



OPTIBAR P 2010 Technical Datasheet

Hygienic pressure transmitter with flush welded diaphragm

- Wide variety thanks to modular design
- SIP/CIP compatible
- Hygienic process connections



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1.1 Pressure transmitter for industrial hygienic processes

The **OPTIBAR P 2010** pressure transmitter was specifically designed with the requirements of both the food and pharmaceutical industries in mind.

It is perfectly suited for cavity-free instrumentation, providing a repeatable measuring signal that is stable over the long term, even with regular SIP/CIP cleaning, while simultaneously guaranteeing a high degree of chemical resistance to process and cleaning solutions.

The modular design of the device makes it possible to combine a wide range of fully welded process connections with a variety of filling media and electrical connections in a way that can accommodate virtually any industrial hygienic process technology requirement. Additional cooling fins can be added at any time for process temperatures higher than 150°C / 302°F.



- ① ISO 228 G1/2" DIN 3852 connection with M12 connector
- ② ISO 228 G1/2" DIN 3852 connection with ISO 4400 plug and cable connector
- ③ 1 1/2" ISO 2852 clamp connection with cooling fins and field housing

Highlights

- Large selection of hygienic process connections, e.g. 3A conformity
- Fully welded flush diaphragm with surface roughness of Ra < 0.4 µm
- Measuring accuracy: ±0.25%
- Measuring range: 0.1...40 bar / 4...580 psi
- Outstanding temperature stability at zero point
- SIP/CIP compatible
- Ingress protection up to IP68

Industries

- Food & Beverage
- Pharmaceutical industry
- Viscous and crystallising media
- General sterile process technology

Applications

- Absolute and gauge pressure measurement, without cavities, in gases and liquids

1.2 Options and variants



M12 connector with ISO 228 G $\frac{1}{2}$ " DIN 3852 flush process connection



Valve plug and cable connector acc. to ISO 4400 with ISO 228 G $\frac{1}{2}$ " DIN 3852 flush process connection



Field housing with cooling fins and 1 $\frac{1}{2}$ " ISO 2852 clamp

2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Measuring principle	Piezoresistive measuring cell
Application range	Measurement of gauge and absolute pressure in gases and liquids
Measuring range	-1...40 bar / -14.5...580 psi; refer also to chapter "Measuring ranges"

Measuring accuracy

Reference conditions	Medium: air
	Temperature: ambient temperature
	Ambient pressure: 1013 mbar / 14.7 psi
	Nominal position: vertical, pressure port down
	Power supply: 24 VDC
Pressure type	Gauge pressure / absolute pressure
Measuring accuracy according to IEC 60770 (terminal based) (Hysteresis, non-linearity, non-repeatability)	Nominal pressure (P_N) < 0.4 bar / 5.8 psi: $\leq \pm 0.5\%$ of URL
	Nominal pressure (P_N) ≥ 0.4 bar / 5.8 psi: $\leq \pm 0.25\%$ of URL (URL = Upper Range Limit)
Ambient temperature effect on zero and span	Nominal pressure (P_N) < 0.4 bar / 5.8 psi: $\leq \pm 1.5\%$ of URL in compensated range of 0...+50°C / +32...+122°F
	Nominal pressure (P_N) ≥ 0.4 bar / 5.8 psi: $\leq \pm 0.75\%$ of URL in compensated range of -20...+85°C / -4...+185°F
	Nominal pressure (P_N) = -1...0 bar / -14.5...0 psi: $\leq \pm 0.75\%$ of URL
Long-term stability	$\leq \pm 0.1\%$ of URL within one year under reference conditions
Step response time	< 10 ms (T90)
Vacuum resistance	$P_N > 1$ bar / 14.5 psi: vacuum resistant
	$P_N \leq 1$ bar / 14.5 psi: on request

