

Technical Information

Ceracore UTC30

Process pressure measurement



Pressure transducer with capacitive, ceramic pressure sensor

Application

Pressure transducer for use in the pressure measurement of liquid and gaseous media.

Your benefits

Dry capacitive ceramic sensor with ultrapure (99.9 %) Al_2O_3 ceramic

- High overload resistance
- Very good long-term stability
- High corrosion resistance
- Digital/analog signal output (SPI, UART, U)
- Small physical size
- Measuring ranges from 0 to 0.1 bar (0 to 1.5 psi) to 0 to 100 bar (0 to 1500 psi)
- Optional temperature output, switch output

Table of contents

About this document	3	Mechanical construction	14
Document function	3	Device height	14
Symbols used	3	Materials	14
Function and system design	4	Electronics housing	15
Measuring principle	4	Process connections	15
CARMEN	4	Interfaces	17
Input	5	Assembly of process connection	18
Measured process variable	5	Certificates and approvals	19
Measuring range	5	RoHS	19
Power supply	6	Pressure Equipment Directive 2014/68/EU (PED)	19
Supply voltage	6	Other standards and guidelines	19
Current consumption	6	Calibration; unit	20
Sensor connection	6	Service	20
Output	8	Test reports (on request)	20
Output signal	8	Ordering information	21
Signal range and signal on alarm of voltage output	8	Disposal	21
Behavior in the event of an error	8	Accessories	21
Dead time, time constant	8	Contact addresses	21
Dynamic behavior	9	Explanations and supplementary documentation ..	22
Damping	9	Terms and abbreviations	22
Switch-on time and Warm-up period	9	Turn down calculation	23
Performance characteristics	10	CARMEN sensor settings	23
Reference operating conditions	10		
Reference accuracy	10		
Total Error Band (TEB)	10		
Long-term stability	12		
Installation	12		
Influence of the installation position	12		
Installation conditions	12		
Process	12		
Process temperature range	12		
Process temperature range, seals	12		
Environment	13		
Ambient temperature range	13		
Storage temperature range	13		
Degree of protection	13		
Climate class	13		
Electromagnetic compatibility (EMC)	13		
Overvoltage protection	13		
Vibration resistance	13		



About this document

Document function




This document contains all the technical data for the device and provides an overview of the device versions and accessories 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

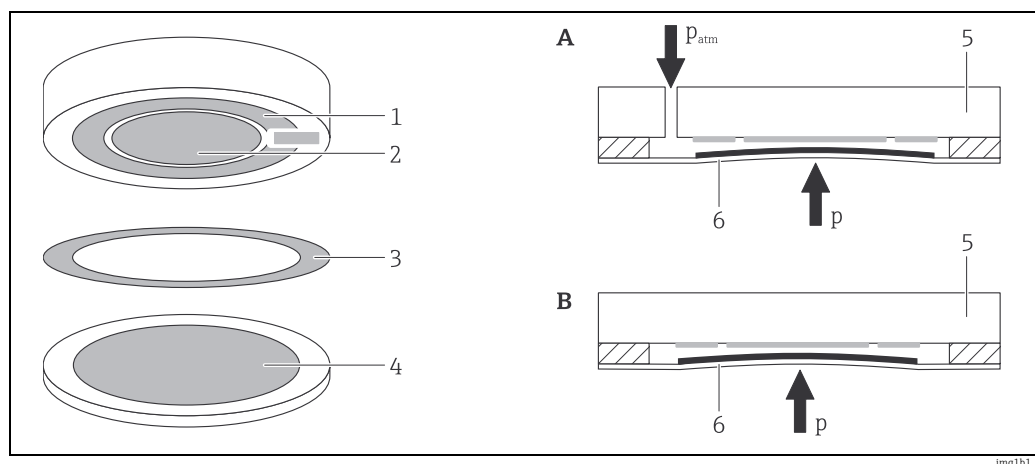
Symbol	Meaning
1, 2, 3, ...	Item numbers
A, B, C, ...	Views

Function and system design

Measuring principle

A capacitive ceramic sensor element is at the core of the UTC30. The basic material is (Al_2O_3), an ultra-pure (99,9%) aluminum oxide ceramic that is highly resistant to many aggressive gases and liquids. Two cylindrical ceramic components (process isolating diaphragm and meter body) are hermetically sealed together. In the case of absolute pressure sensors, the reference vacuum of $3,0 \times 10^{-6}$ mbar that is generated in the production process between the process isolating diaphragm and the meter body becomes permanent, thereby enabling precise pressure measurement relative to the vacuum. In the case of gauge pressure sensors, the back of the process isolating diaphragm is aerated, i.e. this sensor measures the gauge pressure relative to the atmospheric pressure.

In electrical terms, the sensor element represents a plate capacitor whose change in capacitance is a measure for the change in pressure. The capacitive measurement method satisfies the highest requirements with regard to resolution and reproducibility. Together with the hysteresis-free behavior of the Al_2O_3 material, it forms the basis for the excellent technical specifications of the pressure transducer. Furthermore, the sensor element is a dry measuring cell, i.e. there is no separating diaphragm or oil filling which could influence the measurement. Another clear advantage of the capacitive ceramic sensor is its high overload resistance.



- A Gauge pressure cell
 B Absolute pressure cell
 1 Cr electrode
 2 Cp electrode
 3 Brazing ring preform
 4 Counterelectrode
 5 Meter body
 6 Process isolating diaphragm
 p_{atm} Atmospheric pressure

CARMEN

The CARMEN ASIC is used in sensor applications to measure physical variables (e.g. pressure) with external capacitive or resistive sensors in industrial environments.

Each type of sensor has its individual properties. CARMEN must compensate for these physical properties individually. To do so, CARMEN performs the following steps:

- Measurement of the external sensor (capacitance difference, voltage difference, temperature)
- Compensation of the sensor offset
- Gain adjustment
- Linearization of the sensor characteristics
- Compensation of temperature effects
- Output of the corrected and compensated measured values
- Additional functions (damping, filtering, etc.)

For the standard settings of the sensor, → 22.

The functionality and communication are explained in the S&C CARMEN Manual.

