



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
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Services



Solutions

## Technical Information

# Ceraphant T PTC31, PTP31, PTP35

Process pressure

Pressure switch for safe measurement and monitoring of absolute and gauge pressures



### Application

Pressure switch for monitoring absolute and gauge pressures in gases, vapours, liquids and dust.

Ceraphant T PTC31

– with ceramic sensor diaphragm;

Ceraphant T PTP31

– with metallic sensor diaphragm;

Ceraphant T PTP35

– for hygienic applications

- Finely graduated measuring ranges from vacuum to 400 bar/6000 psi
- Versions for use in hygienic applications
- Electronic versions
  - one PNP switch output
  - two PNP switch outputs
  - PNP switch output with additional analog output 4...20 mA (active)

### Your benefits

This compact pressure switch impresses with the latest in technology being used:

- Integrated switching electronics for decentral and economic process monitoring and control.
- Quick and flexible process integration thanks to modular connections.
- High reproducibility and long-term stability.
- Function check and information on site thanks to LEDs and digital display.
- Ceraphire® sensor diaphragm: corrosion-proof, abrasion-proof and extremely overload-resistant.
- Excellent accuracy and briefest response time right to the smallest measuring range.
- Operation and visualisation also with personal computer and ReadWin® 2000 or FieldCare®.
- Upper part of housing can be rotated by 310°, therefore best readability of measured values in all orientations
- DESINA compliant
- 3A approved



## Function and system design

### Measuring principle

#### Ceraphant T PTC31

The process pressure acts on the ceramic sensor diaphragm and the pressure-dependent change in capacitance of the ceramic sensor is measured. A microprocessor evaluates the signal and switches the output or outputs the corresponding measured value.

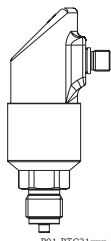
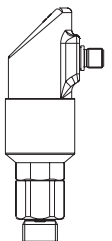
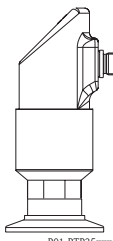
The ceramic sensor is a dry sensor i.e. no fill fluid is needed for pressure transmission. This means that the sensor can fully support a vacuum. Extremely high durability, on a par with the material Alloy, is achieved through the use of the highly pure material Ceraphire® as a ceramic.

#### Ceraphant T PTP31 and PTP35

The process pressure acting upon the metallic separating diaphragm of the sensor is transmitted to a resistance bridge via a fluid. The change in the output voltage of the bridge is proportional to the pressure and can be measured directly.

