

# Special-Sensors for Automation



**Level Sensors**

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We reserve the right to make technical alterations without prior notice.

## Application notes

### Microwave meter MFM

The MFM level meters for continuous monitoring of various liquids allow for an exact determination of the fill level in plastic or metal tanks of any size. With a maximum tolerance of  $\pm 3$  mm the devices offer the highest measurement precision. The level sensors work with numerous liquids such as water, oil or emulsions. To this end microwaves are "guided" in the measuring rod – and are reflected at the surface of the medium, and the sensor determines the fill level. No adjustment for various media is necessary. The aluminium and AISI 316 Ti stainless steel MFM probes are suitable for ambient temperatures between  $-20$  and  $+70$  °C. They are available in optional sizes between 500 and 2000 mm in length. The sensors are equipped with a G3/4 thread and are connected via an M12 plug. The fill level is transmitted to the analysis unit or SPS by means of a 4...20 mA signal.

### Microwave level controllers

The microwave level controllers of the MFC and MFK series respond to media contact at the tip of the sensor. The devices of the MFK series are made of stainless steel and PTFE and are equipped with a G1/2 process connection. The sensors have a length of 40 mm. Thanks to their integrated electronics, no downstream amplifier is required. The sensors do not have to be adjusted to different media, and for containers made of plastic material, no earth connection is required.

Users can adjust the sensitivity of the devices of the MFC series using a pushbutton. Thus, the sensors can distinguish between different layers of liquids (e.g. water and oil) in the containers allowing for an easy separation of liquids. The stainless steel and PTFE microwave sensors can be used for virtually all container types and sensor environments. They are also suited for use with powder or granules. The sensors are available with a length of between 120 mm and 1000 mm thus offering various different installation options.

### Capacitive sensors

The operation of these level sensors is based on a dielectric measuring method. All media which are surround the sensors measuring electrode, built into the tip of the probe, change the state of dielectric balance between the measuring electrode and the surrounding space. This disturbance in the balance triggers a switching command inside the device. The balance can be adjusted with a built-in potentiometer so that materials with different bulk densities and correspondingly different dielectric constants can be measured optimally. Metallic or metal clad vessels should be earthed. In the case of plastic vessels filled with electrically conductive materials, the latter

should be earthed. In the case of plastic vessels filled with non-conducting materials, an earthed metal band applied on the outside of the vessel may be used as a counter-electrode.

### Medium adjustment for capacitive sensors

Level sensors are set in such a way that they switch upon contact with a medium. The medium adjustment should, if possible, take place without removal under operating conditions. If the built-in part of the sensor can be completely submerged or covered during operation, the adjustment must also take place in this state. If only medium contact is possible, the adjustment takes place upon contact. The trimmer potentiometer is protected by a plastic bolt. This bolt must be removed before the desired sensitivity is set. Turning it clockwise increases the response sensitivity. The adjustment potentiometer is turned until the switch output switches through (normally-open contact). You achieve switching point safety by continuing to turn the potentiometer half a turn to one turn. Devices with a LED line are adjusted to two green LEDs. If the medium adjustment has taken place, the plastic bolt must be fixed again.

Electrically conductive media are difficult to monitor using capacitive level controllers. For this task, a microwave compact device (Series MFC, page 2.10) is considerably better suited.

### Laboratory adjustment

If adjustment cannot be carried out with the sensor mounted in operating position, it can be performed upon a similar vessel. It must, however, be made sure that this vessel is set upon an earthed metal plate, or that the liquid within the vessel is earthed by means of an introduced wire. The minimum height and minimum diameter of the experimental vessel should be about 10 cm.

If setting is correct, the filling level monitor reacts correctly if 50% of the electrode diameter is covered. When mounted vertically, sensors reacts upon contact with the medium. Reaction time lag is less than 0.25 sec.

## Application notes

### Opto-sensors UF../UR..

Optical sensors react to a change of the refraction index within the proximity of the sensor tip when being immersed into fluid. The sensor does not have to be adjusted. In rare cases, the container wall or particles within the fluid may reflect the light emitted by the sensor and thus interfere with the fluid detection. A trial run is recommended in such instances. The sensors are designed to be used with the respectively listed fluids under normal conditions. The chemical compatibility and technical suitability of the sensor should be tested when used with unlisted fluids.

#### Resistance UFGS..., UFGS...Ex, URFG...Ex

Water / water steam	Monoethylenglycole
Vegetable oil	Glyceric
Diluted acids	Acetone
Diluted bases	Fuels
Ethyl alcohol	Benzol
Methyl alcohol	Diesel
Isopropanol	Motor oil
Isohexan	Hydraulic oil
n-Heptan	Paraffin Oil DAB

### Sensors for explosion hazardous areas

Fill level monitors for use in zone 0 or zone 20 are operated with the associated amplifiers listed in the respective connection chart. The analysis devices are always operated outside of the Ex area. Sensors of the series KGFT... Ex are used in conjunction with an intermediate amplifier, which is approved for installation in zone 1. Optical Ex sensors URFG-Ex can also be driven with the amplifier SF3 for application in zone 1.

### Thermal level controllers for hazardous areas

EGE provides the TFKS and TFGS series of thermal level controllers for explosive gas atmospheres (zone 0 and 1). The sensors are suitable for stationary and mobile use, e.g. in gasoline or diesel tank trucks. Featuring a G3/4 thread, the devices are available with a maximum length of 400 mm or with a fixed immersion depth. They are connected to SF3 amplifier units. Both sensor types have a nominal resistance of 160  $\Omega$ . Manufactured from aluminum or stainless steel 1.4571, TFKS and TFGS sensors provide IP 68 protection and are suitable for ambient temperatures between -20 and +80 °C. They are connected via M12 plugs.

### Glossary

#### Switching point

Capacitive level sensors react to conductive materials and non-conductive materials with a dielectrical constant  $\epsilon > 1$ . The switching point depends on the material.

When the sensor-tip is immersed in a fluid, a switching command inside the device is triggered. This trigger is set between contact with the liquid and some mm more into the liquid. This distance between the tip of the sensor and the trigger is the nominal switching point. The immersion-distance has a negative sign, e. g. -8 mm.

The following table lists the approximate values for the material dependent reduction factors. In practical applications there could be variations, because of the mounting conditions, for example.

Material	$\epsilon$	Sensitivity in % (approx.)
Steel ST 37	Conductive	100
Saltwater	80	100
Marble	8	65
Porcelain	4-5	50
PE	2,3	10
Öil	2,2	10
Wood	2-7	10-60

The water content of an object or a liquid has a decisive influence on the switching point. A high humidity content increases the switching point considerably.

If the sensor is moistened with conductive materials, its function can be impaired when a conductive film builds up that electrically connects the sensor electrode with a metallic conducting side.

#### Switching point $s_p$

The switching point or rated operating distance is a device parameter that does not take into account sample variances and external influences such as temperature and supply voltages. Optical sensors are switching by immersing the tip. When the sensor tip is immersed in a fluid, the switching point has a negative sign.

#### Effective operating distance $s_r$

The effective operating distance is the operating switching point at nominal voltage and at nominal temperature of 23 °C. It is between 90% and 110% of the rated operating distance.

#### Usable operating distance $s_u$

The usable operating point is in the entire allowable temperature and voltage range is between 80% and 120% of the effective operating distance.

## Application notes

### **Assured operating distance $s_a$**

The assured operating point takes into account all the external influences, sample and media variances and is in the range from 0% to 72% of the rated operating distance point. Within this range a guaranteed switching is ensured.

### **Switching point drift**

The operating distances are given for an ambient temperature of 23 °C. In the permissible temperature range the switching point varies by less than 15% from the value at 23 °C. The temperature of the measured object has no influence on the switch point.

### **Hysteresis $H$**

The switching hysteresis describes the distance between the turn on point while immersing in the liquid and the turn off point during the separation of it from the sensor. The hysteresis brings about a stable switching signal even when there are vibrations, temperature drift, or electrical failures. The hysteresis is defined according to EN 60947-5-2 to be a maximum 20% from the real switching point, and carries a value of typically 10% - 15% from the real switching distance  $s_r$  for EGE sensors.

### **Repeating accuracy $R$**

The repeating accuracy describes the maintenance of the switching point after the repeated immersing in the liquid under specified circumstances. EGE sensors have typical tolerances of less than 3% of the effective operating point.

### **Switching frequency**

The maximum switching frequency of the sensor is determined at nominal switching point  $s_p$  when immersing in the water.

### **Supply voltage**

The operating voltage is the voltage range in which EGE sensors function safely. For a constant voltage supply it is important to make sure that the limits are still observed when the residual ripple is included.

### **Switching current**

This current gives the maximum long-term current for the switching output of the sensor at an ambient temperature of 25 °C and ohmic load. At an elevated ambient temperature, the current load capability decreases.

For analog outputs, the boundary values given in the appropriate technical data, and particularly the permissible values for resistance loads, must be observed.

### **Short circuit protection**

The short circuit proof ensures the sensor against destruction through a short circuit on the output. After removal of the fault, the output is reactivated. Where a maximum overload current is listed, this should not be exceeded.

### **Overcurrent release**

This value indicates the median value of current at which the short circuit protection responds with a tolerance of  $\pm 20\%$ .

### **Reverse polarity protection**

The reverse polarity protection prevents destruction of the sensor by a reversal of the polarity of the voltage supply.

### **Voltage drop $U_d$**

The voltage drop arises at the internal resistance of semiconductor elements, which are in the current-path of the output. It is dependent of the load-current and is declared according to EN 60947-5-2 for a mean current of 50 mA.

### **Residual current $I_r$**

The residual current flows in the load current circuit when the output is blocked. The residual current must be considered when switching sensors in parallel.

### **Minimum load current $I_m$**

The minimum load current is necessary for flawless operation with two-wire devices.

### **Current consumption**

The current consumption is the maximum value of the no-load current  $I_o$  that the sensor can absorb without a load.

### **Ambient temperature**

The ambient temperature indicates the maximum allowable temperature range for the sensor.

