

Technical manual BA 0419



Hydrocont B

Hydrostatic filling level sensor – Ø 40mm

for continuous measurement
of filling levels and temperatures in liquids

High accuracy and long term stable filling level measurement

Ceramic highly overload resp. pressure blow resistive membrane

Food- and drinking water suitable materials

Large selection of styles and materials

ATEX II 1/2 G Ex ia IIC T4 Ga/Gb resp. ATEX II 2 G Ex ib IIC T4 Gb

Certificated for the use in explosive hazardous areas

Integrated evaluation electronic in 2-wire-technology with

- current output 4...20mA, or
- pulse frequency modulated PFM-current signal 90...520 Hz

Integrated over voltage protection

Integrated temperature measurement with Pt100


Customer specific adjustment

ACS-CONTROL-SYSTEM
know how mit system



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Application

The device **Hydrocont B** with integrated analogue evaluation electronic is a compact transmitter for continuous measuring of fill levels and temperatures in liquids at hydrostatic pressures from 0 up to 20 bar within pressure less container, also in explosive hazardous areas, at process temperatures from – 20°C to +120°C.

The use of a capacitive measuring sensor with ceramic membrane, allows the use in nearly all fields of industry resp. of the water industry, like e.g. the measurement of levels in reservoirs, clarification basins, deep wells etc., but also the fill level measurement in closed containers.

Application fields are e.g. water, waste water, solvents, oil, sludge, fat, cleaning liquids, etc.

For hygienic applications, where food or drink water suitability is necessary, a corresponding variant can be ordered where only suitable materials are used.

Function

The device **Hydrocont B** is sunken down into the liquid by the carrying cable and a suitable fastening, e.g. cable clamp fixing, screw plug or connection housing with process connection.

Measuring principle

The device **Hydrocont B** is used for filling level measurement by measuring the hydrostatic pressure.

The height of the liquid column over the measuring membrane causes on the measuring membrane the so-called hydrostatic pressure, that is defined besides the height of the liquid column also by the density of the liquid and the gravitational constant.

$$h = \frac{p}{\rho * g}$$

with h height (filling level)
 p pressure
 ρ density of the liquid
 g gravitational constant

Characteristics of the ceramic measuring membrane

The hydrostatic pressure of the liquid is applied to the ceramic membrane and causes there a variation of the capacity at the back side of the membrane.

A pressure transmitting liquid is not used.

The ceramic membrane offers excellent characteristics like highest pressure and pressure blow strength up to eighty times the nominal pressure, high resistance against chemicals, corrosion and abrasion as well as very good insensitiveness against temperature shocks, highest accuracy and reproducibility, good long term stability and a very low temperature influence.

Signal processing

The filling level proportional hydrostatic pressure signal of the ceramic membrane is measured by the integrated analogue electronic and converted in a output current signal of 4...20mA or into a pulse frequency modulated current signal of 90...520 Hz. The PFM current signal allows transmission distances of more 1000 m.

The measurement signal range is adjusted by factory in many standard measurement ranges. A factory provided adjustment by customer specification is also possible.

Optionally a temperature dependent resistor Pt100 in 3-wire-technology can be integrated in the sensor. By this temperature measurement resistor a temperature measurement of the filling medium with removing the lead resistance can be realized in parallel to the filling level measurement.

When using a wall installation housing a Pt100 – transmitter can be integrated that is adjusted by customer specification.

Integrated over voltage protection components prevents the filling level sensor from destruction by atmospheric influences like e.g. thunderstrike.