Operating conditions

Temperature	
Nominal temperature	-20...+85°C / -4...+185°F
Ambient temperature	-40...+85°C / -40...+185°F
	Ex i zone 0: -20...+60°C / -4...+140°F at $p_{abs} = 0.8...1.1$ bar
	Ex i from zone 1: -20...+70°C / -4...+158°F
Storage temperature	-40...+100°C / -40...+212°F
Medium temperature	Silicone oil: -40...+125°C / -40...+257°F
	Food grade oil: -10...+125°C / +14...+257°F
	With cooling fins (optional): Silicone oil: $P_N > 0$ barg: -40...+300°C / -40...+572°F; $P_N < 0$ barg: -40...+150°C / -40...+302°F Food grade oil: $P_N > 0$ barg: -10...+250°C / +14...+482°F; $P_N < 0$ barg: -10...+150°C / +14...+301°F
	CIP/SIP
Other conditions	
Ingress protection acc. to IEC 529 / EN 60529	Connector M16 ISO 4400: IP65
	Connector M12x1, 4-pin: IP67
	Thread M12, housing in 1.4404 / AISI 316L: IP67

Installation conditions

Mounting position	Any - factory calibration carried out with pressure port down.
Dimensions	For detailed information refer to chapter "Dimensions and weights".
Weight	Min. 200 g / 0.44 lb (depending on pressure port)

Materials

Housing	Stainless steel 1.4404 / AISI 316L
	Field housing (optional): stainless steel 1.4301 / AISI 304
Cable gland	Nickel-plated brass
Fill fluid	Silicone oil
	Food grade oil with FDA approval (Mobil DTE FM 32; Category Code: H1; NSF Registration No.: 130662)
Wetted parts	
Pressure port	Stainless steel 1.4404 / AISI 316L
Separating diaphragm	Stainless steel 1.4435 / AISI 316L; 2.4819 / Hastelloy® C-276
Gasket	Optional and only for DIN threads
	FKM (medium temperature $\leq +200^\circ\text{C}$ / $+392^\circ\text{F}$); FFKM (medium temperature $> +200^\circ\text{C}$ / $+392^\circ\text{F}$)

Surface roughness	
Turning parts	$R_a \leq 0.8 \mu\text{m}$
Diaphragm	$R_a \leq 0.4 \mu\text{m}$
Weld seams	Approx. $R_a \leq 1.5 \mu\text{m}$

Process connections

Thread	Thread ISO 228 G1/2", DIN 3852 ($P_N \geq 1 \text{ bar} / 14.5 \text{ psi}$), Thread ISO 228 G3/4", DIN 3852 ($P_N \geq 600 \text{ mbar} / 8.7 \text{ psi}$), Thread ISO 228 G1", DIN 3852; Thread ISO 228 G1", cone Thread ISO228 G1/2" hygienic design; DIN3852 Thread ISO228 G1" hygienic design; DIN3852
Clamp	Clamp DN25 ISO 2852; clamp DN38 ISO 2852; clamp DN51 ISO 2852 Others on request.

Electrical connection

Output signal	4...20 mA current output; 2-wire
Power supply	Standard: $U_b = 8...32 \text{ VDC}$
	Ex i: $U_b = 10...28 \text{ VDC}$
Safety maximum values (Ex i)	$U_i = 28 \text{ V}$, $I_i = 93 \text{ mA}$, $P_i = 660 \text{ mW}$, $C_i \approx 0 \text{ nF}$, $L_i \approx 0 \mu\text{H}$; The supply connections have a maximum internal capacity of 27 nF to the housing.
Load	$R_{l\text{max}} = [(V_s - V_{s\text{min}}) / 0.02 \text{ A}] \text{ Ohm}$
Short circuit protection	Continuously
Reverse polarity protection	In the event of reversed connections there is no damage but also no function.
Ripple	Supply: 0.05% FSO / 10 V Load: 0.05% FSO / 1 kOhm
Electrical connection	Connector M16 ISO 4400
	Connector M12x1, 4-pin
	Thread M12, housing 316L

