

# Level Sensors

## Magnetostrictive, high-resolution measuring principle

### Model FFG

WIKA Data Sheet LM 20.01



#### Applications

- High-accuracy level measurement for almost all liquid media
- Chemical industry, petrochemical industry, natural gas, offshore, shipbuilding, machine building, power generating equipment, power stations
- Process water and drinking water treatment, food and beverage industry, pharmaceutical industry

#### Special Features

- Process and system-specific solutions possible
- Operating limits:
  - Operating temperature:  $T = -200 \dots +200 \text{ }^\circ\text{C}$
  - Working pressure:  $P = \text{Vacuum to } 100 \text{ bar}$
  - Limit S. G.:  $\rho \geq 400 \text{ kg/m}^3$
- Wide variety of different electrical connections, process connections and materials
- Explosion-protected versions

#### Description

The WIKA Model FFG sensor acts as a measured value transmitter for high-accuracy, continuous level measurement of liquids and is based on identifying the position of a magnetic float following the magnetostrictive measuring principle.



Level Sensor, Magnetostrictive Measuring Principle, Model FFG; Flange Connection

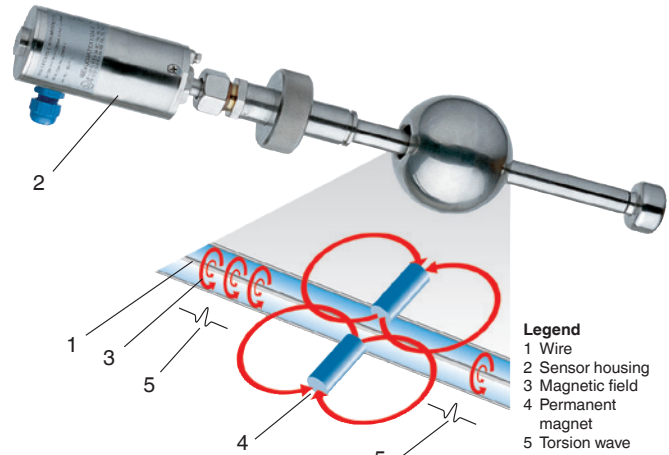
## Further special features

- Large scope of application due to the simple, proven functional principle
- Process connection, guide tube material and float made of stainless steel 1.4571 or plastic
- For harsh operating conditions, long service life
- Continuous measurement of the liquid levels irrespective of physical or chemical changes of state of the measured media, such as: foaming, conductivity, dielectric constant, pressure, vacuum, temperature, vapour, condensation, blistering, effects of boiling, density changes
- Signal transmission over large distances
- Simple installation and commissioning, onetime calibration only, no recalibration necessary.
- Volume-proportional or depth-proportional display of the filling level
- Interface layer measurement and overall level from  $\Delta$ -density 50 kg/m<sup>3</sup>

## Options

- Customer-specific solutions
- Process connection, guide tube material and float made of stainless steel 1.4435, 1.4539, titanium, Hastelloy (others on request)
- In combination with limit switch, stepless setting of the limit values over the entire measuring range

## Illustration of the principle





## Design and operating principle

- The measuring process is initiated by a current impulse. This current generates an axial magnetic field (3) along the length of a wire (1) made of magnetostrictive material, which is held under tension inside the guide tube.
- At the point being measured (liquid level) is a float with permanent magnets (4) acting as a position transducer.
- The interaction of both magnetic fields generates a mechanical torsion wave (5) in the wire.
- This is converted into an electrical signal by a piezoceramic transformer in the sensor housing (2) at the end of the wire.
- The measured propagation delay enables the origination point, and thus the float position, to be determined with high accuracy.

## Product programme

Selection of process connection, material and design  $\Rightarrow$  further information on the indicated pages.