Permissible pressure to the measuring membrane

measurement range	vacuum	overload / burst pressure
0...50 mbar	0,7 bar _{abs}	+4 bar _{rel}
0...100 mbar	0,7 bar _{abs}	+4 bar _{rel}
0...200 mbar	0,5 bar _{abs}	+6 bar _{rel}
0...400 mbar	0 bar _{abs}	+6 bar _{rel}
0...600 mbar	0 bar _{abs}	+10 bar _{rel}
0...1000 mbar	0 bar _{abs}	+10 bar _{rel}
0...2000 mbar	0 bar _{abs}	+18 bar _{rel}
0...4000 mbar	0 bar _{abs}	+25 bar _{rel}
0...5000 mbar	0 bar _{abs}	+40 bar _{rel}
0...6000 mbar	0 bar _{abs}	+40 bar _{rel}
0...10000 mbar	0 bar _{abs}	+40 bar _{rel}
0...20000 mbar	0 bar _{abs}	+40 bar _{rel}
0...1 mwc	0,7 bar _{abs}	+4 bar _{rel}
0...2 mwc	0,5 bar _{abs}	+6 bar _{rel}
0...4 mwc	0 bar _{abs}	+6 bar _{rel}
0...5 mwc	0 bar _{abs}	+10 bar _{rel}
0...6 mwc	0 bar _{abs}	+10 bar _{rel}
0...10 mwc	0 bar _{abs}	+10 bar _{rel}
0...20 mwc	0 bar _{abs}	+18 bar _{rel}
0...25 mwc	0 bar _{abs}	+25 bar _{rel}
0...40 mwc	0 bar _{abs}	+25 bar _{rel}
0...50 mwc	0 bar _{abs}	+40 bar _{rel}
0...60 mwc	0 bar _{abs}	+40 bar _{rel}
0...100 mwc	0 bar _{abs}	+40 bar _{rel}

Safety notes


Each person that is engaged with inauguration and operation of this device, must have read and understood this technical manual and especially the safety notes.



Installation, electrical connection, inauguration and operation of the device must be made by a qualified employee according to the informations in this technical manual and the relevant standards and rules.

The device may only be used within the permitted operation limits that are listed in this technical manual. Every use besides these limits as agreed can lead to serious dangers.

The materials of the device must be chosen resp. checked for suitability to the respective application requirements (contacting substances, process temperature). An unsuitable material can lead to damage, abnormal behavior or destruction of the device and to the resulting dangers.

The device meets the legal requirements of all relevant EC directives.  0158

Safety notes for electrical operating supplies for explosive hazardous areas

If a device is installed and operated in explosive hazardous areas, the general Ex construction standards (EN60079-14, VDE0165), this safety notes and the enclosed EC conformity certificate must be observed.

The installation of explosive hazardous systems must be carried out principally by specialist staff.

The device meets the classification:

II 1/2 G Ex ia IIC T4 Ga/Gb

II 2 G Ex ib IIC T4 Ga

The devices are conceived for measurement of filling levels in explosive hazardous areas.

The measured medium may also be combustible liquids, gases, fogs or steams.

The permitted operating temperatures and pressures are type and variant dependent and can be found in this technical manual.

For applications, which require devices of category 1/2, the process pressure and temperature range of the media has to be between 0,8 bar and 1,1 bar and between -20 °C and 60 °C.

The wall installation housing of variant Hydrocont Ex_BW... resp. the connection housing at the variant Hydrocont Ex_BOG... must be installed outside Ex-zone 0.

The device with over voltage protection Hydrocont Ex1B__0__P... is earthen for safe technical function. Provide sufficient potential compensation along the complete cable way.

Connect the PA-clamp in the wall installation housing or the in the connection housing with the potential compensation of the explosive hazardous area. Install the intrinsically safe circuit earth free.

At variants of the devices with chargeable plastic parts (e.g. wall installation housing, connection housing, cable), a warning marking points out to the safety measures, that must be applied because of the electrostatic charging in operation and especially in the case of maintenance activities.

avoid friction - no dry cleaning - no assembling in pneumatic conveying stream

Installation

Avoid faulting the pressure compensation capillary at the connection side of the carrying cable or cable connection resp. the pressure compensation element of the wall installation housing or connection housing. The hindrance of the air pressure compensation can lead to faulty measurement results.

The environmental air pressure is supplied to the measurement membrane of the probe by a pressure compensation capillary that is integrated in the carrying cable. This capillary may not be folded or sealed. To avoid faulting, a micro air filter is placed at the end of the capillary.

In the case of an application conditioned cutting of the carrying cable there must be especially paid attention that this micro air filter will be replaced to the end of the capillary after the cutting.

At the variant with connection housing – Hydrocont B0G – a user sided cutting of the carrying cable is not scheduled.

After the installation of the cable resp. cables the cable glands of the wall installation housing or connection housing must be fixed screwed on to achieve the tightness of the housing. This is also valid for the respective cover of the housing.

