

# FIELD DEVICES FOR PROCESS AUTOMATION



With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the "Elektrotechnik und Elektroindustrie (ZVEI) e.V." including the supplementary clause: "Extended reservation of title".

We at Pepperl+Fuchs recognise a duty to make a contribution to the future.  
For this reason, this printed matter is produced on paper bleached without the use of chlorine.

# THE SUCCESS STORY OF PEPPERL+FUCHS

- 1945** Walter Pepperl and Ludwig Fuchs lay the foundation of Pepperl+Fuchs: The opening of a radio repair shop
- 1948** Manufacture of transformers
- 1958** Development and production of the first inductive proximity switch
- 1973** The first foreign subsidiary is formed in England
- 1979** Pepperl+Fuchs commences production in Singapore
- 1988** Michael Fuchs and Claus Michael take over the management of the company and Pepperl+Fuchs becomes a limited liability company
- 1991** Split into Factory Automation and Process Automation divisions, new product group level control through a company acquisition
- 1996** The purchase of another company establishes the encoder business
- 1997** New production facilities open at Veszprem/Hungary
- 2000** Expansion of the Factory Automation activities with the purchase of Visolux GmbH and the Microswitch and Photoswitch interests from Honeywell; at the same time the Process Automation sector is expanded by the takeover of ELCON
- 2000** Start of manufacture at Bintan/Indonesia
- 2003** Takeover of the purge and pressurization systems from Bebcu Industries EPS in the USA
- 2004** New Data Matrix Code product range obtained through the acquisition of Omnitron AG and the Position Encoding System, also due to an acquisition
- 2005** Expansion of the Systems & Solutions business area within the Process Automation division aided by the acquisition of EXTEC
- 2006** Pepperl+Fuchs acquires Intrinsic Safety Instrumentation business from Cooper Crouse-Hinds GmbH

Pepperl+Fuchs will continue this policy of growth.



## One company, two divisions

### PRODUCT AREAS FACTORY AUTOMATION

- Binary and analog sensors in various technologies
  - Inductive and capacitive sensors
  - Magnetic sensors
  - Ultrasonic sensors
  - Photoelectric sensors
  - Vision sensors
- Incremental and absolute value rotary encoders
- Counters and secondary switching devices
- RFID Identification systems
- Data Matrix Identification systems
- AS-Interface
- WCS



### BRANCHES FACTORY AUTOMATION

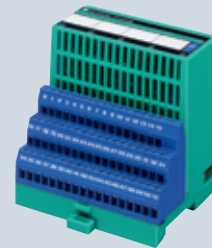
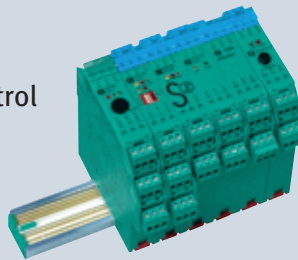
- Machine & Plant Engineering
- Print, Paper and Finishing
- Material Handling
- Packaging Industry
- Automotive Industry
- Doors, Gates and Elevators
- Chemical Apparatus
- Commercial vehicles
- Textile Machines





## PRODUCT AREAS PROCESS AUTOMATION

- Signal conditioners
- Intrinsically safe interface components
- Remote process interface
- Intrinsically safe fieldbus solutions
- Level control sensors
- Operating systems for hazardous areas
- Purge/Pressurization enclosure systems
- Process measuring and control systems engineering at the interface level
- Ex-protection training