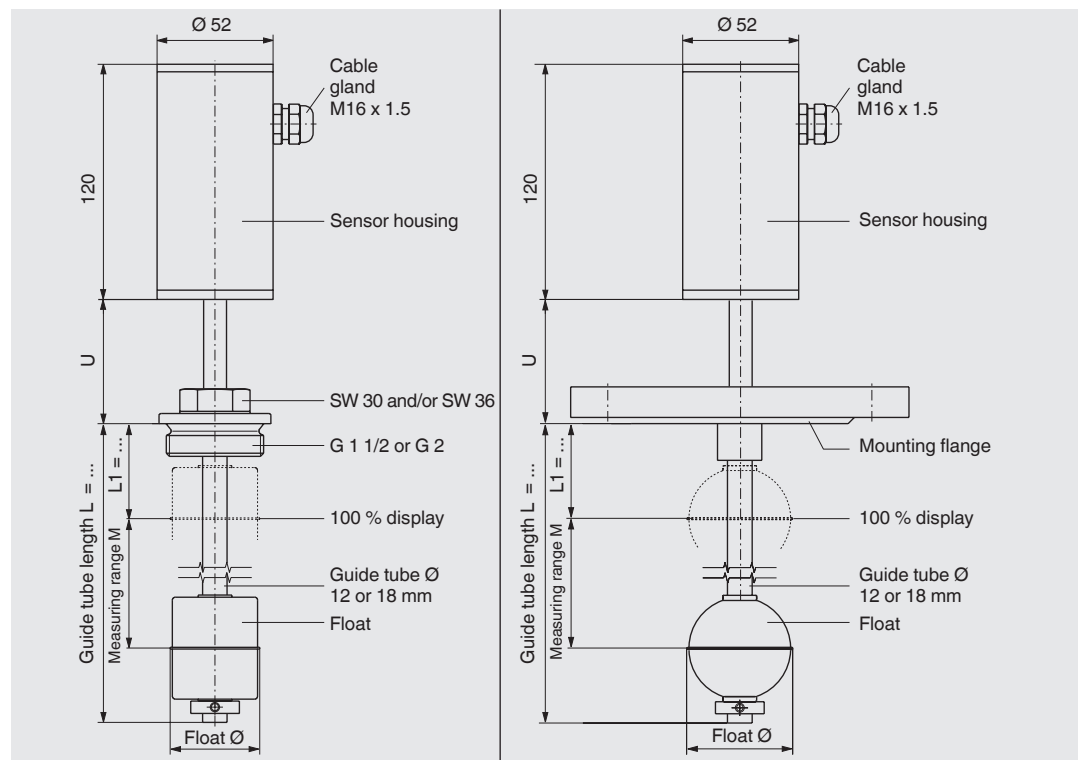
Process connection	Material Stainless steel	Explosion-protected Design	Material PVC / PP / PVDF
 <p><b>Mounting thread</b> G 1 1/2 ... G 2</p>	<p>Page 3 Page 7 (Pharmaceutical design)</p>	<p>Page 4</p>	<p>Page 5</p>
 <p><b>Flange</b> DN 50 ... DN 350 PN 6 ... PN 100</p>	<p>Page 3 Page 6 (E-CTFE coated)</p>	<p>Page 4</p>	<p>Page 5</p>

Float versions: page 7

Determination of the max. guide tube length L for explosion-protected versions, intrinsically safe: page 9

