

# P01

## Pressure switches

### KEY FEATURES

- Compact and robust design for use in harsh environments
- Designed for mobile hydraulics, alternative drives (H2, CNG, LPG) and industrial sectors
- Maximum flexibility through modular design, customization and individualization possible
- High media compatibility (with welded stainless steel measurement cell)
- Designed for OEM needs
- With ECE type approval
- UL Recognized

### TECHNICAL DATA

- Pressure ranges from 0 ... 0.1 bar to 0 ... 7 bar (relative and absolute) with silicon measurement cell
- Pressure ranges from 0 ... 10 bar to 0 ... 2000 bar (relative) with welded stainless steel measurement cell
- High overload pressure
- Media temperatures up to 150 °C / 302 °F
- Protection class IP67/IPX9K (depending on connector type)
- NPN and PNP output available

### ACCESSORIES

- Optional setup interface available

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## TECHNICAL DATA

### Available Standard Pressure Ranges (Other Ranges Available) and Sensor Parameters

Component	Description/Value												
Pressure reference	Relative R (gauge G) / absolute A						Relative R (gauge G)						
Standard pressure range	0.3 bar	1 bar	3.4 bar	7 bar	10 bar	20 bar	50 bar	100 bar	250 bar	400 bar	800 bar	1200 bar	2000 bar <sup>1)</sup>
Overload pressure (per DIN EN 60770-1)	0.6 bar	1.9 bar	6.9 bar	13.8 bar	40 bar	40 bar	100 bar	200 bar	500 bar	800 bar	1000 bar	1600 bar	2200 bar
Bursting pressure (per DIN EN 60770-1)	0.7 bar	2 bar	7 bar	14 bar	70 bar	70 bar	500 bar	1000 bar	2500 bar	4000 bar	> 4000 bar	> 4000 bar	> 4000 bar
Media temperature	-40 ... +85 °C / -40 ... +185 °F						-40 ... +150 °C / -40 ... +302 °F						
Operating and storage temperature	-40 ... +85 °C / -40 ... +185 °F						-40 ... +125 °C (-25 ... +85 °C at cable output) -40 ... +257 °F (-13 ... +185 °F at cable output)						
Material with medium contact	Stainless Steel AISI 316 Ti (EN 1.4571), Silicone Elastomer and NBR seal (For applications with non-aggressive gases and fluids or substances which do not react with above mentioned materials)						Stainless Steel AISI 630 (EN 1.4542), AISI 316 L (EN 1.4435) on request						
Switch point accuracy at operating temperature	≤ 1.0 %FS (0 ... +85 °C) / (+32 ... +185 °F) ≤ 2.5 %FS (-40 ... 0 °C) / (-40 ... +32 °F)						≤ 0.5 %FS (0 ... +105 °C) / (+32 ... +221 °F) ≤ 1.5 %FS (-40 ... 0 °C and +105 ... +125 °C) / (-40 ... +32 °F and +221 ... +257 °F)						
Thereof linearity, pressure hysteresis and repeata- bility (Linearization with limit point setting)	< 0.25 %FS						< 0.25 %FS						
Long-term stability	< 0.2 %FS p.a.						< 0.2 %FS p.a.						

<sup>1)</sup> For common-rail applications.

## TECHNICAL DATA

### Available Outputs

Type	Component	Description/Value
Switch	Output signal	1 x PNP, 2 x PNP, 1 x NPN, 2 x NPN (Output current up to 500 mA)
	Electrical connection	M12 connector (plastic), DIN bayonet (per DIN 72585), DT04-3P, AMP Superseal 1.5, cable output Not all switching outputs or combinations are available for all connectors. Other connectors on request

