

Pressure switches hex 24

NC or NO, maximum voltage 42 V



- Most cost-effective solution for mechanical pressure monitoring
- Stable switching point even after long use and high load
- Switching point can be adjusted when fitted on site¹⁾
- High pressure resistance, compact, small switches, available as normally closed (NC) or normally open (NO)
- For solutions with integrated connectors, please refer to chapter M.1, starting at page 22
- For customized and ready-wired pressure switches, please refer to chapter M.5, starting at page 62.

¹⁾ Pressure switches can also be supplied preset at factory.
Our preset switches are sealed with lacquer paint, set points are embossed on the housing.

Pressure switches hex 24

Technical details

M.3

hex 24



Rated working voltage:	10 ... 42 VAC/DC	
Rated current range (resistive load, DC12 / AC12):	10 mA ... 4 A	
Switching power DC12 / AC12:	100 W / 100 VA	
Temperature resistance of sealing materials:	NBR (diaphragm pressure switch)	-40 °C ... +100 °C
	NBR (piston pressure switch)	-30 °C ... +100 °C
	EPDM	-30 °C ... +120 °C
	EPDM-TW (diaphragm pressure switch)	-20 °C ... +100 °C
	FKM (diaphragm pressure switch)	-5 °C ... +120 °C
	FKM (piston pressure switch)	-15 °C ... +120 °C
	FFKM	-20 °C ... +120 °C
	Silicone (diaphragm pressure switch)	-40 °C ... +120 °C
	HNBR	-30 °C ... +120 °C
Burst pressure (diaphragm pressure switch):	400 bar	
Burst pressure (piston pressure switch)	700 bar (for threads M10, G 1/8, R 1/8 and NPT 1/8 up to max. 600 bar)	
Switching frequency:	200 / min	
Mechanical life expectancy:	1,000,000 cycles (for diaphragm pressure switches, life expectancy value only applies for switching pressures up to max. 50 bar)	
Pressure rise rate:	≤ 1 bar/ms	
Hysteresis:	Average value 5 – 30 % depending on type, not adjustable	
Vibration resistance:	10 g; 5 ... 200 Hz sine wave; DIN EN 60068-2-6	
Shock resistance:	294 m/s ² ; 14 ms half sine wave; DIN EN 60068-2-27	
Protection class:	IP65 with socket device, terminals IP00	
Weight:	approx. 90 g	

Overview of contact materials and maximum overpressure safety

Type:		0163	0164	0166	0167	0168	0169
Material:	Zinc-plated steel (CrVI-free)	●		●		●	●
	Stainless steel		●				
	Brass				●		
Overpressure safety up to:	35 bar				●		
	300 bar			●		●	
	600 bar	●	●				●



M



0163

Diaphragm pressure switches up to 42 V with spade terminal

- Made of zinc-plated steel (CrVI-free)
- Spade terminal
- Overpressure safety up to 600 bar, Burst pressure safety up to 700 bar¹⁾

Adjustment range (Tolerance at room temperature)	Male thread	Article number NO → : :	Article number NC → : :
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0163 Diaphragm pressure switches with spade terminal

0.1 - 1 (± 0.2) bar	G1/4	0163 - 403 03 - X - 011	0163 - 404 03 - X - 015
	G1/8	0163 - 403 28 - X - 603	0163 - 404 28 - X - 604
	M10x1 cyl.	0163 - 403 13 - X - 003	0163 - 404 13 - X - 004
	M10x1 con.	0163 - 403 01 - X - 009	0163 - 404 01 - X - 013
	M12x1.5 cyl.	0163 - 403 02 - X - 010	0163 - 404 02 - X - 014
	NPT1/8	0163 - 403 04 - X - 012	0163 - 404 04 - X - 016
0.5 - 3 (± 0.3) bar	G1/4	0163 - 423 03 - X - 070	0163 - 424 03 - X - 070
	G1/8	0163 - 423 28 - X - 070	0163 - 424 28 - X - 070
	M10x1 cyl.	0163 - 423 13 - X - 070	0163 - 424 13 - X - 070
	M10x1 con.	0163 - 423 01 - X - 070	0163 - 424 01 - X - 070
	M12x1.5 cyl.	0163 - 423 02 - X - 070	0163 - 424 02 - X - 070
	NPT1/8	0163 - 423 04 - X - 070	0163 - 424 04 - X - 070
1 - 10 (± 0.5) bar	G1/4	0163 - 407 03 - X - 027	0163 - 408 03 - X - 031
	G1/8	0163 - 407 28 - X - 607	0163 - 408 28 - X - 608
	M10x1 cyl.	0163 - 407 13 - X - 007	0163 - 408 13 - X - 008
	M10x1 con.	0163 - 407 01 - X - 025	0163 - 408 01 - X - 029
	M12x1.5 cyl.	0163 - 407 02 - X - 026	0163 - 408 02 - X - 030
	NPT1/8	0163 - 407 04 - X - 028	0163 - 408 04 - X - 032
10 - 20 (± 1.0) bar	G1/4	0163 - 411 03 - X - 043	0163 - 412 03 - X - 047
	G1/8	0163 - 411 28 - X - 611	0163 - 412 28 - X - 612
	M10x1 cyl.	0163 - 411 13 - X - 011	0163 - 412 13 - X - 012
	M10x1 con.	0163 - 411 01 - X - 041	0163 - 412 01 - X - 045
	M12x1.5 cyl.	0163 - 411 02 - X - 042	0163 - 412 02 - X - 046
	NPT1/8	0163 - 411 04 - X - 044	0163 - 412 04 - X - 048
20 - 50 (± 2.0) bar	G1/4	0163 - 415 03 - X - 059	0163 - 416 03 - X - 063
	G1/8	0163 - 415 28 - X - 615	0163 - 416 28 - X - 616
	M10x1 cyl.	0163 - 415 13 - X - 015	0163 - 416 13 - X - 016
	M10x1 con.	0163 - 415 01 - X - 057	0163 - 416 01 - X - 061
	M12x1.5 cyl.	0163 - 415 02 - X - 058	0163 - 416 02 - X - 062
	NPT1/8	0163 - 415 04 - X - 060	0163 - 416 04 - X - 064