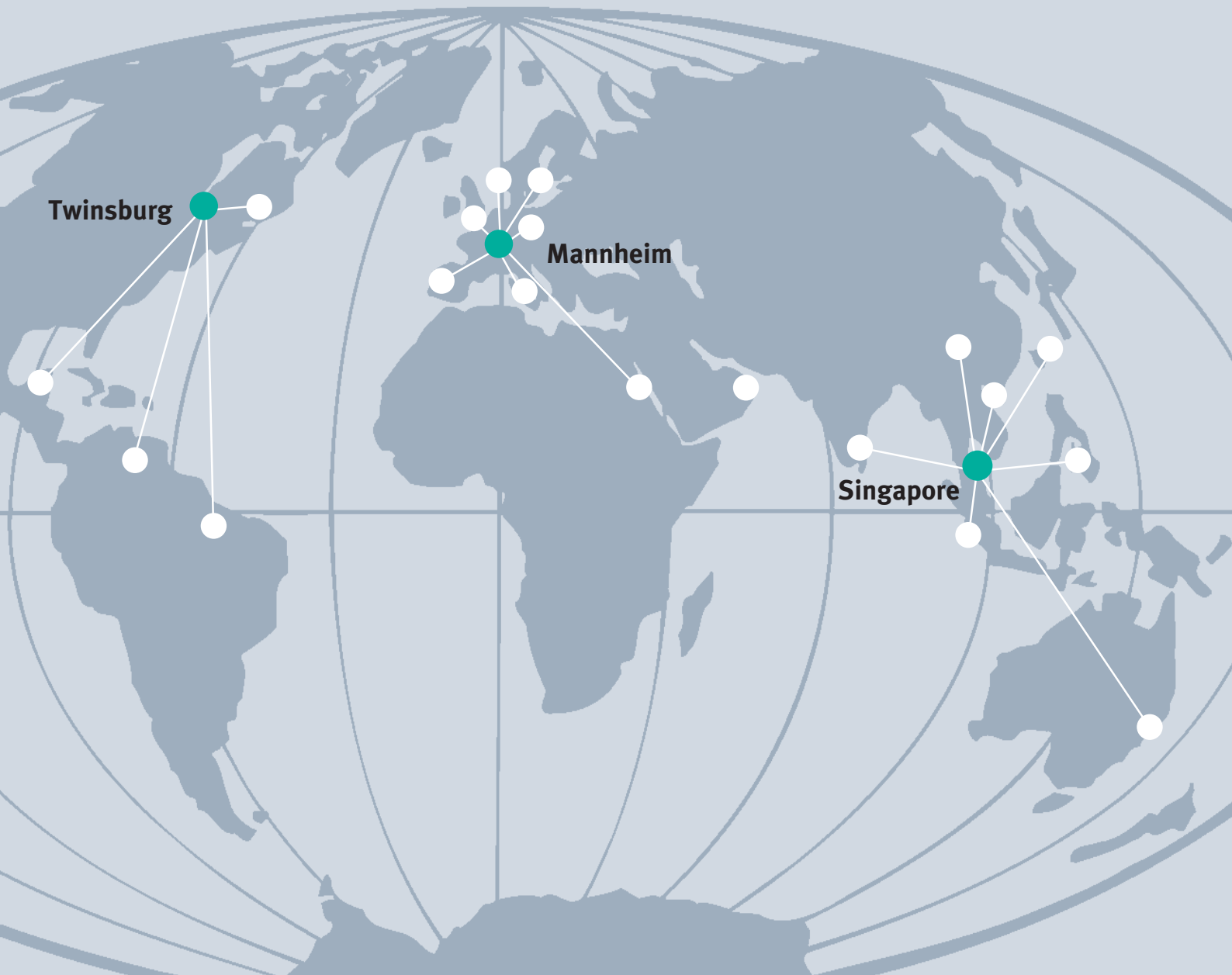
## BRANCHES PROCESS AUTOMATION

- Chemical Industry, Pharmaceuticals
- Oil, Gas and Petrochemical Industry
- Industrial and communal waste water technology
- Energy Production
- Engineering consultant for Process Automation





# WORLDWIDE PRESENCE



# WE ARE RIGHT THERE – WHERE OUR CUSTOMERS ARE...

The three centers of excellence are the focal points of the global presence of Pepperl+Fuchs



## Mannheim

Mannheim is the traditional headquarters of Pepperl+Fuchs and the center of excellence focusing on engineering. More than 600 specialists support the activities of this principal Pepperl+Fuchs location.