### **Electromagnetic compatibility EMC**

The EMC class is a measure of the noise immunity of the sensor against external electrical and magnetic influences. The information is based on the standard EN 61000-6-2.

### **Switch-on impulse suppression**

EGE sensors have a switch-on impulse suppression that blocks the output during the switch-on phase, when the operational voltage is applied.

### **Protection**

The protective system indicates the protection of the sensors against penetration of foreign bodies and water according to EN 60529.

### **LED-Display**

EGE sensors with yellow light-emitting diodes indicate the switching status optically.

### **Housing material**

The housing material determines the chemical resistance of the sensor against external influences. For special applications, other housing materials are available.

### **Connection**

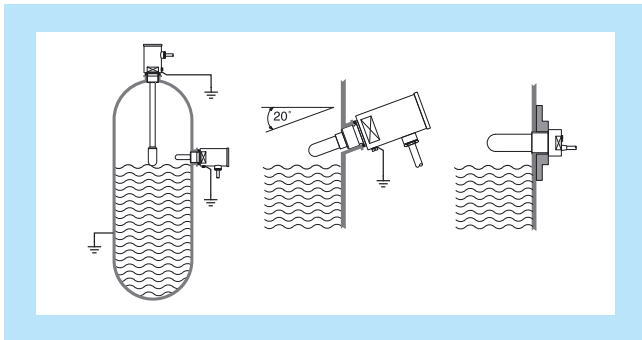
The connection of the sensors is accomplished through plug-in connections or cables. Different cable types and lengths are available upon request.

## Application notes

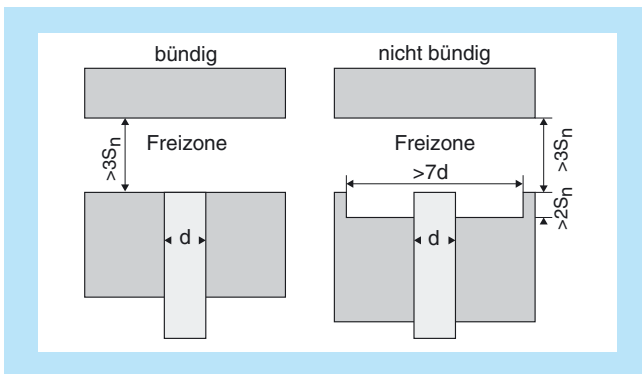
### Instructions for mounting

At the side installation of capacitive sensors we prefer to put the sensor tip on an angle of 20 degree to protect sedimentation.

The sensors should be protected against damages by side power effects for example by blungers.



For flush mounting, the sensor can be built into influencing material up to its active surface without changing its characteristics. For non-flush mounting, a metal-free zone around the sensor must be allowed for. A free zone to the material opposite the sensor must be maintained for all sensors.



The indicated free zones are in accordance with the standard EN 60947-5-2.

### Collocation

When collocating the sensors, a minimum separation must be kept between the devices in order to avoid mutual influence. When in doubt, a test should be conducted under application conditions. For capacitive sensors, the lateral separation from one another must correspond to at least twice the diameter of the sensor. For separations greater than eight times the diameter no mutual influence is to be expected. For oppositely mounted sensors, a minimal separation of eight times the nominal switching separation should be allowed for.

### Threads

The threads of the sensors in this prospectus are manufactured to DIN ISO 228-1, tolerance class B. They are designated with (") or (G).

If it is necessary to combine different threads, e.g. the sensor-thread made to DIN ISO 228-1 and an inner thread made to DIN ISO 229, such inner thread must be widened by a thread drill.

### Torques

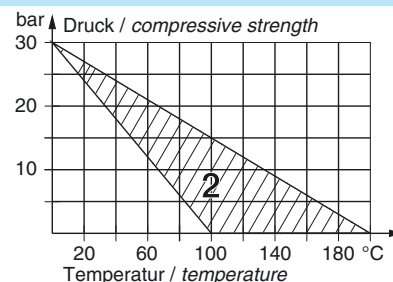
In order to prevent destruction of the threaded bushing during fitting, the following maximum torques must not be exceeded:

Design	Metal housing	Plastic housing
M12x1	10 Nm	1 Nm
M18x1	25 Nm	2 Nm
M30x1,5	40 Nm	5 Nm

PTFE-sensors may only be tightened by hand.

### Sealings

The sealings used for our sensors are made of PTFE, NBR, FPM or AFM. For water applications with water temperatures up to 150 °C and with pressures less than 5 bar, EDPM O-rings must be used. If the temperatures exceed 100 °C or the pressures are higher special sealings are necessary (2). When ordering sensors for such applications, such special sealings must be ordered too.



## Application notes

### Instructions for operation

#### Serial connection

For the serial connection of two wire or three wire sensors the individual voltage drops are added together. Therefore there is a lesser operational voltage at the disposal of the load. The addition of the switch-on delay times should be noted.

#### Parallel connection

The parallel connection of two wire sensors can only be conditionally recommended since the residual currents are added together and flow through the load. For the parallel connection of three wire sensors, the current consumption of the individual devices is added together. Since this current does not flow through the load, the maximum number of parallel connectable three wire sensors depends only on the power supply.

### Approval for safety applications

Sensors for personal security must have a qualification approval according to EN 954-1 and must be labeled accordingly. Sensors that are not labeled must not be used for applications of this kind.

### Valid standards

EN 60947-5-2

Control units; low voltage control units, auxiliary switch, proximity switch

EN 61000-6-4

Electromagnetic compatibility (EMC)  
Interference emissions in the industrial area

EN 61000-6-2

Electromagnetic compatibility (EMC)  
Generic standards immunity for industrial environments

EN 61000-4-2 (ESD)

Electrostatic discharging immunity

EN 61000-4-3 (HF radiated)

Radiated radio-frequency electromagnetic field immunity test

EN 61000-4-4 (Burst)

Electrical fast transient/burst immunity test

EN 61000-4-5 (Surge)

Surge immunity test

EN 60529

Protective systems, IP-designation

EN 60079-0

Explosive atmospheres –  
Part 0: Equipment – General requirements

EN 60079-11

Explosive atmospheres –  
Part 11: Equipment protection by intrinsic safety "i"

EN 61241-0

Electrical apparatus for use in the presence of  
combustible dust – General requirements

### Authorisations

TÜV-cert

TÜV-cert Zertifizierungsstelle - Deutschland  
(technical monitoring certification agency - Germany)

### Certification

TÜV-cert ISO 9001

TÜV-cert Quality control production

Attachment IV of the EC-Guidelines 94/9/EG

TÜV Nord Re-cancelling certificate according to EN 10204

## Microwave meter

### Series MFP

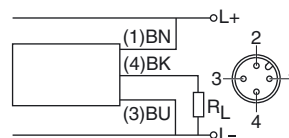
High precision  $\pm 10$  mm

Liquids from  
oil to water

Guided microwave



Design	DC Analog • G3/4												
Dimensions													
Design	Single probe	Parallel probe	<p><b>Sensor length</b></p> <p>The total length L of the sensor is specified by appending "xxx" to the type.</p> <p>xxx: Length in cm</p> <table border="1"> <thead> <tr> <th>Preferred lengths</th> <th>ID-No.</th> </tr> </thead> <tbody> <tr> <td>500 mm: LM050</td> <td>P21200</td> </tr> <tr> <td>800 mm: LM080</td> <td>P21201</td> </tr> <tr> <td>300 mm: LP030</td> <td>P21202</td> </tr> <tr> <td>500 mm: LP050</td> <td>P21203</td> </tr> </tbody> </table> <p><b>Note:</b></p> <p>For single probe installation rules have to be observed.</p>	Preferred lengths	ID-No.	500 mm: LM050	P21200	800 mm: LM080	P21201	300 mm: LP030	P21202	500 mm: LP050	P21203
Preferred lengths	ID-No.												
500 mm: LM050	P21200												
800 mm: LM080	P21201												
300 mm: LP030	P21202												
500 mm: LP050	P21203												
Output	4...20 mA, linear	4...20 mA, linear											
ID-No.	P...	P...											
Typs-sensorelength L	MFP 075 GA-LMxxx	MFP 075 GA-LPxxx											
Supply voltage [V]	20...27 DC	20...27 DC											
Current consumption [mA]	< 75	< 75											
Current output [mA]	4...20	4...20											
Load resistance R <sub>L</sub> [Ω]	200...500	200...500											
Reverse protection	•	•											
Precision [mm]	< ±10	< ±10											
Inactive range [mm]	top: 25, bottom: 15	top: 25, bottom: 30											
Ambient temperature [°C]	-0...+70	-0...+70											
Medium temperature [°C]	-0...+85	-0...+85											
Sensitivity [ε <sub>r</sub> ]	> 20	> 3											
Protection [EN 60529]	IP 67	IP 67											
Housing material	Aluminium												
Material	AISI 316 Ti, PTFE, POM												
Sealing material	NBR, different material on request												
Compressive strength [bar]	6 (25 °C)												
Connection	M12 connector												



Accessories Connecting cable SLG 3..., SLW 3..., see page 2.39



## Microwave meter

### Series MFM

High precision  $\pm 3$  mm

Liquids from  
oil to water

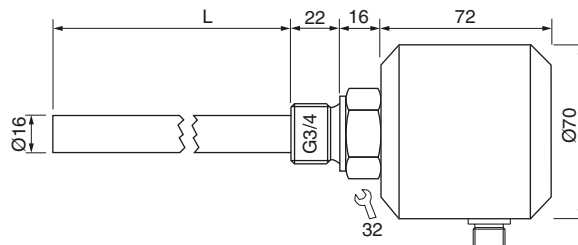
Guided microwave




### Design

DC Analog • G3/4

### Dimensions



### Output

  
4...20 mA, linear

### Sensor length

### ID-No.

P21197...

The total length L of the sensor is specified by appending "Lxxx" to the type.