Seal material – Application areas

NBR	Hydraulic/machine oil, air, nitrogen, etc.	1
EPDM	Brake fluid, hydrogen, oxygen, acetylene, etc.	2
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
HNBR	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 41 for the temperature range and application thresholds of sealing materials.



Article number:

0163 - XXX XX - **X** - XXX

¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

0163

Diaphragm pressure switches up to 42 V with M3 screw terminal

- Made of zinc-plated steel (CrVI-free)
- M3 screw terminal
- Overpressure safety up to 600 bar, Burst pressure safety up to 700 bar¹⁾

Adjustment range (Tolerance at room temperature)	Male thread	Article number NO → :	Article number NC → :
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0163 Diaphragm pressure switches with M3 screw terminal

0.1 - 1 (± 0.2) bar	G1/4	0163 - 401 03 - X - 003	0163 - 402 03 - X - 007
	G1/8	0163 - 401 28 - X - 601	0163 - 402 28 - X - 602
	M10x1 cyl.	0163 - 401 13 - X - 001	0163 - 402 13 - X - 002
	M10x1 con.	0163 - 401 01 - X - 001	0163 - 402 01 - X - 005
	M12x1.5 cyl.	0163 - 401 02 - X - 002	0163 - 402 02 - X - 006
	NPT1/8	0163 - 401 04 - X - 004	0163 - 402 04 - X - 008
0.5 - 3 (± 0.3) bar	G1/4	0163 - 421 03 - X - 070	0163 - 422 03 - X - 070
	G1/8	0163 - 421 28 - X - 070	0163 - 422 28 - X - 070
	M10x1 cyl.	0163 - 421 13 - X - 070	0163 - 422 13 - X - 070
	M10x1 con.	0163 - 421 01 - X - 070	0163 - 422 01 - X - 070
	M12x1.5 cyl.	0163 - 421 02 - X - 070	0163 - 422 02 - X - 070
	NPT1/8	0163 - 421 04 - X - 070	0163 - 422 04 - X - 070
1 - 10 (± 0.5) bar	G1/4	0163 - 405 03 - X - 019	0163 - 406 03 - X - 023
	G1/8	0163 - 405 28 - X - 605	0163 - 406 28 - X - 606
	M10x1 cyl.	0163 - 405 13 - X - 005	0163 - 406 13 - X - 006
	M10x1 con.	0163 - 405 01 - X - 017	0163 - 406 01 - X - 021
	M12x1.5 cyl.	0163 - 405 02 - X - 018	0163 - 406 02 - X - 022
	NPT1/8	0163 - 405 04 - X - 020	0163 - 406 04 - X - 024
10 - 20 (± 1.0) bar	G1/4	0163 - 409 03 - X - 035	0163 - 410 03 - X - 039
	G1/8	0163 - 409 28 - X - 609	0163 - 410 28 - X - 610
	M10x1 cyl.	0163 - 409 13 - X - 009	0163 - 410 13 - X - 010
	M10x1 con.	0163 - 409 01 - X - 033	0163 - 410 01 - X - 037
	M12x1.5 cyl.	0163 - 409 02 - X - 034	0163 - 410 02 - X - 038
	NPT1/8	0163 - 409 04 - X - 036	0163 - 410 04 - X - 040
20 - 50 (± 2.0) bar	G1/4	0163 - 413 03 - X - 051	0163 - 414 03 - X - 055
	G1/8	0163 - 413 28 - X - 613	0163 - 414 28 - X - 614
	M10x1 cyl.	0163 - 413 13 - X - 013	0163 - 414 13 - X - 014
	M10x1 con.	0163 - 413 01 - X - 049	0163 - 414 01 - X - 053
	M12x1.5 cyl.	0163 - 413 02 - X - 050	0163 - 414 02 - X - 054
	NPT1/8	0163 - 413 04 - X - 052	0163 - 414 04 - X - 056

Seal material – Application areas

NBR	Hydraulic/machine oil, air, nitrogen, etc.	1
EPDM	Brake fluid, hydrogen, oxygen, acetylene, etc.	2
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
HNBR	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 41 for the temperature range and application thresholds of sealing materials.