### Mechanical Data

Component	Description/Value
Pressure connection	G 1/4", G 1/4" with manometer pin, 1/4" NPT, SAE04 (7/16-20UNF), SAE06 (9/16-18UNF), selected metrical pressure connectors, e.g. M14 x 1.5 and other pressure connectors on request, possible limitations of the pressure range. Pressure connections are available with a reduced diameter of the pressure channel to dampen pressure peaks.
Material housing	Stainless steel, AISI 304 (EN 1.4301)
Material connector	Glass-fiber reinforced plastic (PBT)
Installation torque	Max. 35 Nm
Protection class	IP67/IPX9K (depending on connector type)

### Power Supply, Cable Connection

Parameter	Description
Voltage supply (DC)	$U_{VCC}$ : 9 ... 36 V (allowable ripple @ 50 Hz: 10%)
Electrical protection	Short circuit protected, signal on GND/VCC and inverse polarity protection
Maximum cable length	For CE conformity (EMC), the maximum overall cable length must not exceed 30 m

### Functional Safety

Standard	Description
EN ISO 13849-1:2015	PL b / Category B $MTTF_D = 649$ years (1 x PNP) $MTTF_D = 484.8$ years (2 x PNP) $MTTF_D = 481$ years (2 x NPN)

# TECHNICAL DATA

## Functional Safety

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Standard	Description
SN 29500	MTTF = 324.5 years (1 x PNP) MTTF = 242.4 years (2 x PNP) MTTF = 240.5 years (2 x NPN)

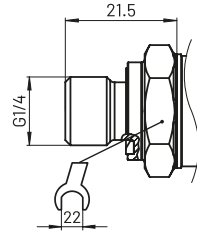
# TECHNICAL DRAWINGS AND PIN ASSIGNMENTS

## Available Standard Pressure Connections

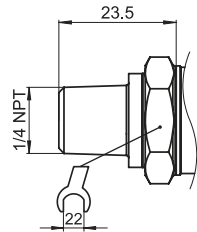
### Connection

### Drawing

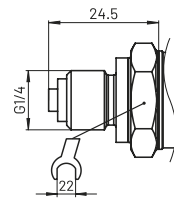
G1/4", DIN EN ISO 1179-2:2014-03 (formerly DIN 3869:1994-05)



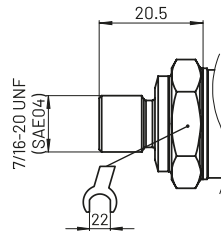
1/4" NPT per „Nominal width for US-standard bevelled pipe thread NPT“



G1/4" according to DIN EN 837-1:1997-02 (formerly DIN 16288)



SAE04 (7/16-20UNF) - O-Ring

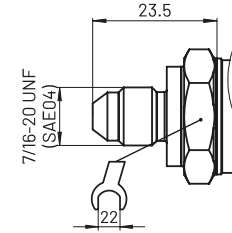


## Available Standard Pressure Connections

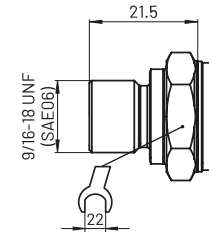
### Connection

### Drawing

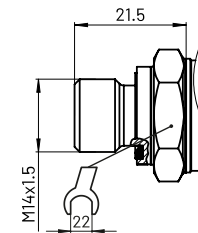
SAE04 (7/16-20UNF) - Cone



SAE06 (9/16-18UNF) - O-Ring



M14 x 1.5, DIN EN ISO 9974-2:2000-09



# TECHNICAL DRAWINGS AND PIN ASSIGNMENTS

## Available Electrical Connections, Protection Class

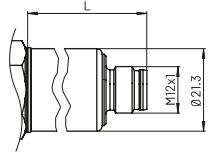
### Connection

### Drawing

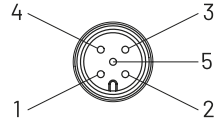
### Pins

### Pin Assignment

Circular plug-in connector M12x1, 5-pole, IP67



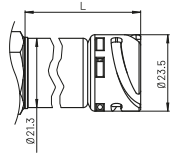
PBT-GF30  
L = 30.8



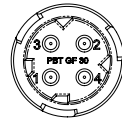
Pin	1 Output	2 Outputs
1	VCC	VCC
2	-	OUT2
3	GND	GND
4	OUT	OUT1
5	-	-

Do not connect the pins marked with „-“!