### Type-sensor length L

MFM 075 GA-Lxxx

### Supply voltage [V]

20...27 DC

### Current consumption [mA]

< 100

### Current output [mA]

4...20

### Load resistance $R_L$ [ $\Omega$ ]

200...500

xxx: Length in cm

### Reverse protection

•

### Preferred lengths

### Precision [mm]

$\pm 3$

500 mm: L050

### ID-No.

### Inactive range [mm]

top: 20, bottom: 30

1100 mm: L110

P21197050

### Ambient temperature [ $^{\circ}$ C]

-20...+70

P21197110

### Medium temperature [ $^{\circ}$ C]

-20...+80

### Sensitivity [ $\epsilon_r$ ]

> 1.8

### Protection [EN 60529]

IP 67

### Housing material

Aluminium

### Material

AISI 316 Ti

### Sealing material

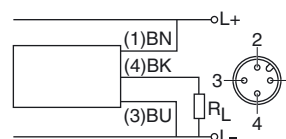
NBR, different material on request

### Compressive strength [bar]

6 (25  $^{\circ}$ C)

### Connection

M12 connector



### Accessories

Connecting cable SLG 3..., SLW 3..., see page 2.39

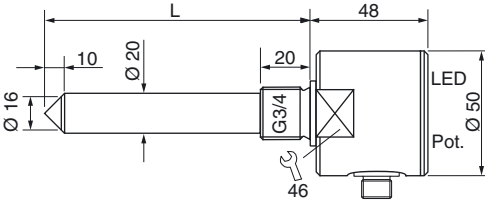

## Microwave-Compact

Series MFC  
G3/4 thread

DC 16...30 V

Sensor length up to 1000 mm



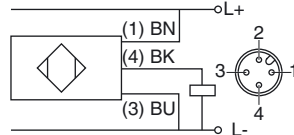
Design	DC PNP • G3/4	
Dimensions		
Switching point sp	[mm]	-6
Switching output		
ID-No.	P21188...	
Type-sensor length L	MFC 075 GSP-Lxxx	
Supply voltage	[V]	16...30 DC
Switching current	[mA]	200
Short circuit proof	•	
Overcurrent release	[mA]	250
Reverse protection	•	
Voltage drop	[V]	2
Current consumption	[mA]	50
Switching frequency	[Hz]	ca. 5
Ambient temperature	[°C]	-20...+85
Sensitivity*	[εr]	pre-selectable
Protection	[EN 60529]	IP 67
LED display	•	
Housing material	AISI 316 Ti / PTFE	
Sealing material	NBR, different materials on request	
Compressive strength	[bar]	16 (25 °C)
Connection	M12 connector	
Accessories	Connecting cable SLG 3... SLW 3..., see page 2.39	

**Sensor length**  
The total length L of the sensors is specified by appending "Lxxx" to the type.  
xxx: length in mm

<b>Preferred excess lengths</b>	<b>ID-No.</b>
120 mm: L120	P21188012
200 mm: L200	P21188020
400 mm: L400	P21188040

Adjustment note ε<sub>r</sub>:  
Remove the protection screw.  
By pressing the button with the screwdriver provided, you can adjust the sensitivity.

*Sensitivity	
○	green : ε <sub>r</sub> ≥60
○○	green : ε <sub>r</sub> ≥25
○○○	green : ε <sub>r</sub> ≥4
○○○○	green : ε <sub>r</sub> ≥1,7



## Microwave-Compact

**Series MFK**  
**G1/2 thread**

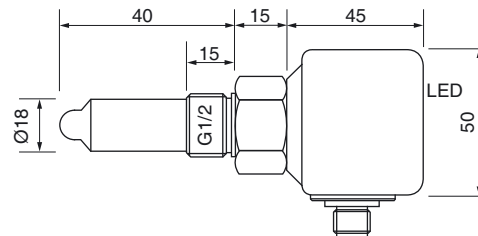
**DC 16...30 V**


**Sensor length 40 mm**

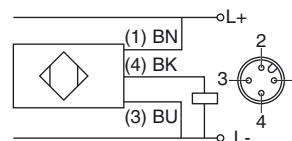


### Design DC PNP • G1/2

#### Dimensions



Switching point sp [mm]	-6
Switching output	
ID-No.	P21193
Type	MFK 50 GSP
Supply voltage [V]	16...30 DC
Switching current [mA]	200
Short circuit proof	•
Overcurrent release [mA]	250
Reverse protection	•
Voltage drop [V]	2
Current consumption [mA]	40
Switching frequency [Hz]	approx. 5
Ambient temperature [°C]	-20...+85
Sensitivity [εr]	> 10
Protection [EN 60529]	IP 67
LED display	•
Housing material	PBT / AISI 316 Ti / PTFE
Sealing material	NBR, different materials on request
Compressive strength [bar]	16 (25 °C)
Connection	M12 connector



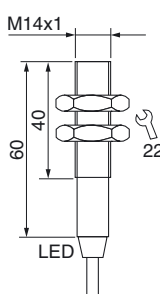
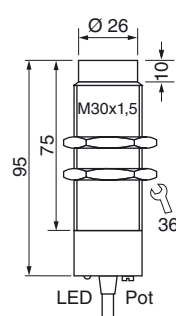
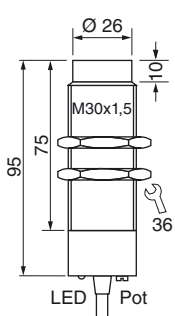



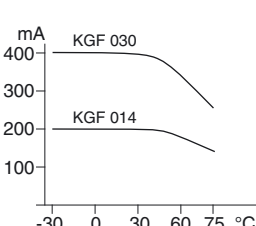
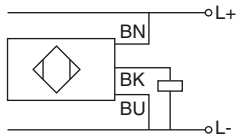
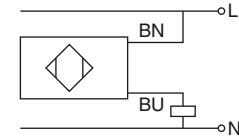
### Accessories Connecting cable SLG 3... SLW 3..., see page 2.39

## Integral switch

Series KGF  
PTFE housing  
M14x1  
M30x1.5

AC 20...250 V  
DC 10...55 V



Design	DC PNP • M14x1		DC PNP • M30x1.5		AC • M30x1.5	
Dimensions						
Switching point sp [mm]	-2	-2	-3	-3	-3	-3
Switching output						
Best.-Nr.	P20130	P21106	P20051	P20052	P20002	P20003
Type	KGf 014 GSP	KGf 014 GOP	KGf 030 GSP	KGf 030 GOP	KGf 030 WS	KGf 030 WO
Supply voltage [V]	10...33 DC		10...55 DC		20...250 AC	
Switching current [mA]	200		400		400	
Short circuit proof	•		•		-	
Overcurrent release [mA]	800		800		-	
Reverse protection	•		•		-	
Voltage drop [V]	1 DC		1 DC		8 AC	
Minimum load current [mA]	-		-		5	
Current consumption [mA]	4		4		2.5	
Switching frequency [Hz]	10		10		10	
Ambient temperature [°C]	-25...+75		-25...+75		-25...+75	
EMC-class	A		A		A	
Protection [EN 60529]	IP 67		IP 67		IP 67	
LED display	•		•		•	
Housing material	PTFE		PTFE		PTFE	
Connection	2 m PVC-cable 3x0.34 mm <sup>2</sup>		2 m PVC-cable 0.5 mm <sup>2</sup>		2 m PVC-cable 0.5 mm <sup>2</sup>	
Switching current						
Accessories	fixing nuts are part of delivery					

## Integral switch

**Series KGF/KGMR**  
**G3/4 thread**

**AC 20...250 V**  
**DC 10...55 V**



Design	AC • G3/4		DC PNP • G3/4		DC PNP • G3/4
<b>Dimensions</b>					
Switching point sp [mm]	-2	-2	-2	-2	-3
Switching output					
ID-No.	P20005	P20006	P20055	P20056	P21101
Type	KGF 075 WS	KGF 075 WO	KGF 075 GSP	KGF 075 GOP	KGMR 107 GSP
Supply voltage [V]	20...250 AC		10...55 DC		10...55 DC
Switching current [mA]	400		400		300
Short circuit proof	-		•		•
Overcurrent release [mA]	-		800		800
Reverse protection	-		•		•
Voltage drop [V]	8 AC		1 DC		1.5 DC
Minimum load current [mA]	5		-		-
Current consumption [mA]	2.5		4		4
Switching frequency [Hz]	10		10		10
Ambient temperature [°C]	-25...+75		-25...+75		-25...+75
EMC-class	A		A		A
Protection [EN 60529]	IP 67		IP 67		IP 67
LED display	•		•		•
Housing material	PTFE		PTFE		PTFE / AISI 316 Ti
Sealing material	-		-		FPM
Connection	2 m PVC-cable 0.5 mm <sup>2</sup>				
Switching current					

## Integral switch

Series **KGFR**  
PTFE housing  
G1 thread

AC 20...250 V  
DC 10...55 V



Design	AC • G1		DC PNP • G1			
Dimensions						
Switching point sp	[mm]	-6	-6	-6	-6	
Switching output						
ID-No.		P20009	P20010	P20063	P20064	P21198
Type		KGFR 100 WS	KGFR 100 WO	KGFR 100 GSP	KGFR 100 GOP	KGFR 100 GSOP
Supply voltage	[V]	20...250 AC		10...55 DC	10...55 DC	10...30 DC
Switching current	[mA]	400		400	400	200
Short circuit proof		-		•	•	•
Overcurrent release	[mA]	-		800	800	450
Reverse protection		-		•	•	•
Voltage drop	[V]	8 AC		1 DC	1 DC	1.5 DC
Minimum load current	[mA]	5		-	-	-
Current consumption	[mA]	2.5		4	4	10
Switching frequency	[Hz]	10		10		
Ambient temperature	[°C]	-25...+75		-25...+75		
EMC-class		A		A		
Protection	[EN 60529]	IP 67		IP 67		
LED display		•		•		
Housing material		PTFE		PTFE		
Connection		2 m PVC-cable 0.5 mm <sup>2</sup>		GSP/GOP: 2 m PVC-cable 0.5 mm <sup>2</sup> GSOP: 2 m PVC-cable 0.34 mm <sup>2</sup>		
Switching current						