Article number:

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¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

0169

Piston pressure switches up to 42 V

- Made of zinc-plated steel (CrVI-free)
- Spade or M3 screw terminal
- Overpressure safety up to 600 bar, Burst pressure safety up to 700 bar¹⁾

Adjustment range (Tolerance at room temperature)	Male thread	Article number NO → :	Article number NC → :
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0169 Piston pressure switches with spade terminal

50 - 150 (± 5) bar	G1/4	0169 - 419 03 - X - 011	0169 - 420 03 - X - 015
	G1/8	0169 - 419 28 - X - 603	0169 - 420 28 - X - 604
	M10x1 cyl.	0169 - 419 13 - X - 003	0169 - 420 13 - X - 004
	M10x1 con.	0169 - 419 01 - X - 009	0169 - 420 01 - X - 013
	M12x1.5 cyl.	0169 - 419 02 - X - 010	0169 - 420 02 - X - 014
	NPT1/8	0169 - 419 04 - X - 012	0169 - 420 04 - X - 016

100 - 200 (± 5) bar	G1/4	0169 - 493 03 - X - 011	0169 - 494 03 - X - 015
	G1/8	0169 - 493 28 - X - 603	0169 - 494 28 - X - 604
	M10x1 cyl.	0169 - 493 13 - X - 003	0169 - 494 13 - X - 004
	M10x1 con.	0169 - 493 01 - X - 009	0169 - 494 01 - X - 013
	M12x1.5 cyl.	0169 - 493 02 - X - 010	0169 - 494 02 - X - 014
	NPT1/8	0169 - 493 04 - X - 012	0169 - 494 04 - X - 016

0169 Piston pressure switches with M3 screw terminal

50 - 150 (± 5) bar	G1/4	0169 - 417 03 - X - 003	0169 - 418 03 - X - 007
	G1/8	0169 - 417 28 - X - 601	0169 - 418 28 - X - 602
	M10x1 cyl.	0169 - 417 13 - X - 001	0169 - 418 13 - X - 002
	M10x1 con.	0169 - 417 01 - X - 001	0169 - 418 01 - X - 005
	M12x1.5 cyl.	0169 - 417 02 - X - 002	0169 - 418 02 - X - 006
	NPT1/8	0169 - 417 04 - X - 004	0169 - 418 04 - X - 008

100 - 200 (± 5) bar ²⁾	G1/4	0169 - 491 03 - X - 003	0169 - 492 03 - X - 007
	G1/8	0169 - 491 28 - X - 601	0169 - 492 28 - X - 602
	M10x1 cyl.	0169 - 491 13 - X - 001	0169 - 492 13 - X - 002
	M10x1 con.	0169 - 491 01 - X - 001	0169 - 492 01 - X - 005
	M12x1.5 cyl.	0169 - 491 02 - X - 002	0169 - 492 02 - X - 006
	NPT1/8	0169 - 491 04 - X - 004	0169 - 492 04 - X - 008

Seal material – Application areas

NBR	Hydraulic/machine oil, air, nitrogen, etc.	1
EPDM	Brake fluid, hydrogen, oxygen, acetylene, etc.	2
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
HNBR	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 41 for the temperature range and application thresholds of sealing materials.

Article number:

0169 – XXX XX – X – XXX

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¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

²⁾ Please consult us before ordering the pressure switch 0169 in the adjustment range 100-200 bar with small threads (e.g. G1/8, NPT 1/8).

General technical explanations

User information

Our pressure monitoring products may only be installed and started up by authorised specialists. The safety regulations of country-specific authorities must be observed, especially when working with mains voltages and oxygen, and in potentially explosive areas.

Product information

The technical information in this catalogue is based upon fundamental testing during product development and empirical values. The information cannot be used for all application scenarios.

Testing of the suitability of our products for a specific application (such as the checking of material compatibilities) remains the responsibility of the user. It may be the case that suitability can only be verified by appropriate field testing.

Mounting position

For mechanical and electronic pressure switches as well as transmitters there is no limitation due to the mounting position with regard to the accuracy of the pressure measurement.

However, other boundary conditions of the application may require a certain mounting position, e. g. horizontal installation to avoid waterlogging on the electrical connection or vertical installation to prevent debris from accumulating in the bore of the pressure connection.