Approvals and certificates

CE	The device fulfils the statutory requirements of the EU directives. The manufacturer certifies that these requirements have been met by applying the CE marking.
Electromagnetic compatibility (EMC) acc. to EN 61326-1:2013	EMC Directive: 2014/30/EU
	For more information consult the relevant declaration of conformity.
Pressure equipment directive	2014/68/EU
Ex	
ATEX	II 1G Ex ia IIC T4 Ga or II 1D Ex ia IIIC T85°C Da
IECEX	Ex ia IIC T4 Ga or Ex ia IIIC T85°C Da

Other standards and approvals	
Vibration resistance acc. to EN 60068-2-6	G1/2": 20g RMS (25...2000 Hz)
	All except G1/2": 10g RMS (25...2000 Hz)
Shock resistant (impact) according to EN 60068-2-27	G1/2": 500g / 1 ms
	All except G1/2": 100g / 1 ms
Hygienic	3-A approved; FDA approved materials

2.2 Dimensions and weights

Connection plug

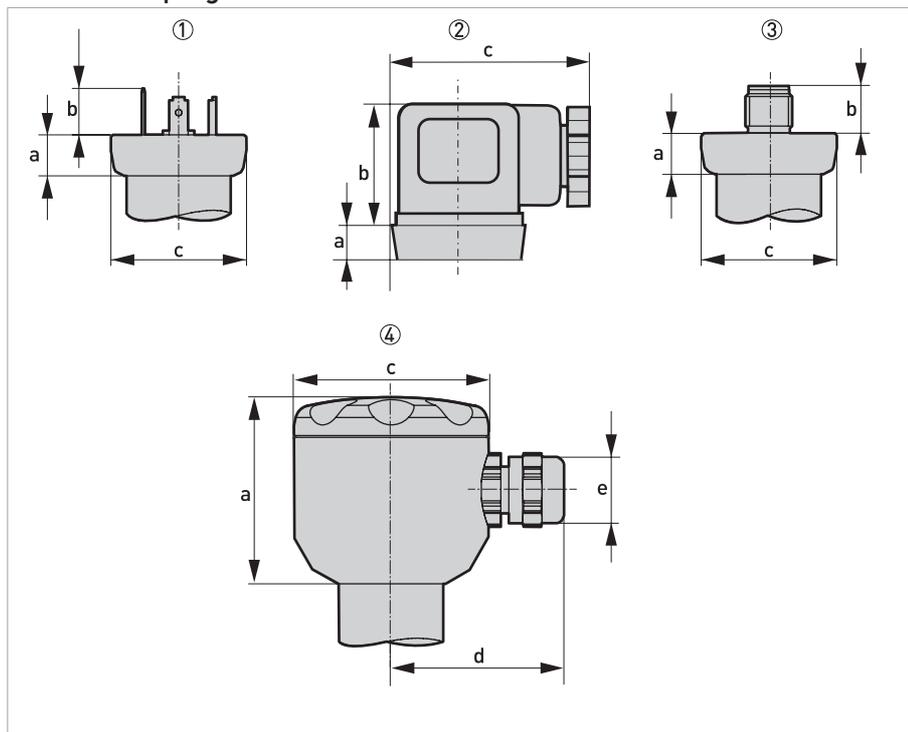


Figure 2-1: Dimensions for connection plug and field housing

- ① ISO 4400 (cable connector is part of delivery)
- ② ISO 4400 (with cable connector)
- ③ M12x1 (4-pin)
- ④ Field housing

	Dimensions							
	①		②		③		④	
	[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
a	10.5	0.4	10.5	0.4	10.5	0.4	48	1.9
b	12	0.47	33	1.3	12	0.47	-	-
c	Ø34.5	Ø1.36	Ø50	Ø1.97	Ø34.5	Ø1.36	Ø49.5	Ø1.95
d	-	-	-	-	-	-	44	1.7
e	-	-	-	-	-	-	M12x1.5	

