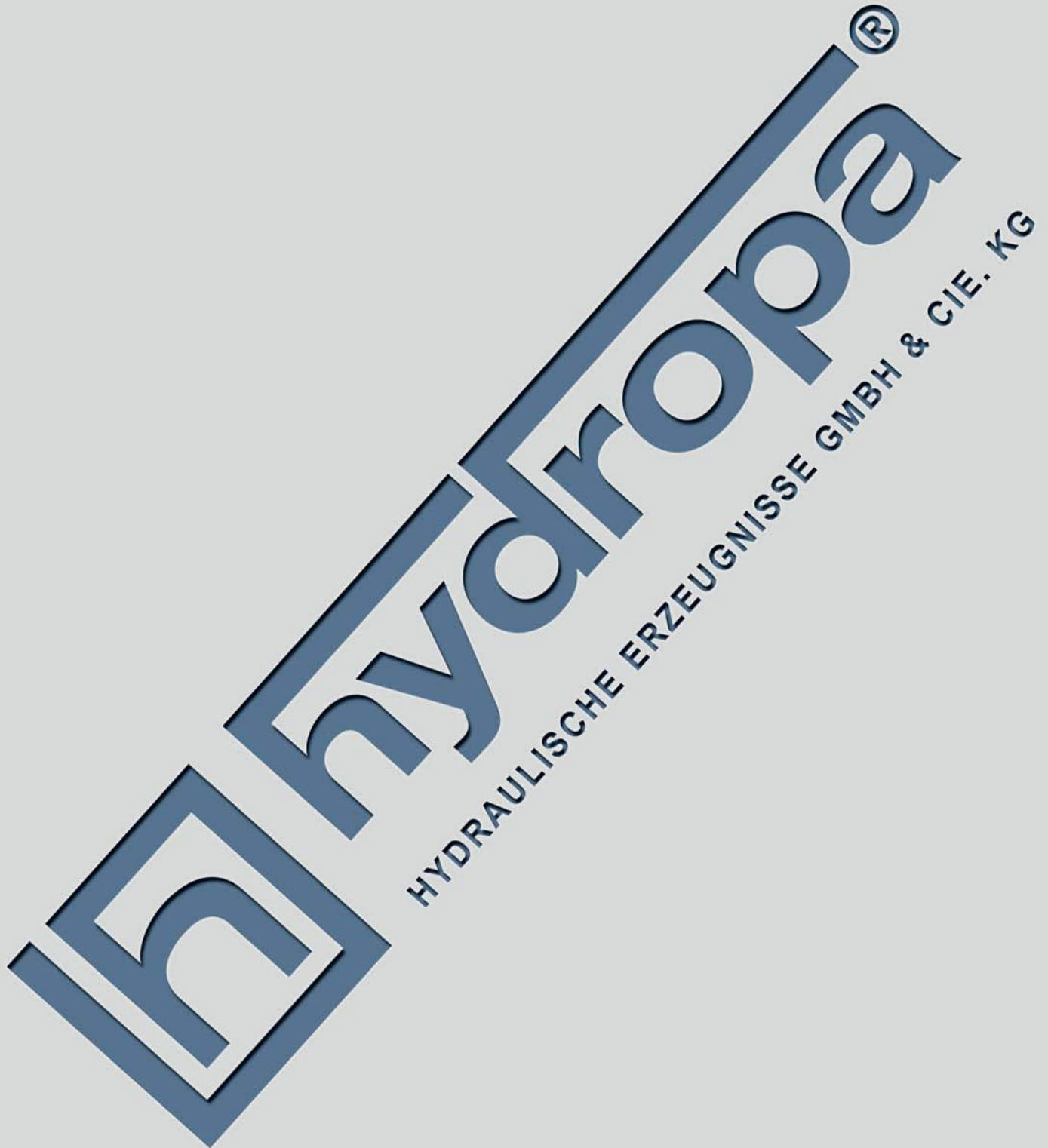
Calculation result for the subsystem:

Symmetrized $MTTF_d$ value	100 years
Average diagnostic coverage DC_{avg}	99 %
PFH_D (subsystem)	$2,5 \cdot 10^{-8}$ 1/h
PL (subsystem)	e

Forced disconnection

The pressure switches are designed in such a way that the safety-related contact pair of the microswitches is positively opened when the set pressure is exceeded or undershot by a corresponding positive opening differential pressure. This results in an inherently safe separation of the output signals. The minimum pressure required for this is known as the positive opening pressure and must be calculated by the control and/or machine manufacturer for each application.