## Standard version

Process connection, guide tube material and float made of stainless steel 1.4571

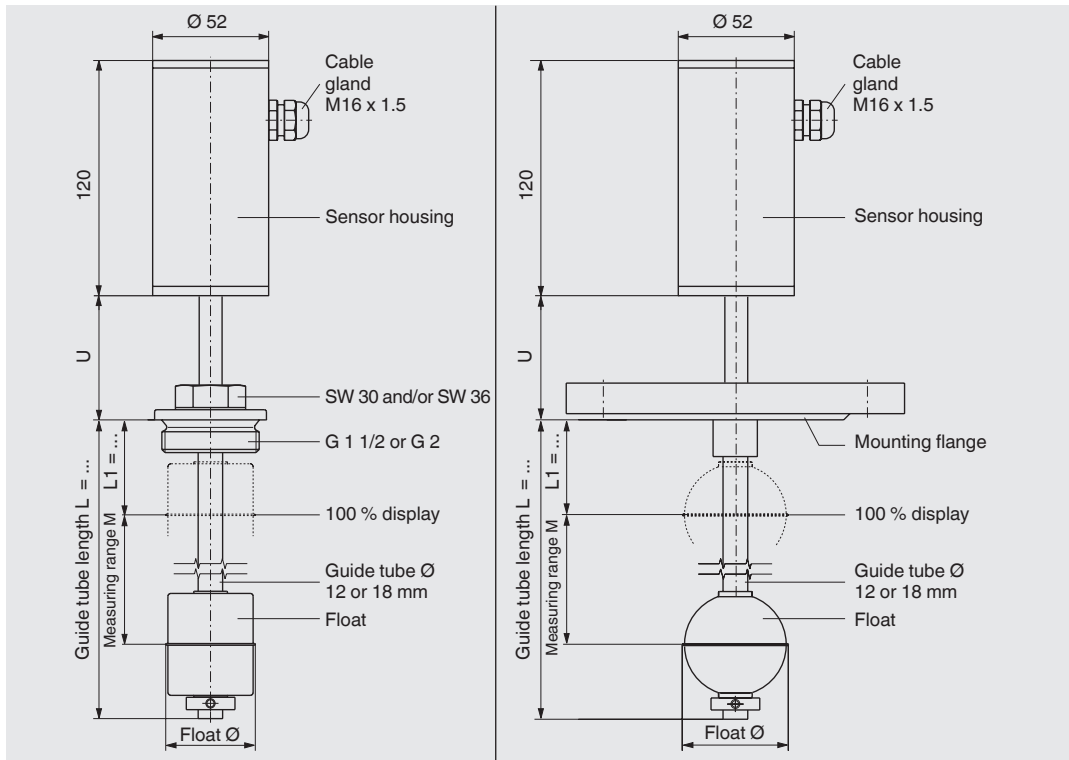


	Mounting thread		Flange	
Electrical connection	Sensor housing ■ Stainless steel 1.4301			
Process connection	Mounting thread downwards G 1 1/2 or G 2		Mounting flange ■ DIN DN 50 ... DN 200, PN 6 ... PN 100 ■ ANSI 2 ... 8, Class 150 ... 600	
Guide tube diameter	12 mm	18 mm	12 mm	18 mm
Guide tube length L max.	3000 mm	6000 mm	6000 mm	6000 mm
Float	Material stainless steel 1.4571 (Option: Buna, titanium) Float diameter from 44 ... 120 mm Float selection depending on guide tube diameter and process conditions (see page 8)			
Max. working pressure	See table on page 8			
Temperature range standard	Medium: -45 ... +125 °C, sensor housing: -40 ... +85 °C Option: ■ High and low temperature version: -200 ... +200 °C			
Output signal	4 ... 20 mA, 2-wire			
Power supply	10 ... 30 V DC			
Error message	Adjustable to 3.6 mA or 21.5 mA			
Measuring accuracy	< ±0.5 mm			
Resolution	< 0.1 mm			
Analogue component	±0.1 % (20 °C) + 0.005 % / K			
Load	900 Ohm at U <sub>B</sub> = DC 30 V ;    650 Ohm at U <sub>B</sub> = DC 24 V ;    100 Ohm at U <sub>B</sub> = DC 12 V			
Mounting position	Vertical ± 30°			
Ingress protection	IP 68 per EN 60 529 / IEC 529			

# Explosion-protected version, intrinsically safe

II 1/2G EEx ia IIC T6-T3 IIBExU 02 ATEX 1124 X

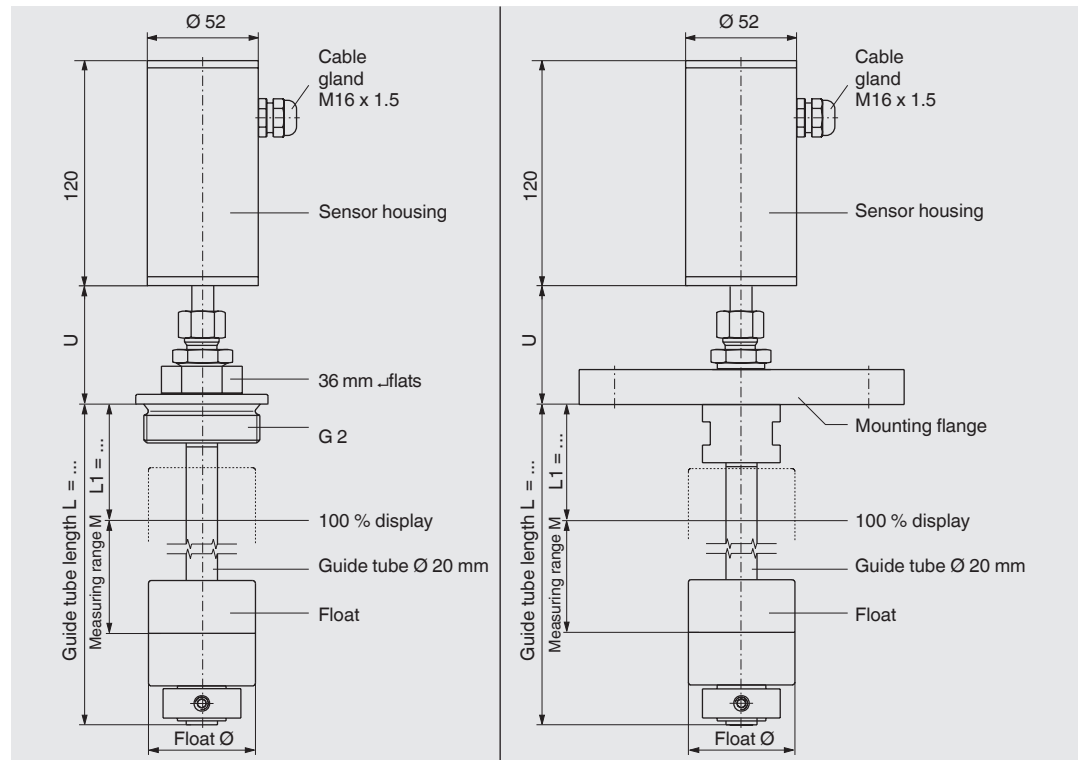
Process connection, guide tube material and float made of stainless steel 1.4571