Input

Measured process variable

- Gauge pressure or absolute pressure
- Temperature

Measuring range

Sensor	Maximum sensor measuring range		Lowest calibratable span ¹⁾	MWP	OPL	Vacuum resistance
	lower (LRL)	upper (URL)				
[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar _{abs} (psi _{abs})]
Sensors for gauge pressure measurement						
0.1 (1.5)	-0.1 (-1.5)	+0.1 (+1.5)	0.04 (0.6)	2.7 (40.5)	4 (60)	0.7 (10.5)
0.2 (3)	-0.2 (-3)	+0.2 (+3)	0.08 (1.2)	3.3 (49.5)	5 (75)	0
0.4 (6)	-0.4 (-6)	+0.4 (+6)	0.16 (2.4)	4 (60)	6 (90)	0
1 (15)	-1 (-15)	+1 (+15)	0.4 (6)	6.7 (100.5)	10 (150)	0
2 (30)	-1 (-15)	+2 (+30)	0.8 (12)	12 (180)	18 (270)	0
4 (60)	-1 (-15)	+4 (+60)	1.6 (24)	16.7 (250.5)	25 (375)	0
10 (150)	-1 (-15)	+10 (+150)	4 (60)	26.7 (400.5)	40 (600)	0
20 (300)	-1 (-15)	+20 (+300)	8 (120)	26.7 (400.5)	40 (600)	0
40 (600)	-1 (-15)	+40 (+600)	16 (240)	40 (600)	60 (900)	0
100 (1500) ¹⁾	-1 (-15)	+100 (+1500)	40 (600)	100 (1500)	150 (2250)	0
Sensors for absolute pressure measurement						
0.1 (1.5)	0	+0.1 (+1.5)	0.04 (0.6)	2.7 (40.5)	4 (60)	0
0.2 (3)	0	+0.2 (+3)	0.08 (1.2)	3.3 (49.5)	5 (75)	0
0.4 (6)	0	+0.4 (+6)	0.16 (2.4)	4 (60)	6 (90)	0
1 (15)	0	+1 (+15)	0.4 (6)	6.7 (100.5)	10 (150)	0
2 (30)	0	+2 (+30)	0.8 (12)	12 (180)	18 (270)	0
4 (60)	0	+4 (+60)	1.6 (24)	16.7 (250.5)	25 (375)	0
10 (150)	0	+10 (+150)	4 (60)	26.7 (400.5)	40 (600)	0
20 (300)	0	+20 (+300)	8 (120)	26.7 (400.5)	40 (600)	0
40 (600)	0	+40 (+600)	16 (240)	40 (600)	60 (900)	0
100 (1500) ¹⁾	0	+100 (+1500)	40 (600)	100 (1500)	150 (2250)	0

1) on request

WARNING

The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure.

- The measuring device must be operated only within the specified limits!

Power supply

Supply voltage

Type	Value
Digital output	2.9 ... 5.5 V DC
Analog output	4.9 ... 5.1 V DC ¹⁾

1) other values on request

Current consumption

Connection of the sensor	Current consumption
Female header strip	< 1.6 mA
Male pin header strip	< 2.0 mA

Sensor connection

NOTICE

Incorrect polarity can damage the ASIC!

- Ensure polarity is correct.

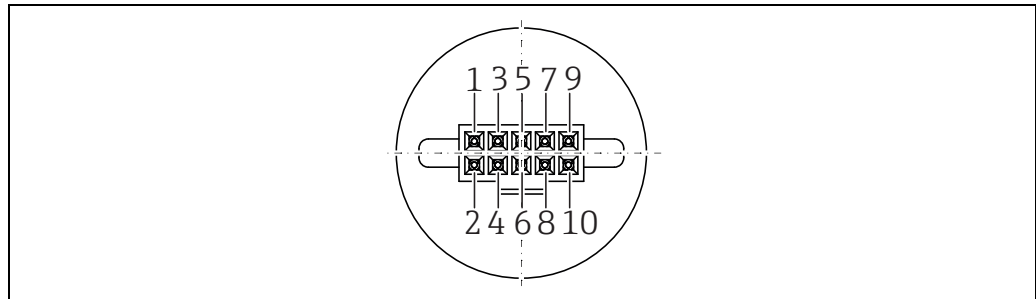
NOTICE

Incorrect analog measured value due to cable break from GND!

- Prevent cable break from GND.

Female header strip 2x5 pins (1.27 mm (0.05 in) spacing)

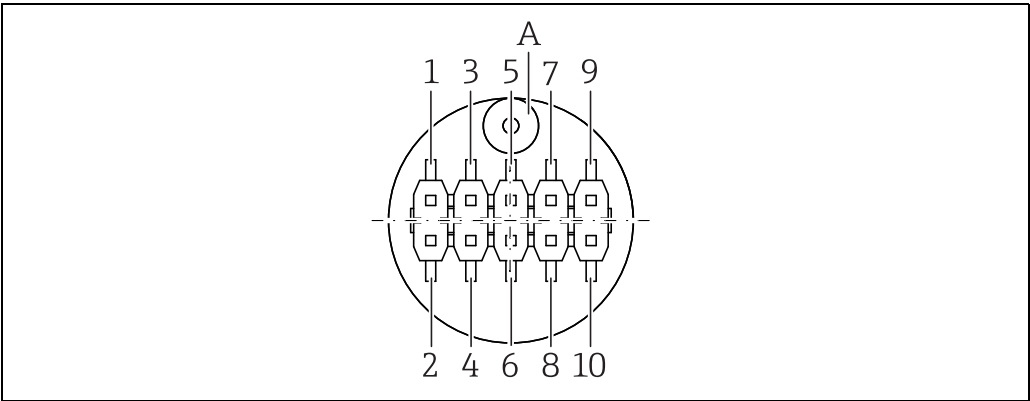
- Socket type: SAMTEC SFML-105-02-L-D
- Insertion force (axial only): max. 40 N



imgdf1_

PIN	Designation	Explanation	Application		
			Digital		Analog
			UART	SPI	
1	GND	Negative supply voltage	X	X	X
2	RESET_N	Reset (low active)	optional	optional	optional
3	VDD	Positive supply voltage	X	X	X
4	DAC	Analog output	optional	optional	optional
5	SW_OUT	Switch output (open drain)	optional	optional	optional
6	SPI_SEL	Communication mode selection (UART "GND" or SPI "VDD")	force to "GND"	force to "VDD"	force to "GND"
7	SCK	SPI clock, must be connected to GND if SPI is used	–	X	–
8	CS_N	Chip select (low active)	optional	optional	–
9	TxD/SO_RDY	Digital communication output	X	X	–
10	RxD/SI	Digital communication input, must be connected to GND if not used	X	X	force to "GND"