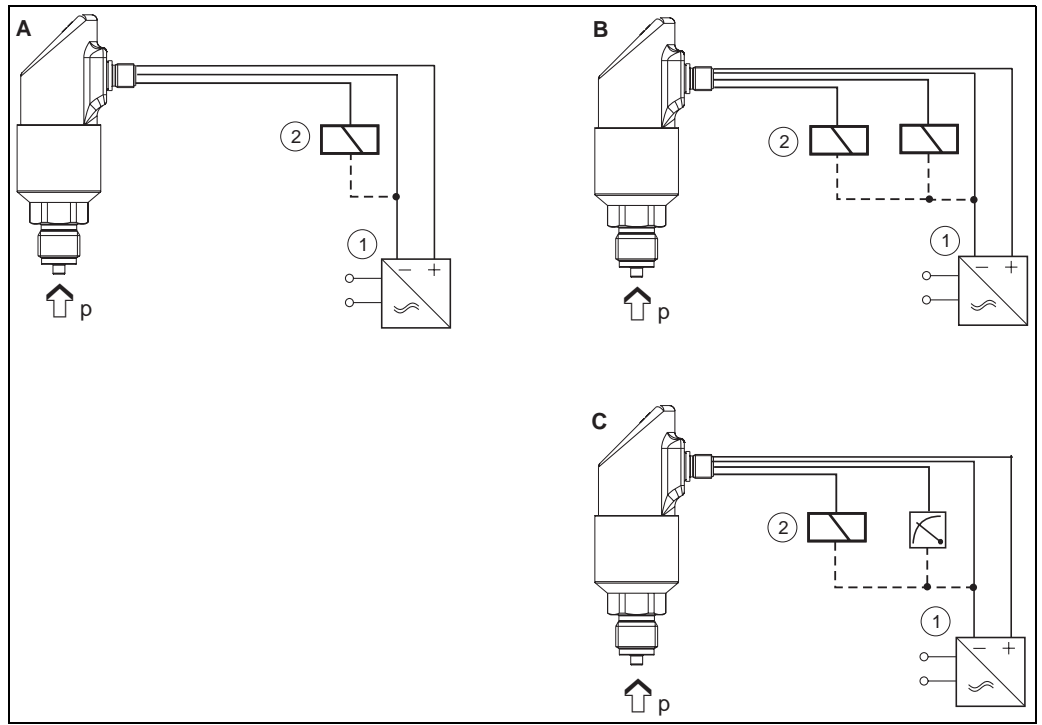
### Measuring system

#### Synopsis

Ceraphant product family	PTC31	PTP31	PTP35
	 P01-PTC31xxx-14-xx-xx-xx-001	 P01-PTP31xxx-14-xx-xx-xx-001	 P01-PTP35xxx-14-xx-xx-xx-001
Measuring cell	With capacitive measuring cell and ceramic measuring diaphragm (Ceraphire®)	With piezoresistive measuring cell and metallic measuring diaphragm	With piezoresistive measuring cell and metallic measuring diaphragm for hygienic applications
Field of application	Measurement and monitoring of absolute and gauge pressures	Measurement and monitoring of absolute and gauge pressures	Measurement and monitoring of absolute and gauge pressures in hygienic processes
Process connection	Thread – G ¼ female – G ¼A and G ½A – G ½A, hole 11 mm – M 12x1,5 – 7/16-20 UNF – ¼ FNPT and ½ MNPT	Thread – G ¼ female – G ¼A and G ½A – G ½A, hole 11 mm – M 12x1,5 – 7/16-20 UNF – ¼ FNPT and ½ MNPT – G ½A flush mounted	Hygiene – Clamp ½" - 2" – G 1A – Varivent F, N – DIN 11851 – APV inline – SMS 1½"
Measuring range	0 to 0.1 bar/1.5 psi to 0 to 40 bar/600 psi	0 to 1 bar/15 psi to 0 to 400 bar/6000 psi	0 to 1 bar/15 psi to 0 to 40 bar/600 psi
Process temperature	–40 °C to +100 °C (104 °F to 212 °F)	–40 °C to +100 °C (104 °F to 212 °F)	–40 °C to +100 °C 135 °C max. 1 hour (104 °F to 212 °F 275 °F max. 1 hour)

### DC voltage version

Positive signal at electronics switch output (PNP). Power supply, e.g. with a transmitter power supply unit. Preferred in conjunction with programmable logic controllers (PLC) or to control relays.



A: 1x PNP switch output

B: 2x PNP switch output

C: PNP switch output with additional analog output 4...20 mA (active).

① Transmitter power supply unit

② Load (e.g. programmable logic controller, process control system, relay)

## Input

<b>Measured variable</b>	The measured variable for the pressure switch can be selected as either gauge pressure or absolute pressure.
<b>Measuring range</b>	Measuring ranges up to 400 bar/6000 psi, see "Ordering information" section.

## Output

<b>Output signal</b>	<p>DC voltage version: Positive voltage signal (rate depends on power supply voltage) at electronics switch output (PNP). Short-circuit proof version.</p> <ul style="list-style-type: none"> <li>■ 1x PNP switch output</li> <li>■ 2x PNP switch output</li> <li>■ PNP switch output with additional active analog output 4...20 mA. The analog output continuously represents the measuring range configured or specified by the sensor.</li> </ul>
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**Range of adjustment**

- Switch output:
  - Switch point (SP): 0.5...100 % in increments of 0.1 % (min. 1 mbar \*) of the upper range limit (URL)
  - Switch-back point (RSP): 0...99.5 % in increments of 0.1 % (min. 1 mbar \*) of the upper range limit (URL)
  - Min. distance between SP and RSP: 0.5% URL
  - \* measuring ranges with negative gauge pressure up to 4 bar in increments of min. 10 mbar
- Analog output (if available):
  - Lower range value (LRV) and upper range value (URV) can be set anywhere within the sensor range (LRL - URL). Turn down of the analog output up to 4:1 of the upper range limit (URL).
- Damping: can be set anywhere between 0...40 s in increments of 0.1 s
- Factory setting (if no customer-specific settings have been ordered):
  - Switch point SP 1: 45 %; Switch-back point RSP 1: 44.5 %
  - Switch point SP 2: 55 %; Switch-back point RSP 2: 54.5 %
  - Analog output: LRV 0 %; URV 100 %