## Twinsburg

Since 1983, Twinsburg/Ohio has been the headquarters for the American market. 200 employees on site develop specific solutions for the American customers of Pepperl+Fuchs.



## Singapore

More than 550 employees are engaged in the Singapore center of excellence of Pepperl+Fuchs. Since 1979, all activities associated with the Asiatic economic area have been controlled from Singapore. This region is becoming of increasing importance due to the growth market in China.

## We create markets

The global presence of Pepperl+Fuchs:

- Technology centers with their own development groups in Berlin, Tuttlingen and Sulbiate/Italy offer customers specific solutions. Furthermore the locations operate highly flexible production in small batch sizes.
- The production facilities in Hungary and Indonesia are equipped for series production in large quantities.
- The worldwide sales network guarantees that we are close to our customers and enforces Pepperl+Fuchs to react swiftly and competently to customer requirements. You are in need of contact addresses of our sales partners?

Please try the internet at [www.pepperl-fuchs.com/company/presence](http://www.pepperl-fuchs.com/company/presence).







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## Overview of all level measuring methods

### Limit value detection

Measuring principle	Application	Design/type	Page		
<b>Float switch</b>	Standard	Initiator	18		
		Micro switch	26		
		Hg change-over contact	30		
	Ex-area zone 1	Initiator	18		
	Float switch combination		34		
<b>Vibration</b>	Standard	LVL-A*	38		
		LVL-AH	44		
		LVL-B*	50		
		LVL-S1	58		
		LVL-T1	62		
		LVL-M*	66		
		LVL-M*H	80		
		LVL-M2C	94		
	WHG	LVL-A*	38		
		LVL-T1	62		
	Ex-area zone 0	EEx ia	LVL-M*	66	
	WHG		EEx d	LVL-M*H	80
				LVL-M2C	94
	Ex-area zone 2	EEx nA	LVL-M*	66	
	WHG		EEx nC	LVL-M*H	80
				LVL-M2C	94
		Ex-area zone 20	LVL-B*	50	
	<b>Conductive</b>	Standard	LKL-P	108	
		WHG			
		Ex-area zone 1 + 2			
<b>Capacitive</b>	Standard	Compact version	122		
	Ex-area zone 20	Device with extension			
<b>Magnet-operated immersion probe</b>	Standard	Plastic	132		
		Stainless steel	134		
	Ex-area zone 0	Stainless steel	136		

Continuous level measurement

Measuring principle	Application	Design/type	Page
<b>Magnet-operated immersion probe</b>	Standard	Plastic	142
		Stainless steel	144
	Ex-area zone 0	Stainless steel	146
<b>Hydrostatic</b>	Standard	LHC-M**	150
	Ex-area zone 0	PPC-M**	164
	Ex-area zone 1 + 2	Level probe	178
	Ex-area zone 21 + 22	LHC-M40	150
		PPC-M**	164
<b>Ultrasonic</b>	Standard	LUC4	186
		LUC-M**	190
	Ex-area zone 0 + 1	LUC-M**	190
	Ex-area zone 2		
	Ex-area zone 21 + 22		
<b>Guided microwave</b>	Standard	LTC	202
	WHG	LTC	202
	WHG	LTC	202
	Ex-area zone 0 + 1		
	Ex-area zone 22		
	Ex-area zone 21 + 22	LTC	202

## 4 steps to a suitable level measuring method

Find the suitable measuring method for your application in 4 steps:

**1. step**      **Measuring task**

**2. step**      **Measuring principle**

**3. step**      **Range of applications**

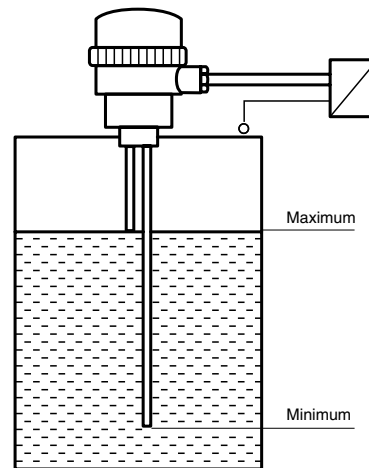
**4. step**      **System construction**

### 1. Measuring task

#### Limit value detection

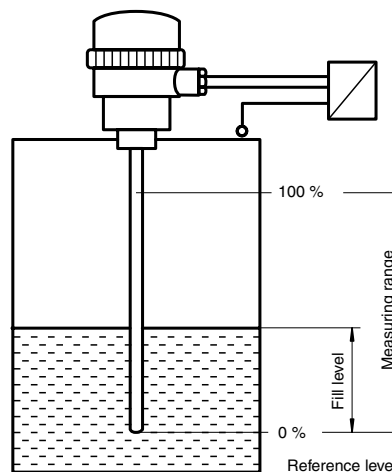
Limit value switches signal whether the medium being monitored has reached, risen above, or fallen below, a set level (VDI/VDE Directive 3519) based on its installation height.

Examples: overflow/dry-run protection,  
minimum-maximum control  
overspill protection



#### Continuous level measurement

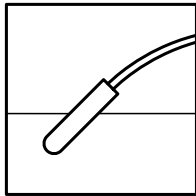
Measuring sensors detect the current fill level. This is done by determining the distance from the surface of the medium to the preset reference level. Continuous level measurement allows usage evaluation, loss control, and above all, precise process control (VDI/VDE Directive 3519).



## 2. Measuring principle

### Limit value detection

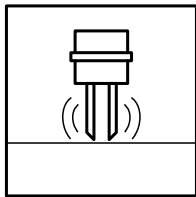
#### Float switch



Float switches are used for simple limit value detection in liquids. Due to the higher density of the liquid, the float switch floats on the liquid surface.

The float switch is secured by means of its cable fastener at a level suitable for the given application. The switching process is triggered by the rocking movements of the sensor. Initiators and micro switches are used as switching elements.

#### Vibration

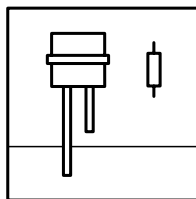


The piezoelectrically activated vibration of a vibrating fork is damped when the fork comes into contact with the medium.

Using this change, an electronic system determines the switching signal.

The function is independent of fluctuations in the physical properties of the medium.

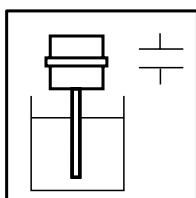
#### Conductive



The conductivity of the liquid medium may vary within a wide range. Once the liquid reaches the fill limit determined from the installation height of the electrode, the medium closes the DC-free alternating current circuit between the two electrodes (or between the container wall and an electrode).

A switching signal is produced from the sudden increase in current consumption. Combustible liquids such as fuels, oils and solvents are non-conductive and cannot be measured by this measuring principle. Acids, lyes and solutions containing water are conductive and are detected very well. Aggressive liquids can be detected without problems using probes made from highly-resistant materials.

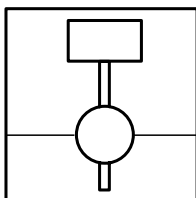
#### Capacitive



An insulated metal probe mounted in a metal container forms a capacitor together with the metal wall whose capacitance continually increases as the medium level increases.

Hence, for capacitive measurements a medium with a constant permittivity is required. The simple and robust construction (as rod or rope sensor) allows level measurement of liquids, granular solids, conductive and non-conductive media.

#### Magnet-operated immersion probe



Magnet-operated immersion probes are used in clean liquids, such as e. g. solvents or oils. The float, guided by a probe tube, floats on the liquid surface.