Male pin header strip 2x5 pins (2,54 mm (0,1 in) spacing)



A Reference air tube for orientation of the pin assignment

PIN	Designation	Explanation	Application		
			Digital		Analog
			UART	SPI	
1	SPI_SEL	Communication mode selection (UART "GND" or SPI "VDD")	force to "GND"	force to "VDD"	force to "GND"
2	SCK	SPI clock, must be connected to GND if SPI is not used	–	X	–
3	VDD	Positive supply voltage	X	X	X
4	TxD/SO_RDY	Digital communication output	X	X	X
5	GND	Negative supply voltage	X	X	X
6	RxD/SI	Digital communication input, must be connected to GND if not used	X	X	force to "GND"
7	DAC	Analog output	optional	optional	X
8	SW_OUT	Switch output (open drain)	optional	optional	optional
9	CS_N	Chip select (low active)	optional	optional	–
10	RESET_N	Reset (low active)	optional	optional	optional

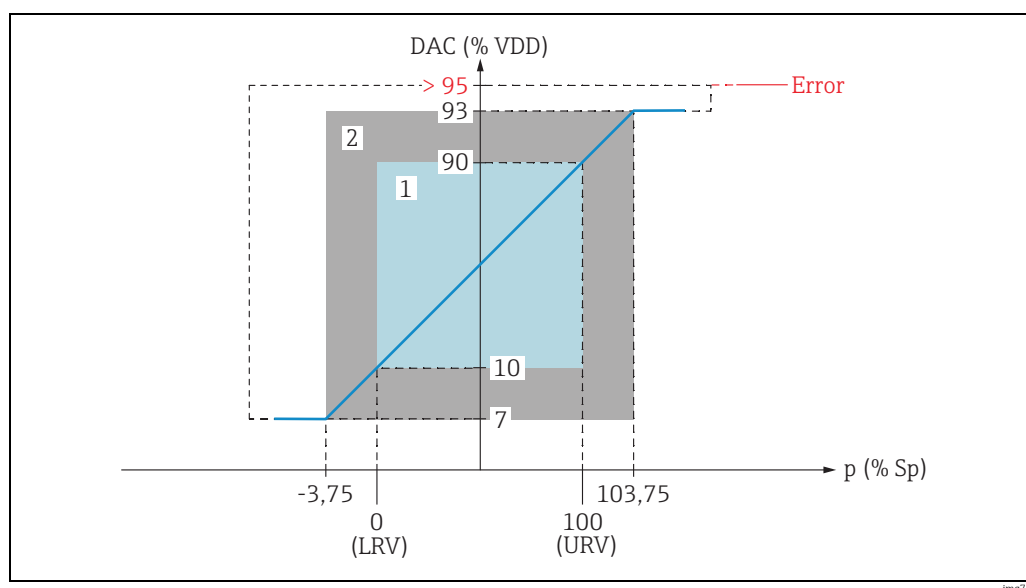
Output

Output signal

Type	Output
Voltage output (pressure)	10 to 90 % VDD (ratiometric, VDD = 5.0 V DC)
	10 to 90 % VDDA (absolut, VDDA = 2.65 V DC)
Digital output (pressure & temperature)	SPI
	UART
Switch output (pressure) ¹⁾	Switch (via CARMEN)

1) On request

Signal range and signal on alarm of voltage output



1 Calibrated measuring range
2 Extended measuring range
DAC Digital-to-analog converter

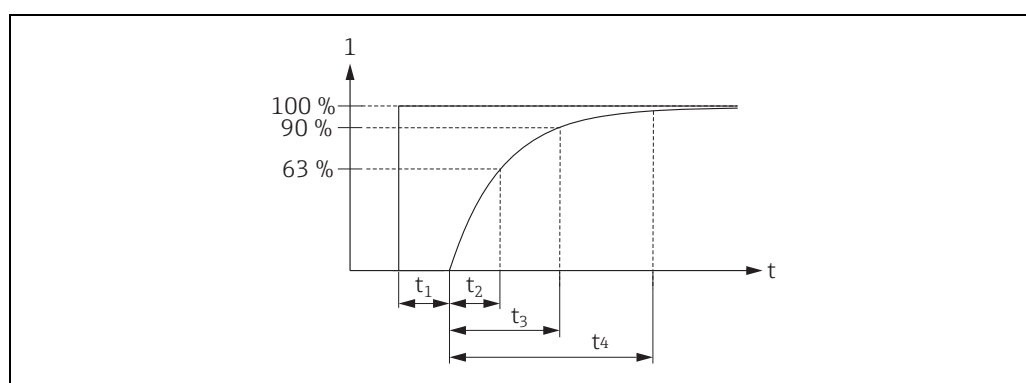
The signal range and the signal on alarm are based on NAMUR NE 43. The error value of the signal on alarm can be configured and is displayed in the illustration for the example > 95 % VDD (CARMEN standard sensor setting).

Behavior in the event of an error

See the S&C CARMEN Manual

Dead time, time constant

Presentation of the dead time and the time constant:



1 % of the measured value

Dynamic behavior

Output	Sampling rate [ms]	Dead time (t ₁) [ms]	Time constant T63 (t ₂) [ms]	Time constant T90 (t ₃) [ms]	Time constant T99 (t ₄) [ms]
Digital	20	40	74	88	99
	5	10	18,5	22	25
	1,25 ¹⁾	3,75	6	7	8
Analog	20	29	63	75	88
	5	8	15,5	19	22
	1,25	2	4,5	6	8,5

- 1) The maximum sampling rate that can be configured for measured value recording is 1.25 ms, but the maximum speed of the digital output is limited to 2.5 ms.

Damping

Customizable setting: 0 to 40 s

Switch-on time and Warm-up period

The switch-on time is the time that elapses from when the supply voltage is switched on to when the first digital value or initial analog value is available.

The warm-up period is the time that elapses from when the supply voltage is switched on to the first digital measured value or analog value within the specified reference accuracy (e.g. 0.1 % span).