LRL = Lower Range Limit / URL = Upper Range Limit

LRV = Lower Range Value / URV = Upper Range Value

**Switching capacity**

DC voltage version:

- Switch status ON:  $I_a \leq 250$  mA, switch status OFF:  $I_a \leq 1$  mA
- Switching cycles: >10,000,000
- Voltage drop PNP:  $\leq 2$  V
- Overload resistance: Automatic load check of switching current;
  - max. capacitance load: 14  $\mu$ F at max. supply voltage (without resistive load)
  - max. period length: 0.5 s; min.  $t_{on}$ : 40  $\mu$ s
  - Periodic disconnection from a protective circuit in event of overcurrent ( $f = 2$  Hz) and indication of "Warning"

**Inductive load**

To prevent electrical interference, only operate an inductive load (relays, contactors, solenoid valves) when directly connected to a protective circuit (free-wheeling diode or capacitor).

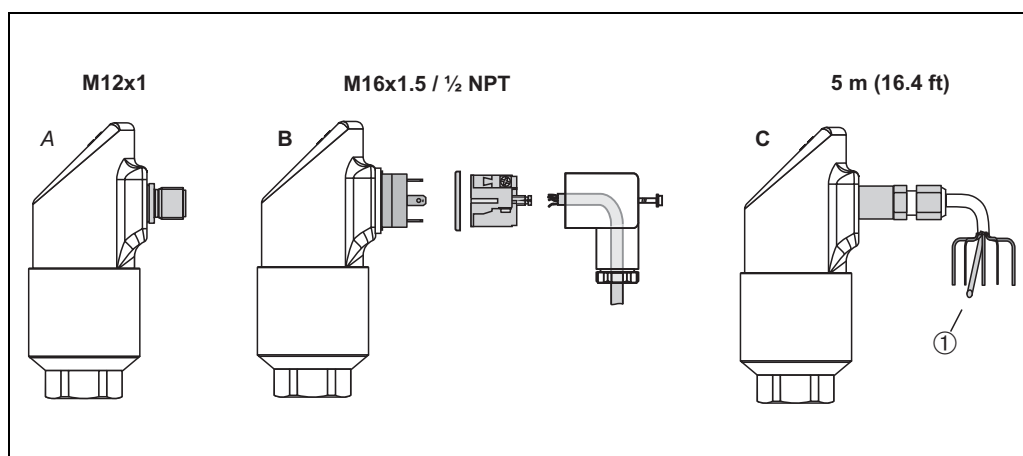
**Signal on alarm**

- Analog output
  - $\leq 3,6$  mA / last current value /  $\geq 21,0$  mA adjustable (if setting  $\geq 21.0$  mA the output is  $\geq 21.5$  mA)
- Switch outputs: In safe state (switch normally open)

**Load**

Max.  $(V_{Supply} - 6.5 \text{ V}) / 0.22 \text{ A}$  (analog output)

## Power supply

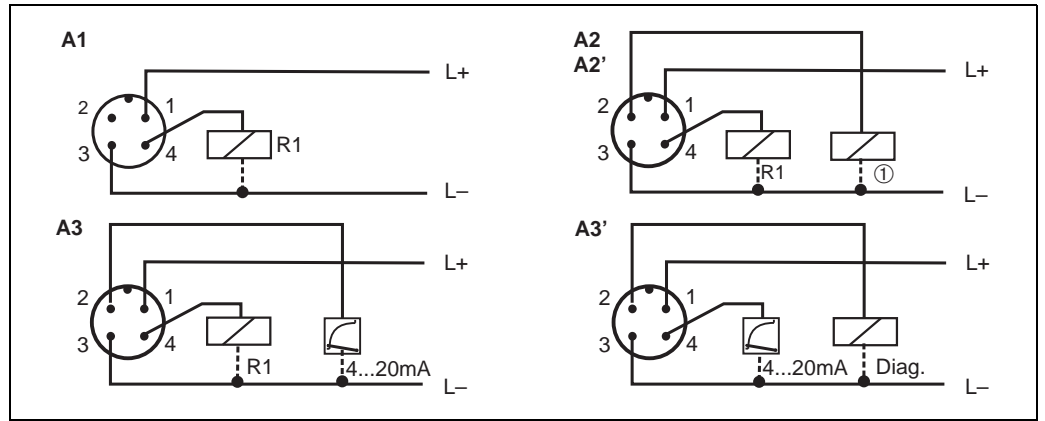
**Electrical connection****Connector and cable connection**