Pressure transmitter with threaded connection

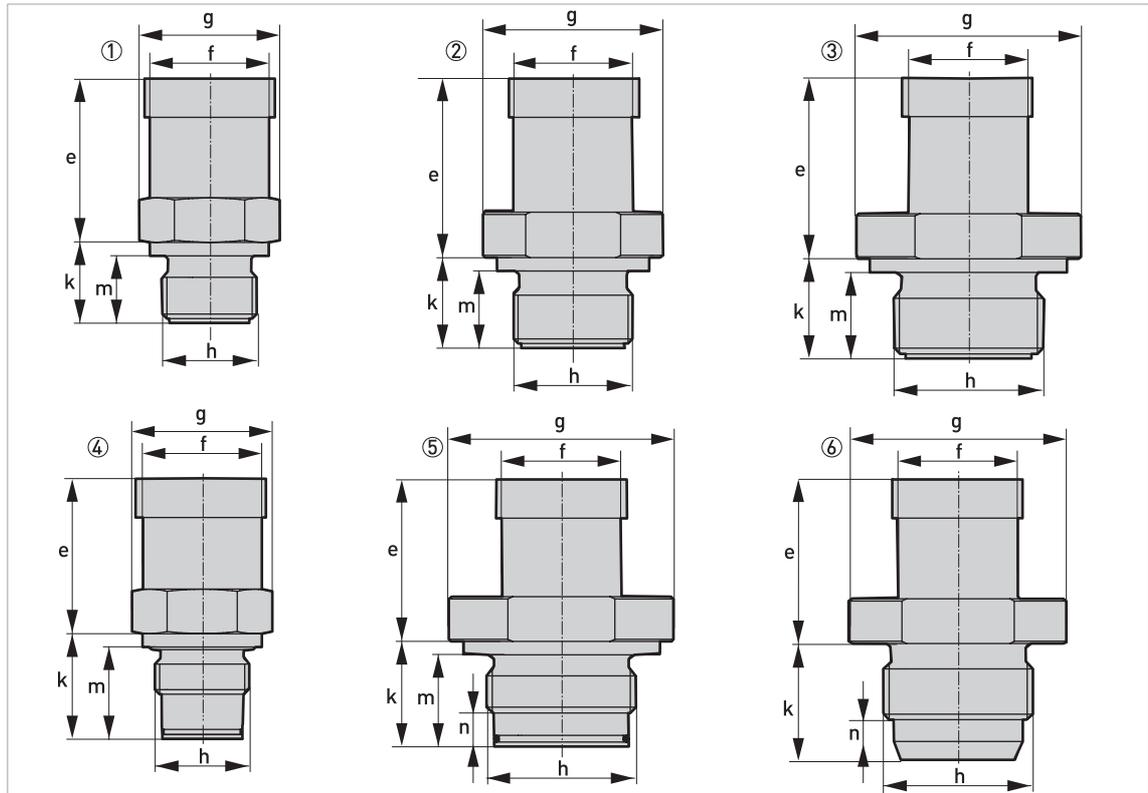


Figure 2-2: Dimensions for pressure transmitter with threaded connection

- ① G1/2" DIN 3852 flush
- ② G3/4" DIN 3852 flush
- ③ G1" DIN 3852 flush
- ④ G1/2" DIN 3852 flush hygienic design
- ⑤ G1" DIN 3852 flush hygienic design
- ⑥ G1" cone

	Dimensions											
	①		②		③		④		⑤		⑥	
	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]
e	60	2.36	60	2.36	60	2.36	60	2.36	60	2.36	60	2.36
f	Ø26.5	Ø1.04	Ø26.5	Ø1.04	Ø26.5	Ø1.04	Ø26.5	Ø1.04	Ø26.5	Ø1.04	Ø26.5	Ø1.04
g	WS27		WS34		WS41		WS27		WS41		WS34	
h	G½"		G¾"		G1"		G½"		G1"		G1"	
k	18	0.71	20	0.79	22	0.87	23.5	0.93	23.5	0.93	26	1.02
m	15	0.59	17	0.67	19	0.75	20.5	0.81	20.5	0.81	-	-
n	-	-	-	-	-	-	-	-	7.5	0.3	9	0.35

The entire length of the device is made up of the electrical connection (a), the transmitter housing (e) and the process connection (k).

With cooling fins (optional) additional 32 mm / 1.26".

