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EGE

Brochure No. 2

Level Sensors

Special-Sensors for Automation

E20323

Level Sensors

Contents

EGE-ELEKTRONIK SPEZIAL-SENSOREN GMBH
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Technique & Application

Sensors

Microwave meter

The MFP level meter for continuous monitoring of various liquids allow measurement of the fill level in plastic or metal tanks of any size. The devices offer a high measurement precision. They work with numerous liquids such as water, oil or emulsions.
Principle of measurement: The microwaves are “guided” along the rod – and are reflected at the surface of the medium. From this the sensor determines the fill level. No adjustment is necessary for various media.
The devices are made of aluminium and AISI 316 Ti stainless steel and are suitable for ambient temperatures between – 20 and +70 °C. Additional devices are available for monitoring highly corrosive liquids with a coated probe and non-metallic thread.
The fill level meters are available in sizes between 300 and 1200 mm in length. The sensors are equipped with a G3/4 thread and are connected via an M12 plug. The display shows the fill level either in cm or percentage value. You can program additional functions such as a fixed offset value or measuring range.

Microwave level controllers

The microwave level controllers of the MFC and MFK series respond to media contact at the tip of the sensor. They are especially insensitive to soiling and build-up. 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.

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.

Technique & Application

Sensors/ Terminology

Opto-Sensors UF...

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 ntormal conditions. The chemical compatibility and technical suitability of the sensor should be tested when used with unlisted fluids.

Resistance UFGS..., UFGSs...Ex	
Water	Monoethylenglycole
Vegetable oil	Glyceric
Diluted acids	Aceton
Diluted bases	Fuels
Ethyl alcohol	Benzol
Methyl alcohol	Diesel
Isopropanol	Motor oil
Isohexan	Hydraulic oil
n-Heptan	Paraffin Oil DAB

Conductive level controller

The CFC 050 GSOP enables level detection of fluids with a conductivity >10 µS/cm. Typical applications are dry-running protection or overflow protection in vessel or pipes. The CFC 050 GSOP works with a measuring electrode and a complementary electrode witch is connected to the metallic thread. The switching signal is triggered when the fluid has contact to both electrodes.
Adhesions or splash are no problem.
Using the screw-on-electrode the CFC 050 GSOP can even be used in plastic container. The electrodes can easily be shortened by the user.

Medium (example)	Conductivity (µS/cm)
Concentrated acid or alkaline	up to 1000 000
Industrial contaminated water	up to 500 000
Methylalkohol	440 000
Seawater	55 000
Ethylalkohol	1300
Drinking water	100...2000
Distilled water	0.5...5
Organic or mineral oils	0

Hydrostatic fill level sensor

The hydrostatic fill level sensors of the series DGC 075 are suitable for fill level measuring in liquids and are available for fill levels up to 2000 cm. The measuring range can be adjusted simple and fast by potentiometer and 4 LEDs on the measuring head. It is easy to install with its G3/4 thread, for example in the tank wall, and has protection class IP 67. The sensor has a 4....20 mA signal exit.

Sensors for explosion hazardous ares

Fill level monitors for use in zone 0 are operated with the associated amplifiers listed in the respective connection chart. The analysis devices operated outside of the Ex area. Sensors of the series KGFTa...Ex are used in conjunction with an intermediate amplifier, which is approved for installation in zone 0 or zone 1.

Switching point

Capacitative level sensors react to conductive materials and non-conductive materials with a dielectrical constant ε >1.8. The switching point depends on the material.
In the same installation situation, sensors are more sensitive when using conductive materials.
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 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.

Nominal 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 su

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

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Terminology

Assured operating distance sa
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 sr 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 ±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_0 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.

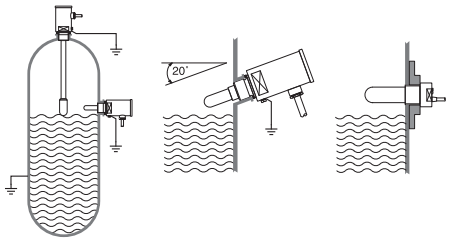
Connection
The connection of the sensors is accomplished through plug-in connections or cables. Different cable types and lengths are available upon request.

Technique & Application

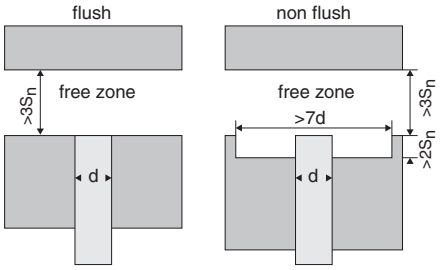
Installation and operation

Instructions for mounting

The sensor tip of short level sensors installed from the side must be located inside the container. To prevent build-up, it is recommended to install these sensors at a tilted angle of approx. 20°. With rod-style sensors, make sure that the tip is not affected by lateral forces. Such forces may occur, for example, when using sensors near filling openings or mixers.
Only use materials for housing and sealing that are suitable for the respective application.