Output	Sampling rate [ms]	Switch-on time [ms]	Warm-up period [ms]
Digital	20	38.75	98.75
	5	23.75	38.75
	1.25	20	23.75
Analog	20	10	50
	5	10	35
	1.25	10	30

Performance characteristics

Reference operating conditions

- As per DIN EN IEC 62828
- Ambient temperature T_A = constant, in range: +23 to +27 °C (+73 to +81 °F)
- Relative humidity ϕ = constant, in range: 5 to 80 % RH.
- Ambient pressure p_A = constant, in range: 860 to 1 060 mbar (12.47 to 15.37 psi)
- Position of measuring cell = constant, in range: process isolating diaphragm pointing downwards (see also the "Influence of installation position" section → 12)
- Process isolating diaphragm material: Al_2O_3 (aluminum oxide ceramic FDA, ultrapure 99.9 %)
- Analog output supply voltage: 4.9 to 5.1 V DC
- Digital output supply voltage: 2.9 to 5.5 V DC

Reference accuracy

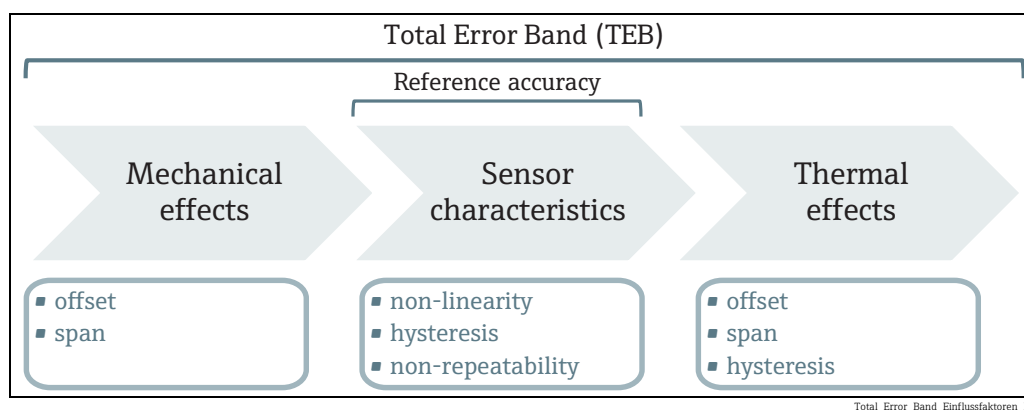
The reference accuracy includes the non-linearity [DIN EN 61298-2 3.9], the non-repeatability [DIN EN 61298-2 3.10] and the pressure hysteresis [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 61298-2].

Sensor	Reference accuracy in % of calibrated span
Platinum	$\pm 0,1 \times TD$ for TD ¹⁾ 1:1 to TD 5:1

1) TD = Turn Down, → 23.

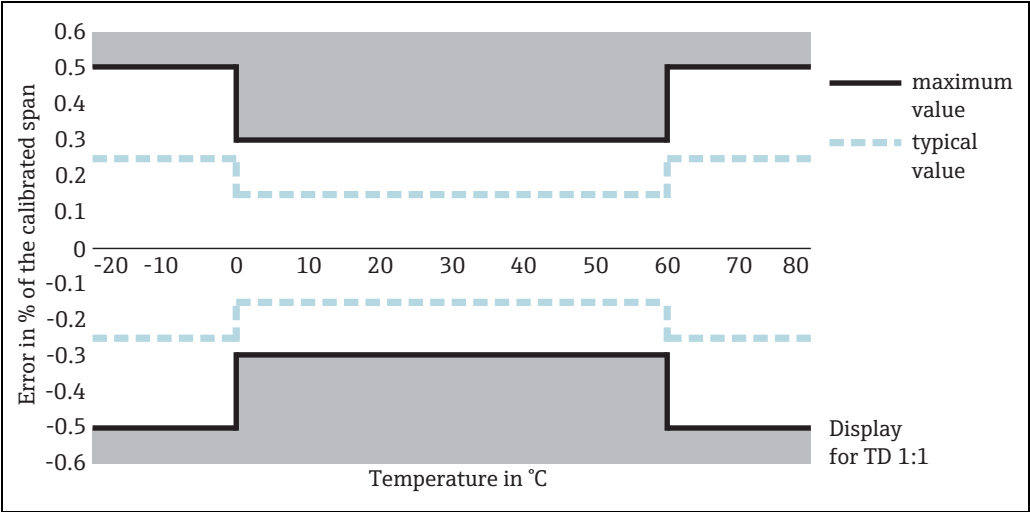
Total Error Band (TEB)

The Total Error Band includes the following influencing factors:



Total Error Band

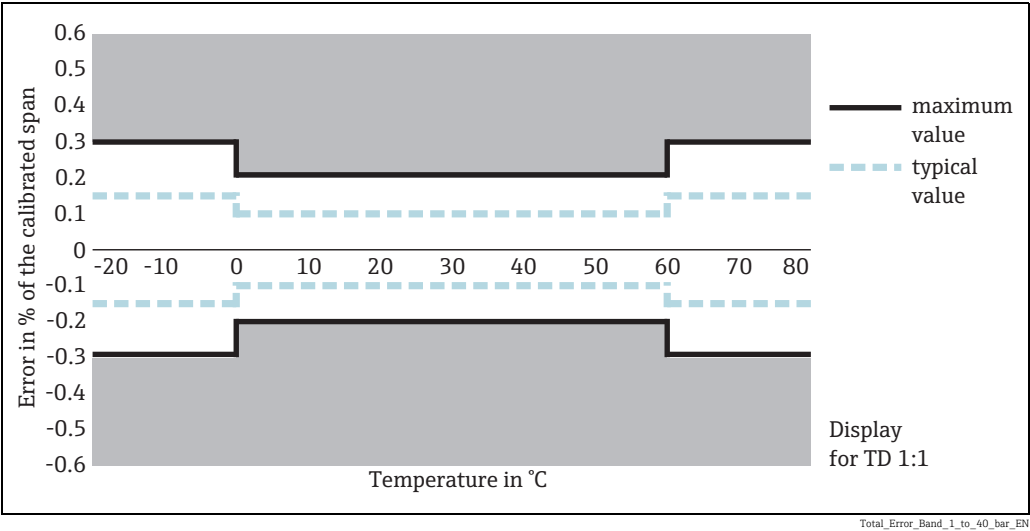
- Sensor measuring range: 0.1 to 0.4 bar
- Process temperature: -20 to 80 °C



Temperature range	Error in % of the calibrated span	
	Typ. value	Max. value
0 to +60 °C (+32 to +140 °F)	$\pm 0.15 \times \text{TD}$	$\pm 0.30 \times \text{TD}$
-20 to 0 °C (-4 to +32 °F) +60 to +80 °C (+140 to +176 °F)	$\pm 0.25 \times \text{TD}$	$\pm 0.50 \times \text{TD}$