Pressure transmitter with cooling fins and hygienic process connections

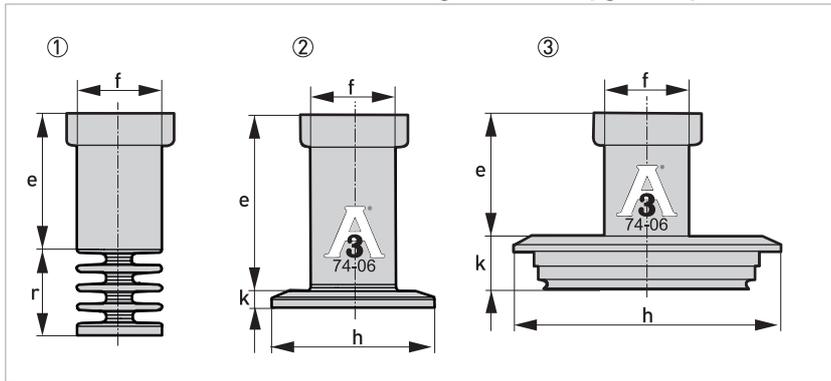


Figure 2-3: Dimensions for pressure transmitter with cooling fins and hygienic process connections

- ① Cooling fins (optional)
- ② Clamp DIN 32678 / ISO 2852, 3-A approved
- ③ Varivent® DN40/50, 3-A approved

	Dimensions					
	①		②		③	
	[mm]	[""]	[mm]	[""]	[mm]	[""]
e	50	1.97	50	1.97	48	1.89
f	Ø26.5	Ø1.04	Ø26.5	Ø1.04	Ø26.5	Ø1.04
h	-	-	DN25: 50.5 DN38: 50.5 DN51: 64	DN25: 2.0 DN38: 2.0 DN51: 2.5	Ø84	Ø3.3
k	-	-	5	0.2	17	0.67
r	32	1.26	-	-	-	-

The entire length of the device is made up of the electrical connection (a), the transmitter housing (e) and the process connection (k).

Other hygienic connections are available on request.

2.3 Measuring ranges

Pressure in bar

Nominal pressure (gauge/abs.)	0.10	0.16	0.25	0.40	0.50	0.60	1	1.6
Max. working pressure (MWP)	0.5	1	1	2	2	5	5	10
Burst pressure (OPL)	1.5	1.5	1.5	3	3	7.5	7.5	15

Nominal pressure (gauge/abs.)	2	2.5	4	5	6	10	16	25	40
Max. working pressure (MWP)	10	10	20	20	40	40	80	80	105
Burst pressure (OPL)	15	15	25	25	50	50	120	120	210

Pressure in psi

Nominal pressure (gauge/abs.)	1.45	2.32	3.63	5.80	7.50	8.70	14.5	23.2
Max. working pressure (MWP)	7.3	14.5	14.5	29	29	72.5	72.5	145
Burst pressure (OPL)	21.8	21.8	21.8	43.5	43.5	108.8	108.8	217.6

Nominal pressure (gauge/abs.)	29	36.3	58.0	72.5	87.0	145	232.1	362.6	580
Max. working pressure (MWP)	145	145	290	290	580	580	1160	1160	1523
Burst pressure (OPL)	217.6	217.6	362.6	362.6	725	725	1740	1740	3046

3.1 General notes on installation

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Do a check of the packing list to make sure that you have all the elements given in the order.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Intended use

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The **OPTIBAR P 2010** pressure transmitter is designed to measure the absolute pressure and gauge pressure of gases and liquids.

3.3 Technical limits

The device was constructed solely for use within the technical limits indicated on the nameplate and in the technical data. Applications outside of these limits are not permitted and could lead to significant risk of accident. For this reason, observe the following limits:

- Do not exceed the maximum working pressure (MWP).
- Do not exceed the indicated permissible operating temperature range.
- The permissible ambient temperatures given may not be exceeded or undershot.
- Check the materials used for the wetted parts (e.g. gasket, process connection, separating diaphragm etc.) for suitability as regards process compatibility.