IP protection class

The IP protection class is a defined protection level code (sealing) of electrical equipment housings in line with IEC 60529 (formerly DIN 40050 – Part 2). Protection of a housing against the following is tested here:

- The penetration of solid extraneous particles, such as dust
- Access of hazardous parts
- Penetration of water

IP protection tests are performed as type tests.

The IP protection type code, made up of two digits, specifies the protection of a housing against the penetration of solid extraneous particles and water.

The numeric code therefore provides conclusions to be drawn on the level of personal safety as well as the functional protection / mid to longterm functional reliability of electrical equipment.

Protection types IP00, IP65, IP67 and IP6K9K

IP00:

No protection against penetration of solid particles or water, no protection against contact.

IP6X:

Protection against penetration of dust (dust proof). Full contact protection.

IPX5:

A jet of water from a nozzle, aimed at equipment (such as a pressure switch) from all directions, must not have any harmful effect.

IPX7:

Protection from water, when equipment (such as a pressure switch) is immersed in water under defined pressure and time conditions. Water must not penetrate into the equipment in harmful quantities.

IP6K9K:

Devices satisfying these requirements must be dust-proof and be able to withstand loads during the use of high-pressure cleaners and steam jets. The standard stipulates a water pressure from 80 to 100 bar at a temperature of 80 °C for testing.

IP6KX:

Dust must not penetrate. Letter K: Specific to the electrical equipment of road vehicles.

IPX9K:

Protection against penetration of water at high pressure / for steam jet cleaning. Water aimed at the housing from every direction at greatly increased pressure may not have any damaging effects.

We are able to offer IP67 / IP6K9K for many of our mechanical and electronic pressure switches (pre-wired or with integrated connector) and for our transmitters.

IP67 / IP6K9K is the recommended protection for mobile hydraulics and any equipment exposed to the outdoor environment.

Cylindrical threads

Cylindrical threads are either sealed on the front by underlaying an appropriate sealing ring (such as a copper sealing ring) or by already having integrated O-rings or gaskets.

If the corresponding thread types do not provide specifications regarding the roughness of the counter sealing surface, we recommend the following values:

$$R_{a_{max}} 1.6 \mid R_{max} 6.3 \mid R_{mr}(-0.10) > 5\% C_{ref} 5\%$$

Conical threads (cone-shaped threads)

Conical threads guarantee tolerance compensation of the two threaded parts. The sealing function is realised with thread flanks which deform permanently and enter into a metallic frictional fit. Conical threads are not screwed in down to the screw-in depth, but fixed with the tightening torque required for the leak tightness.

Remember not to exceed the permitted tightening torque of the pressure switch or transmitter presented in the following table (to prevent damaging the threaded pin beforehand, causing it to become untight during operation or to snap off when tightened).

Tightening torques of steel threads

The specifications below are to be understood upper material thresholds for the housing of pressure switches or transmitters. Remember during installation that the type and material of the seal, the condition of mating surfaces (e.g. dry or oily) and the material of the counter-piece all have a bearing on the tightening torque.

Threads M10, G 1/8, R 1/8 and NPT 1/8 are limited to overpressure strengths of up to 600 bar.

Values 30% lower than in the following table must be used for brass housings.

Thread	Tightening torque
NPT 1/8; M 10 x 1 conical	max. 18 Nm
M 10 x 1 cyl.; G 1/8	max. 20 Nm
M 12 x 1.5; 7/16 – 20 UNF	max. 30 Nm
G 1/4; 9/16 – 18 UNF	max. 40 Nm
NPT 1/4; M 14 x 1.5	max. 40 Nm

Gaseous applications

In particular using additional sealant to attain the required leak tightness may be necessary for gas applications.

Plasma cleaning for oxygen applications

When pressure switches/transmitters are used with oxygen, the surfaces must be free of oil and grease residues to prevent spontaneous combustion. Special requirements must also be observed for oxygen applications with regard to the material selection of housings and seals as well as the permitted operating pressure (see also page 17). We would be pleased to advise you if necessary.

For these operating conditions, we offer plasma cleaning of the components in order to achieve the required elimination of oil and grease. The components are packed and sealed in plastic bags. The packaging is marked with safety instructions for use in oxygen applications.

Plasma cleaning LABS-free (PWIS-free)

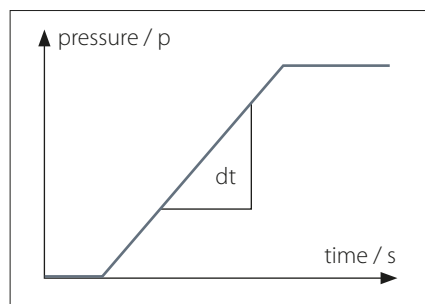
Our products are always manufactured without the use of substances that interfere with the wetting of the paint throughout the entire manufacturing process. For use in LABS-free applications, we offer plasma cleaning of the components. The components are packed and sealed in plastic bags. The packaging is marked with safety instructions for use in LABS applications.