Total Error Band

- Sensor measuring range: 1 to 40 bar
- Process temperature: -20 to 80 °C

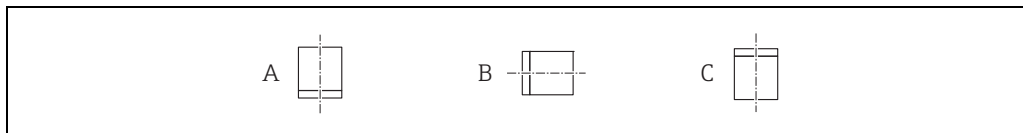


Temperature range	Error in % of the calibrated span	
	Typ. value	Max. value
0 to +60 °C (+32 to +140 °F)	$\pm 0.10 \times \text{TD}$	$\pm 0.20 \times \text{TD}$
-20 to 0 °C (-4 to +32 °F) +60 to +80 °C (+140 to +176 °F)	$\pm 0.15 \times \text{TD}$	$\pm 0.30 \times \text{TD}$

Long-term stability $\leq 0,1$ %/year related to the upper range limit (URL).

Installation


Influence of the installation position Any installation position is possible but it may cause a zero point shift.



img296_

	Process isolating diaphragm pointing downwards (A)	Process isolating diaphragm axis is horizontal (B)	Process isolating diaphragm pointing upwards (C)
<1 bar (15 psi)	Reference position, no effect	Up to +0.1 mbar (0.0015 psi)	Up to +0.2 mbar (0.0030 psi)
≥ 1 bar (15 psi)	Reference position, no effect	<0.1 mbar (0.0015 psi)	Up to +0.1 mbar (0.0015 psi)

Installation conditions

- During installation, electrical connection and operation, no moisture may penetrate the device.
- The back of the sensor element must not be encapsulated. For a version suitable for encapsulation, the electronics housing (→  15) must be used.

Process

Process temperature range -20 to $+80$ °C (-4 to 176 °F)
Extended temperature range -40 to $+125$ °C (-40 to $+257$ °F) (on request)

Process temperature range, seals

Seal	Notes	Process temperature range
FKM	–	-20 to $+80$ °C (-4 to $+176$ °F)
FKM	FDA21 CFR177.2600 USP Class VI 3A; BAM	0 to $+80$ °C ($+32$ to $+176$ °F)
EPDM	FDA21 CFR177.2600 USP Class VI (up to $+70$ °C ($+158$ °F)) 3A DVGW (W270, W534), WRAS, ACS NSF61	-20 to $+80$ °C (-4 to $+176$ °F)
NBR	–	-20 to $+80$ °C (-4 to $+176$ °F)

Environment

Ambient temperature range -20 to +80 °C (-4 to 176 °F)
Extended temperature range -40 to +125 °C (-40 to +257 °F) (on request)

Storage temperature range -40 to +125 °C (-40 to +257 °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)

Electromagnetic compatibility (EMC) No specifications (open system)

Overvoltage protection 6 V DC (maximum voltage for CARMEN ASIC)

Vibration resistance

Test standard	Vibration resistance
GL VI-7-2 Part 7: Guidelines for the Performance of Type Approvals Chapter 2: Test Requirements for Electrical/Electronic Equipment and Systems	Guaranteed for 5 to 25 Hz: ±1.6 mm (0.06 in); 25 to 100 Hz: 4 g in all 3 axes

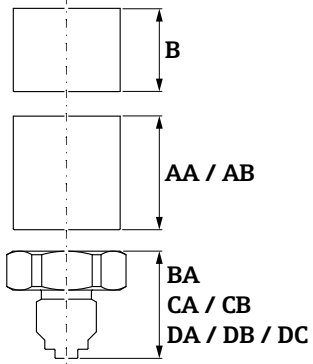
Mechanical construction

Device height

The total height is calculated from

- the height of the housing and
- the height of the individual process connection.

The individual heights of the components can be found in the following sections. To calculate the total height, simply add up the individual heights of the components. You can use the following table for this:

Section	Page	Height	Example
Electronics housing	→ 15	B	
Process connections	→ 15	AA / AB BA CA / CB DA / DB / DC	
Device height			

Materials

Materials in contact with process

Component part	Material
Process connections	316L
Process isolating diaphragm	Al ₂ O ₃ aluminum-oxide ceramic FDA, ultra-pure 99.9 % ¹⁾
Seal	<ul style="list-style-type: none"> ■ FKM ■ FKM (inkl. FDA approval) ■ EPDM ■ NBR

- 1) The US Food & Drug Administration (FDA) has no objections to the use of ceramics made of aluminum oxide as a surface material in contact with foodstuffs. This declaration is based on the FDA certificates of our ceramic suppliers.

TSE free (Transmissible Spongiform Encephalopathy)

The following applies to all device components in contact with the process:

- They do not contain any materials derived from animals.
- No additives or operating materials derived from animals are used in production or processing.

Process connections

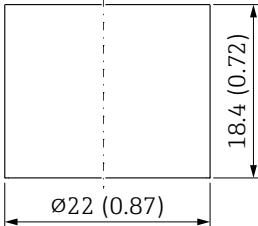
Endress+Hauser supplies a threaded connection made of stainless steel in accordance with AISI 316L (DIN/ EN material number 1.4404 or 1.4435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.

Materials not in contact with process

Component part	Material
Electronics housing	316L

Electronics housing

B



Technical drawing of Electronics housing B. It shows a square profile with a dashed centerline. The width is labeled as $\varnothing 22$ (0.87) and the height is labeled as 18.4 (0.72).

imgf16

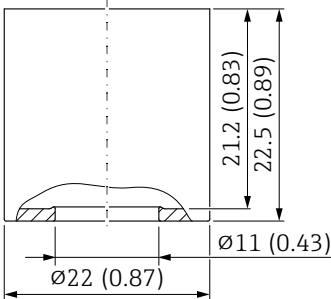
Unit of measurement mm (in)

Position	Designation	Material
B	Electronics housing (optional ¹⁾)	316L

1) The electronics housing is mounted if the male pin header strip 2x5 pins is selected.