Mounting thread		Flange			
Electrical connection	Sensor housing	■ Stainless steel 1.4301			
Process connection	Mounting thread downwards G 1 1/2 or G 2	Mounting flange ■ DIN DN 50 ... DN 200, PN 6 ... PN 100 ■ ANSI 2 ... 8, Class 150 ... 600			
Guide tube diameter	12, 17.2 or 18 mm				
Guide tube length L max.	See variants A and B on page 8				
Float	Material stainless steel 1.4571 (Option: Buna, titanium) Float diameter from 44 ... 120 mm Float selection depending on guide tube diameter and process conditions (see page 8)				
Max. working pressure	See table on page 8				
Temperature class	T3	T4	T5	T6	
Process temperature	Max. 85 °C	100 °C	135 °C	150 °C	
Ambient temperature at the sensor housing	Max. 40 °C	55 °C	85 °C	85 °C	
Output signal	4 ... 20 mA, 2-wire				
Power supply	10 ... 30 V DC				
Signal and supply circuit	In intrinsically safe version EEx ib IIC $U_i < 30 \text{ V}$ ; $I_i < 200 \text{ mA}$ ; $L_i < 250 \mu\text{H}$ ; $C_i < 5 \text{ nF}$				
Error message	Adjustable to 3.6 mA or 21.5 mA				
Measuring accuracy	< ±0.5 mm				
Resolution	< 0.1 mm				
Analogue component	±0.1 % (20 °C) + 0.005 % / K				
Load	900 Ohm at $U_B = \text{DC } 30 \text{ V}$ ;		650 Ohm at $U_B = \text{DC } 24 \text{ V}$ ;		100 Ohm at $U_B = \text{DC } 12 \text{ V}$
Mounting position	Vertical ± 30°				
Ingress protection	IP 68 per EN 60 529 / IEC 529				

## Plastic version

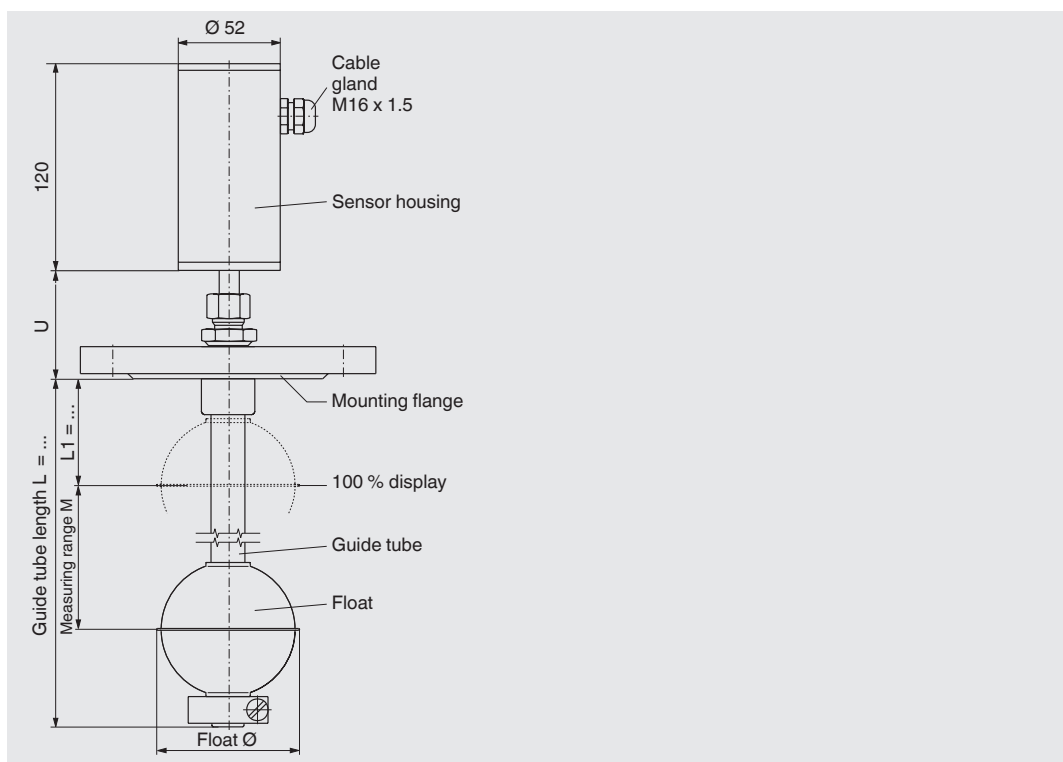
Process connection, guide tube material and float made of PVC, polypropylene or PVDF