Vacuum

The values given in the technical details for the vacuum range are specified in millibars (mbar) below atmospheric pressure.

Pressure change rate (~rise / ~fall)

The pressure change rate denotes the pressure over time for the rising/falling pressure. It is specified in bar/s.



The maximum pressure change rate for mechanical pressure switches is 1,000 bar/s. For SUCO electronic pressure monitoring products the maximum pressure change rate can be up to 5,000 bar/s.

Overpressure protection

The specified overpressure protection in the catalogue is based on a static pressure. The values refer to the hydraulic or pneumatic part of the switch.

It is best practice to use 30 - 50% lower values for dynamic pressure compared to static pressure. These empirical values are based on the knowledge that, in pressure systems, unexpected pressure peaks which are higher than the working pressure are generated as a result of activation of valves, sudden falling or rising load or simply the change of cross-sections in the pipes. With conventional measurement techniques (such as manometers), these pressure peaks are hardly measurable. Faster measurement systems must therefore be used for this data acquisition. Attempts are being made to take this into account by using empirical or corrective factors.

If the pressure conditions are known and the pressure change rates are 100 bar/s, our pressure switches and transmitters can be used up to the permitted overpressure protection as per data sheet / catalogue. Only 50 % of the specified overpressure protection is permitted when operating at the maximum permitted pressure change rate of $\leq 1,000$ bar/s for mechanical pressure switches, and at $\leq 5,000$ bar/s for transmitters.

RoHS-Compliance

= Restriction of Hazardous Substances
(EC Directive 2011/65/EU)



CE-Mark

= Communauté Européenne



European Parliament and Council directives must be observed when products are launched onto the market. If a directive exists for a product, it must be applied. Only products for which a directive exists may bear the CE mark.

Only products which have been tested according to CE directive or corresponding standards may carry the CE mark.

Mechanical pressure switches with a supply voltage above 50 VAC or 75 VDC are covered by the 2014/35/EU Low Voltage Directive. Variants for potentially explosive areas are covered in addition by the 2014/34/EU ATEX Product Directive.

Our electronic products satisfy EMC (Electromagnetic Compatibility) Directive 2014/30/EC. Mechanical pressure switches do not fall under the EMC Directive.

The Machinery Directive 2006/42/EC is not applicable, because our products are classed as components.

Our product designs are based upon „good engineering practise“ in line with Article 4, Paragraph 3 of the Pressure Equipment Directive (2014/68/EU), meaning neither a declaration of conformity may be issued nor a CE mark affixed.

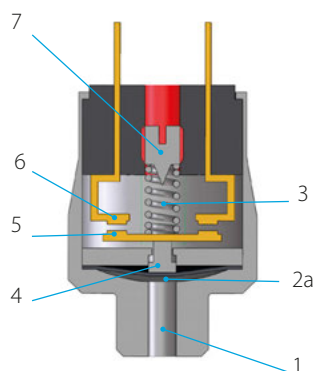
The current product-specific CE declaration is available in the download area of our homepage:

www.suco.de/en/downloads

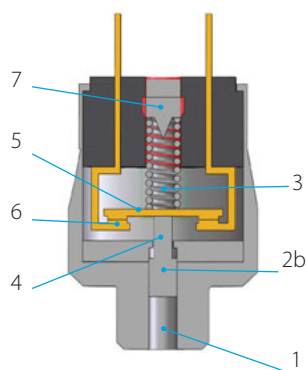
Subject to technical changes

Technical explanations for mechanical pressure switches

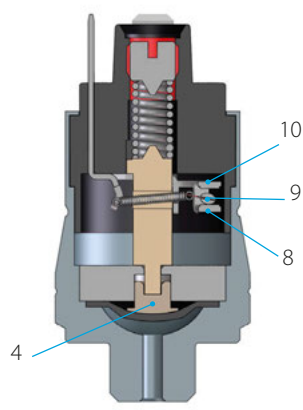
Diaphragm pressure switch
NO



Piston pressure switch
NC



Change-over



What is a mechanical pressure switch?

Mechanical pressure switches from SUCO monitor the pressure of liquid or gaseous media, and close or open an electrical circuit on reaching a set threshold.

Diaphragm pressure switches

SUCO diaphragm pressure switches are used in pressure ranges from 0.1 bar to 100 bar, meaning overpressure safety of 35, 100, 300 / 400 and 600 / 700 bar, depending on the used diaphragm type.

Piston pressure switches

Pressure ranges from 10 bar to 400 bar can be monitored with SUCO piston pressure switches (dependent on size); overpressure safety of up to 600 / 700 bar can be attained.

Sizes of pressure switches

Mechanical pressure switches from SUCO can be divided into sizes hex 24, hex 27 and 30 A/F. Each particular size has specific hydraulic, pneumatic and electric properties (specified on the relevant catalogue page in the technical details).