Process connections

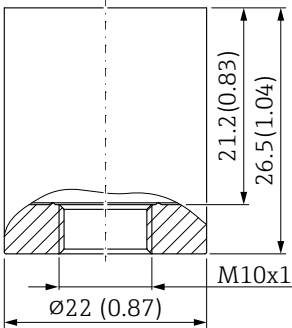
AA



Technical drawing of Process connection AA. It shows a capsule profile with a dashed centerline. The width is labeled as $\varnothing 22$ (0.87). The height from the base to the top of the capsule is labeled as 21.2 (0.83), and the total height including the base is labeled as 22.5 (0.89). The base diameter is labeled as $\varnothing 11$ (0.43).

img929

AB/AC



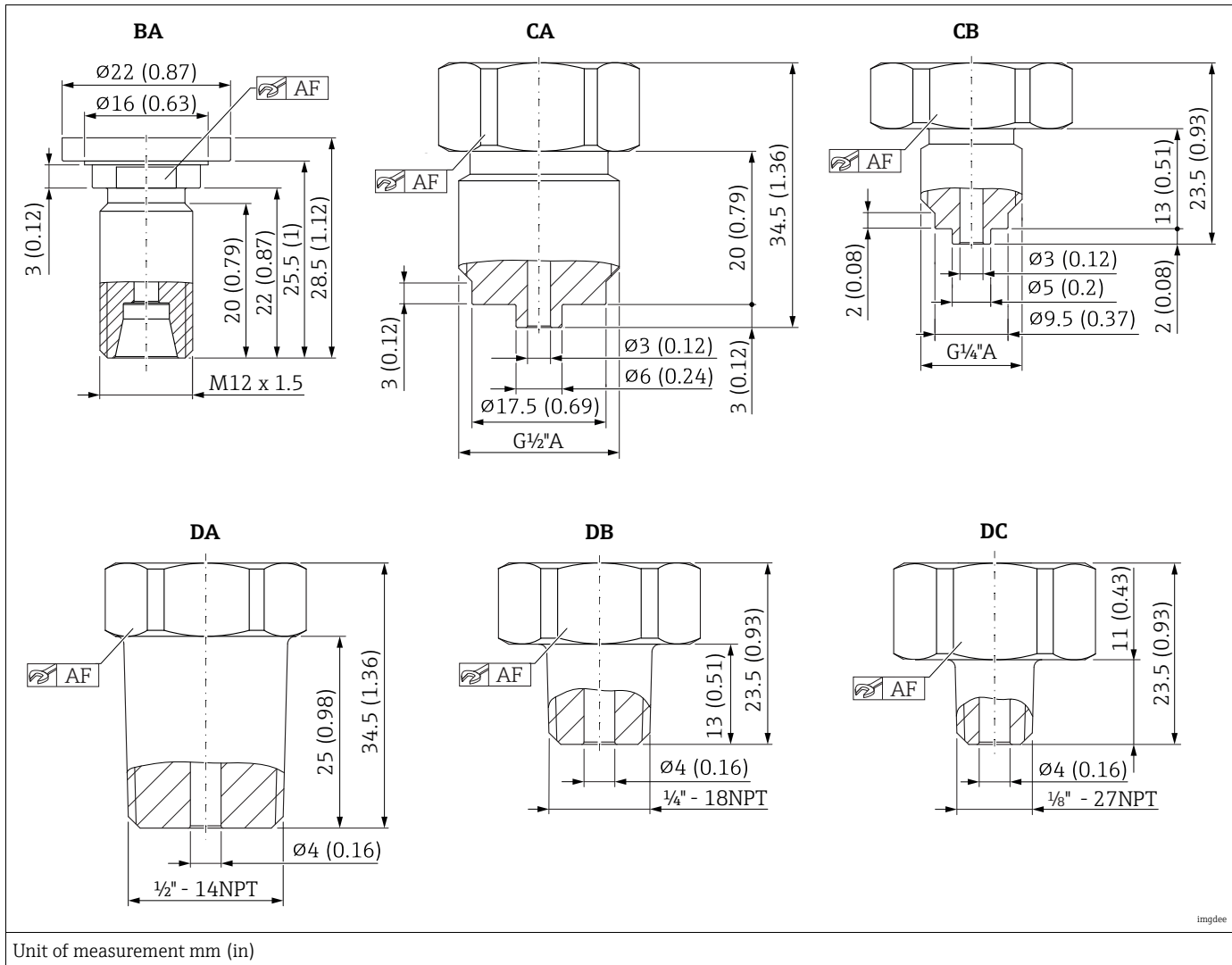
Technical drawing of Process connection AB/AC. It shows a capsule profile with a dashed centerline. The width is labeled as $\varnothing 22$ (0.87). The height from the base to the top of the capsule is labeled as 21.2 (0.83), and the total height including the base is labeled as 26.5 (1.04). The base is labeled as M10x1.

imge71

Unit of measurement mm (in)

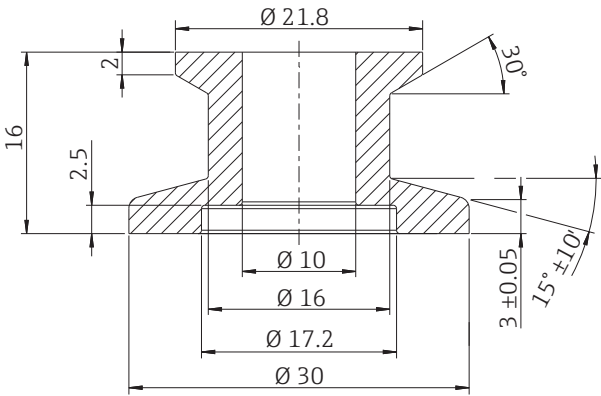
Position	Designation	Material
AA ¹⁾	Capsule $\varnothing 22 \times 22.5$ mm, flush-mounted	316L
AB ²⁾	Capsule $\varnothing 22 \times 26.5$ mm, M10 \times 1	316L
AC	Capsule $\varnothing 22 \times 26.5$ mm, M10 \times 1	Titan (3.7035)

- 1) The "AA" capsule is used if the process connection KB on the following page is used.
- 2) The "AB" capsule is used if one of the process connections BA to DC on the following page is used.