By means of its magnetic field, the ring magnet built into the float activates the reed contacts installed in the guide pipe. These are switched when the float is located in the appropriate position.

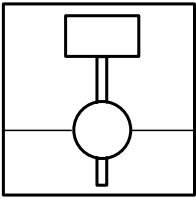
The reed contacts are designed as normally closed, normally open or change-over contact switches. The measurement is independent of the electrical properties of the liquid, as well as the pressure, temperature and density.



## 4 steps to a suitable level measuring method

### Continuous level measurement

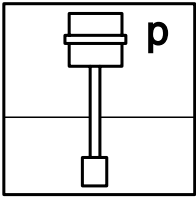
#### Magnet-operated immersion probe



A float moves along a vertical guide tube. The permanent magnet fixed in the float switches the contacts of a reed contact resistor chain. This resistor chain acts as a voltage divider and provides the voltage values corresponding to the medium level.

The resolution is dependent on the number of contacts used. The measurement is independent of the electrical properties of the filling material, as well as the pressure, temperature and density.

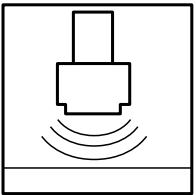
#### Hydrostatic



The pressure in a liquid increases with increased filling height. This hydrostatic pressure is transmitted to the measuring cell via a stainless steel diaphragm.

Foam, build-up, fluctuating electrical properties of the liquid and the container design do not affect the measurement values.

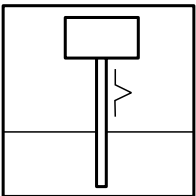
#### Ultrasonic



The level height is calculated from the time it takes for ultrasonic pulses to travel from the sensor to the surface of the medium and back.

Chemical and physical properties of the medium do not influence the measurement result. Therefore, aggressive and abrasive, viscous and adhesive media can be measured without problems.

#### Guided microwave



The system is based on the reflection of an electromagnetic pulse that is directed on a sensor rod/cable and reflected by filling material. The electronics integrated into the sensor determines the filling state from the echo time of the pulse and shows this in the display.

The electromagnetic pulse is sent out, reflected on the filling material and received again. The echo time of the pulse is proportional to the distance from the surface of the medium. The measurement procedure and the accuracy of the measurement depend significantly on pressure, temperature, vapour, dust, foam, viscosity, conductivity and pH value.

### 3. Range of applications

In addition to pressure and process temperature, properties of the medium such as "water contamination" or "flammability", determine which standards, laws and ordinances are to be applied.

The degree of danger, and thus the expenditure for protective measures, increases from simple measuring systems for non-water-contaminating and non-flammable media up to expensive devices for water-contaminating, flammable media.

Classification are as follows:

**Standard:** These are devices and systems which do not require special arrangements.

**WHG:** The German Water Resources Law (Wasserhaushaltsgesetz WHG) requires design approval or a mark of conformity when using protective devices for systems which store water-contaminating media. According to the system ordinances (VAWS), overspill prevention systems require a general design approval given by the German Institute for Structural Engineering (Deutsches Institut für Bautechnik DIBt). For systems based on Commercial Regulation § 24, see notes on Ex zone 0.

**Ex-area:**

**Zone 0:** In this most dangerous zone, only devices are allowed that have been certified and possess a certificate of conformity or test certificate from the German Federal Physical and Technical Institute (Physikalisch-Technische-Bundesanstalt Braunschweig PTB).

**Zone 1, 2:** In Germany, many standard devices can be used in these zones, if their power supplies and evaluation units are **intrinsically safe** according to DIN EN 50020. For this, the supplied electrical energy must remain below the ignition power of the explosion group IIA, IIB, IIC.

**ATEX:** If devices have been approved in accordance with Regulation 94/9/EC (ATEX), then Device Category 1 refers to use in zones 0 or 20.

