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71609340
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Technical Information
Deltacore USD50B
Differential pressure measurement

Silicon differential pressure sensor

Application
The differential pressure sensors USD50B with piezoresistive sensor and welded metal diaphragm are typically used in the process and environmental industry.
Applications are level, volume or mass measurement in liquids, differential pressure monitoring, e.g. of filters and pumps as well as flow measurement (volume or mass flow).

Your benefits
- Measuring ranges from 100 mbar (1.5 psi) to 40 bar (600 psi)
- Bridge output signal (mV)
- High accuracy, repeatability and long-term stability
- High overload resistance:
  - Up to 160 bar (2320 psi) on one side, 420 bar (6092 psi) as an option
  - Up to 240 bar (3600 psi) on both sides, 630 bar (9450 psi) as an option
- 316 L (stainless steel) version
- Optional choice of diaphragm materials and filling oils

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About this document

Document function

This document contains all the technical data for the device and provides an overview of the device versions that can be ordered.

Symbols used

Safety symbols

Symbol	Meaning
⚠ WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
NOTICE	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

Symbols for certain types of information

Symbol	Meaning
	**Tip** Indicates additional information.
	Reference to documentation
	Reference to page

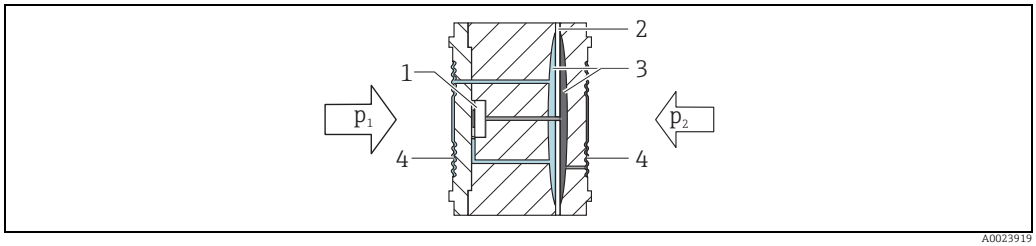
Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
A, B, C, ...	Views

Function and system design

Measuring principle

Metallic process diaphragm



1 Measuring element
2 Overload diaphragm
3 Filling oil
4 Process diaphragm

The metallic process diaphragms (4) are deflected on both sides by the applied pressures p1 and p2. A filling oil (3) transfers the pressure to a resistance measuring bridge (semiconductor technology). The differential pressure-dependent change in the bridge output voltage is put out.

Input

Measured variable

Differential pressure

Measuring range

Sensor	Maximum sensor measuring range		MWP	OPL	
	Lower (LRL)	Upper (URL)		One-sided	Both-sided
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
Option PN 160 / 16 MPa / 2320 psi					
100 (1.5)	−100 (−1.5)	+100 (+1.5)	160 (2320)	240 (3600)	240 (3600)
500 (7.5)	−500 (−7.5)	+500 (+7.5)			
3000 (45)	−3000 (−45)	+3000 (+45)			
16000 (240)	−16000 (−240)	+16000 (+240)			
40000 (600)	−40000 (−600)	+40000 (+600)	160 (2320) [1) 2)]	"+"-side: 160 (2320), "−"-side: 100 (1500)	240 (3600)
Option PN 420 / 42 MPa / 6092 psi					
100 (1.5)	−100 (−1.5)	+100 (+1.5)	420 (6092) [1)]	420 (6092)	630 (9450)
500 (7.5)	−500 (−7.5)	+500 (+7.5)			
3000 (45)	−3000 (−45)	+3000 (+45)			
16000 (240)	−16000 (−240)	+16000 (+240)			
40000 (600)	−40000 (−600)	+40000 (+600)	420 (6092) [1) 2)]	+"-side: 420 (6092), "−"-side: 100 (1500)	630 (9450)

1) MWP only both-sided

2) For one-sided pressurization of the negative side, the MWP is 100 bar (1500 psi).

⚠ WARNING

- The measuring device must be operated only within the specified limits!
- The specified values are only achieved in the reference installation (→ 🖹 8).
- The maximum pressure for the sensor depends on the lowest-rated element with regard to pressure.
- The sensors have been designed for high pressure levels with load changes. For very frequent load changes up to the nominal pressure 0 to 420 bar (0 to 6092 psi), check the zero point regularly.