Position	Designation	AF	Material
BA	24° cutting ring fitting M12x1.5; 6L	14	316L
CA	Thread ISO 228 G1/2", EN837	24	316L
CB	Thread ISO 228 G1/4", EN837	24	316L
DA	ASME 1/2" MNPT, bore 4mm	24	316L
DB	ASME 1/4" MNPT, bore 4mm	24	316L
DC	ASME 1/8" MNPT, bore 4mm	24	316L
KB	Small flange DN16 (DIN 28403)	–	316L

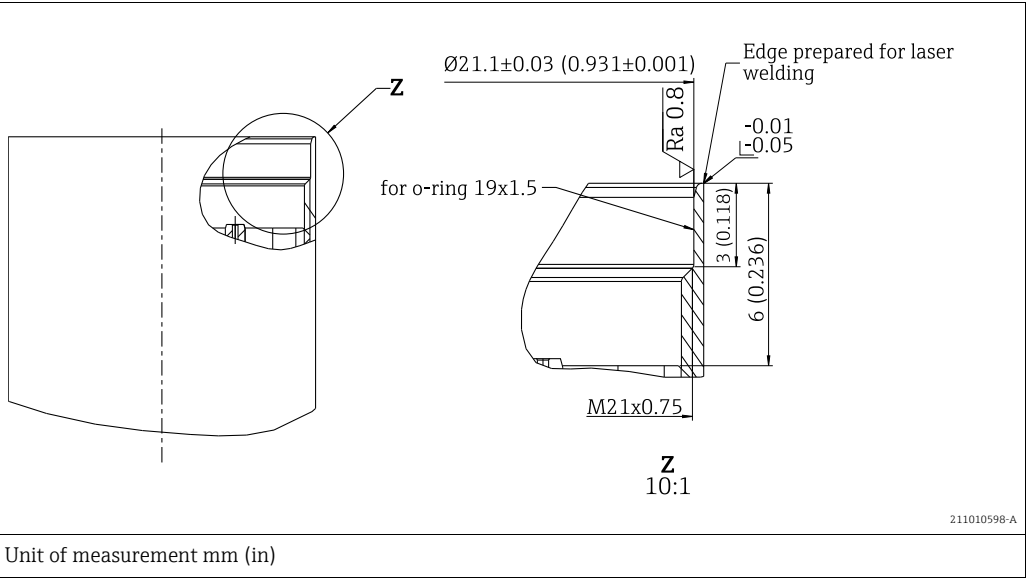
KB



UTC30_Prozessanschluss_KB

Unit of measurement mm (in)

Interfaces

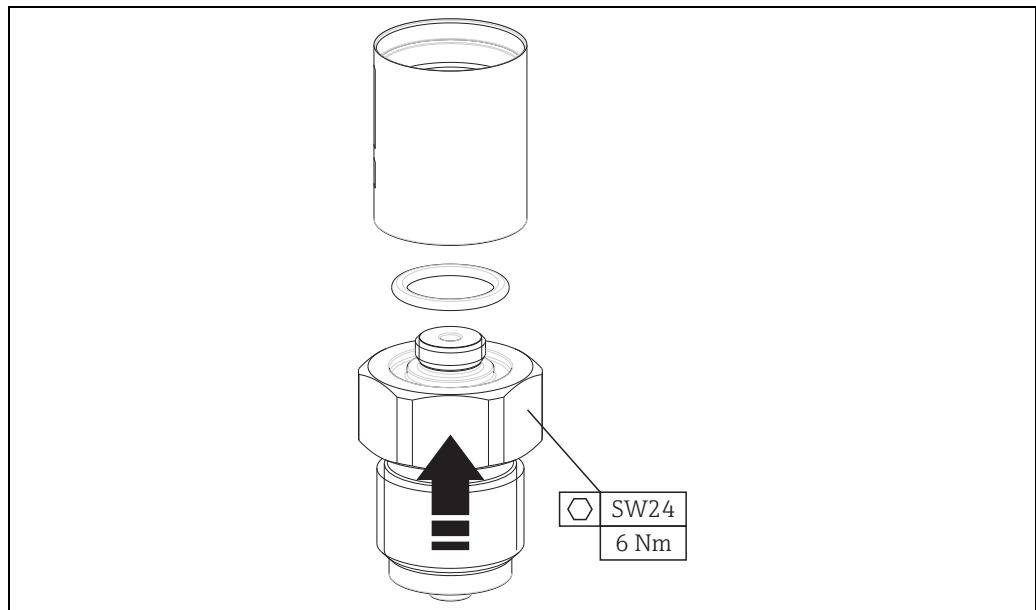


Unit of measurement mm (in)

Assembly of process connection

Please observe the following points when assembling the enclosed process connections:

- Before assembly, make sure that the seal and all sealing surfaces are as clean as possible. The sealing surfaces must not be damaged.
- Screw the process connection to the sensor assembly, observe a torque of 6 Nm.



UTC30_Montage_Prozessanschluss

Certificates and approvals

RoHS	The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU.
Pressure Equipment Directive 2014/68/EU (PED)	<p>Pressure equipment with allowable pressure ≤ 200 bar (2 900 psi)</p> <p>Pressure equipment (with a maximum allowable pressure $PS \leq 200$ bar (2 900 psi)) can be classified as pressure accessories in accordance with Pressure Equipment Directive 2014/68/EU. If the maximum allowable pressure is ≤ 200 bar (2 900 psi) and the pressurized volume of the pressure equipment is $\leq 0,1$ l, the pressure equipment is subject to the Pressure Equipment Directive (cf. Pressure Equipment Directive 2014/68/EU, Article 4, point 3). The Pressure Equipment Directive only requires that the pressure equipment shall be designed and manufactured in accordance with the "sound engineering practice of a Member State".</p> <p><i>Reasons:</i></p> <ul style="list-style-type: none"> ■ Pressure equipment directive (PED) 2014/68/EU Article 4, point 3 ■ Pressure equipment directive 2014/68/EU, Commission's Working Group "Pressure", Guideline A-05 + A-06 <p><i>Note:</i></p> <p>A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (safety accessory in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).</p>
Other standards and guidelines	<p>The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity. The following were also applied:</p> <p>DIN EN IEC 62828-1, 62828-2:</p> <p>Reference conditions and procedures for testing industrial and process measurement transmitters Part 1: General procedures for all types of transmitters Part 2: Specific procedures for pressure transmitters</p> <p>DIN 16086:</p> <p>Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications on data sheets. Procedure for writing specifications in data sheets for electrical pressure measuring instruments, pressure sensors and pressure transmitters.</p> <p>EN 61010-1 (IEC 61010-1):</p> <p>Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Equipment</p> <p>EN 60529:</p> <p>Degrees of protection provided by enclosures (IP code)</p>

Calibration; unit

Designation
Nominal range; mbar
Nominal range; bar
Nominal range; psi
Nominal range; Pa
Nominal range; kPa
Nominal range; MPa
Nominal range; mmH ₂ O
Nominal range; mH ₂ O
Nominal range; inH ₂ O
Nominal range; ftH ₂ O
Nominal range; mmHg

Service

Designation
3-point calibration certificate (on request)
5-point calibration certificate (on request)

Test reports (on request)

3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate

Ordering information

Detailed ordering information is available from the following sources:
In the Product Configurator on the Endress+Hauser website:
www.sensors-components.endress.com



Product Configurator - the tool for individual product configuration

- Product-specific configuration data
- Depending on the device: direct input of information specific to measuring point, such as measuring range
- Automatic verification of exclusion criteria

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.