For further information about intrinsic safety please refer to the manual "Explosion protection".

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### 4. System construction for limit value detection and continuous level measurement

The system construction is the complete measuring system consisting of the selected measuring sensor (level detector) and the required signal conditioning components.

A detailed description of the possible system constructions appear on the data sheets of the individual level measuring devices.

## Questionnaire level control

### Information for the selection of suitable level sensors for limit value detection or continuous level measurement

Company:		Responsible person:	
		Department:	
		Tel.-No.:	
		Fax-No.:	
Plant, operation, key words:			
<b>Type of control</b>	<b>limit value detection</b>		<b>continuous level measurement</b>
	<input type="radio"/> maximum <input type="radio"/> minimum <input type="radio"/> linked switching points as min-max-control		<input type="radio"/> continuous measurement <input type="radio"/> continuous measurement with limit value detection
Do you need devices in explosion proof version?	<input type="radio"/> yes, Ex-area zone: <input type="radio"/> no		temp.-class:
Do you need certified overspill preventions?	<input type="radio"/> in acc. with WHG for non flammable liquids <input type="radio"/> no		
Which measuring principle would you prefer?	<b>limit value detection</b>		<b>continuous level measurement</b>
	<input type="radio"/> float switches <input type="radio"/> vibration <input type="radio"/> conductive <input type="radio"/> capacitive <input type="radio"/> magnet-operated immersion probe		<input type="radio"/> hydrostatic <input type="radio"/> magnet-operated immersion probe <input type="radio"/> ultrasonic <input type="radio"/> guided microwave
<b>Vessel</b>	shape:	material:	
	connection piece for the probe:	level:	
	coating of the inside walls:	height of level limit:	
Explanations for the vessel type:			
Operating pressure in the vessel:	max.:	bar	min.:
Operating temperature in the vessel:	max.:	°C	min.:
			bar
			°C
<b>Medium name:</b>	<input type="radio"/> liquid <input type="radio"/> flammable <input type="radio"/> non-flammable <input type="radio"/> adhesive <input type="radio"/> coating		<input type="radio"/> solid (bulk material) <input type="radio"/> density: <input type="radio"/> bulk material: <input type="radio"/> concentration: <input type="radio"/> viscosity:
Conductive medium?	<input type="radio"/> yes	<input type="radio"/> no	conductance:
If known, dielectric constant:			
Which of the following materials are resistant against the medium?	<input type="radio"/> stainless steel 1.4571 <input type="radio"/> Hastelloy B/C <input type="radio"/> titanium <input type="radio"/> tantalum		<input type="radio"/> PP <input type="radio"/> PTFE
Which supply voltage is available:	<input type="radio"/> V AC		<input type="radio"/> V DC
Type of signal conditioning	<input type="radio"/> standard casing <input type="radio"/> eurocard		

Please insert a sketch of the vessel including the switching points and the connection piece of the probe.

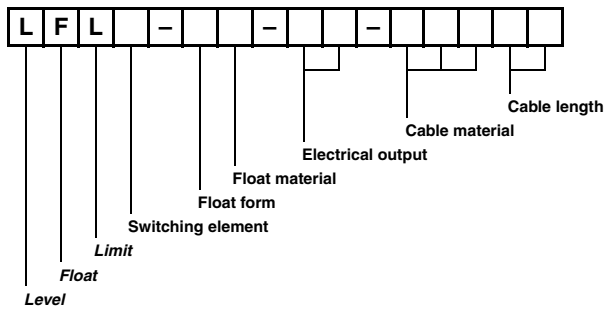
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# Type code of float switches

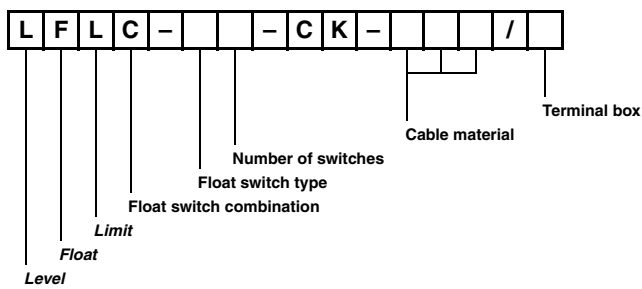
The figure below shows the used characters and numbers of the float switches type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the float switches.