How does a pressure switch work?

Function description for **normally open (NO)**: Pressure is applied to the diaphragm (2a) / pistons (2b) through the pressure connector (1).

If the generated pressure force is greater than the force of the pre-tensioned pressure spring (3), the plunger (4) moves towards the counter-contact (6), carrying along the contact disc (5), and closes the circuit.

The switch opens again when the pressure is reduced by the hysteresis value.

Function description for **normally closed (NC)**: Engaging happens in the reverse order.

The adjustment screw (7) enables the switching point to be changed within the adjustment range.

The micro switch of a **change-over contact system** (snap-action) offers both, a NC and a NO contact.

The swivel contact (9) is activated by the plunger (4). The circuit is closed by the NC (8) as long as no pressure is applied.

When the applied pressure exceeds the set switching point, the swivel contact changes over and closes the circuit via the NO (10).

Utilisation category

The utilisation category specifies for example voltages and currents, and the type of load, our pressure switches are designed for (according to DIN EN 60947-5-1).

AC voltage

AC12: Control of ohmic loads and semiconductor loads in input circuits of opto-couplers (such as PLC inputs).

AC14: Control of electromagnetic loads, 72 VA.

DC voltage

DC12: Control of ohmic loads and semiconductor loads in input circuits of opto-couplers (such as PLC inputs).

DC13: Control of electromagnets.

B10d value

According to DIN EN ISO 13849-1, the B10d value specifies the anticipated service life (with a 10% probability of failure). The B10d value is therefore directly dependent on the respective application of the pressure switch. For ohmic loads and currents < 1 A, we specify the B10d value as 1 million cycles of electrical life.

The specification of a MTTF time (mean time to failure) is not possible without knowing the specific conditions in the application. However, the MTTF time can be determined easily from the B10d value:

$$MTTF_d = \frac{B_{10d}}{0,1 n_{op}}$$

n_{op} : number of cycles per year

B_{10d} : number of cycles until 10 % of components have failed.

Minimum current / minimum working voltage

The minimum working current and minimum working voltage depend greatly on operating and ambient conditions. Physically, the build-up of impurity layers on the contact rivets must be countered with mechanical friction and/or electrical erosion.

Classification of electrical switch functions

			Contact form DIN EN- 60947-5-1	Symbol IEC 60617
NO	NO, normally open	SPST single pole, single throw	X	
NC	NC, normally closed	SPST single pole, single throw	Y	
Change-over contacts	CO, change over (snap action)	SPDT single pole, double throw	C	

It has proven useful in many applications to deploy our pressure switches with silver contact rivets ensuring that they are fail safe to 10 mA and 10 V. Variants with gold contacts are available in our catalogue for even lower currents and voltages.

Potential-free – galvanically isolated

Mechanical pressure switches from SUCO are potential-free, i.e. no auxiliary energy is required. Also, there is no electrical contact between the individual, live parts and the housing.

Adjustment range of switching point

The pressure range, within which the switching point of a pressure switch can be set, is called adjustment range. The switching point corresponds to the pressure value at which the electric circuit is opened or closed by the pressure applied.

If no switching point is specified on order, the pressure switches are adjusted by approximately half the adjustment range at factory.

The setting ranges specified for the respective device series apply to increasing pressure. For switching points that are specified for falling pressure and are within the maximum value of the setting range minus the hysteresis, the next higher setting range must be selected (see also section „Hysteresis“).

Switching point tolerances

The switching point tolerances specified by us pertain to room temperature (RT) and condition as new.

The values can change as a result of temperature, ageing and deployment conditions.

It is not possible to specify generally applicable value for switching point tolerances over temperature as the medium has a significant influence on the sealing materials in the pressure switch.

Double the tolerance stated for RT and condition as new can be assumed as a typical magnitude for the tolerance over the entire temperature range.

Based on their design, piston switches may exhibit an increase in switching points due to storage (dry run, stick-slip effect). Following a short start phase, the switching points return to the value set at the factory.

Pressure change rates of > 1bar/s may have an effect on the switching point for diaphragm pressure switches.

The switching point (for rising pressure) and hysteresis increase, whilst the switch-back point (for falling pressure) sinks.

Also, the effect of the maximum (system) pressure on the switchback point (for falling pressure ramp) must be factored in for tolerance-critical applications. The higher the (system) pressure, the lower the resulting switch-back value.