- A: M 12x1 connector;  
 B: M 16x1.5 or 1/2 NPT valve plug  
 C: cable, 5 m (16.4 ft) long, 5-core  
 ① reference pressure supply

P01-PTx3xxxx-04-xx-xx-xx-001

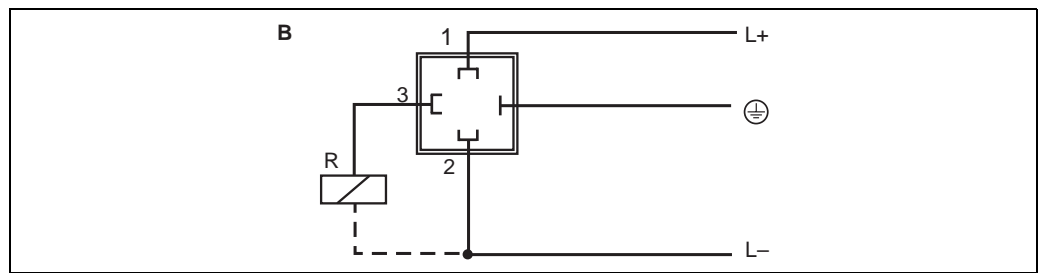
**Device connection**

- DC voltage version with M 12x1 connector



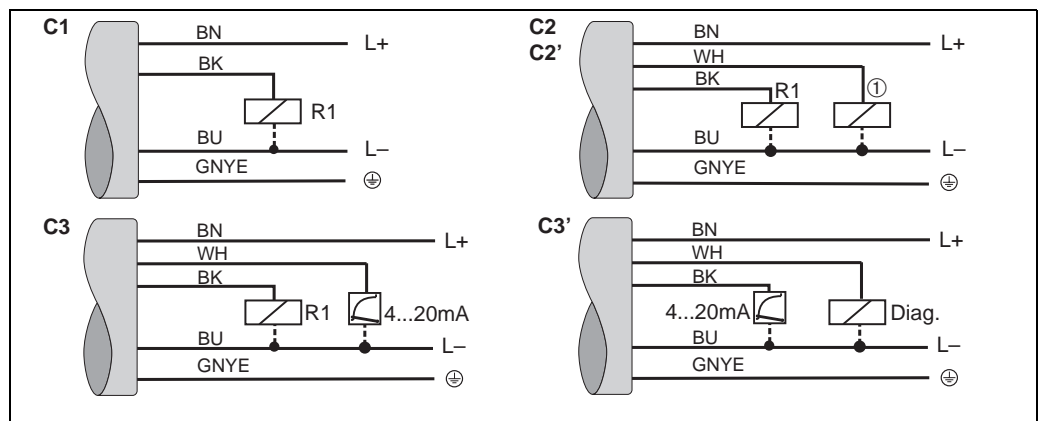
A1: 1x PNP switch output  
 A2: PNP switch outputs R1 and ① (R2)  
 A2': PNP switch outputs R1 and ① (diagnosis/break contact with adjustment "DESINA")  
 A3: PNP switch output with additional analog output  
 A3': PNP switch output with additional analog output (PIN assignment with "DESINA" setting)

- DC voltage version with M 16x1.5 or 1/2 NPT valve plug



B: 1x PNP switch output

- DC voltage version with cable



C1: 1x PNP switch output  
 C2: 2x PNP switch output  
 C2': PNP switch outputs R1 and ① (diagnosis/break contact with adjustment "DESINA")  
 C3: PNP switch output with additional analog output  
 C3': PNP switch output with additional analog output (assignment with "DESINA" setting)