	Mounting thread	Flange
Electrical connection	Sensor housing ■ Stainless steel 1.4301	
Process connection	Mounting thread downwards G 2"	Mounting flange ■ DIN DN 65 ... DN 125, PN 10 ■ ANSI 2 1/2" ... 5", Class 150 FF
Guide tube diameter	20 mm	
Guide tube length L max.	3000 mm	
Float	Material ■ PVC ■ Polypropylene ■ PVDF Float diameter from 44 ... 80 mm Float selection depending on guide tube diameter and process conditions (see page 8)	
Max. working pressure	3 bar	
Temperature range standard	Medium: ■ PVC 0 ... +60 °C ■ Polypropylene -10 ... +80 °C ■ PVDF -10 ... +100 °C Sensor housing: -40 ... +85 °C	
Output signal	4 ... 20 mA, 2-wire	
Power supply	10 ... 30 V DC	
Error message	Adjustable to 3.6 mA or 21.5 mA	
Measuring accuracy	< ±0.5 mm	
Resolution	< 0.1 mm	
Analogue component	±0.1 % (20 °C) + 0.005 % / K	
Load	900 Ohm at U <sub>B</sub> = DC 30 V ; 650 Ohm at U <sub>B</sub> = DC 24 V ; 100 Ohm at U <sub>B</sub> = DC 12 V	
Mounting position	Vertical ± 30°	
Ingress protection	IP 68 per EN 60 529 / IEC 529	

## Stainless steel version, E-CTFE coated

Process connection, guide tube material and float made of stainless steel 1.4571, E-CTFE coated