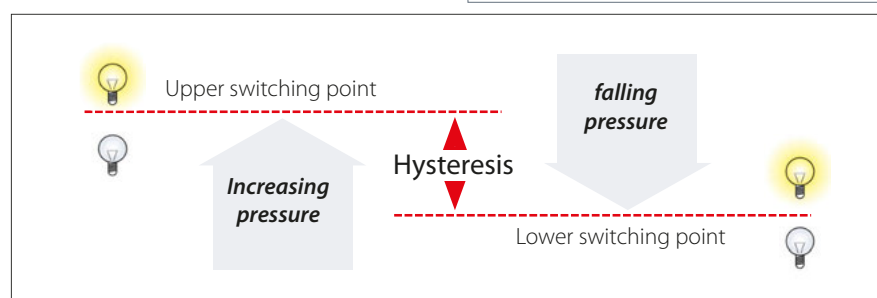
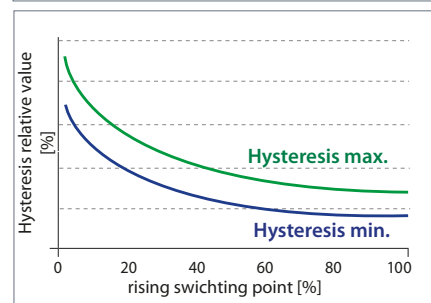
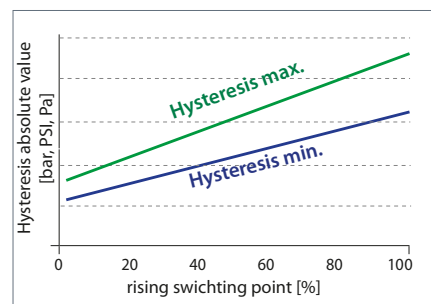
Hysteresis

Rising / falling switching point

The pressure difference between the rising (upper) and falling (lower) switching points (refer to the figure, e.g. NO) is known as hysteresis (switch-back difference).

Hysteresis has no constant value due to the structural layout of a mechanical pressure switch. In absolute values, the hysteresis is also the smallest with the smallest adjustment range. The hysteresis increases with increasing adjustment range.

Hysteresis over rising switching point



Technical explanations for mechanical pressure switches

Hysteresis can be set at SUCO in range from approx. 10 % (at end of adjustment range) to 30 % or higher (at start of adjustment range), related to the respective switching point for hex 27 and 30 A/F pressure switches with adjustable hysteresis.

Due to their design, pressure switches with an overpressure resistance of 100 bar have smaller hystereses than the series with 300 bar or 400 bar overpressure resistance. Piston pressure switches have a slightly larger hysteresis than diaphragm pressure switches.

The specifications in the catalogue only represent typical average values. Please ask about the possible setting ranges you may require. Our electronic pressure switches are excellently suited to extremely low or high hysteresis. The lowest possible hysteresis is set if nothing is specified in the order.

Switching frequency

The switching frequency provides information on the possible number of cycles in one minute. The value of 200/min specified by us is a guideline value. Higher switching frequencies can be attained depending on switch type and conditions of use.

Sealing materials

The priority in sealing material selection is the chemical resistance. The temperature range only becomes a selection criterion when different sealing materials are suitable for the medium.

NBR (Buna-N)

This is the standard material most commonly used. It is a special SUCO material mix with high level of cold flexibility so that the sealing properties of the pressure switch are also retained at low temperatures.

NBR is denoted by number „1“ in our order number.

EPDM

This material is the solution of choice for applications with brake fluids. It is particularly suitable for applications with (process) water. Approval from the BAM (Federal Institute for Material Testing) is in place for oxygen applications.

The safety regulations from country-specific authorities must be observed for oxygen applications. EPDM may not come into contact with oil because this would entail swelling and softening of the material, and so failure of the pressure switch.

EPDM is denoted by number „2“ in our order number.

EPDM-TW with drinking water approval

This EPDM material is intended for drinking water applications (up to max. 35 bar overpressure safety) according to Elastomer Guideline, WRAS (Water Regulation Advisory Scheme), ACS (Attestation de Conformité Sanitaire) and NSF 61 (National Sanitation Foundation) and for use in medical and pharmaceutical applications.

EPDM-TW may not come into contact with oil because this would entail swelling and softening of the material, and so failure of the pressure switch. Sealing is only available upon request, so please consult us before ordering.

EPDM-TW is denoted by number „5“ in our order number.

FKM / FPM (Viton®)

This is a diaphragm material suitable for high temperature exposure and exhibits special chemical resistance. It has been tested in the hydraulic sector and has been proven to work successfully with critical oils. FKM / FPM is denoted by number „3“ in our order number.

FFKM

This diaphragm material is suitable for temperature exposure up to 120°C and can withstand very aggressive conditions such as chemical species including organic or inorganic acids, diluted alkalis, ketones, esters, alcohols, fuels and hot water. FFKM is denoted by number „6“ in our order number.

TPE (Thermoplastic elastomers)

This sealing material is available only for our electronical products of the Performance Series.

TPE offers similar media compatibility like NBR, e.g. suitable for mineral oil and hydraulic fluids.

Additionally the material can be used with diluted acids and bases and cold water, too.

TPE is denoted by number „7“ in our order number.