Cable specification: all three connection versions 5-core; 4 x 0.2 mm<sup>2</sup> (AWG25), PE 0.75 mm<sup>2</sup> (AWG18)  
 – Core colours: BN = brown, BK = black, WH = white, BU = blue, GNYE = green/yellow

<b>Supply voltage</b>	<ul style="list-style-type: none"> <li>■ DC voltage version 12...30 V DC</li> </ul>
<b>Current consumption</b>	Without load < 60 mA, with reverse polarity protection
<b>Power supply failure</b>	<ul style="list-style-type: none"> <li>■ Behaviour in case of overvoltage (&gt;30 V) The device works continuously without any damage up to 34 V DC. The specific properties are no longer guaranteed if the supply voltage is exceeded. No damage is caused to the device in case of a short-term overvoltage up to 1 kV (as per EN 6100-4-5)</li> <li>■ Behaviour in case of undervoltage If the supply voltage drops below the minimum value, the device switches off (status as if not supplied with power = switch open).</li> </ul>

## Performance characteristics

The percentage information in the "Performance characteristics" section refer to the upper range limit (URL).

<b>Reference operating conditions</b>	To DIN IEC 60770 or DIN IEC 61003 T = 25 °C (77 °F), relative humidity 45 to 75 %, ambient air pressure 860 to 1060 hPa
<b>Switch output</b>	<ul style="list-style-type: none"> <li>■ Accuracy: deviation &lt;0.5 %</li> <li>■ Non-repeatability: &lt;0.2 %</li> <li>■ Response time: ≤20 ms</li> </ul>
<b>Analog output</b>	<ul style="list-style-type: none"> <li>■ Maximum measured error: Non-linearity + hysteresis + non-repeatability: ≤0.5 % (as per limit point method)</li> <li>■ Non-linearity: ≤0.2 % (as per limit point method)</li> <li>■ Rise time <math>T_{90}</math>: ≤200 ms</li> <li>■ Settling time <math>T_{99}</math>: ≤400 ms</li> </ul>
<b>Influences of air pressure changes</b>	In the case of air pressure changes the following additional measuring errors might occur: 400 bar: max. 0.0275 % 100 bar: max. 0.1 % 40 bar: max. 0.275 % 10 bar: max. 1 %
<b>Long-term drift</b>	≤0.15 % per year
<b>Long-term reliability</b>	Mean time between failure (MTBF) > 100 years (calculated according to "British Telecom Handbook of Reliability Data No. 5)
<b>Thermal change</b>	<ul style="list-style-type: none"> <li>≤ ± 1.5 % (-20 to +45 °C / -4 to 113 °F)</li> <li>≤ ± 2.0 % (-40 to +85 °C / -40 to 185 °F)</li> <li>≤ ± 2.5 % (-40 to +100 °C / -40 to 212 °F)</li> </ul>

## Operating conditions: Installation instructions

### Installation instructions

- Any orientation
- Any position-dependent zero shift can be corrected. Offset:  $\pm 20\%$  URL
- Housing can be rotated up to  $310^\circ$

## Operating conditions: Environment

**Ambient temperature range** -40 to +85 °C, briefly up to +100 °C (-40 to 185 °F, briefly up to 212 °F)

**Storage temperature** -40 to +85 °C (-40 to 185 °F)

### Degree of protection

- M 12x1 connector  
Gauge pressure sensors <10 bar: IP 60 / sensors for gauge pressure  $\geq 10$  bar and absolute pressure: IP 66
- M 16x1.5 or  $\frac{1}{2}$  NPT valve plug  
Gauge pressure sensors <10 bar: IP 60 / sensors for gauge pressure  $\geq 10$  bar and absolute pressure: IP 65
- Cable: IP 66

For applications where the device is installed outdoor or cleaned from outside we recommend the use of a protection cap

**Shock resistance** 50 g to DIN IEC 68-2-27 (11 ms)

**Vibration resistance** 20 g to DIN IEC 68-2-6 (10-2000Hz)

### Electromagnetic compatibility

- Interference emission as per EN 61326, class B electrical equipment
- Interference immunity as per EN 61326, appendix A (industrial use)