### Flange (Ball float E-CTFE coated)

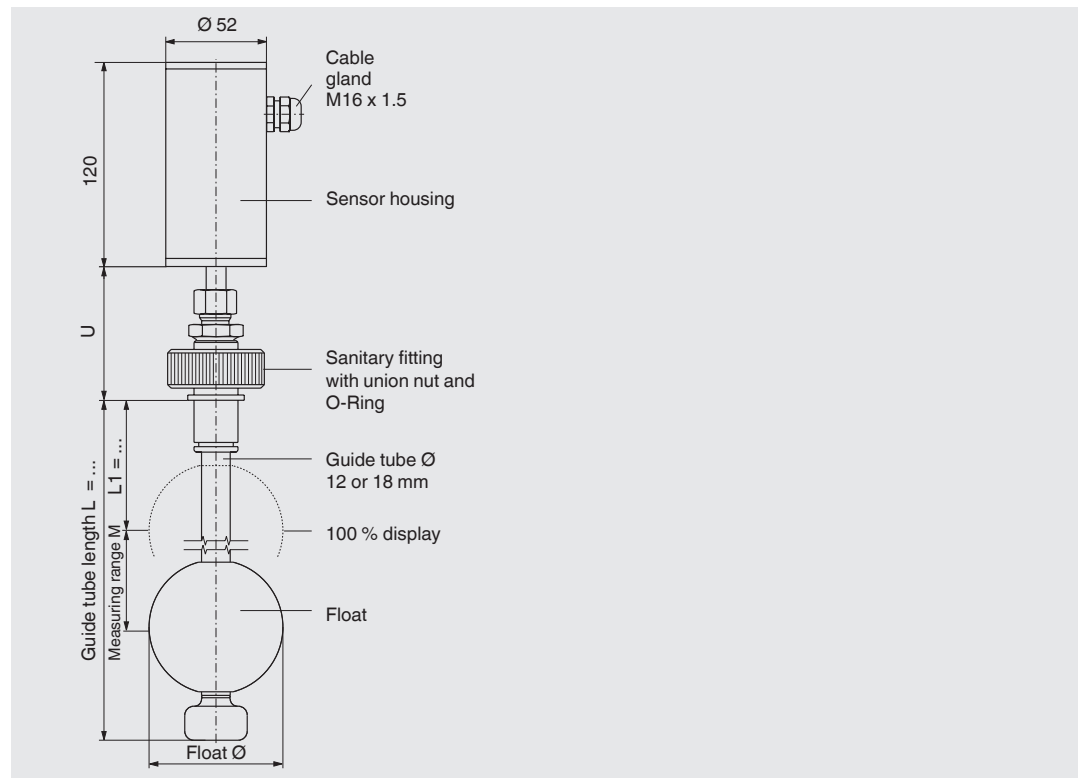
Electrical connection	Sensor housing ■ Stainless steel 1.4301
Process connection	Mounting flange ■ DIN DN 50 ... DN 200, PN 6 ... PN 100 ■ ANSI 2 ... 8, Class 150 ... 600
Guide tube diameter	18 mm
Guide tube length L max.	4000 mm
Float	Material stainless steel 1.4571 (E-CTFE coated or PTFE) Float diameter from 80 ... 121 mm Float selection depending on guide tube diameter and process conditions (see page 8)
Max. working pressure	See table on page 8
Temperature range standard	Depending on medium Sensor housing: -40 ... +85 °C
Output signal	4 ... 20 mA, 2-wire
Power supply	10 ... 30 V DC
Signal and supply circuit	In intrinsically safe version EEx ib IIC $U_i < 30 \text{ V}$ ; $I_i < 200 \text{ mA}$ ; $L_i < 250 \text{ } \mu\text{H}$ ; $C_i < 5 \text{ nF}$
Error message	Adjustable to 3.6 mA or 21.5 mA
Measuring accuracy	$< \pm 0.5 \text{ mm}$
Resolution	$< 0.1 \text{ mm}$
Analogue component	$\pm 0.1 \% (20 \text{ }^\circ\text{C}) + 0.005 \% / \text{K}$
Load	900 Ohm at $U_B = \text{DC } 30 \text{ V}$ ; 650 Ohm at $U_B = \text{DC } 24 \text{ V}$ ; 100 Ohm at $U_B = \text{DC } 12 \text{ V}$
Mounting position	Vertical $\pm 30^\circ$
Ingress protection	IP 68 per EN 60 529 / IEC 529
Option	Coating anti-static

## Pharmaceutical design

Option: Explosion-protected version, intrinsically safe

II 1/2G EEx ia IIC T6-T3 IBEExU 02 ATEX 1124 X

Process connection, guide tube material and float made of stainless steel 1.4435 or 1.4539