## Integral switch

Series KA  
G1 thread

DC 10...55 V



Design	DC PNP • G1 • L= 45 mm	DC PNP • G1 • L=120 mm
Dimensions		
Switching point sp [mm]	-8	-8
Switching output		
ID-No.	P21010	P21011
Type-sensor length L	KA-L45-GPP	KA-L120-GPP
Supply voltage [V]	10...55 DC	
Switching current [mA]	400	
Short circuit proof	•	
Overcurrent release [mA]	800	
Reverse protection	•	
Voltage drop [V]	2	
Minimum load current [mA]	-	
Current consumption [mA]	4	
Switching frequency [Hz]	5	
Ambient temperature [°C]	housing: -25...+70 / sensor tip: -25...+120	
EMC-class	A	
Protection [EN 60529]	IP 67	
LED display	•	
Housing material	PTFE / AISI 316 Ti	
Sealing material	FPM	
Compressive strength [bar]	30 (25 °C)	
Connection	terminal screws	
Switching current		

## Integral switch

Series KB  
G1 thread

DC 10...55 V



Design	DC PNP • G1			
Dimensions				
Switching point sp	-8			
Switching output				
ID-No.	P21012	P21013	P21014	P21015
Type-sensor length L	KB-L200-GPP	KB-L400-GPP	KB-L600-GPP	KB-L1000-GPP
Supply voltage [V]	10...55 DC			
Switching current [mA]	400			
Short circuit proof	•			
Overcurrent release [mA]	800			
Reverse protection	•			
Voltage drop [V]	2			
Minimum load current [mA]	-			
Current consumption [mA]	4			
Switching frequency [Hz]	5			
Ambient temperature [°C]	housing: -25...+70 / sensor tip: -25...+120			
EMC-class	A			
Protection [EN 60529]	IP 67			
LED display	•			
Housing material	PTFE / AISI 316 Ti			
Sealing material	FPM			
Compressive strength [bar]	16 (25 °C)			
Connection	terminal screws			
Switching current				



## Integral switch

**Series KFC**  
**G1/2 thread**

**DC 18...33 V**

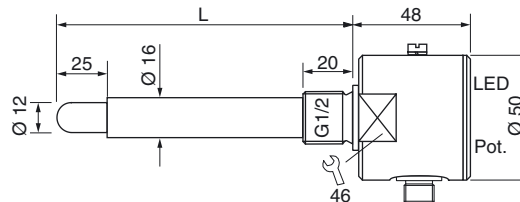
**Stainless steel housing**





**PTFE-sensor**

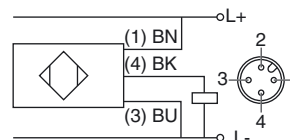
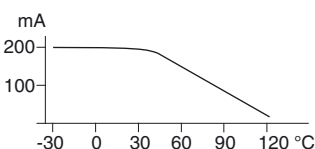


### Design DC PNP • G1/2

#### Dimensions



Switching point sp [mm]	-6			
Switching output				
ID-No.	P21161	P21162	P21163	P21164
Type-sensor length L	KFC 050 GSP-L50	KFC 050 GSP-L100	KFC 050 GSP-L200	KFC 050 GSP-L400
Supply voltage [V]	18...33 DC			
Switching current [mA]	200			
Short circuit proof	•			
Overcurrent release [mA]	250			
Reverse protection	•			
Voltage drop [V]	2			
Minimum load current [mA]	-			
Current consumption [mA]	10			
Switching frequency [Hz]	5			
Ambient temperature [°C]	housing: -25...+75 / sensor tip: -25...+120			
EMC-class	A			
Protection [EN 60529]	IP 67			
LED display	•			
Housing material	AISI 316 Ti / PTFE			
Sealing material	FFKM (Kalrez)			
Compressive strength [bar]	16 (25 °C)			
Connection	M12 connector			
Switching current				



### Accessories Connecting cable type SLG 3... SLW 3..., see page 2.39

## Opto-integral switch

**Series UFGS**  
**Opto glass-sensor**  
**G3/4 thread**

**DC 10...33 V**

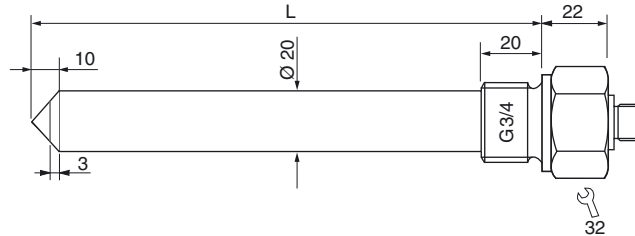
**Resistant to detergents**  
**Resistant to hydraulic oil • motor oil**



### Design

**DC PNP • G3/4**

### Dimensions



Switching point sp [mm] -10  
 Switching output

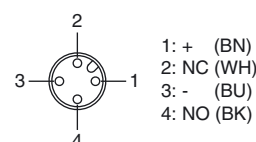
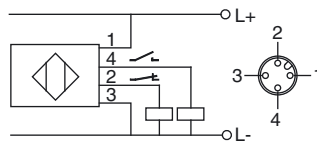
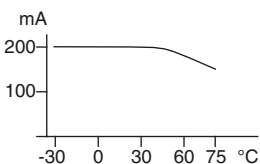
<b>ID-No.</b>	<b>P21181...</b>
Type-sensor length L [mm]	UFGS 075 GSOP-Lxxxx
Supply voltage [V]	10...33 DC
Switching current [mA]	200
Short circuit proof	•
Overcurrent release [mA]	250
Reverse protection	•
Voltage drop [V]	2
Minimum load current [mA]	-
Current consumption [mA]	10
Switching frequency [Hz]	5
Ambient temperature [°C]	-25...+70
<b>EMC-class</b>	<b>A</b>
Protection [EN 60529]	IP 67
LED display	plug with LED
Housing material	AISI 316 Ti / glass
Sealing material	FFKM (Kalrez)
Compressive strength [bar]	16 (25 °C)
Connection	M12 connector

### Sensor length

The total length L of the sensors is specified by appending "Lxxxx" to the type.

xxxx: length in mm

Preferred excess lengths	ID-No.
120 mm: L120	P21181012
200 mm: L200	P21181020
400 mm: L400	P21181040
600 mm: L600	P21181060
1000 mm: L1000	P21181100



### Accessories

Connecting cable type SLW 4-2 LED (Z01157), see page 2.39

## Opto-integral switch

**Series UFS**  
**G3/4 thread**

**DC 10...33 V**

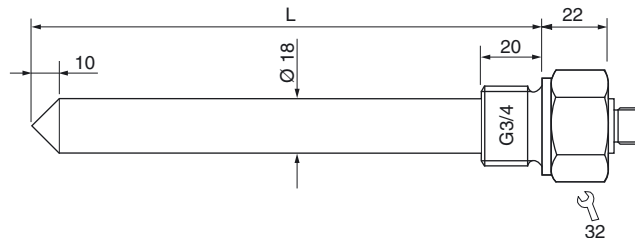
**Plug connection**



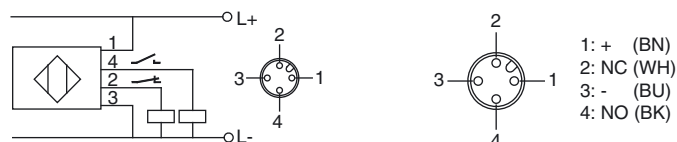
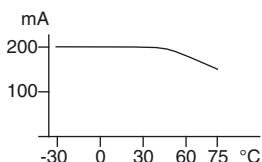
### Design

**DC PNP • G3/4**

### Dimensions



Switching point sp [mm]	-10	-10	-10	-10	-10
Switching output					
ID-No.	<b>P21121</b>	<b>P21122</b>	<b>P21123</b>	<b>P21124</b>	<b>P21125</b>
Type	UFS 075 GSOP-L100	UFS 075 GSOP-L200	UFS 075 GSOP-L400	UFS 075 GSOP-L600	UFS 075 GSOP-L1000
Supply voltage [V]	10...33 DC				
Switching current [mA]	200				
Short circuit proof	•				
Overcurrent release [mA]	250				
Reverse protection	•				
Voltage drop [V]	2				
Minimum load current [mA]	-				
Current consumption [mA]	10				
Switching frequency [Hz]	5				
Ambient temperature [°C]	-25...+70				
EMC-class	A				
Protection [EN 60529]	IP 67				
LED display	plug with LED				
Housing material	AISI 316 Ti/Polysulfon				
Sealing material	FPM				
Compressive strength [bar]	16 (25 °C)				
Connection	M12 connector				



### Accessories

Connecting cable type SLW 4-2 LED (Z01157), see page 2.39

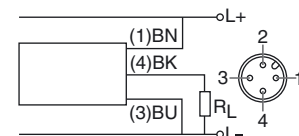
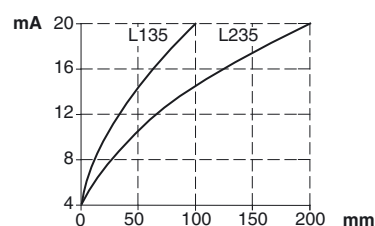
## Analog sensor

Series KFA  
up to 200 °C

4...20 mA  
output



Design	G1/2		KU 120 GI
Dimensions			
Sensing length M [mm]	100	200	
Output	-	-	
ID-No.	P21151	P21152	P21153
Type-sensor length L	KFA 150-L135	KFA 150-L235	KU 120GI
Supply voltage [V]	-	-	24 DC ±20%
Current output [mA]	-	-	4...20
Current consumption [mA]	-	-	50
Working resistance [Ω]	-	-	50...400
Reaction frequency [Hz]	-	2	5
Ambient temperature [°C]	-	-35...+200	-20...+60
EMC-class	-	A	A
Protection [EN 60529]	-	IP 68	IP 65
LEM-connection	-	IP 54	IP 54
LED display	-	-	•
Housing material	-	PKS / AISI 316 Ti	Aluminium
Sealing material	-	PTFE	-
Compressive strength [bar]	-	16	-
Connection	2 m PTFE-cable / LEM 01 plug system		M12 connector