## Operating conditions: Process

### Medium temperature range

- PTC31: -40 °C...+100 °C (-40 °F to +212 °F)
- PTP31: -40 °C...+100 °C (-40 °F to +212 °F)
- PTP35: -40 °C...+100 °C, +135 °C for max. 1 hour (-40 °F to +212 °F, +275 °F for max. 1 hour)

Please also note the temperature limits of the seal used (see page 12: Material)

Extreme jumps in temperature can result in temporary errors. Temperature compensation takes effect after several minutes. Internal temperature compensation is faster the smaller the temperature jump and the longer the time interval

### Limiting medium pressure range

- For overload resistance see "Ordering information" section
- Vacuum resistance  
For ceramic sensor with nominal value  $> 100$  mbar (1.5 psi):  $0 \text{ mbar}_{\text{abs}}$  (0 psi)  
For ceramic sensor 100 mbar (1.5 psi):  $700 \text{ mbar}_{\text{abs}}$  (10.2 psi)  
For metal sensor:  $10 \text{ mbar}_{\text{abs}}$  (0.1 psi)

### Pressure specifications

The maximum pressure for the measuring device is dependent on the weakest element with regard to pressure, see the following sections "Ordering information: Measuring range" and "Mechanical construction"

The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of +20 °C (-4 °F) and may be applied to the device for an unlimited time.

The test pressure (Over Pressure Limit OPL) corresponds to 1.5 times the MWP and may be applied for a limited time only in order to avoid lasting damage.

## Certificates and approvals

<b>CE mark</b>	The device meets the legal requirements of the EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.
<b>UL listing</b>	The device was examined by Underwriters Laboratories Inc. USA (UL) in accordance with the standards UL 61010B-1 and CSA C22.2 No. 1010.1-92 and listed under the number E225237 UL for Canada and the USA.
<b>Pressure Equipment Directive</b>	This measuring device corresponds to Article 3 (3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and has been designed and manufactured according to good engineering practice.
<b>Suitability for hygienic processes</b>	<p>The Ceraphant T PTP35 is suitable for the employment in hygienic processes. An overview of permitted process connections on page 11 and 12. Many versions meet the requirements of 3A-Sanitary Standard No. 74.</p> <p>Note! The gap-free connections can be cleaned without residue using the usual cleaning methods.</p>
<b>TSE Certificate of Suitability</b>	<p>Ceraphant T PTP35</p> <p>The following applies to wetted device components: They do not contain any materials derived from animals. No auxiliaries or operating materials derived from animals are used in production or processing. Process wetted device components are listed in the "Mechanical construction" and "Ordering information" sections.</p>
<b>Standards and guidelines</b>	<p>DIN EN 60770 (IEC 60770): Transmitters for use in industrial-process control systems Part 1: Methods for performance evaluation.</p> <p>DIN EN 61003-1, publication date:1993-12 Industrial-process control systems - Instruments with analog inputs and two- or multi-state outputs - Part 1: Methods of evaluating the performance.</p> <p>DIN 16086 Electrical pressure measuring instruments; pressure sensors, pressure transmitters, pressure measuring instruments; concepts, specifications on data sheets</p> <p>IEC 60592 Degrees of protection provided by enclosures (IP code).</p> <p>EN 61326 Electrical equipment for measurement, control and laboratory use - EMC requirements.</p> <p>IEC 61010 Safety requirements for electrical equipment for measurement, control and laboratory use.</p> <p>EN 61000-4-5 Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques; Section 5: Surge immunity test</p>
<b>Registered trademarks</b>	<p>Ceraphire® Registered trademark of Endress+Hauser GmbH+Co.KG, Maulburg, Germany</p> <p>ReadWin® Registered trademark of Endress+Hauser Wetzler GmbH+Co.KG, Nesselwang, Germany</p> <p>LEXAN® Registered trademark of General Electric Plastics B.V., Bergen op Zoom, Netherlands</p> <p>THERMOPLAST® Registered trademark of Kraiburg TPE GmbH, Waldkraiburg, Germany</p>