Strange substances that come into the housing can lead to faulty measurement results or to the destruction of the device and to the resulting dangers.

For simplifying the system sided cable run the connection head of the variant with connection housing – Hydrocont B0G – can be arbitrary rotated after installation of the device.

After the opening of the housing at first pull out the clamp plate after removing the two screws that fixes the clamp plate.

At pulling out the clamp plate take care that the sensor cables that are connected at the bottom side of the clamp plate will not be damaged or detached.

Loosen now the three screws below. Rotate the connection head into the desired orientation. After that fix the three screws, put in the clamp plate and fix it again with the two screws.

Maintenance

The device is free of maintenance.

Special substances can lead to solid coatings on the membrane.

Such depositions can lead to faulty measurement results of the device.

In the case of coat forming liquids the membrane must be regularly cleaned e.g. with clear water.

Don't use sharp tools or aggressive chemicals for cleaning.

Repair

A repair may only be carried out by the manufacturer.

If the device must be sent back for repair, the following informations must be enclosed:

- An exact description of the application.
- The chemical and physical characteristics of the product.
- A short description of the occurred error.

Before returning the device for repair, the following measures must be proceeded:

- All stick product residues must be removed. This is especially important, if the product is unhealthy, e.g. caustic, toxic, carcinogenic, radioactive etc.
- A returning must be refrained, if it is not possible by 100% to remove the unhealthy product completely, because e.g. it is penetrate into cracks or is diffused through plastic.

Electrical connection

The electrical connection of the device must be carried out according to the respective country specific standards. Incorrect installation or adjustment could cause applicationally conditioned risks.

Use only twisted shielded signal and measurement wires and install these wires separated from power leading wires. Connect the cable shield only at one side to earth, ideally at the installation place of the device. The earthing of the cable shield of an connected cable can be done at the installation place of the wall installation housing or connection housing by using the terminal PE.

The metallic parts of the device (probe housing, screwing thread of the connection housing) are electrically connected with the terminal PE in the connection housing resp. with the shield connection of the open cable connection.

The cable glands are suitable für cable diameter from 7 to 13 mm.

After the installation of the cable the cable gland must be firmly screwed to ensure the tightness of the connection housing. The same is valid for the housing cap.

The voltage applied to the plug contacts may not exceed 45 V, at the variant with PFM signal 30 V, to avoid damage of the electronic.

All connections are polarity protected.

A load, e.g. the measuring shunt of an evaluation device, in series with a device with 4...20 mA current signal in 2-wire-technology reduces the supply voltage available at the device. This results in a maximum value for this resistor, where a correct function is still possible.