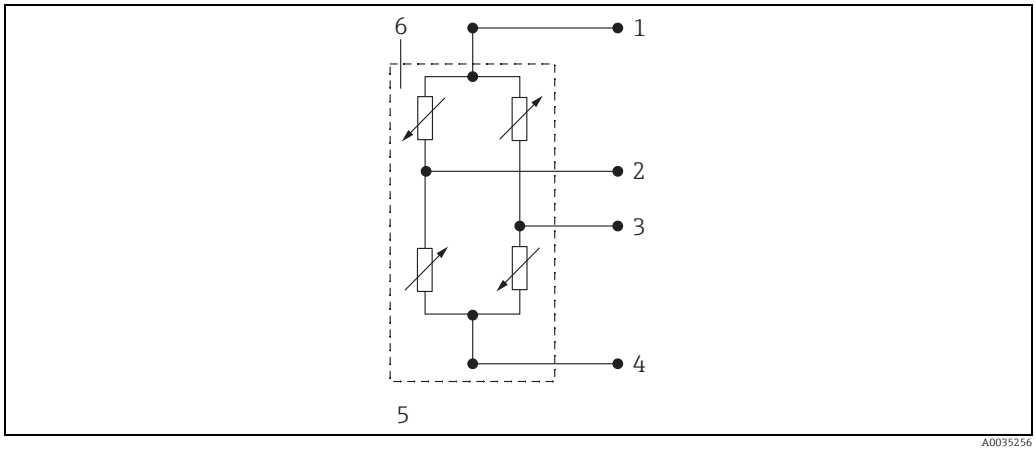
Power supply

Current supply

<1 mA

Electrical connection

Wiring diagram



1 Positive current supply (red)
2 Positive output signal (green)
3 Negative output signal (blue)
4 Negative current supply (black)
5 Isolated potential housing
6 Bridge

Output

Uncompensated bridge output signal with cable connection.
Specifications valid at 0.5 mA supply current.

Output signal

Sensor [mbar (psi)]	Typical span (referred to zero point)
100 (1.5)	21 to 27 ±mV
500 (7.5)	51 to 55 ±mV
3.000 (45)	
16.000 (240)	
40.000 (600)	

Bridge resistance

4.3 to 5.6 kΩ (at 25 °C (77 °F))

Dynamic behavior

Warm-up period	Time constant T63
~2 ms	max. 90 ms

Performance characteristics

Reference operating conditions

- According to IEC 62828-2
- Ambient temperature T_A = constant, in the range +22 to +28 °C (+72 to +82 °F)
- Humidity j = constant, in the range: 5 to 80 % rH ± 5 %
- Ambient pressure p_U = constant, in the range: 860 to 1 060 mbar (12.47 to 15.37 psi)
- Position of measuring cell: horizontal ±1°
- Measuring span based on zero point

Sensor characteristics

Sensor [mbar (psi)]	Nonlinearity [%] of ± span [1)]	Temperature coefficient [2)]			
		On zero point [% /10K]]		On span [% /10K]]	
	at 30 °C (86 °F)]	30 to 85 °C (86 to 185 °F)]	−40 to +30 °C (−40 to 86 °F)]	30 to 85 °C (86 to 185 °F)]	−40 to +30 °C (−40 to 86 °F)]
100 (1.5)	0.5	−0.5 to +0.5	−1.0 to +1.0	−0.5 to +0.5	−0.7 to +0.7
500 (7.5)	0.5	−0.5 to +0.5	−0.5 to +0.5	−0.5 to +0.5	−0.7 to +0.7
3000 (45)	0.5	−0.5 to +0.5	−0.5 to +0.5	−0.5 to +0.5	−0.7 to +0.7
16000 (240)	0.5	−1.0 to +1.0	−1.0 to +1.0	−0.5 to +0.5	−0.7 to +0.7
40000 (600)	0.5	−0.5 to +0.5	−0.5 to +0.5	−0.5 to +0.5	−0.7 to +0.7

1) Verified by measurements at temperature steps T1(30 °C (86 °F)) → T2(85 °C (185 °F)) → T3(30 °C (86 °F)) → T4(−40 °C (−40 °F)) → T5(30 °C (86 °F))

2) Typical values, maximum 100 % higher values possible

Static pressure influence

The "static pressure influence" describes the influence on the output due to changes in the static pressure of the process (difference between the output at any static pressure and the output at atmospheric pressure [IEC 62828-2 / IEC 61298-3] and thus the combination of influence of the working pressure on the zero point and the span).

Measuring cell [mbar (psi)]	Influence on the zero point	Influence on the span
100 (1.5)	±0.203 % of URL per 70 bar	±0.15 % of span per 70 bar
500 (7.5)	±0.075 % of URL per 70 bar	±0.14 % of span per 70 bar
3000 (45)		
16000 (240)		
40000 (600)		

* Data on static pressure influence refer to pressurization on both sides

Long-term stability

±0.1 % of URL / 1 year

Installation

Reference installation

Reference installation according to installation instructions EA01440O.