If the application allows the positive opening pressure to be used as the safety-related cut-off pressure, the inherently safe forced disconnection of the safety-related contacts allows the exclusion of the "non-opening of contacts" fault in accordance with EN ISO 13849-2; Table D.8. Due to this error exclusion, an error exclusion can be declared for the pressure switch during PL verification. As a result, the reliability parameter ($B10D$ value) is no longer relevant for the calculation of the failure probability of the safety function.



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EG-Konformitätserklärung nach Maschinenrichtlinie 2006/42/EG

*EU- Declaration of Conformity acc. to machinery directive
2006/42/EG*

Name des Ausstellers: <i>certificate provider:</i>	Hydropa GmbH & Cie. KG
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Dokumentationsbevollmächtigter: <i>authorised person for documentation:</i>	Jasmine Krzykalla
Adresse des Bevollmächtigten <i>authorised person's adress:</i>	Därmannsbusch 4 58456 Witten
Gegenstand der Erklärung: <i>Object of the declaration:</i>	Sicherheitsdruckschalter DS6, DS6-SP 1- oder 2-kanalige Ausführung Funktion Steigend (S) oder Fallend (F), Seriennummer: MM.YY (Kalenderwoche/Herstellungsjahr)

Hiermit erklären wir, dass das oben genannte Produkt allen einschlägigen Bestimmungen der Maschinenrichtlinie 2006/42/EG entspricht.

Die speziellen technischen Unterlagen gemäß Anhang VII Teil A wurden erstellt. Der Bevollmächtigte für das Zusammenstellen der technischen Unterlagen verpflichtet sich, die Unterlagen auf begründetes Verlangen an die einzelstaatlichen Stellen zu übermitteln.

We hereby declare that the above mentioned product correspond to all relevant provisions of the machinery directive 2006/42/EG. The relevant technical documentation is compiled in accordance with annex VII part A. The person authorised for the compilation of the technical documentation commits himself to forward the documents to the national authorities upon a reasoned request.

Folgende harmonisierte Normen wurden unter anderem angewandt:

- EN ISO 12100:2010 Sicherheit von Maschinen – Allgemeine Gestaltungsleitsätze Risikobeurteilung und Risikominderung
- EN ISO 13849-1:2016 Sicherheit von Maschinen – Sicherheitsbezogene Teile von Steuerungen – Teil 1: Allgemeine Gestaltungsleitsätze
- EN ISO 13849-2:2013 Sicherheit von Maschinen – Sicherheitsbezogene Teile von Steuerungen – Teil 2: Validierung

The following harmonized standards have been applied inter alia:

- *EN ISO 12100:2010 Safety of Machinery – General principles for design, risk assessment and risk reduction*
- *EN ISO 13849-1:2016 Safety of Machinery – Safety related parts of control systems – part 1: General principles for design*
- *EN ISO 13849-2:2013 Safety of Machinery – Safety related parts of control systems – part 2: Validation*

Das Produkt entspricht weiterhin der Richtlinie 2011/65/EU & Richtlinie 2015/863/EU (RoHS) unter Berücksichtigung der in Art. 4 Abs. 1 genannten Ausnahmen für Blei (Pb) als Legierungsbestandteil in Messing und Aluminium. Die von uns in Verkehr gebrachten Aluminiumbauteile weisen einen max. Pb Massenanteil von 0,4% auf (Ausnahme 6b < 0,5% Pb), die in der Kupferlegierung / Messing von 3,5% (Ausnahme 6c < 4% Pb).

The product also complies with Directive 2011/65 / EU & Directive 2015/863 / EU (RoHS), taking into account the exceptions for lead (Pb) as an alloy component in brass and aluminum, as stated in Article 4 (1). The aluminum components placed on the market by us have a max. Pb mass fraction of 0.4 & on (exception 6b < 0.5% Pb), that in the copper alloy / brass of 3.5% (exception 6c < 4% Pb).