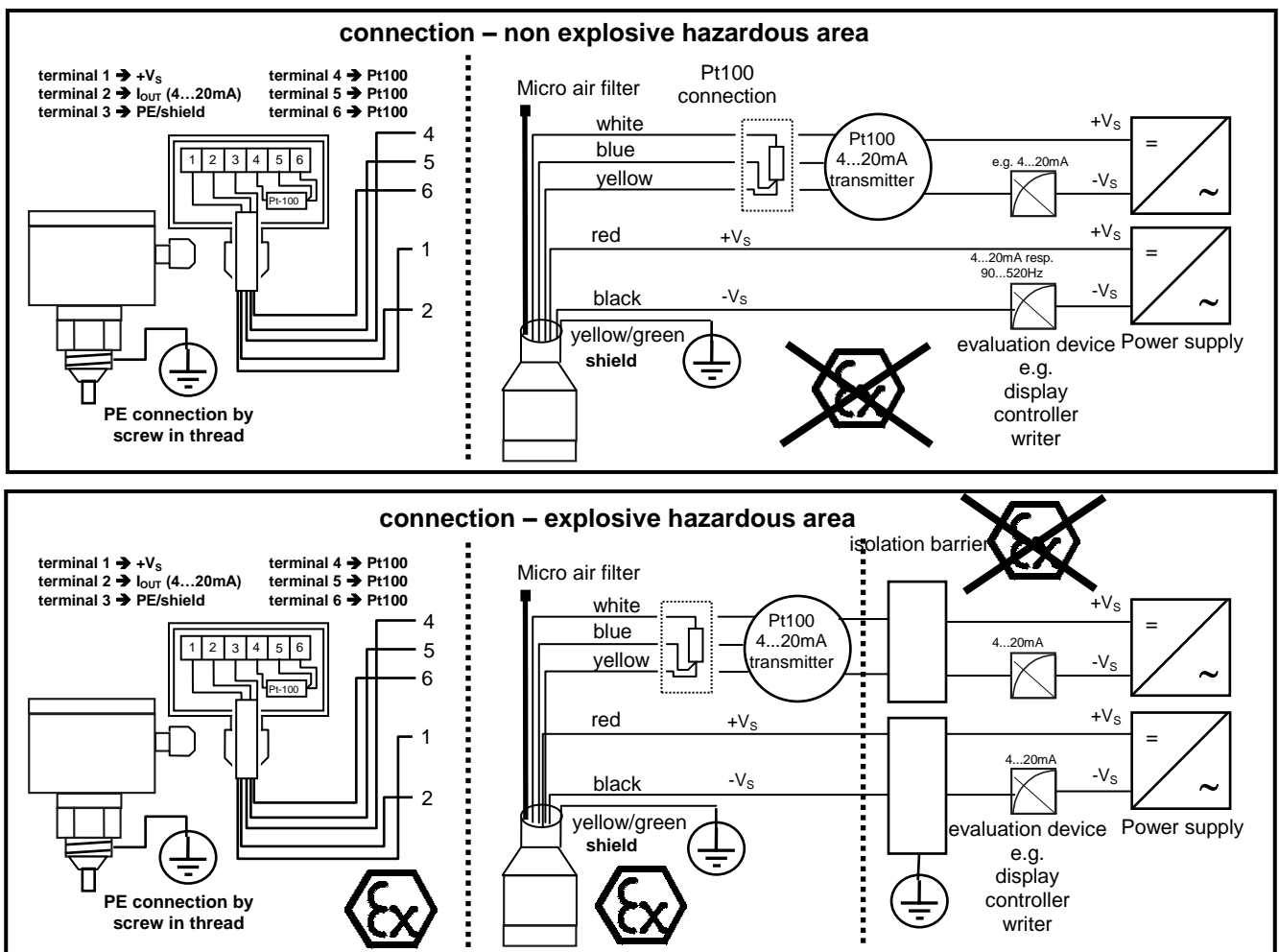
The maximum load at signal current 20mA can be calculated by the equation:

$$R_L \text{ max} = (V_S - 11,5V) / 20\text{mA} \text{ with } V_S = \text{applying supply voltage.}$$

The integrated temperature measurement resistor Pt100 is galvanically separated against the fill level evaluation circuit and against the metallic parts of the device up to 500 V_{AC}.

Informations for the connection of the temperature measurement resistor Pt100 to the used Pt100-transmitter can be found in the technical manual of the transmitter.

For inauguration it is suggested, to deactivate all connected control devices, to avoid unwanted control reactions.



Technical data

Auxiliary supply

Supply voltage:	reverse polarity protected <u>Signal 4...20mA</u> 11,5 to 45 V DC at Ex-type 11,5 V to 30 V DC at earthed –L-connection and overvoltage protection 11,5 V to 30 V DC <u>Signal 90...520Hz</u> 13 V to 30 V DC
Ripple voltage:	$\leq 2 V_{PP}$ condition: within the permitted supply voltage range

Signal output 4...20mA / 90...520Hz

Signal type:	<u>Signal 4...20mA</u> linear characteristic from ≤ 4 mA resp. ≥ 20 mA, minimum 2,75 mA \pm 0,75 mA / maximum 27 mA <u>Signal 90...520Hz</u> signal 5mA \pm 10%, overlapping supply current (10mA), $T_{Pulse}=110\mu s\pm 20\%$
Permitted load:	$R_L \max = (V_S - V_{S \min}) / 20mA$ $V_{S \min} = 11,5$ V resp. 13 V
Characteristic deviation ^{3) 5) 12)} :	$\leq 0,1\%$ resp. $0,2\%$ FS ²⁾
Nonlinearity ¹²⁾ :	$\leq \pm 0,1\%$ / $0,2\%$ FS ²⁾
Hysteresis ¹²⁾ :	negligible
Long term deviation ¹²⁾ :	$\leq \pm 0,1\%$ FS ²⁾ / year not cumulative
Temperature deviation ¹²⁾ :	T_k ⁴⁾ Zero $\leq \pm 0,10\%$ FS ²⁾ / 10 K, max. $\pm 0,75\%$ FS ²⁾ T_k ⁴⁾ Span $\leq \pm 0,10\%$ FS ²⁾ / 10 K, max. $\pm 0,5\%$ FS ²⁾ $\leq \pm 0,10\%$ FS ²⁾ / 10 K, max. $\pm 0,8\%$ FS ²⁾ ($\leq 0..0,4$ bar)
Influence of supply voltage:	$\leq \pm 0,01\%$ FS ²⁾ / 10V
Minimum delay time:	≤ 2 ms