3.4 Installation specifications

Install the device only when depressurised and without power!

For installation the respective regulations for explosion protection have to be fulfilled.

For installations outdoor and in damp areas, the following points must be observed:

- *To ensure that no moisture can get into the connector, the device should be connected electrically immediately after installation. Otherwise a moisture admission has to be prevented e.g. by using a suitable protection cap.*
- *Select an installation if possible, where a mounting position allows draining of spray and condensate. Sealing surfaces should not be submerged!*
- *When using devices with cable glands or output, the cable should be looped facing down so that any liquid that collects on the cable can drip off.*
- *Install the device so it is protected from direct sunlight. In the worst case scenario, the permissible operating temperature will be exceeded in the presence of direct sunlight. This can negatively affect or damage the functionality of the device. In addition, it can lead to temporary measuring errors if the internal pressure of the device increases due to the sunlight.*
- *When installing outside where the risk of lightning or overvoltage may exist and damage the device, we recommend installing suitable overvoltage protection between the supply device or control cabinet and the device.*

- *Handle this highly sensitive electronic measuring device with care, both in and out of the packaging!*
- *Only remove the packaging and any protection cap from the device immediately before installing to prevent damage to the diaphragm! Keep the supplied protection cap! Remove the protection cap slowly and carefully to avoid any negative pressure on the diaphragm.*
- *Handle the unprotected diaphragm with extreme care; it is very easily damaged.*
- *A device with a gauge reference in the housing (small hole next to the electrical connection) must be installed so that the gauge reference necessary for measurement is protected from dirt and moisture. Should the pressure transmitter be exposed to fluid admission, the air pressure compensation is blocked by the gauge reference. Accurate measurement in this state is not possible. It can also result in damage to the pressure transmitter.*
- *Ensure that no mechanical stress is applied to the pressure port during installation as this may result in a shift in the characteristic curve. This applies in particular to very small pressure ranges as well as to devices with plastic pressure ports.*
- *With hydraulic systems, arrange the device so that the pressure port faces up (venting).*

3.5 Mounting

Do not screw in using the housing! Tightening this way can cause damage to the rotary mechanism on the housing.

- *Prior to installing the transmitter, it is essential to verify whether the version of the device on hand completely fulfils the technical and safety requirements of the measuring point. This applies in particular to the measuring range, overpressure resistance, temperature, explosion protection and operating voltage.*
- *Check the materials used for the wetted parts (e.g. gasket, process connection, separating diaphragm etc.) for suitability as regards process compatibility.*
- *The device must not be heated by radiated heat (e.g. exposure to the sun) to an electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*

4.1 Safety instructions

*All work on the electrical connections may only be carried out with the power disconnected.
Take note of the voltage data on the nameplate!*

Observe the national regulations for electrical installations!

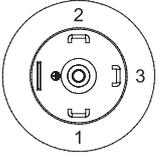
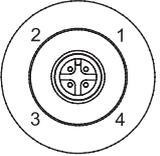
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

*Observe without fail the local occupational health and safety regulations.
Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.*

*Look at the device nameplate to ensure that the device is delivered according to your order.
Check for the correct supply voltage printed on the nameplate.*

4.2 Terminal assignment

Install the device only when depressurised and without power!

Electrical connections	ISO 4400	M12x1 (4-pin)	Field housing
-			-
Supply +	1	1	wh (white)
Supply -	2	2	bn (brown)
Shielding	Ground contact	4	gn/ye (green/yellow)