Accessories

Connecting cable SLG 3-2, see page 2.39

# Level Sensors



## -230 °C-Low temperature

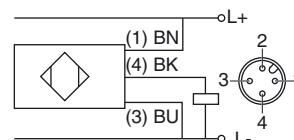
### Series KGFP

Detection of liquid gases  
Detection of cooled granules

Sensor for connection to an external amplifier



Design	G1/2		KU 125...
Dimensions			
Switching point sp	adjustable	adjustable	adjustable
Switching output			
ID-No.	P21167	P21196	P21166
Type	KGFP 050	KGFP 051	KU 125 GPP
Application area	liquid gases	cooled granules	
Medium temperature [°C]	-230...+80		-
Cable temperature [°C]	-80...+120		-
Supply voltage [V]	-		24 DC ±20%
Current consumption [mA]	-		50
Switching current [mA]	-		400
Hysteresis [%]	-		10 (adjustable)
Switching frequency [Hz]	-		10
Ambient temperature [°C]	-		-20...+60
EMC-class	-		A
Protection [EN 60529]			
housing	IP 68		IP 65
plug	IP 67		IP 67
LED display	-		•
Power on LED	-		•
Housing material	AISI 316 Ti / PTFE		Aluminium
Connection	2 m PTFE-cable with LEM 02 plug system		M12 connector



#### Accessories

Connecting cable type SLG 3... or SLW..., see page 2.39

## 230 °C-High temperature

### Series KGFT

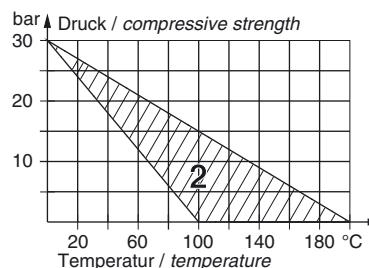
Sensor for connection to an external amplifier



Design	G1/4	G1/2	G1/4	G1/2	G1/4
Dimensions					
Switching point sp [mm]	-6	-6	-6	-6	-6
ID-No.	P21092	P21093	P21119	P21120	P21108
Type	KGFT 025	KGFT 050	KGFT 125	KGFT 150	KGFT 325
Temperature range [°C]	-35...+180	-35...+180	-35...+200	-35...+200	-35...+230
Protection [EN 60529]	IP 68	IP 68	IP 68	IP 68	IP 68
sensor	IP 54	IP 54	IP 54	IP 54	IP 54
plug LEM 01					
Compressive strength [bar]	10	10	30	30	0.5
Housing material	PTFE / AISI 316 Ti	PTFE / AISI 316 Ti	PEEK / AISI 316 Ti	PEEK / AISI 316 Ti	PEEK / AISI 316 Ti
Sealing material	FPM	FPM	PTFE	PTFE	EP
Connection	2 m PTFE-cable with LEM 01 plug system				

For special applications the seal must be determined separately. In such cases, the combination of pressure and temperature is of great importance (see diagram). Special EPDM seals will be used on customers request for water applications up to +150 °C and pressure up to 5 bar. Special seals are necessary for applications with media temperatures above +100 °C or where pressures are higher (2).

If water damp phases cannot be excluded, the KGFT...-CER sensor must be used. (see page 2.23)



Required amplifiers:

KK 030 GSP , KU 120..., KUA 120..., see page 2.24 - 2.25

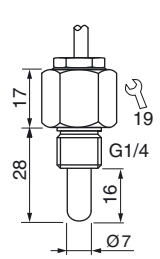
## 200 °C-High temperature • Steam proof

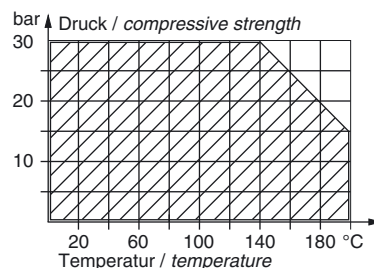
### Series KGFT-CER

Sensor for connection  
to an external amplifier

30 bar at 140 °C  
15 bar at 200 °C



<b>Design</b>	<b>G1/4</b>
<b>Dimensions</b>	
Switching point sp [mm]	-6
<b>ID-No.</b>	<b>P21199</b>
Type	KGFT 125-CER
Temperature range [°C]	-35...+200
Protection [EN 60529]	
sensor	IP 68
plug LEM 01	IP 54
Compressive strength [bar]	30 at 140 °C / 15 at 200 °C
Housing material	AISI 316Ti / Ceramic
Sealing material	PTFE
Connection	2 m PTFE-cable with LEM 01 plug system



Required amplifiers:

KK 030 GSP, KU 120..., see page 2.24

## Amplifier

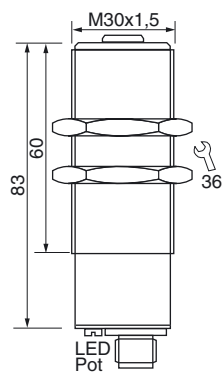
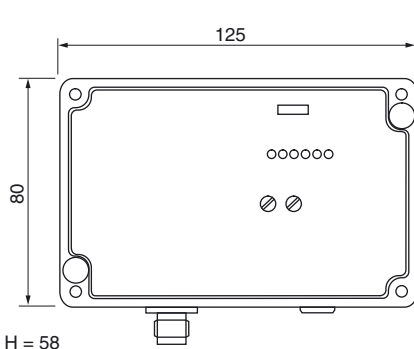




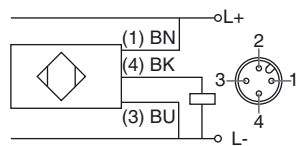
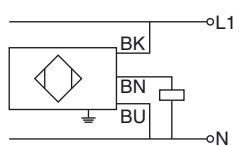
### Series KK-KU

For sensors **KGFT**  
up to **+230 °C**

**IP 67 Protection**

**LED display**



Design	KK 030...	KU 120...		
Dimensions				
Switching point sp	adjustable	adjustable		
Switching output				
ID-No.	P21095	P21107	P21118	P21117
Type	KK 030 GSP	KU 120 GPP-24	KU 120 WP-230	KU 120 WP-115
Supply voltage [V]	16...55 DC	24 DC ±20%	230 AC ±10%	115 AC ±10%
Current consumption [mA]	15		50	
Switching current max. [mA]	200		400	
Hysteresis [%]	10		10 (adjustable)	
Switching frequency [Hz]	15		5	
Ambient temperature [°C]	-5...+60		-20...+60	
EMC-class	A		A	
Protection [EN 60529]	IP 67		IP 65	
LEM-Connection	IP 54		IP 54	
LED display	LED yellow		LED-array	
Power on LED	LED green		•	
Housing material	AISI 316 Ti		Aluminium	
Sensor Connection	LEM 01 plug		LEM 01 plug	
Connection	M12 connector	M12 connector	2 m PVC-cable 4x0.75 mm <sup>2</sup>	
				

Accessories

Connecting cable type SLG 3... or SLW 3..., see page 2.39



## Amplifiers

### Series KUA

**Automatic adjustment on medium**

**For sensors KGFT up to +230 °C**

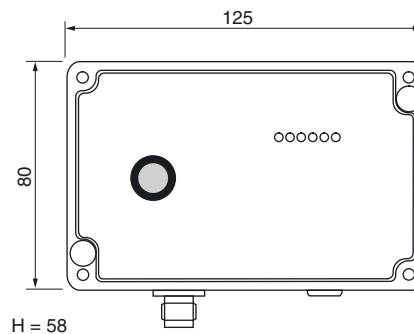
**Cable break monitoring**


**LED display**



### Design KUA 120 GSOP

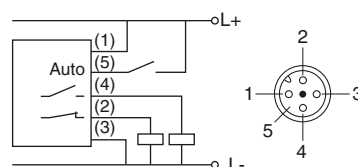
#### Dimensions



Switching point sp automatic adjustment by push-button or control input  
 Switching output 

ID-No.	P21190
Type	KUA 120 GSOP
Supply voltage [V]	18...30 DC
Current consumption [mA]	approx. 100
Switching current max. [mA]	100
Hysteresis [%]	10
Switching frequency [Hz]	10
Ambient temperature [°C]	0...+60
EMC-class	A
Protection [EN 60529]	IP 65
LEM-Connection	IP 54
LED display	LED-array
Cable break monitoring	•
Housing material	Aluminium
Sensor Connection	LEM 01 plug
Connection	M12 connector

The capacitive amplifier is designed to be connected to the level controller of type KGFT... The adjustment depending on different media or installation situations is carried out by automatic adjustment.



	unbetätigt	betätigt	Kabelbruch
LED-Zeile			
Schaltausgang Schliesser			
Schaltausgang Öffner			

Accessories Connecting cable type SLG 5... or SLW 5..., see page 2.39

## Dust - $\text{Ex}$ Intrinsically safe • Zone 20

### Series KGEX

Category 1  
Dust  $\text{Ex}$  II 1D T95 °C

Proximity switches  
Level controller



Design	M18x1	M30x1.5	G1	G3/4
Dimensions				
Installation flush (f) non flush (nf)				
Operating distance sn [mm]	8 nf	10 nf	-10	-5
ID-No.	P21157	P21158	P21159	P21160
Type	KGEX 018	KGEX 030	KGEX 100	KGEX 107
Ambient temperature [°C]	-25...+75			
Ex marking	II 1D T95 °C			
Certificate No.	TÜV 03 ATEX 2046			
Maximum values	Ci = negligibly small Li = negligibly small			
Only for the connection to certified intrinsically safe circuits with the following maximum values:	Ii = 80 mA Ui = 12.6 V Pi = 252 mW			
Housing material	PVDF	PTFE	PTFE	PTFE / AISI 316 Ti FPM
Protection [EN 60529]	IP 67			
Connection	2 m PVC-cable 3x0.5 mm <sup>2</sup>			
For the connection to amplifiers EGE 903 Ex..., page 2.34				
Note	fixing nuts are part of delivery			