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 in-fluence. 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

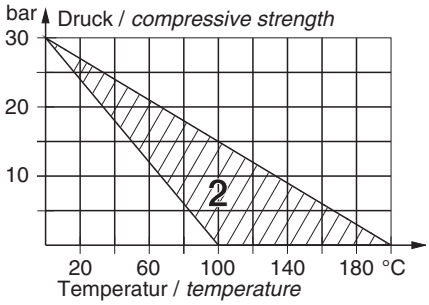
The threads of the sensors in this prospectus are manufactured to DIN ISO 228-1, tolerance class B. They are designated with (") or (G).
If it is necessary to combine different threads, e.g. the sensor-thread made to DIN ISO 228-1 and an inner thread made to DIN ISO 229, such inner thread must be widened by a thread drill.

Torques

In order to prevent destruction of the threaded bushing during fitting, PTFE-sensors may only be tightened by hand.

Sealings

The sealings used for our sensors are made of PTFE, NBR, FPM or AFM. If the temperatures exeed 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.



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 61508 and must be labeled accordingly. Sensors that are not labeled must not to be used for applications of this kind.

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Probes
Compact models
Amplifiers

Opto switch-compact

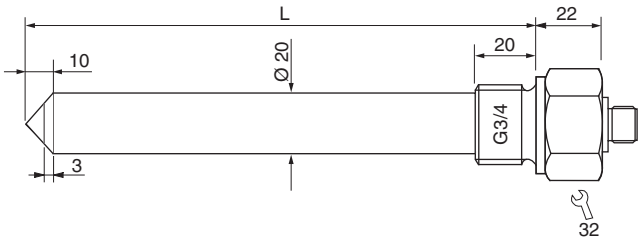
Opto glass-sensor
G3/4 thread

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		
ID-No.		**P21181...**
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
EMC-class		A
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

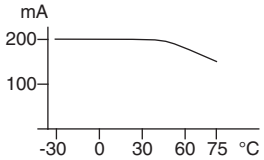
Sensor length

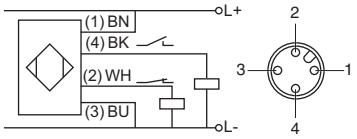
The total length L of the sensors is specified by appending “Lxxxx” to the type.

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

Switching current





Accessories	connecting cable type SLW 4-2 LED (Z01157), see page 2.35

Opto switch-compact

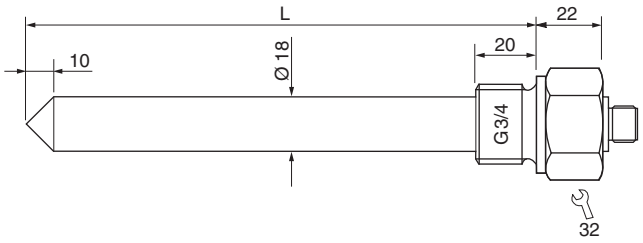
G3/4 thread

DC 10...33 V

Plug connection

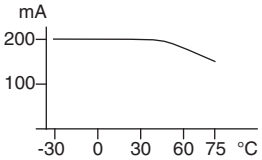
Design	*DC PNP • G3/4*

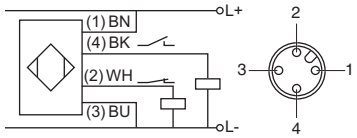
Dimensions



Switching point sp	[mm]	−10	
Switching output			
ID-No.		**P.....**	
Type-sensor length L	[mm]	UFS 075 GSOP-Lxxxx	**Sensor length**
Supply voltage	[V]	10...33 DC	
Switching current	[mA]	200	The total length L of the sensors is specified by appending “Lxxxx” to the type.
Short circuit proof		•	
Overcurrent release	[mA]	250	
Reverse protection		•	
Voltage drop	[V]	2	xxxx: length in mm
Minimum load current	[mA]	–	
Current consumption	[mA]	10	**Preferred excess lengths** **ID-No.**
Switching frequency	[Hz]	5	60 mm: L060 P21209
Ambient temperature	[°C]	−25...+70	100 mm: L100 P21121
EMC-class		A	200 mm: L200 P21122
Protection	[EN 60529]	IP 67	400 mm: L400 P21123
LED display		plug with LED	600 mm: L600 P21124
Housing material		AISI 316 Ti / PES	1000 mm: L1000 P21125
Sealing material		FPM	
Compressive strength	[bar]	16 (25 °C)	
Connection		M12 connector	

Switching current





Accessories	connecting cable type SLW 4-2 LED (Z01157), see page 2.35

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