4.3 Electrical connection diagram

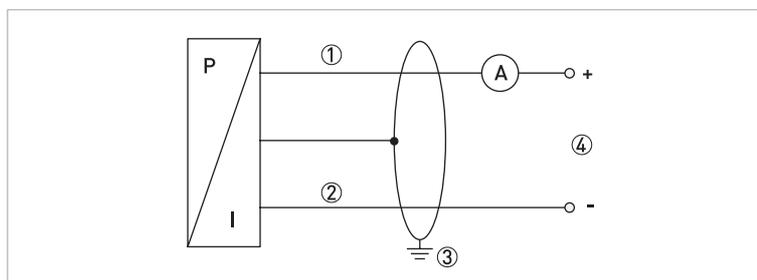


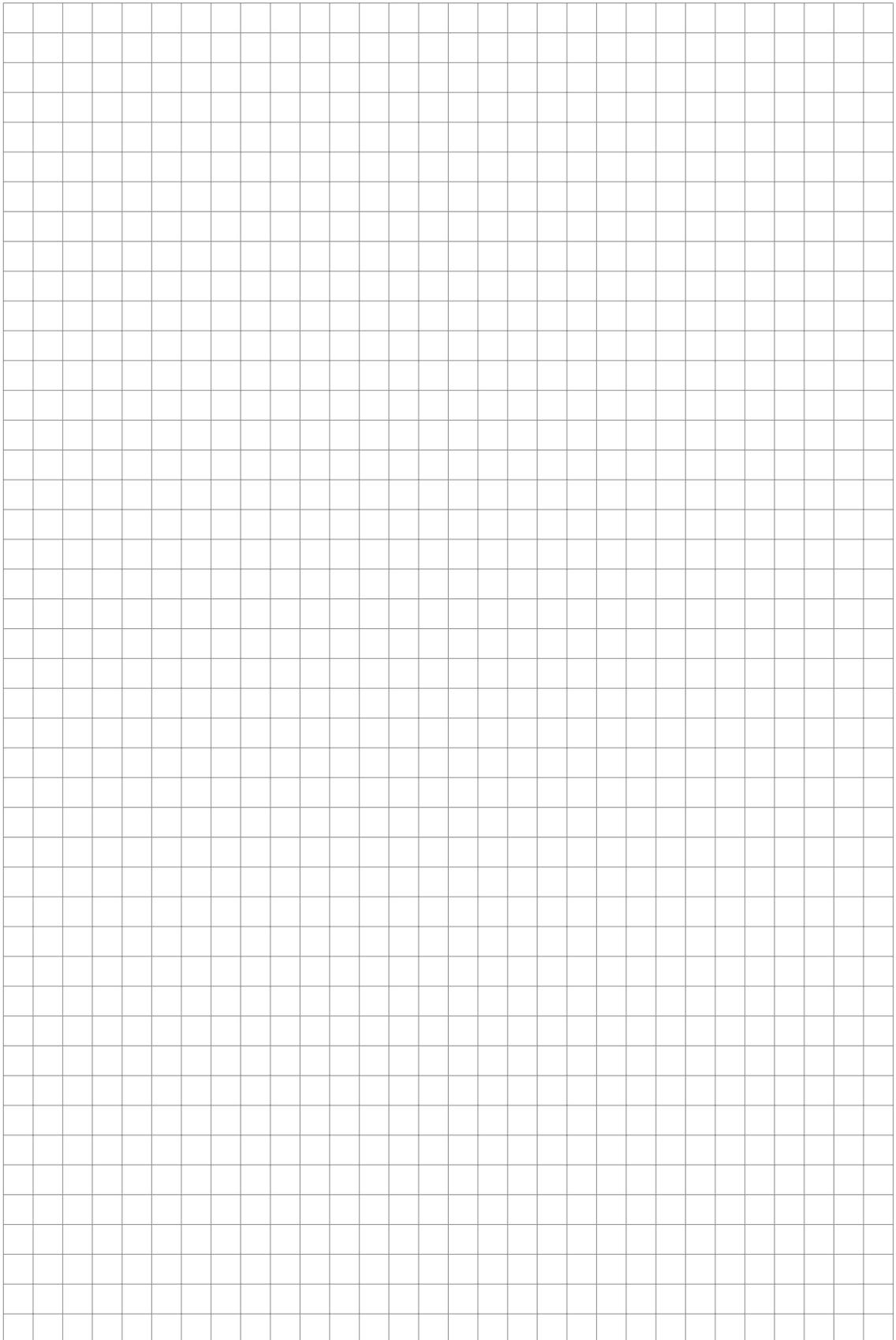
Figure 4-1: Electrical connection diagram 2-wire 4...20 mA

- ① Supply +
- ② Supply -
- ③ Shielding

The characters of the order code highlighted in light grey describe the standard.