## Dust - Compact model • Zone 22

### Series KGEX

#### Category 3

Dust II 3D T80 °C

DC 24 V

PNP switching output



Design	M18x1	M30x1.5	DC PNP • G1	DC PNP • G3/4
<b>Dimensions</b>				
Installation flush (f) non flush (nf)				
Switching point sp [mm] (Adjustable)	5 f (1...7)	10 f (3...15)	-6	-3
Switching output				
ID-No.	P21170	P21171	P21172	P21173
Type	KGEX 018 GSP	KGEX 030 GSP	KGEX 100 GSP	KGEX 107 GSP
Ex-Marking	II 3D T 80 °C			
Supply voltage [V]	10...55 DC			
Switching current [mA]	300			
Short circuit proof	•			
Overcurrent release [mA]	800			
Reverse protection	•			
Voltage drop max. [V]	1.5			
Current consumption [mA]	4			
Switching frequency [Hz]	25	25	10	10
Ambient temperature [°C]	-25...+70			
EMC-class	A			
LED display	•			
Housing material	Br-Ni / PPO	Br-Ni / PPO	PTFE	PTFE / AISI 316 Ti FPM
Protection [EN 60529]	IP 67			
Connection	2 m PVC-cable 3x0.5 mm <sup>2</sup>			
Note: Do not use in the presence of conductive dusts				

## $\text{Ex}$ - Sensor • Zone 0

Series **UFGS..Ex**  
Opto glass-sensor

$\text{Ex}$  II 1G Ex ia IIC T6...T4  
Category 1

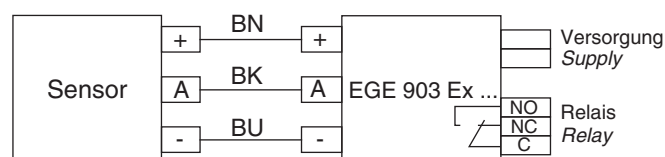
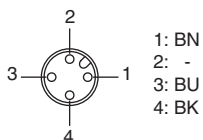
Resistant in kerosine • motor fuels

3-wire sensor, intrinsically safe



Design	G3/4									
Dimensions										
Switching point sp [mm]	-10									
ID-No.	P21183...									
Type-sensor length L [mm]	UFGS 075 Ex-Lxxxx									
Ex marking	II 1G Ex ia IIC T6...T4									
Certificate no.	TÜV 01 ATEX 1662									
Ambient temperature for temperature classes [°C]	T6: 75 T5: 90 T4: 100									
Max. power Pi [mW]	252									
Housing material	AISI 316 Ti / glass									
Sealing material	FFKM (Kalrez)									
Tightening torque [Nm]	100									
Ambient temperature [°C]	-25...+70									
Protection [EN 60529]	IP 67									
Compressive strength [bar]	16									
Connection	M12 connector									
		<p><b>Sensor length</b></p> <p>The total length L of the sensors is specified by appending "Lxxxx" to the type.</p> <p>xxxx: length in mm</p> <p><b>Preferred excess lengths ID-No.</b></p> <table border="0"> <tr> <td>120 mm: L120</td> <td>P21183012</td> </tr> <tr> <td>200 mm: L200</td> <td>P21183020</td> </tr> <tr> <td>400 mm: L400</td> <td>P21183040</td> </tr> <tr> <td>1000 mm: L1000</td> <td>P21183100</td> </tr> </table>	120 mm: L120	P21183012	200 mm: L200	P21183020	400 mm: L400	P21183040	1000 mm: L1000	P21183100
120 mm: L120	P21183012									
200 mm: L200	P21183020									
400 mm: L400	P21183040									
1000 mm: L1000	P21183100									

For the connection to amplifiers EGE 903 Ex..., page 2.34



Accessories Plug M12, SBW-DC or SBG-DC

## Ex - Sensor • Zone 0

Series URFG..Ex  
Opto glass-sensor

Ex II 1G Ex ia IIC T6...T4  
Category 1

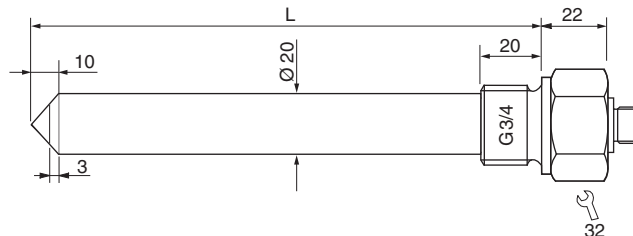
Resistant in kerosine • motor fuels

2-wire sensor, intrinsically safe



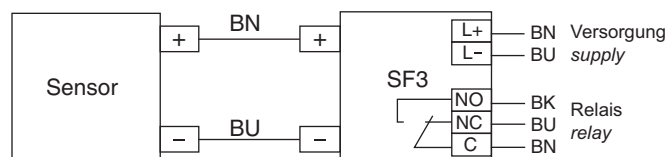
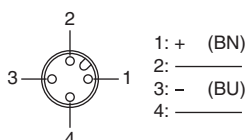
### Design G3/4

#### Dimensions



Switching point sp [mm]	-10	
ID-No.	P21185...	
Type-sensor length L [mm]	URFG 075 Ex-Lxxxx	<b>Sensor length</b>
Ex marking	II 1G Ex ia IIC T6	The total length L of the sensors is specified by appending "Lxxxx" to the type.
Certificate no.	TÜV 00 ATEX 1632	xxxx: length in mm
Ambient temperatur for temperature classes [°C]	T6: 70 T5: 80 T4: 100	<b>Preferred excess lengths ID-No.</b>
Maximum values	li = 154 mA Ui = 23.1 V Pi = 890 mW	120 mm: L120 P21185012 200 mm: L200 P21185020 400 mm: L400 P21185040 1000 mm: L1000 P21185100
Housing material	AISI 316 Ti / glass	
Sealing material	FFKM (Kalrez)	
Tightening torque [Nm]	100	
Ambient temperature [°C]	-25...+70	
Protection [EN 60529]	IP 67	
Compressive strength [bar]	16	
Connection	M12 connector	

For the connection to amplifiers SF3, page 2.35



### Accessories Plug M12, SBW-DC or SBG-DC

# Level Sensors



## Ex - Sensor • Zone 0 - 1

### Series TF...Ex

Thermal level sensor

For fuel tanks and fuel trucks

Ex II 1G Ex ia IIC T4

Ex II 2G Ex ia IIC T4

Category 1, Category 2

2-wire sensor, intrinsically safe



Design	G3/4 fixed fitting length		G3/4 adjustable fitting length	
<b>Dimensions</b>				
Switching point sp [mm]	-10		-10	
Type	TFGS 026 Ex-L200	TFGS 126 Ex-L200	TFKS 026 Ex-L400	TFKS 126 Ex-L400
ID-No.	P21191	P21194	P21192	P21195
Fitting length L [mm]	200	200	400 (variable)	400 (variable)
Zone	0	1	0	1
Ex marking	II 1G Ex ia IIC T4	II 2G Ex ia IIC T4	II 1G Ex ia IIC T4	II 2G Ex ia IIC T4
Certificate No.	TÜV 07 ATEX 553745			
Maximum values	Ii = 154 mA Ui = 23.1 V Pi = 890 mW Ci ≤ 100 nF Li ≤ 0.8 µH			
Nominal resistance [Ω]	160			
Reaction time [s]	approx. 2			
Start-up time [s]	40			
Ambient temperature [°C]	-20...+80			
Function indicator	at the amplifier			
Housing material	AISI 316 Ti	AISI 316 Ti	AISI 316 Ti	AISI 316 Ti
Pipe material	AISI 316 Ti	Aluminium	AISI 316 Ti	Aluminium
Sealing material	PVDF, FPM			
Protection [EN 60529]	IP 68			
Connection	M12 connector			
Sensors for the connection to amplifiers SF3, page 2.35				
Accessories	Plug M12, SBW-DC or SBG-DC			

## Ex - Sensor • Zone 0

### Series KEAC

Ex ia IIC T6...T4  
Category 1

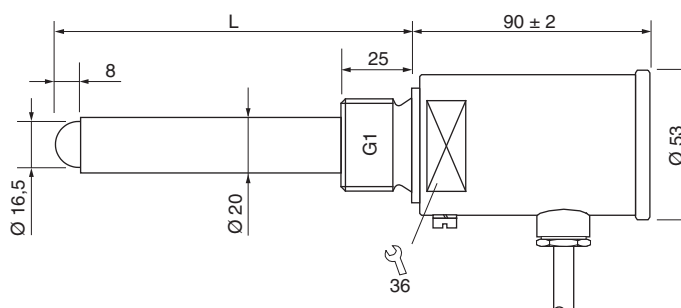
Medium up to 120 °C  
Sensor length up to 1 m



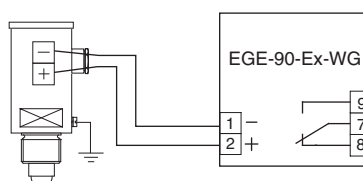
### Design G1

#### Dimensions

Sensitivity adjustable



Switching point sp [mm]	-8	-8	-8	-8	-8
ID-No.	P21086	P21087	P21088	P21089	P21090
Type-sensor length L [mm]	KEAC-L80	KEAC-L200	KEAC-L400	KEAC-L600	KEAC-L1000
Ex marking	Ex ia IIC T6...T4				
Certificate no.	TÜV 96 ATEX 1095				
Ambient temperature for temperature classes [°C]	T6: 80 T5: 95 T4: 120				
Max. power Pi [mW]	50				
Housing material	AISI 316 Ti / PTFE				
Sealing material	FPM				
Force thread [Nm]	100				
Sensitivity	adjustable with pot				
Ambient temperature [°C]	housing: -25...+75 / sensor tip: -40...+120				
Protection [EN 60529]	IP 67				
Compressive strength [bar]	30				
Connection	terminal screws				