Signal output temperature

Sensor type:	Pt100 class B 3-wire-connection
Measurement deviation ⁸⁾ :	$\leq \pm (0,25 K + 0,3 K + 0,005 * [t])$ equals e.g. $\leq 0,9$ K at $+70^\circ C$ with $[t]$ = process temperature in $^\circ C$, no sign, unit K
Long term deviation ⁸⁾ :	$\leq \pm 0,15$ K / year ⁸⁾
Rise time ⁹⁾ :	$t_{90} \leq 240$ s
Transmitter:	Optionally integrated in the wall installation housing for converting the Pt100 signal into a temperature proportional analogue signal Type e.g. KTM or ExKTM, with standard measurement ranges or adjustment by customer specification, signal 4...20 mA or 0...10V. Read the technical manual of the respective Pt100 transmitter.

Over voltage protection

Category:	not available for Ex-variant Ex0B coarse protection / fine protection
Signal voltage:	max. 30V peak value, to PE connection
Nominal bypass surge current:	10 000 A – wave 8/20 μs
Trigger voltage:	90V coarse protection 33V fine protection

- ²⁾ Referring to nominal measuring span resp. full scale (FS)
³⁾ Nonlinearity + Hysteresis + Reproducibility
⁴⁾ T_k = Temperature coefficient
⁵⁾ At limit point adjustment
⁸⁾ At reference conditions
⁹⁾ According to DIN EN 60751 / water / 0,4 m/s / temperature step 23 to 33 $^\circ C$
¹²⁾ Higher values for special measuring range