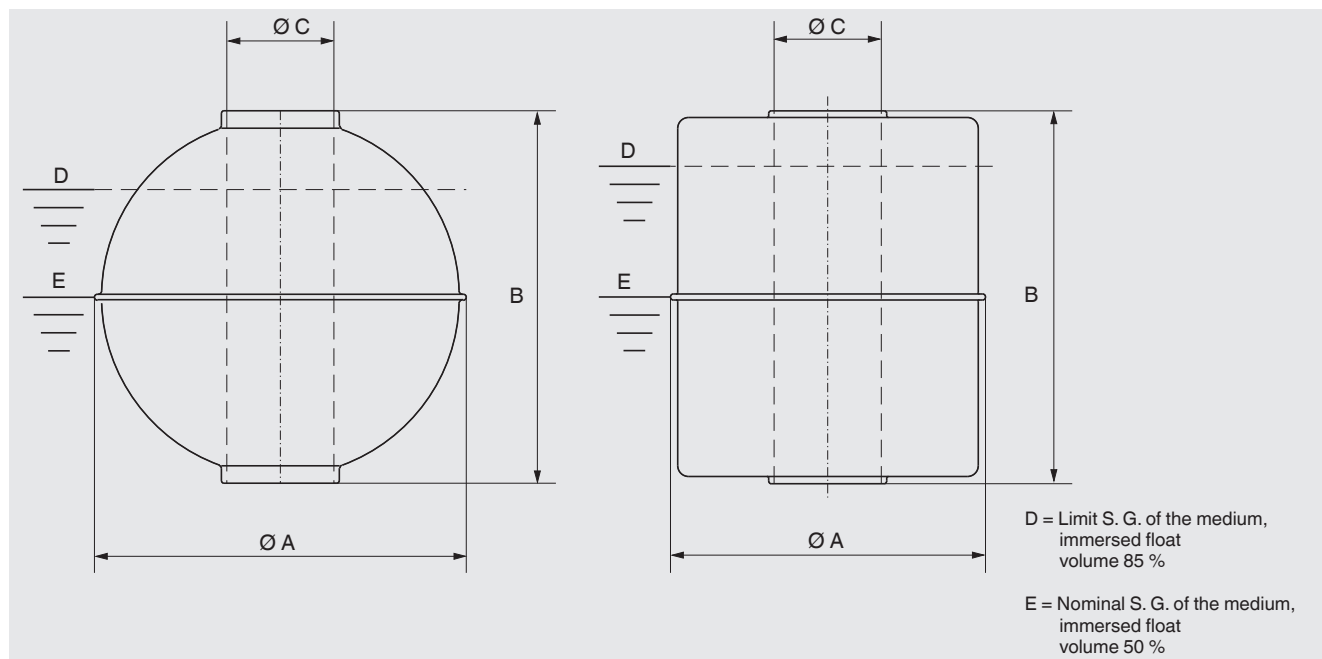


### Mounting thread

Electrical connection	Sensor housing	■ Stainless steel 1.4301
Process connection	Mounting thread with sanitary fitting below	■ Option: DIN 11851 fitting, clamp pipe fitting, flange (DIN, ANSI, JIS) or other sterile connections
Guide tube diameter	17.2 mm (surface ground and polished, Ra <0.4 µm)	
Guide tube length L max.	6000 mm	
Float	Material stainless steel 1.4435 (surface ground and polished, Ra <0.4) or stainless steel 1.4539 (surface electropolished) Float diameter of 80 mm Float selection depending on guide tube diameter and process conditions (see page 8)	
Max. working pressure	16 bar	
Temperature range standard	Medium: -45 ... +125 °C, sensor housing: -40 ... +85 °C Option: ■ High and low temperature version: -200 ... +200 °C	
Ex version	Category 1/2	Medium      Sensor housing
	T6	-25 °C ... +85 °C      -40 °C ... +40 °C
	T5	-25 °C ... +100 °C      -40 °C ... +55 °C
	T4	-25 °C ... +135 °C      -40 °C ... +85 °C
	T3	-25 °C ... +150 °C      -40 °C ... +85 °C
Output signal	4 ... 20 mA, 2-wire	
Power supply	10 ... 30 V DC	
Signal and supply circuit	In intrinsically safe version EEx ib IIC U <sub>i</sub> < 30 V ; I <sub>i</sub> < 200 mA ; L <sub>i</sub> < 250 µH ; C <sub>i</sub> < 5 nF	
Error message	Adjustable to 3.6 mA or 21.5 mA	
Measuring accuracy	< ±0.5 mm	
Resolution	< 0.1 mm	
Analogue component	±0.1 % (20 °C) + 0.005 % / K	
Load	900 Ohm at U <sub>B</sub> = DC 30 V ;      650 Ohm at U <sub>B</sub> = DC 24 V ;      100 Ohm at U <sub>B</sub> = DC 12 V	
Mounting position	Vertical ± 30°	
Ingress protection	IP 68 per EN 60 529 / IEC 529	

## Spherical floats (K)

## Cylindrical floats (Z)



Material	Suits guide tube Ø mm	Form	Ø A mm	B mm	Ø C mm	Max. working pressure bar	Max. working temp. °C	Limit S. G. 85 % kg/m <sup>3</sup>	Nominal S. G. 50 % kg/m <sup>3</sup>
Stainless steel 1.4571	12	Z	44	52	15	16	200	818	1390
	12	K	52	52	15	40	200	769	1307
	12	K	62	61	15	32	200	597	1015
	12	K	83	81	15	25	200	408	693
	18	K	80	76	23	25	200	679	1155
	18	K	98	96	23	25	200	597	1016
	18	K	105	103	23	25	200	533	907
	18	K	120	117	23	25	200	389	661
Titanium 3.7035	12	Z	44	52	15	16	200	720	1224
	12	K	52	52	15	25	250	707	1201
	12	K	52	52	15	110	250	1040	1770
	12	K	62	62	15	25	250	505	859
	12	K	83	81	15	25	250	278	473
	18	K	80	76	23	25	250	665	1130
	18	K	98	96	23	25	250	595	841
	18	K	105	103	23	25	250	369	627
Stainless steel 1.4571 E-CTFE coated	18	K	81	77	22	25	depending on medium	718	1220
	18	K	99	97	22	25	depending on medium	675	1148
	18	K	106	104	22	25	depending on medium	633	1076
	18	K	121	118	22	3	depending on medium	459	781
PVC	16	Z	55	54	22	3	60	798	1357
	20	Z	80	79	25	3	60	537	974
Polypropylene	16	Z	55	54	22	3	80	582	989
	20	Z	80	79	25	3	80	431	723
PVDF	16	Z	55	69	22	3	100	821	1396
	20	Z	80	79	25	3	100	681	1157
Pharmaceutical design									
Stainless steel 1.4435	17.2	K	80	88	23	16	150	790	1350
Stainless steel 1.4539	17.2	K	80	76	23	16	150	621	1056