Note different materials on request

## Ex - Sensor • Zone 0 • with Ex-Preamplifier

Series KGFT  
up to 200 °C

Ex ia T6...T3

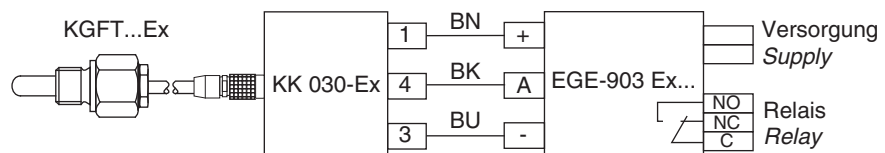
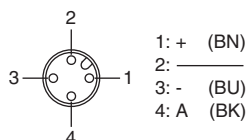
Ex II (1) 2G Ex ia IIC T6...T4

Category 1



Design	G1/4	G1/2	KK 030 Ex
Dimensions			
Switching point sp [mm]	-8	-8	-
Sensitivity adjustable	-	-	•
ID-No.	P21149	P21150	P21144
Type	KGFT 125 Ex	KGFT 150 Ex	KK 030 Ex
Ex marking	Ex ia IIC T6...T3		II (1) 2G Ex ia IIC T6...T4
Certificate No.	TÜV 01 ATEX 1670		TÜV 01 ATEX 1671
Ambient temperatures for temperature classes [°C]	T6: 80 T5: 95 T4: 130 T3: 195		T6: 75 T5: 90 T4: 120
Max. power Pi [mW]	110		252
Housing material	AISI 316 Ti/PEEK		AISI 316 Ti
Sealing material	PTFE		-
Torque [Nm]	50	100	50
Ambient temperatur [°C]	-35...+200		-25...+60
Protection [EN 60529]	IP 68		IP 54
LEM-connection	IP 54		-
Compressive strength [bar]	30		-
LED display	-		•
Connection	2 m PTFE-cable plug system LEM 01		LEM 01 / M12 connector

The KK 030 Ex ex-preamplifier is operated in zone 1. It is connected between the KGFT...Ex ex-sensors and the EGE 903 ex-amplifier (see page 2.34).



Note required amplifier EGE 903..., connecting cable SLG 3..., SLW 3..., see page 2.39



## - Amplifiers

Series EGE 90 Ex

Dust and gas

Cable break and short circuit monitoring

Connection of 2-lead sensors



Design	EGE 90 Ex...				
Dimensions					
ID-No.	P30340	P30341	P31035	P30342	P31036
Type	EGE 90 Ex1-230	EGE 90 Ex1-115	EGE 90 Ex1-24	EGE 90 Ex-WG 230	EGE 90 Ex-WG 24
Supply voltage [V]	230 AC +15/-10%	115 AC +15/-10%	24 DC ±15%	230 AC +15/-10%	24 DC ±15%
Certificate no.	TÜV 97 ATEX 1148				
Ex marking	II (1) GD [Ex ia] IIC				
Maximum values	U <sub>o</sub> = 12.6 V I <sub>o</sub> = 15.9 mA P <sub>o</sub> = 50 mW C <sub>o</sub> = 1.15 µF L <sub>o</sub> = 120 mH				
Output	relay / change over				
Switching voltage max. [V]	250 AC / 24 DC				
Switching current max. [A]	4 AC / 4 DC				
Switching power	cos φ >0.7 / L/R <200 ms				
Ambient temperature [°C]	-20...+60				
Protection [EN 60529]	IP 20				
Connection	terminal screws				
Note:	The amplifier EGE 90 EX1 is suited for connection of NAMUR sensors.				

## Ex - Amplifiers

### Series EGE 903 Ex

Dust and gas

Cable break and short circuit monitoring

Connection of 3-lead sensors



Design	EGE 903 Ex...		
Dimensions			
ID-No.	P21141	P21142	P21143
Type	EGE 903 Ex-230	EGE 903 Ex-115	EGE 903 Ex-24
Supply voltage [V]	230 AC +10/-15%	115 AC +10/-15%	24 DC ±15%
Certificate no.	TÜV 01 ATEX 1663		
Ex marking	II (1) GD [Ex ia] IIC		
Maximum values	$U_o = 12.6 \text{ V}$ $I_o = 80 \text{ mA}$ $P_o = 252 \text{ mW}$ $C_o = 270 \text{ nF}$ $L_o = 5.4 \text{ mH}$		
Output	relay / change over		
Switching voltage max. [V]	250 AC / 24 DC		
Switching current max. [A]	4 AC / 4 DC		
Switching power	$\cos \varphi > 0.7 / \text{L/R} < 200 \text{ ms}$		
Ambient temperature [°C]	-20...+60		
Protection [EN 60529]	IP 20		
Connection	terminal screws		

## **Ex** - Amplifier • Zone 1

### Series SF3

Gas **Ex** II (1) 2G Ex em [ia/ib] IIC T6

Installation in Zone 1  
Increased safety

For the connection of 160 Ω Thermo-sensors  
For the connection of Opto-level sensors



Design	SF3				
Dimensions					
ID-No.	P21174				
Type	SF3				
Supply voltage [V]	24 DC +15/-10%				
Ex marking	II (1) 2G Ex em [ia/ib] IIC T6				
Certificate no.	TÜV 04 ATEX 2447				
Ambient temperature for temperature classes [°C]	T6: 35 T5: 50 T4: 85				
Maximum values	U <sub>O</sub> = 23.1 V I <sub>O</sub> = 154 mA P <sub>O</sub> = 890 mW C <sub>O</sub> = 86 nF L <sub>O</sub> = 0.4 mH				
Connectable sensors	Opto-level sensors (URF...) / Level sensors (R <sub>f</sub> = 160 Ω)				
Output relay	increased safety			intrinsically safe	
Switching voltage [V]	250 AC	250 DC	60 DC	24 DC	Ex ib IIC 30 V
Switching current [A]	2 AC	0.3 DC	0.8 DC	2 DC	IIC: 0.1 DC IIB: 0.25 DC IIA: 0.34 DC
Switching power	cos φ ≥0.7 / L/R ≤200 ms				
Ambient temperature [°C]	-20...+60				
Protection [EN 60529]	IP 54				
Housing material	PA, Aluminium				
Connection	sensor: tabs size 6.3-0.8 (DIN 46244)			relay/supply: 2 m PVC-cable 0.5 mm <sup>2</sup>	

## Ex - housing for amplifier • Zone 1/21

### System GAM

Dust  $\text{Ex}$  II 2D IP 66 T 65 °C

Gas  $\text{Ex}$  II (1) 2G Ex em [ia/ib] II CT6

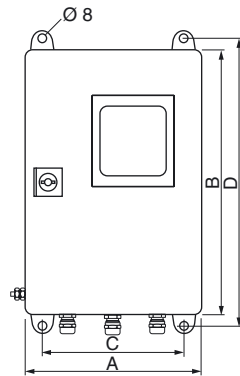
For installation of amplifiers  
within Zone 1/21



### Design

### GAM...

#### Dimensions

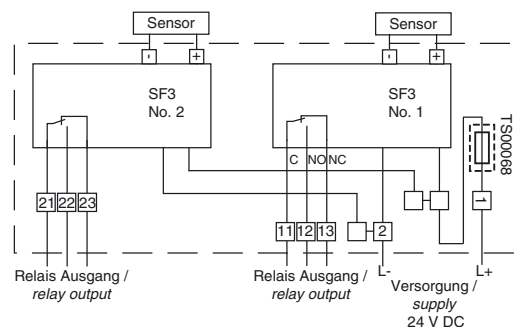


Type	ID-No.	A	B	C	D	Amount of SF3
GAM-SF1530	P21175	150	300	110	320	1
GAM-SF2030	P21176	200	300	160	320	2
GAM-SF3030	P21177	300	300	260	320	4
GAM-SF3040-5	P21178	300	400	260	420	5
GAM-SF3040	P21179	300	400	260	420	6

ID-No.	P21175	P21176	P21177	P21178	P21179
Type	GAM-SF1530	GAM-SF2030	GAM-SF3030	GAM-SF3040-5	GAM-SF3040
Housing dimensions [mm]	150x300x120	200x300x120	300x300x120	300x400x120	300x400x120
Number of amplifiers	1	2	4	5	6
Ex marking	II (1) 2G Ex em [ia/ib] IIC T6 / II 2D IP 66 T 65 °C				
Certificate no.	TÜV 04 ATEX 2555 X				
Ambient temperature for temperature classes [°C]	T6: 27 T5: 42 T4: 60				
Electrical connection	connection terminals 2.5 mm <sup>2</sup>				
Relay output	connection terminals 1.5 mm <sup>2</sup>				
Power supply	sensor: tabs nominal size 6.3 - 0.8 mm (DIN 46244)				
Sensor connection	4...8				
Cable diameter [mm]	-20...+60				
Ambient temperature [°C]	sheet steel case, lacquered				
Housing material	IP 66				
Protection [EN 60529]					

#### Example:

Schematic for the installation of two amplifiers in a GAM-SF2030 housing.