Bayonet connector DIN 72585, 4-pole, IP67



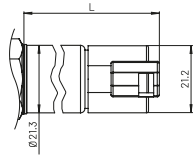
L = 35.6



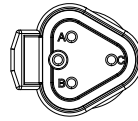
Pin	Function
1	VCC
2	OUT
3	GND
4	-

Do not connect the pins marked with „-“!

Connector DT04-3P 3-pole, IP67

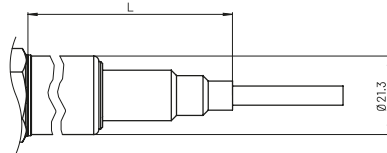


L = 42.7



Pin	Function
A	VCC
B	GND
C	OUT

Cable output IP67/IPX9K (Oil-resistant cable on request)



L = 55.5

Litz wire	1 Output	2 Outputs
brown	VCC	VCC
white	-	OUT2
blue	GND	GND
black	OUT	OUT1
grey	-	-

Do not connect the litz wires marked with „-“!

## Available Electrical Connections, Protection Class

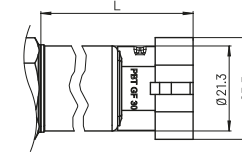
### Connection

### Drawing

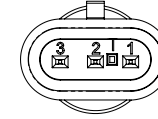
### Pins

### Pin Assignment

Connector for AMP Superseal 1.5 3-pole, IP67



L = 38.2

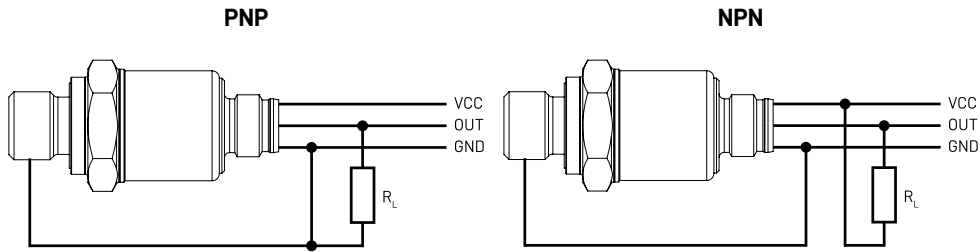


Pin	Function
1	GND
2	OUT
3	VCC

STW standard pin assignments are shown, other pin assignments on request. The actual pin assignment is shown on the product label.

# TERMINAL LAYOUTS

## Recommended terminal layout



# QUALIFICATION

## Compliance Information

Standard	Description
ISO/IEC 17050-1	Conformity
UL recognized	UL File Number E317934 (for variants with thin-film based measurement cell)
KBA (Kraftfahrt-Bundesamt)	Certification According UN ECE Regulation No. 10

## DETAILED QUALIFICATION

### EMC industrial (CE)

Standard	Test Description	Test Parameter
DIN EN 61000-6-3:2007 + A1:2011 DIN EN 55011:2007 + A2:2007	Emissions - Residential, commercial and light-industrial environments	Conducted emission 150 kHz to 30 MHz; Radiated emission 30 MHz to 1000 MHz, 10 m
DIN EN 61000-6-2:2005 DIN EN 61000-4-2:1998 + A2:2001	Immunity - Industrial environments - Electrostatic discharge immunity test	330 $\Omega$ / 150 pF Contact discharge $\pm 2, \pm 4$ kV Air discharge $\pm 2, \pm 4, \pm 8$ kV
DIN EN 61000-6-2:2005 DIN EN 61000-4-3:1998 + A2:2001	Immunity - Industrial environments - Radiated, radio-frequency, electromagnetic field immunity test	80 MHz to 2.7 GHz $\rightarrow$ 10 V/m 3 m, horizontal and vertical AM 80 %, 1 kHz
DIN EN 61000-6-2:2005 DIN EN 61000-4-4:2001 + A2:2001	Immunity - Industrial environments - Electrical fast transient / burst immunity test	Supply lines $\pm 2$ kV data lines $\pm 1$ kV waveform: 5/50 ns tr/th repetition frequency 5 kHz
DIN EN 61000-6-2:2005 DIN EN 61000-4-5:2001	Immunity - Industrial environments - Surge immunity test	Supply lines (symmetrical) $\pm 0.5$ kV Supply lines (asymmetrical) $\pm 0.5$ kV
DIN EN 61000-6-2:2005 DIN EN 61000-4-6:2001	Immunity - Industrial environments - Immunity to conducted disturbances, induced by radio-frequency fields	150 kHz to 80 MHz, 10 V 80% AM, sine at 1 kHz