ECO (epichlorhydrin)

ECO is only used in our vacuum switches. This material has similar properties to NBR in terms of chemical resistance, and can be used in gas applications as well as oil and fuel applications.

ECO is denoted by number „4“ in our order number.

Silicone

Silicone is suitable for use within a wide temperature range. The SUCO silicone diaphragm is FDA-approved (Food & Drug Administration) for the food sector.

Silicone is a soft material reserved for sensitive applications in the low pressure range (below 10 bar) with maximum overpressure safety to 35 bar. Piston switches are therefore not offered with silicone seals. Silicone is also not suitable for oil applications.

Silicone is denoted by number „8“ in our order number.

H-NBR

This is a special SUCO material mixture optimised for ester-based bio-oils. The multitude of bio-oils on the market means suitability of the material for the respective oil must be determined. This diaphragm material can also be used for a number of mineral and synthetic oils.

H-NBR is denoted by number „9“ in our order number.

Medium compatibility

The specifications on medium compatibility in this catalogue cannot be generalised as they pertain to the sealing materials used in our pressure switches.

Saturated and superheated steam applications

The sealing materials mentioned are not suitable for saturated or superheated steam applications.

Conversion table for pressure units

Unit symbol	Unit name	Pa= N/m ²	bar	Torr	lbf/in ² , PSI
1 Pa = N/m ²	Pascal	1	0.00001	0.0075	0.00014
1 bar	Bar	100 000	1	750.062	14.5
1 Torr = 1 mmHg	Millimetres, mercury column	133.322	0.00133	1	0.01934
1 lbf/in ² = 1 PSI	Pound-force per square inch	6 894	0.06894	51.71	1

Conversion table for temperature units

	K	°C	F
K	1	K - 273.15	9/5 K - 459.67
°C	°C + 273.15	1	9/5 °C + 32
F	5/9 (F + 459.67)	5/9 (F - 32)	1

Water applications

Standard piston switches are not suitable for water applications.

Pressure switches in stainless steel with EPDM seal have a special sealing system and can therefore also be used for water with corrosion protection, water mixtures or emulsions. The use of other fluid mixtures should be clarified with SUICO (e.g. swelling of EPDM sealing could happen by water – oil mixture).

Pressure switches with stainless steel housings with EPDM-TW diaphragm, SUICO type „5“ are designed for the use of drinking water.

Gas applications

Our pressure switches are suitable for liquid and gaseous media. Gaseous media place particular demands on leak-tightness however. The leakage rate is dependent on the respective gaseous medium, the working pressure and the permeability of the seal material used in the pressure switch.

Their lower leakage rates mean diaphragm pressure switches are better suited for gas pressures than piston pressure switches. The latter can also be used however if certain measures are taken (such as venting of the housing).

For gaseous applications below 10 bar (145 PSI) in combination with pressure switches with high IP class, i.e. IP 67 and IP6K9K, in general we recommend to use ventilation. Please consult us; we are able to offer suitable solutions.

Oxygen applications

Our mechanical pressure switches are suitable for use with oxygen. We recommend the use of our EPDM diaphragm. The resistance to internal burnout of the diaphragm has been tested by the BAM (Federal Institute for Material Testing).

Pressure switches with steel housings with zinc-nickel coating are, in conjunction with oxygen, only approved to a maximum working pressure of 10 bar.

Pressure switches with brass housings are, in conjunction with oxygen, only approved to a maximum working pressure of 35 bar.

Pressure switches with stainless steel housings are, in conjunction with oxygen, only approved to a maximum working pressure of 50 bar.

DGUV accident prevention regulations (such as DGUV 500, Section 2.32 and BGI 617) must be observed for first operation.

Please specify when ordering „oil and grease-free, for use with oxygen“.

Underpressure safety of pressure switches

Our pressure switches are underpressure safe down to 300 mbar (relative).

Overpressure safety of vacuum switches

Our vacuum switches are overpressure safe up to 20 or 35 bar depending on type.

cCSAus approval

Almost all of our mechanical pressure switches (sizes hex 24 and hex 27), and vacuum switch 0151, have cCSAus approval. The CSA mark together with „c“ and „us“ combines the control stamps for introduction onto the Canadian and American markets. The cCSAus certificate also includes the test of the relevant UL standard.

Checked by an official institution and verified with regular company visits by CSA inspectors, this approval guarantees the highest levels of quality and operational reliability for our products.

You can download the current cCSAus certificate on the download area of our homepage: <http://www.suco.de/en/downloads>

Product information

The technical information in this catalogue is based upon fundamental testing during product development, as well as upon empirical values. The information cannot be used for all application scenarios.

Testing of the suitability of our products for a specific application (e.g. also the checking of material compatibilities) rests under the responsibility of the user. It may be the case that suitability can only be guaranteed with appropriate field testing.

Please consult us about gas, water and oxygen applications.

Subject to technical changes.