Process

Process temperature range

−40 to +85 °C (−40 to 185 °F)

Devices with inert oil: Minimum process and ambient temperature -20 °C (-4 °F)

Process pressure range

Pressure data

⚠ WARNING

- MWP (Maximum Working Pressure): This value refers to a reference temperature of +20 °C (68 °F) and may be applied to the sensor for an unlimited time.
  Note the pressure-temperature dependence of the MWP. For pressure values permitted at higher temperatures, please refer to EN 1092-1: 2001 Tab. 18, ASME B 16.5a - 1998 Tab. 2-2.2 F316, ASME B 16.5a - 1998 Tab. 2.3.8 N10276, JIS B 2220.
- OPL (Over Pressure Limit): The test pressure corresponds to the overload limit of the sensor and may only be applied for a limited time to prevent permanent damage.

Oxygen applications (gaseous)

Oxygen and other gases can react explosively with oils, fats and plastics. The following precautions must be taken:

- All components of the system, such as devices, must be cleaned in accordance with national requirements.
- Depending on the materials used, a certain maximum temperature and pressure must not be exceeded in oxygen applications.
  - For filling oil: Inert oil
    - p_{max}: 80 bar (1200 psi)
    - T_{max}: 60 °C (140 °F)

Environment

Ambient temperature range

−40 to +85 °C (−40 to 185 °F)

Devices with inert oil: Minimum process and ambient temperature -20 °C (-4 °F)

Storage temperature range

−40 to +85 °C (−40 to +185 °F)

Degree of protection

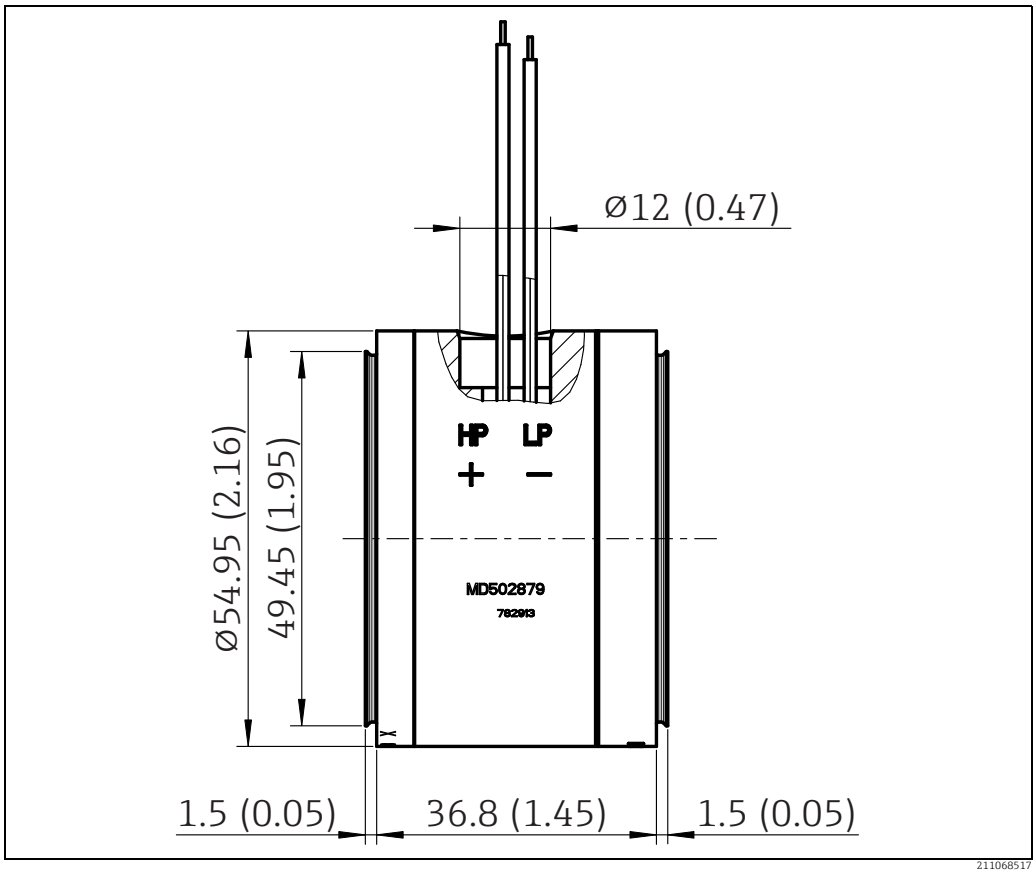
System	Degree of protection
Open	IP00

Climate class

System	Climate class	Note
Open	Class 3K3	Air temperature: 5 to 40 °C (41 to 104 °F), Relative humidity: 5 to 85 % satisfied according to 60721-3-3 (condensation not permitted)

Mechanical construction

Dimensions



** Unit of measurement: mm (in)*

Materials

Materials in contact with process

- Process diaphragm: stainless steel AISI 316L (1.4435)
  - Optional: Alloy C276 (2.4819)
- Base body: stainless steel AISI 316L (1.4404)

Materials not in contact with process

Filling fluid:
- Silicone oil
- Inert oil
  - (not suitable for temperatures below -20 °C (-4 °F))
  - For oxygen applications: see chapter "Process" (→ 🖹 9).