### FCC, 47 CFR Part15, Subpart B

Standard	Test Description	Test Parameter
FCC 47 CFR Part15 Subpart B: 2008, Class A	Emissions - Conducted emission from power port	Frequency: 150 kHz - 30 MHz
FCC 47 CFR Part15 Subpart B: 2008, Class A	Emissions - Radiated emission	Frequency: 30 MHz - 1 GHz

### EMC automotive

Standard	Test Description	Test Parameter
UN ECE R10 DIN EN 55025:2003-11, IEC/CISPR 25:2002	Emissions - Radiated emissions from components - ALSE method	150 kHz to 3 GHz, 1 m



## DETAILED QUALIFICATION

### EMC automotive

Standard	Test Description	Test Parameter
IEC/CISPR 25:2002, DIN EN 55025:2003-11	Emissions - Conducted emission - voltage probe method <sup>TMC)</sup>	150 kHz - 108 MHz
IEC/CISPR 25:2002, DIN EN 55025:2003-11	Emissions - Conducted emission - current probe method <sup>TMC)</sup>	150 kHz - 108 MHz
UN ECE R10 ISO 11452-2:2004, ISO 11452-5:2002-04	Immunity - For components to electromagnetic Energy	ALSE - 400 MHz - 2000 MHz, 200 V/m Stripline - 0.01 MHz - 400 MHz, 200 V/m
ISO 7637-2:2004	Emissions - Voltage transient emissions	12 V: +75/-100 V
ISO 7637-2:2004	Emissions - Voltage transient emissions	24 V: +150/-450 V
UN ECE R10 ISO 7637-2:2004-09	Immunity - Electrical transient conduction along supply lines only (24V System) - Level 4	Pulse 1 (24 V) -600 V, 5000 pulses Pulse 2a (24 V) +50 V, 5000 pulses Pulse 2b (24 V), +20 V, 10 pulses Pulse 3a (24 V), -200 V, 1 h Pulse 3b (24 V), +200 V, 1 h Pulse 4 (24 V), -16 V, 1 pulse
ISO 7637-3:1999	Immunity - Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines (24V System) - Level 4	CCC Pulse 3a: -80 V, 1 h Pulse 3b: +80 V, 1 h
ISO 10605:2001-12	Immunity - ESD component test method -Powered-up test	2 k $\Omega$ /330 pF Contact discharge: $\pm$ 8 kV Air discharge: $\pm$ 15 kV
ISO 10605:2001-12	Immunity - ESD component test method - Packaging and Handling test (unpowered test)	2 k $\Omega$ /150 pF Contact discharge: $\pm$ 4 kV, $\pm$ 6 kV

TMC) applicable only for Thin-film based Measurement Cell.