## Ceraphant T PTP35

<b>10</b>	<b>Certificate</b>								
	A	For non-hazardous areas							
<b>20</b>	<b>Electrical connection</b>								
	1	M12x1 connector: IP 60, with sensors for gauge pressure $\geq 10$ bar and absolute pressure: IP 66							
	2	M16x1.5 valve plug, ISO 4400: IP 60; with sensors for gauge pressure $\geq 10$ bar and absolute pressure: IP 65							
	3	$\frac{1}{2}$ NPT valve plug, ISO 4400: IP 60; with sensors for gauge pressure $\geq 10$ bar and absolute pressure: IP 65							
	4	5 m (16.4 ft) cable: IP 66							
<b>30</b>	<b>Electronics, output signal</b>								
	A	12...30V DC, PNP switch, 3-wire							
	B	12...30V DC, 2 PNP switch, 4-wire							
	C	12...30 V DC, PNP switch + 4...20mA, 4-wire							
<b>40</b>	<b>Display</b>								
	1	With digital display							
<b>50</b>	<b>Sensor</b>								
		Gauge pressure			Max. working pressure MWP	Overload OPL			
	3H	0...1 bar / 0...100 kPa			2.7 bar	4 bar			
	3M	0...4 bar / 0...400 kPa			10.7 bar	16 bar			
	3P	0...10 bar / 0...1000 kPa			26.7 bar	40 bar			
	3S	0...40 bar / 0...4000 kPa			100 bar	160 bar			
		Negative gauge pressure			Max. working pressure MWP	Overload OPL			
	7H	-1...1 bar / -100...100 kPa			2.7 bar	4 bar			
	7M	-1...4 bar / -100...400 kPa			10.7 bar	16 bar			
	7P	-1...10 bar / -100...1000 kPa			26.7 bar	40 bar			
		Absolute pressure			Max. working pressure MWP	Overload OPL			
	4H	0...1 bar / 0...100 kPa			2.7 bar	4 bar			
	4M	0...4 bar / 0...400 kPa			10.7 bar	16 bar			
	4P	0...10 bar / 0...1000 kPa			26.7 bar	40 bar			
	4S	0...40 bar / 0...4000 kPa			100 bar	160 bar			
<b>60</b>	<b>Configuration and unit</b>								
	1	Sensor range: bar							Calibration in sensor range
	2	Sensor range: kPa/MPa							Calibration in sensor range
	3	Sensor range: psi							Calibration in sensor range
	S	Switch output 1, see additional specification							Calibration in sensor range
	T	Switch output 1 + 2, see additional specification							Calibration in sensor range
	U	Switch and analog output, see additional specification							Calibration in sensor range
	V	Switch output 1, switch output 2 DESINA, see add. spec.							Calibration in sensor range
	W	Analog output, switch output DESINA, see add. spec.							Calibration in sensor range
<b>70</b>	<b>Process connection, material</b>								
	Clamp connections								
	DA	ISO 2852 DN12-22 ( $\frac{3}{8}$ " ), 316L, 3A, DIN32676, DN10-20							
	DB	ISO 2852 DN25-38 (1...1 $\frac{1}{2}$ " ), 316L, 3A, DIN32676, DN25-40							
	DL	ISO 2852 DN40-51 (2" ), 316L, 3A, DIN32676, DN50							
	Hygienic connections								
	BA	Thread ISO 228 G1A, metal taper seal, 316L, flush-mounted for sleeve 52005087							
	BB	Thread ISO 228 G1A, O-ring seat seal, 316L, flush-mounted for sleeve 52001051							
	KL	SMS 1 $\frac{1}{2}$ " PN 25, 316L, 3A							
	LB	Varivent F pipe DN 25-32, PN 40, 316L, 3A							
	LL	Varivent N pipe DN4 0-162, PN 40, 316L, 3A							
	PH	DIN 11851 DN 40 PN 40, 316L, 3A							
	PL	DIN 11851 DN 50 PN 25, 316L, 3A							
	HL	APV Inline DN 50 PN 40, 316L, 3A							
<b>80</b>	<b>Seal, filling fluid</b>								
	4	O-ring EPDM, oil conform to FDA							
	8	Without O-ring, oil conform to FDA (only for process connections BA, BB, DA)							
<b>90</b>	<b>Additional equipment</b>								
	A	Without additional equipment							
	B	Final inspection report							
	C	3.1.B process connection, inspection certificate to EN10204							
	D	Final inspection report + 3.1 (process connection), inspect. certificate to EN10204							
<b>PTP35 -</b>									

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**Endress+Hauser**   
People for Process Automation