## Product group LFL



## Product group LFLC



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

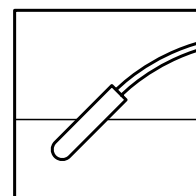
Continuous immersion probes

Hydrostatic pressure sensors





The float switch consists of a float body with a built-in switching element and a connection cable.  
 The switching element switches when it crosses the horizontal position in either direction.  
 The following mercury-free switching elements are available:  
 Initiators, small operation balls with inductive position detection, micro switches with operation ball.  
 Mercury-change-over contacts are still available.



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Float switch, ball LFL\*-BK-\*\*-\*\*\*\*\*  
 Float switch, sleeve LFL\*-CK-\*\*-\*\*\*\*\*

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Float switch, initiator, LFL1-**-N (EN 60947-5-6 (NAMUR)) Ex zone 1 .....	18
Float switch, initiator, LFL1-**-Z* (24 V DC), 2-wire .....	22
Float switch, micro switch, LFL2-**-U (250 V AC), change-over contact. ....	26
Float switch, Hg, LFL3-**-U (250 V AC), change-over contact .....	30
Float switch combination, LFLC .....	34

## Float switch

## Dimensions

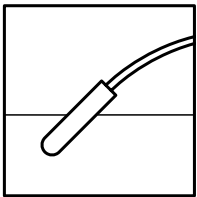
Float switches



Vibration limit switches

LFL1-\*\*-N

Conductive limit switches



Capacitive limit switches



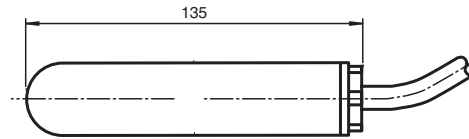
### Features

- Switching element: floating switch with initiator, **mercury-free**
- Electrical connections in acc. with NAMUR for hazardous area
- Limit value detection for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

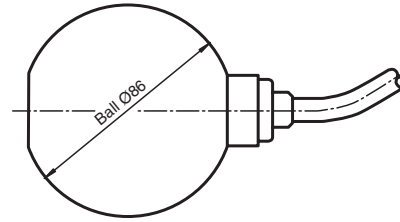
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors



Sleeve design LFL1-CK-N



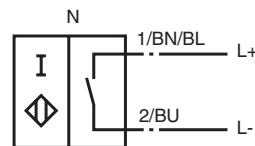
Ball design LFL1-BK-N

### Function

The initiator (normally open contact) is integrated in a PP float and is activated in the event of deviations from the horizontal position. The switching ball in the float, which moves along an axis, activates the switching event in the initiator inductively. The switch output provided by the initiator is a switch signal in accordance with EN 60947-5-6 (NAMUR).