Accessories

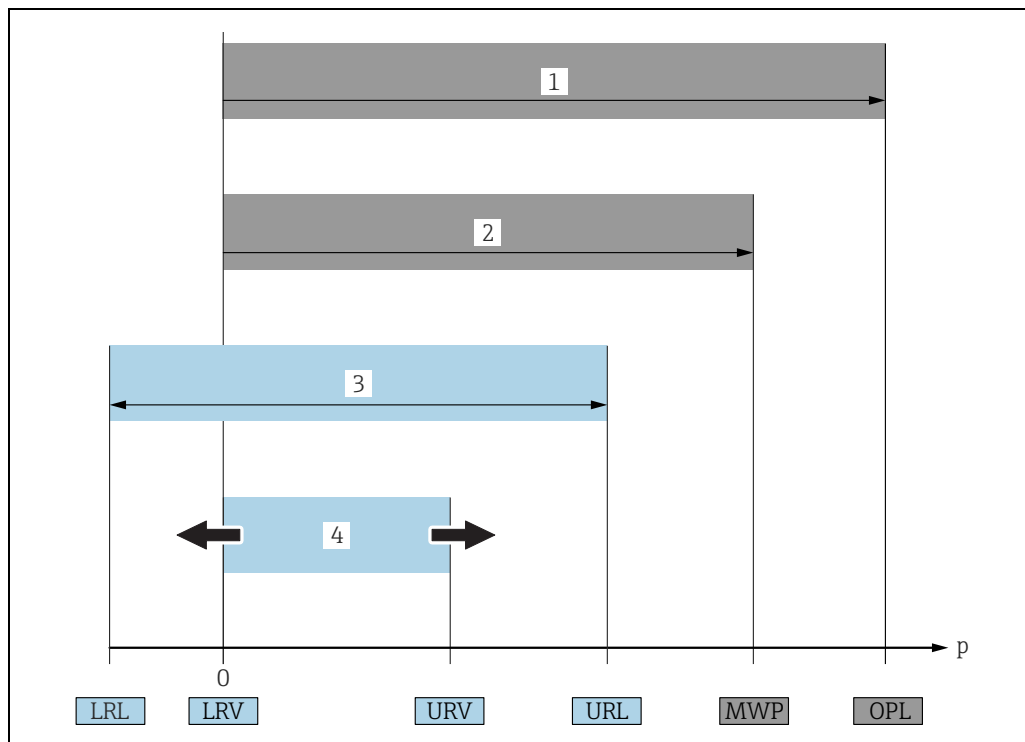
Designation	Type
Process connection	24° cutting ring fitting M12x1.5; 6L
	Thread ISO 228 G1/2", EN837
	Thread ISO 228 G1/4", EN837
	ASME 1/2" MNPT, bore 4 mm
	ASME 1/4" MNPT, bore 4 mm
	ASME 1/8" MNPT, bore 4 mm
O-ring	FKM
	FKM, FDA
	EPDM
	NBR
Cable	Adapter cable for female header strip 2x5 pins (1,27 mm spacing) Mating connector for SAMTEC

Contact addresses

Internet: www.sensors-components.endress.com
E-mail: sensors-components.pcm@endress.com

Explanations and supplementary documentation

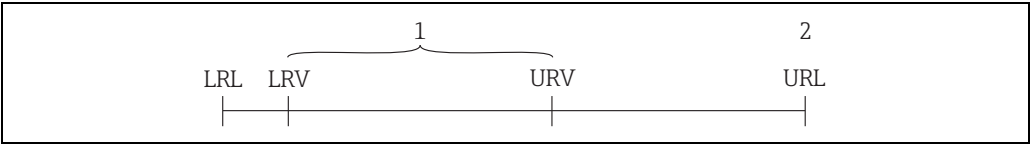
Terms and abbreviations



img9df

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. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. The test pressure corresponds to the overload limit of the sensor ($OPL = 1,5 \times MWP$) and may only be applied for a limited period of time so that no permanent damage occurs.
2	MWP	The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS", which corresponds to the MWP of the measuring instrument. The MWP refers to a reference temperature of +20 °C (+68 °F) and may be applied at the device for an unlimited period.
3	Maximum sensor measuring range	Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/adjustable span.
4	Calibrated/adjusted span	Span between LRV and URV Default setting: 0 to URL Other calibrated spans can be ordered as customized spans.
–	p	Pressure
–	LRL	Lower range limit
–	URL	Upper range limit
–	LRV	Lower range value
–	URV	Upper range value
–	TD	Turn Down Example - see the following section.
–	CARMEN	Capacitive And Resistive Measurement ENdress+Hauser → 4
–	Sampling rate	The sampling rate is the integration time for recording the measured value and also the update interval for the output of measured values. Exception: If a sampling rate of 1.25 ms is configured, the integration time is 1.25 ms but the update interval 2.5 ms.

Turn down calculation



- 1 Calibrated/adjusted span
- 2 Upper range limit

Example

- Sensor: 10 bar (150 psi)
- Upper range limit (URL) = 10 bar (150 psi)
- Lower range limit (LRL) = -1 bar (-15 psi)

Turn down (TD):

$$TD = \frac{URL}{|URV - LRV|}$$
$$TD = \frac{10 \text{ bar (150 psi)}}{|5 \text{ bar (75 psi)} - 0 \text{ bar (0 psi)}|} = 2$$

In this example, the TD is 2:1.

- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

CARMEN sensor settings

Default settings	
Measuring mode	Continuous
Damping	0
Analog initial value	< 5 %
Analog error value	> 95 %
Analog error behavior	0, 1, 2, 4, 5, 9, 10, 15, 17, 18
Digital error behavior	0, 1, 2, 4, 5, 9, 10, 15, 17, 18
UART Baud rate	57.6 kBd
Digital continuous transmission	Activated
Switching threshold, on	0 %
Switching threshold, off	0 %
Switching delay	0 s

The sensor setting is configurable, see S&C CARMEN Customer Manual.



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