Certificates and approvals

RoHS

The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU.

Other standards and guidelines

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity. The following were also applied:

DIN EN 60770 (IEC 60770):

Transmitters for use in industrial process control systems Part 1: Methods for evaluating the performance of transmitters for control and regulation in industrial process control systems.

DIN 16086:

Procedure for writing specifications in data sheets for electrical pressure measuring instruments, pressure sensors and pressure transmitters.

Explanations and supplementary documentation

Supplementary documentation

Installation instructions: EA01440O

Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), our products are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Such products may not be disposed of as unsorted municipal waste and can be returned to Endress+Hauser for disposal at conditions stipulated in our General Terms and Conditions or as individually agreed.

Contact addresses

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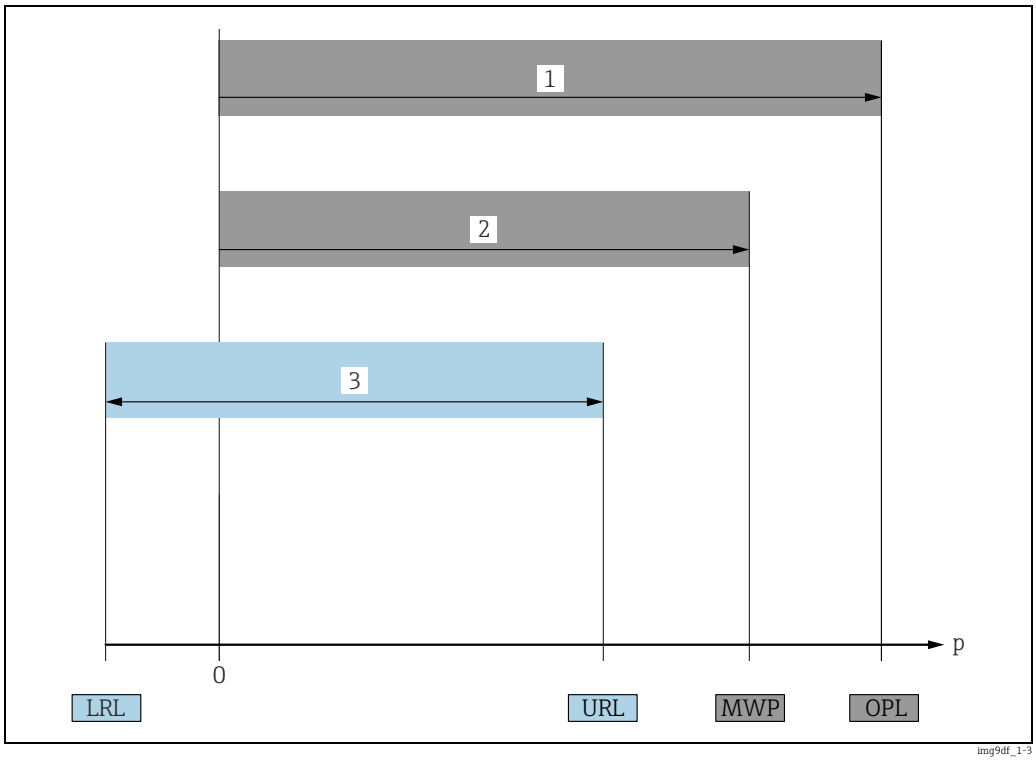
Terms and abbreviations



Item	Term/abbreviation	Explanation
1	OPL	The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. in addition to the measuring cell, the process connection must also be taken into account. Also observe pressure-temperature dependency. The test pressure corresponds to the overload limit of the sensor (OPL = 1.5 x MWP) and may only be applied for a limited time to prevent permanent damage.
2	MWP	The MWP (maximum working pressure) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. in addition to the measuring cell, the process connection must also be taken into account. Also observe pressure-temperature dependency. The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS", this corresponds to the MWP of the measuring device. The MWP refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time.
3	Maximum sensor measuring range	Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/adjustable span.
–	p	Pressure
–	LRL	Lower range limit
–	URL	Upper range limit

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