Technical data

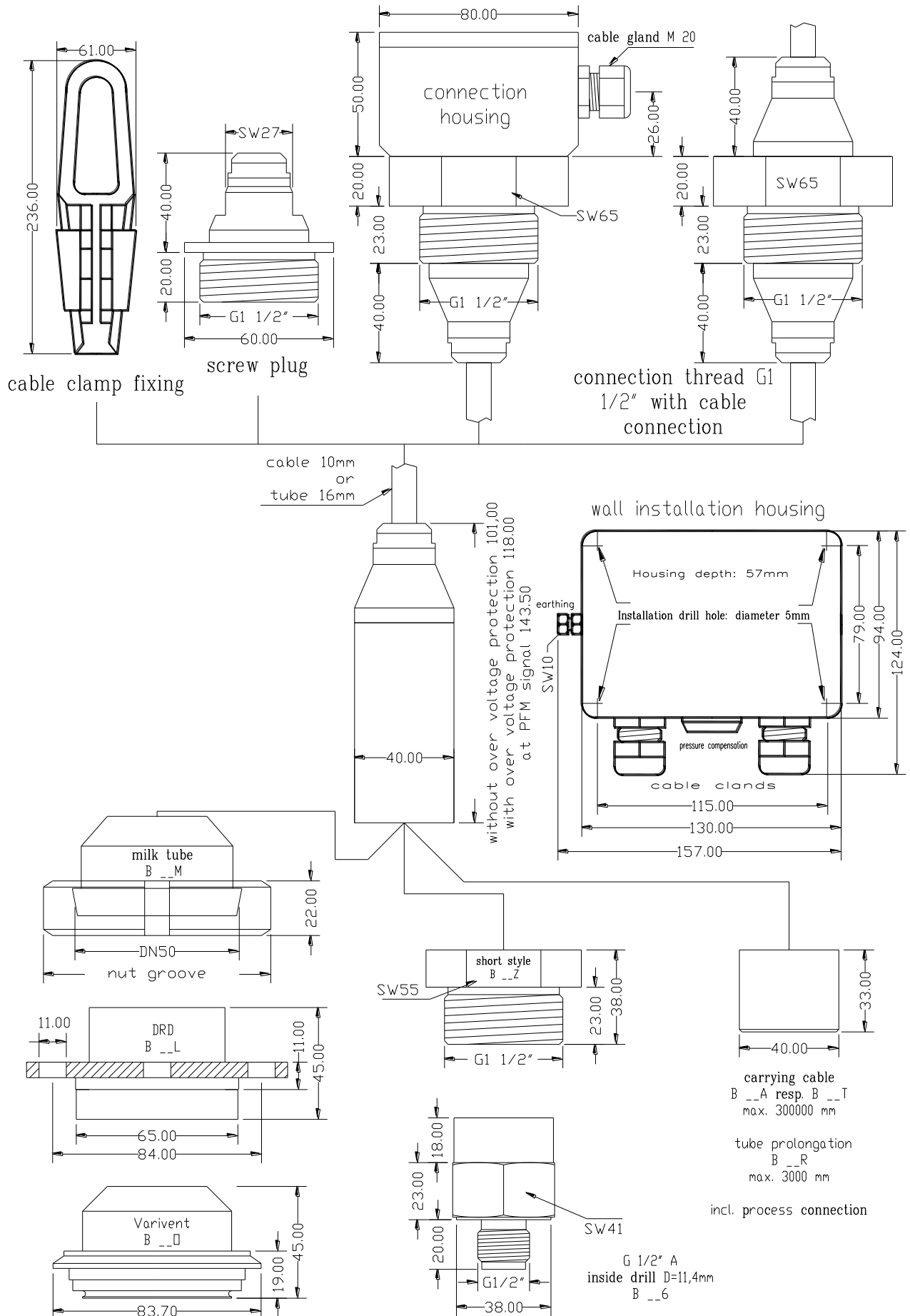
Materials

Membrane: (medium contact)	Ceramic AL ₂ O ₃	99,9%
Probe: (medium contact)	Steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti) / navy bronze CU SN 12 / hastelloy C / PEEK / titanium	
Carrying cable: (medium contact)	PE – polyethylene FEP – fluorinatedethylenepropylene	
Tube prolongation: (medium contact)	Steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)	
Screw plug:	CrNi-steel	
Connection housing:	Connection head	POM – polyoxymethylene (Delrin®) / PP – polypropylene / CrNi-steel
	Screw-in thread	CrNi-steel
Wall installation housing:	PS – polystyrene or PC – polycarbonate	
Cable gland:	Housing PA – polyamide resp. CrNi-steel, gaskets CR / NBR	
Connection cable:	PE – polyethylene	
Pressure compens. element:	PTFE or PES	
Cable clamp fixing:	Steel, hot galvanized, jaw weather proof plastic CrNi-steel	
Gaskets:	medium contact	→ FPM – fluorelastomere (Viton®) EPDM – etylene-propylene-dienmonomere CR – chloroprene-rubber (Neopren®) FFKM – perfluorelastomere (Kalrez®)
	others	→ FPM – fluorelastomere (Viton®) silicone

Environmental conditions

Environmental temperature:	Standard - carrying cable (A / T)	– 20°C...+70°C	
	Others (R / Z / 6 / M / L / O)	– 20°C...+85°C	
	Wall installation housing	– 20°C...+70°C	
	Connection cable	– 20°C...+70°C	
Process temperatures:	Standard - carrying cable (A / T)	– 20°C...+70°C	
	Tube prolongation (R)	– 20°C...+85°C	
	Others (Z / 6 / M / L / O)	– 20°C...+125°C	
	Gasket - CR	– 20°C...+120°C	
	Gasket - FFKM / FFKM hd	– 15°C...+125°C	
Process pressure range:	0... 20 bar		
Vacuum- / overload resistance:	depends on meas. range, see table perm. pressure to the membrane		
Weight:	0,4 kg + (sensor length in meter x 0,04 kg)		
Protection classification:	Probe	IP68	DIN EN 60529
	Screw plug	IP67	DIN EN 60529
	Connection housing	IP67	DIN EN 60529
	Wall installation housing	IP65	DIN EN 60529
Climatic classification:	4K4H	DIN EN 60721-3-4	
Shock classification:	15 g / 11ms	DIN EN 60068-2-27	
EM – compatibility:	Emission	DIN EN 61326-1	operation device class B
	Immunity	DIN EN 61326-1	industrial range
Reference conditions:	DIN EN 60770-1		
	T = 25 °C, relative humidity 45...75 %, environmental air pressure 860...1060 kPa		