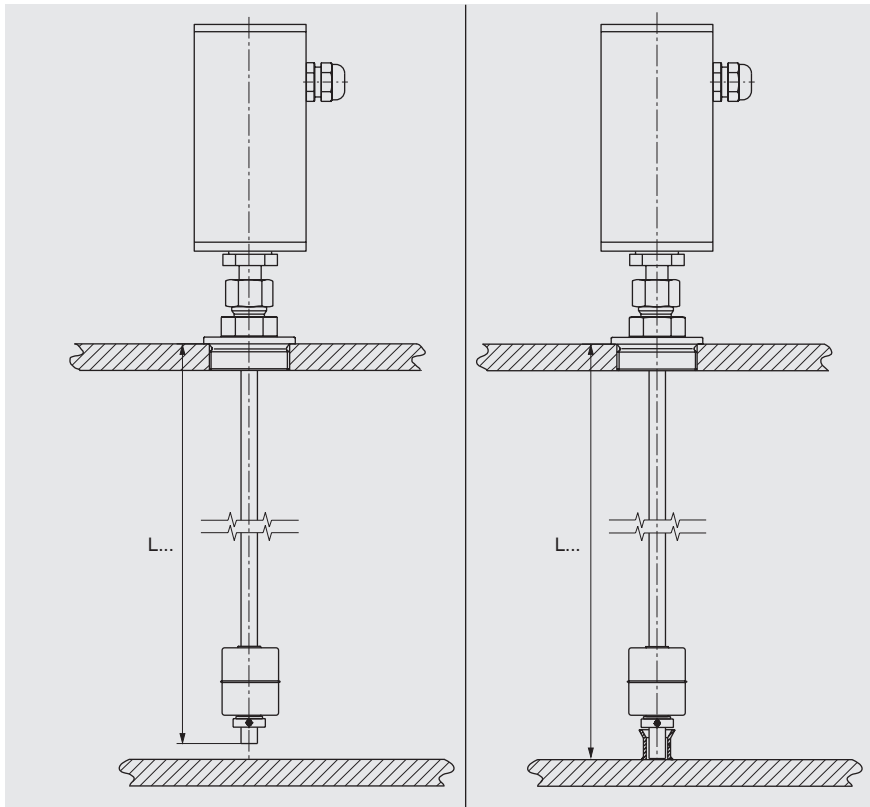
Note: The optimum float will be selected after a feasibility test carried out by WIKA.



## Determination of the max. guide tube length L for explosion-proof versions, intrinsically safe

Version A: Fixed to the tank ceiling

Version B: Fixed to the tank ceiling and floor



Guide tube	Max. guide tube length L	
	Version A	Version B
Ø 12 x 1	660 mm	3500 mm
Ø 16 x 1	1270 mm	6000 mm
Ø 17.2 x 1.6	2100 mm	6000 mm
Ø 18 x 1.5	3000 mm	6500 mm

### **Ordering information**

Model / Version / Electrical connection / Process connection / Guide tube diameter / Guide tube length (insertion length) L / Contact separation / 100 % Mark L1 / Measuring range M (Span 0 % - 100 %) / Process specifications (operating temperature and working pressure, S.G. Limit) / Options

The specifications given in this document represent the state of engineering at the time of publishing.  
We reserve the right to make modifications to the specifications and materials.



**WIKAI Alexander Wiegand SE & Co. KG**  
Alexander-Wiegand-Straße 30  
63911 Klingenberg/Germany  
Tel. (+49) 9372/132-0  
Fax (+49) 9372/132-406  
E-mail [info@wika.de](mailto:info@wika.de)  
[www.wika.de](http://www.wika.de)