## - housing for screw terminals

### Series GK...

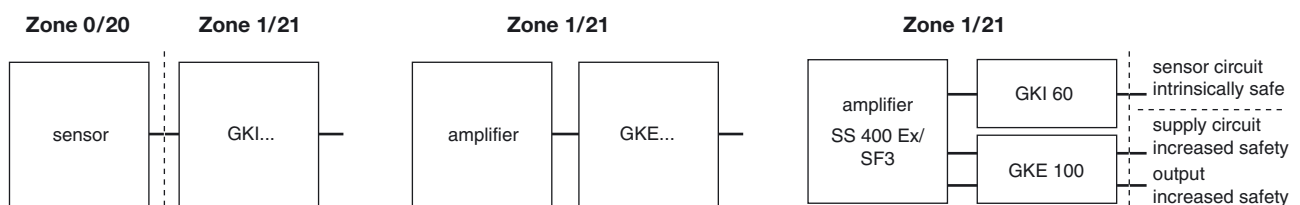
- II 2G Ex e II T6
- II 2G Ex ia IIC T6
- II 2G Ex e [ia] IIC T6
- II 2D IP 65 T 75 °C

For the connection of supply- and signal lines in Zone 1/21



Design	GK...				
Dimensions					
ID-No.	Z01168	Z01169	Z01170	Z01171	Z01172
Type	GKE 60	GKE 100	GKI 60	GKI 100	GKEI 100
Amount of terminals	4	8	4	8	4 Ex e + 4 Ex ia
Dimensions [mm]	58x64	98x64	58x64	98x64	98x64
Electric circuit	increased safety		intrinsically safe		intrinsically safe + increased safety
Ex marking	II 2G Ex e II T6 II 2D IP 65 T 75 °C		II 2G Ex ia IIC T6 II 2D IP 65 T 75 °C		II 2G Ex e [ia] IIC T6 II 2D IP 65 T 75 °C
Certificate No.	BVS 05 ATEX E022 X				
Ambient temperature [°C]	-20...+70				
for temperature classes [°C]	T4, T5, T6 : 70				
Rated voltage [V]	275				
Rated current [A]	2				
Cross section wires	single wire multistrand		0.5...2.5 mm <sup>2</sup> 0.5...1.5 mm <sup>2</sup>		
Cable diameter [mm]	4...8				
Housing material	Aluminium				
Protection [EN 60529]	IP 65				
Connection	terminal space				

The enclosure for screw terminals type GK... is designed for the connection of intrinsically safe and / or non-intrinsically safe circuits in explosion-hazardous areas of category 2 (zone 1 and 21).



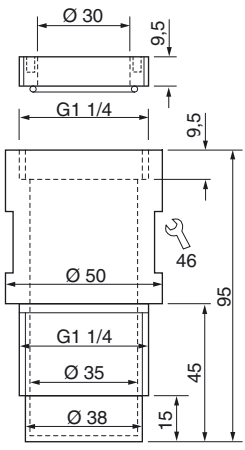
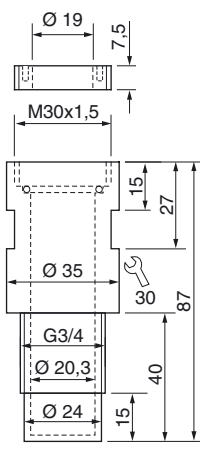
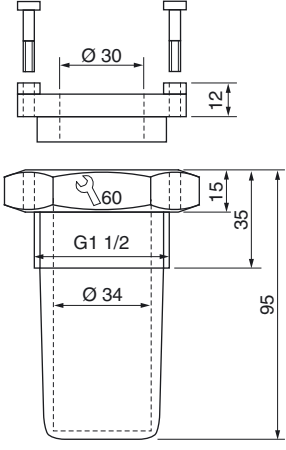
## Accessories • Mounting sleeves

**It is not necessary to empty the vessel for routine sensor inspection.**

**PTFE housing for high chemical resistance**

**O-ring moisture barrier**



Design	KNM-35	KNM-20	KPM-35
Dimensions			
ID.-No.	P40501	P40500	P40502
Type	KNM-35	KNM-20	KPM-35
Housing material	PTFE	PTFE	Crastin
Torque max. [Nm]	1	1	3
Compressive strength [bar]	3	3	6
Thread	G1 1/4	G3/4	G1 1/2
For sensor type	KNK-025...	KNK-015...	KNK-025...
Usefully sensors	see in our catalogue „Capacitive proximity switches“		

### Fitting in of sleeves and sensors

Mounting sleeves are used for lateral or vertical passage through the vessel side. In order to ensure full pressure resistance, the thread should be screwed into the vessel threaded bush over a length of approximately 20 mm. If this is not possible because the vessel side is too thin, a suitable bush must be installed. However, the threaded passage should not be longer than the thread on the mounting sleeve. The interior thread must comply with DIN ISO 228. Sealing of the thread is either carried out with hemp and a sealing paste according to DIN-DVGW, or with PTFE sealing tape if higher chemical resistance is required. In any case, chemical resistance of the seal must be checked for this application. When screwing in the sleeve, maximum admissible torque must not be exceeded.

Metallic or metal clad vessels should be earthed. In the case of plastic vessels filled with electrically conductive materials, the latter should be earthed. In the case of plastic vessels filled with non-conducting materials, an earthed metal band applied on the outside of the vessel may be used as a counter electrode. For fitting the sensor, the closing ring is unscrewed from the

mounting sleeve. The sensor connecting cable must be fitted through the closing ring and the sensor fitted into the sleeve. After this, the closing ring is screwed back into the mounting sleeve, until the gasket is firmly pressed against the sensor housing. This ensures that no external humidity will penetrate into the mounting sleeve, as this might lead to sensor switching failures.

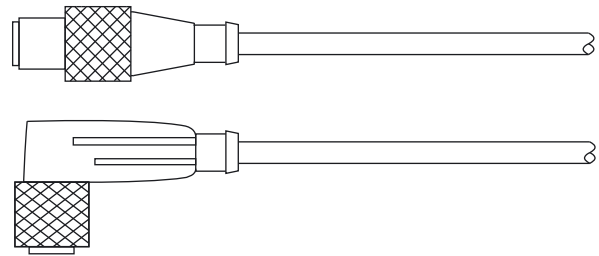
### Sensor compensation

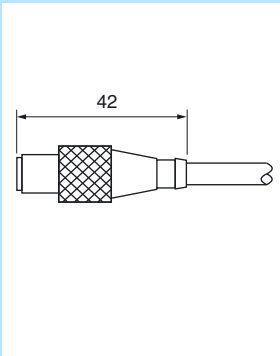
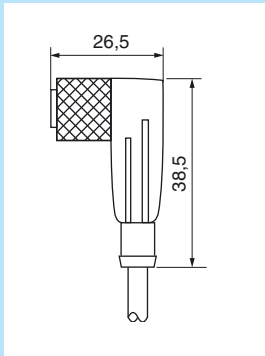
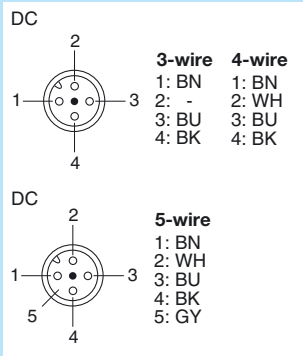
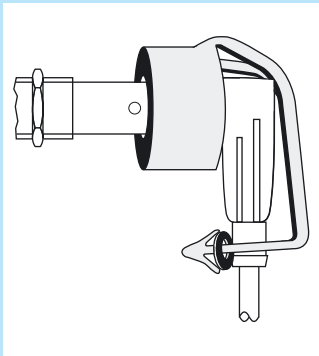
To start with, the plastic screw which protects the compensating potentiometer against humidity must be removed. The screwdriver blade used for compensation should be narrower than 2.4 mm. The sensor is now fitted into the sleeve, and the vessel filled to a level allowing for complete immersion of the sleeve. Beginning at the left limit, turn the potentiometer clockwise until the switching output is operated (NO), after which the potentiometer is turned further clockwise about one revolution. The switching output of the sensor should now be closed. In case of very small bulk densities and corresponding small dielectric constant, it may be necessary to turn only half a revolution.

## Accessories

### M12 connector System SL

### Finished cable plug housing Self locking screw plug Protection IP 67



Cable plug housing straight	Cable plug housing angular	Pin-assignment	Plug-lock
		<p>DC</p>  <p>3-wire 1: BN 2: - 3: BU 4: BK</p> <p>4-wire 1: BN 2: WH 3: BU 4: BK</p> <p>5-wire 1: BN 2: WH 3: BU 4: BK 5: GY</p>	
<b>SLG...</b>	<b>SLW...</b>	<b>DC</b>	<b>PL-M12</b>

TYPE	ID-NO.	DESIGN
SLG 3-2	Z01076	Cable plug housing M12x1 DC, straight 2 m PVC-cable 3x0.34 mm <sup>2</sup>
SLG 3-5	Z01077	Cable plug housing M12x1 DC, straight 5 m PVC-cable 3x0.34 mm <sup>2</sup>
SLW 3-2	Z01078	Cable plug housing M12x1 DC, angular 2 m PVC-cable 3x0.34 mm <sup>2</sup>
SLW 3-5	Z01079	Cable plug housing M12x1 DC, angular 5 m PVC-cable 3x0.34 mm <sup>2</sup>
SLW 3-2-LED	Z00052	Cable plug housing M12x1 DC, angular 2 m PVC-cable 3x0.34 mm <sup>2</sup> PNP with LED
SLG 4-2	Z00445	Cable plug housing M12x1 DC, straight 2 m PVC-cable 4x0.25 mm <sup>2</sup>
SLG 4-5	Z00449	Cable plug housing M12x1 DC, straight 5 m PVC-cable 4x0.25 mm <sup>2</sup>
SLW 4-2	Z00446	Cable plug housing M12x1 DC, angular 2 m PVC-cable 4x0.25 mm <sup>2</sup>
SLW 4-5	Z00450	Cable plug housing M12x1 DC, angular 5 m PVC-cable 4x0.25 mm <sup>2</sup>
SLW 4-2-LED	Z01157	Cable plug housing M12x1 DC, angular 2 m PVC-cable 4x0.25 mm <sup>2</sup> PNP with LED
SLG 5-2	Z01150	Cable plug housing M12x1 DC, straight 2 m PVC-cable 5x0.34 mm <sup>2</sup>
SLW 5-2	Z01151	Cable plug housing M12x1 DC, angular 2 m PVC-cable 5x0.34 mm <sup>2</sup>
PL-M12	Z01182	Plug-lock for sensors in Ex areas

### TECHNICAL DATA

Protection	IP 67	Supply voltage	250 VAC / 300 VDC
Contact resistance	≤ 5 mΩ	Insulation resistance	>10 <sup>9</sup> Ω
Switching current	4 A (CSA=3 A)	Testing voltage	2.0 KV eff.
Temperature range	-25...+80 °C		

### Note

Sensors with NC output are connected to 4 pole cable plug housings. In this case, the break output is connected to the white lead (connection 2).



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