Dimension drawing



Order code

Type:

B	standard	
Ex0B	ATEX II 1/2 G Ex ia IIC T4 Ga/Gb	not for variant electronic – output type P – 90...520Hz
Ex1B	ATEX II 2 G Ex ib IIC T4 Ga	not for variant electronic – output type P – 90...520Hz
Ex2B	ATEX II 2 G Ex ia IIC T6 (bei HART)	

Wall installation housing:

0	without wall installation housing
W	wall installation housing

Put-in device – process connection:

0	without put-in device		
S	cable clamp fixing	steel, hot galvanized	
U	cable clamp fixing	CrNi-steel	
V	screw plug	G 1½"	steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)
G	connection housing	G 1½"	DIN EN ISO228-1 material like material – probe
H	connection thread	G 1½"	DIN EN ISO228-1 material like material – probe cable connection specify cable length

Variant sensor – process connection:

A	standard
T	food and drink water suitability of all medium contacting materials
R	tube prolongation Ø 16mm only for connection housing – type G or connection thread – type H
Z	Thread ISO 228-1 – G½"B
6	Thread ISO 228-1 – G½"B, inner bore
M	Dairy coupling DIN 11851 – DN50, PN25
L	DRD – DN50 / Ø65mm, PN25
O	Varivent® – Type N / tube DN40-162 / 1½"-6", PN40

Electronic – output:

0	2-wire-technology	4...20 mA
P	2-wire-technology	PFM 90...520 Hz

Measurement range:

P	0...50 mbar	A	0...1 m water column (mwc)
8	0...100 mbar	B	0...2 m water column (mwc)
0	0...200 mbar	C	0...4 m water column (mwc)
1	0...400 mbar	M	0...5 m water column (mwc)
6	0...600 mbar	D	0...6 m water column (mwc)
2	0...1000 mbar	E	0...10 m water column (mwc)
3	0...2000 mbar	F	0...20 m water column (mwc)
4	0...4000 mbar	L	0...25 m water column (mwc)
9	0...5000 mbar	G	0...40 m water column (mwc)
7	0...6000 mbar	J	0...50 m water column (mwc)
5	0...10000 mbar	K	0...60 m water column (mwc)
Z	0...20000 mbar	H	0...100 m water column (mwc)
		Y	special measuring range separate spec. necessary

Accuracy measuring system¹⁾ – material measuring membrane (medium contact):

H	0,2%	ceramic AL ₂ O ₃	99,9% (highly clean)
L	0,1%	Linearization protocol ceramic AL ₂ O ₃	99,9% (highly clean)

Over voltage protection:

0	without over voltage protection
P	integrated over voltage protection not für variant type Ex0B

Temperature sensor:

0	without temperature sensor
1	integrated temperature sensor Pt100
2	integrated temperature sensor Pt100 with an installed Pt100 transmitter in the wall installation housing specify temperature measurement range separately

Material probe (medium contact):

1	steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)
3	navy bronze CU SN 12
4	hastelloy C
6	PEEK
7	titanium

Material gaskets (medium contact):

1	FPM fluorelastomere (Viton®)
2	CR chloroprene-rubber (Neopren®)
3	EPDM etylene-propylene-dienmonomere for food applications
4	FFKM perfluorelastomere (Kalrez®)
6	FFKM perfluorelastomere high density for gas applications
7	FFKM – perfluorelastomere (Kalrez®) – construction form type R / T /
8	FFKM hd – perfluorelastomere high density – construction form type R / T / S

Material probe prolongation (medium contact):

A	PE polyethylene
E	FEP fluorinated ethylene propylene
D	tube Ø 16mm steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)

Sensor length incl. process connection: measure in mm

Hydrocont

mm

¹⁾ Higher values for special measuring range

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