Sensor		
VGK2	4 Version	
	A Absolute pressure	
	R Gauge pressure	
	N Gauge pressure with negative nominal measuring range (-1...x)	
	Measuring range	
	1	100 mbar / 10 kPa / 1.5 psi
	2	160 mbar / 16 kPa / 2.3 psi
	4	250 mbar / 25 kPa / 3.6 psi
	5	400 mbar / 40 kPa / 6 psi
	6	500 mbar / 50 kPa / 7.5 psi
	7	600 mbar / 60 kPa / 8.7 psi
	A	1.0 bar / 100 kPa / 15 psi
	B	1.6 bar / 160 kPa / 23 psi
	C	2.0 bar / 200 kPa / 30 psi
	D	2.5 bar / 250 kPa / 36 psi
	E	4.0 bar / 40 kPa / 60 psi
	F	5.0 bar / 500 kPa / 75 psi
	G	6.0 bar / 600 kPa / 87 psi
	H	10 bar / 1 MPa / 150 psi
	K	16 bar / 1.6 MPa / 232 psi
	M	25 bar / 2.5 MPa / 375 psi
	N	40 bar / 4 MPa / 600 psi
	Z	Customer specific measuring range (on request)
	Process connection / Material	
	0	Thread ISO 228 G1/2", DIN 3852; 316L, ($P_N \geq 1$ bar)
	1	Thread ISO 228 G3/4", DIN 3852; 316L, ($P_N \geq 600$ mbar)
	2	Thread ISO 228 G1", DIN 3852; 316L
	7	Thread ISO 228 G1/2", hygienic design; DIN 3852; 316L
	8	Thread ISO 228 G1", hygienic design; DIN 3852; 316L
	B	Clamp DN25 (1"); PN16; DIN 32676 / ISO 2852; 316L; 3-A ($P_N \geq 250$ mbar);
	C	Clamp DN38 (1 1/2"); PN16; DIN 32676 / ISO 2852; 3-A
	D	Clamp DN51 (2"); PN16; DIN 32676 / ISO 2852; 3-A
	K	Thread ISO 228 G1", Cone; 316L; ($P_N \geq 600$ mbar)
V	Varivent® DN40-162; PN25; 316L; 3-A	
Z	Customer process connection	
Diaphragm / Fill fluid		
S	Stainless steel 316L (1.4435) / silicone oil (standard for process connections 0...2)	
T	Stainless steel 316L (1.4435) / FDA approved food grade oil (standard for process connections 7...V)	

Accuracy class	
2	0.25%
5	0.5% ($P_N < 400$ mbar; measuring range code: 0...4)
Special	
0	Without
C	Cooling fins ($T_{Process} \leq +300^\circ\text{C} / +572^\circ\text{F}$)
Sealing (sensor / process connection)	
0	Without (standard for process connections B...V)
V	FKM ($T_{Process} \leq +200^\circ\text{C} / +392^\circ\text{F}$; standard for process connections 0...8)
F	FFKM ($T_{Process} > +200^\circ\text{C} / +392^\circ\text{F}$; standard for process connections 0...8)
Approval	
0	Without
1	ATEX/IECEX group II, category 1G + 1D, Ex ia
SIL	
0	Without
Output	
0	2-wire 4...20 mA
Electrical connection	
M	Plug M12x1; 4-pin; IP67
V	Valve connector ISO 4400; M16; IP65
F	Field housing M12x1.5; 1.4301 (AISI 304); IP67
Language - Manual	
1	EN - English
2	DE - German
F	FR - French
P	PT - Portuguese (on request)
L	PL - Polish (on request)
R	RU - Russian (on request)
Z	CZ - Czech (on request)
Services	
0	Without
M	see additional VZPA/B code
Marking	
0	Without
T	Tag Plate (30 x 19mm)



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