# DETAILED QUALIFICATION

## Climatic and mechanical tests

Standard	Test Description	Test Parameter
DIN EN 60068-2-1:1995-03	Tests at constant temperature: Low temperature - operation	-40 °C for 96 h
DIN EN 60068-2-2/A2 :1995-01	Tests at constant temperature: High temperature - operation	+125 °C for 96 h
DIN EN 60068-2-14:2000-08	Temperature cycling test - Rapid change of Temperature	10 cycles, -40 °C to +125 °C Transfer time < 30 s Dwell time: 60 min. In operation
DIN EN 60068-2-14:2000-08	Temperature cycling test - specified change rate of Temperature	10 cycles, -40 °C to 125 °C Temp. Change rate: 3K/min. Dwell time: 60 min. In operation
ISO 16750-4:2010-04	Ice water shock test - Submersion test	number of cycles: 10 holding time(th) at Tmax +125 °C: 1 h water temperature: 0 °C to +4 °C immersion time: 5 min. In operation
DIN EN 60068-2-52:2000-02	Salt spray test - cyclic <sup>TMCI</sup>	5% NaCl, 4 cycles á 24 h, +35 °C
DIN EN 60068-2-30:2000-02, DIN EN 50016:1962-12	Humid heat - Damp heat cyclic test <sup>TMCI</sup>	+25 °C to +55 °C and 96% relative humidity 6 cycles á 24 h
DIN EN 60068-2-78:2002-09	Damp heat, steady-state test	+40 °C and 96% relative humidity Not in operation for 20 days 23 h In operation for the last hour Duration: 21 days
ISO 16750-4:2010-04 IEC 60068-2-60	Corrosion test with flow of mixed gas <sup>TMCI</sup>	Test Ke, Method 4 Duration: 10 days SO <sub>2</sub> , H <sub>2</sub> S, NO <sub>2</sub> , Cl <sub>2</sub>
DIN EN ISO 6270-2:2005	Condensation water atmospheres <sup>TMCI</sup>	4 cycles, 96 h

# DETAILED QUALIFICATION

## Climatic and mechanical tests

Standard	Test Description	Test Parameter
DIN EN 60068-2-14 Na:2000-08	Life-time Temperature cycling test - Rapid change of Temperature (Weibull) <sup>TMC)</sup>	Test duration: 9 days Min. temperature: -50 °C Max. temperature: +125 °C Holding time: 30 min. Cycles: 216
ISO 16750-1:2018 Annex B	Life-time Temperature cycling test - Rapid change of Temperature (Weibull) <sup>SMC)</sup>	Test duration: 12 days Min. temperature: -50 °C Max. temperature: +125 °C Holding time: 30 min. Cycles: 268 Not in operation
DIN EN 60068-2-6:1996-05	Vibration (sinusoidal) <sup>TMC)</sup>	5 Hz - 2000 Hz - 5 Hz, 1 oct/min., 20 g 5 h /axis, 3 axes
DIN EN 60068-2-6:2008 DIN EN 60068-2-14:2010	Vibration (sinusoidal) with temperature superimposition <sup>SMC)</sup>	5 - 2000 - 5 Hz, 1 oct/min., 20 g 5 h/axis, 3 axes Test Nb, Temperature superimposition: -40 °C to +85 °C, 3 K/min. Duration time= 15 min., Change= 60 min. 2 Temp. cycles/axis
ISO 16750-3:2012 Test VII	Vibration (random) with temperature superimposition <sup>SMC)</sup>	10 - 2000 Hz, 32 h/axis, 3 axes, random vibration Temperature superimposition: -40 °C to +85 °C, 4 cycles
SAE J 1211 part 4.4:1978-11	Immersion and splash <sup>TMC)</sup>	Agents: gasoline, diesel, de-greaser, anti-freezing agent After test: drying at +125 °C, 48 h
ISO 16750-5:2010	Chemical resistance	Agents: diesel, motor oil, hydraulic oil, gear oil, bio-diesel, E10, urea "Caelo" After test: drying at +70 °C, 48 h
DIN EN 60529:1991	IP Protection grade	IP67 (depending on connector type)

# DETAILED QUALIFICATION

## Climatic and mechanical tests

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Standard	Test Description	Test Parameter
DIN 40050-9:1993-05	IP Protection grade	IPX9K (depending on connector type)
SMC) applicable only for Silicon based Measurement Cell.		
TMC) applicable only for Thin-film based Measurement Cell.		