### Electrical connection

Cable colours  
brown or black = L+  
blue = L-



<b>Application</b>			Float switches
Description	inductive proximity switch with switching ball		
<b>Function and system design</b>			Vibration limit switches
Equipment architecture	A measuring system consists of a float switch LFL1-**-N and a transformer isolated barrier, e. g. KFD2-SR2-Ex1.W.		
<b>Auxiliary energy</b>			Conductive limit switches
Supply voltage	8.2 V ± 2 V		
Current consumption	< 1.0 mA unswitched (de-energised at the bottom), > 2.2 mA switched (floated up at the top)		
Reverse polarity protection	yes		
<b>Operating conditions</b>			Capacitive limit switches
Mounting conditions			
Installation instructions	range of application and minimum length between mounting and float: - PVC version: ≥ 50 mm (2 in), preferred for water, waste water, slightly aggressive liquids - PUR version: ≥ 100 mm (4 in), preferred for fuels, heating oils, oily fluids - CSM/CM version: ≥ 100 mm (4 in), preferred for many acids and lyes  mounting: - The float switch is mounted either from sideways through a cable gland ≥ G1A into the vessel or - by means of a counter weight or rods (e. g. float switch assembly) from the top. - The pivot of the cable should always be horizontal.		
<b>Process conditions</b>			Limit value immersion probes
Process temperature	-20 ... 70 °C (253 ... 343 K)		
Process pressure (static pressure)	sleeve design: ≤ 3 bar at 20 °C (293 K) ball design: ≤ 2 bar at 20 °C (293 K)		
Density	sleeve design: ≥ 0.8 g/cm <sup>3</sup> ball design: ≥ 0.6 g/cm <sup>3</sup>		
<b>Mechanical specifications</b>			Continuous immersion probes
Protection degree	IP68		
<b>Mechanical construction</b>			Hydrostatic pressure sensors
Versions	sleeve design: LFL1-CK-N-PVC3, LFL1-CK-N-PUR3, LFL1-CK-N-CSM3 ball design: LFL1-BK-N-PVC3, LFL1-BK-N-PUR3, LFL1-BK-N-CSM3		
Material	float: PP (polypropylene) cable: - PVC version: PVC cable, highly flexible (2 x 0.75 mm <sup>2</sup> ) - PUR version: PUR cable, highly flexible (2 x 0.50 mm <sup>2</sup> ) - CSM/CM version: CSM/CM cable (chlorinated polyethylene, (2 x 0.75 mm <sup>2</sup> ))		
Switching point	switch angle: upper switching point +12°, lower switching point -12°, measured against the horizontal		
<b>Certificates and approvals</b>			
Ex approval	TÜV 99 ATEX 1407, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>		
Type of protection	⊕ II 2G EEx ia IIB T5		
<b>General information</b>			
<b>Directive conformity</b>			
Directive 89/336/EC (EMC)	EN 60947-5-2, EN 60947-5-2 A1		
Directive 94/9 EC (ATEX)	EN 50014, EN 50020		
<b>Conformity</b>			
Protection degree	EN 60529		
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .		

Accessories

- LFL-Z231, counter nut, G1A, PVC
- LFL-Z32, counter weight, grey cast iron with plastic coating (Polycarbonate)
- LFL-Z33, counter weight, grey cast iron with ECTFE coating (Halar)

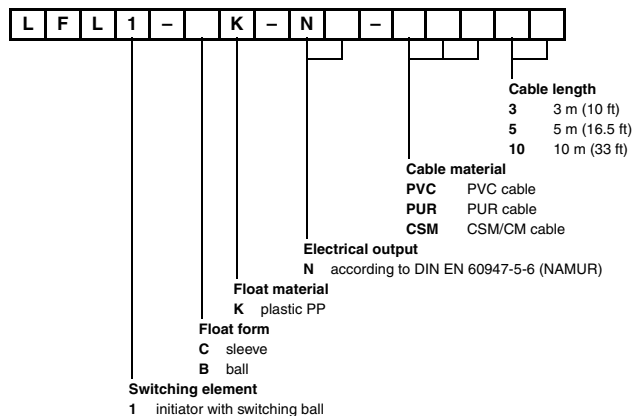


- LFL-Z131, cable gland G1A, PVC
- LFL-Z132, cable gland G1A, brass
- LFL-Z161, cable gland G2A, PVC
- LFL-Z431, cable gland 1 NPT, PVC
- LFL-Z432, cable gland 1 NPT, brass
- LFL-Z461, cable gland 2 NPT, PVC

Note

Users should take appropriate precautions when using accessories in potentially hazardous areas!

Type code/model number



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors



## Float switch

## Dimensions

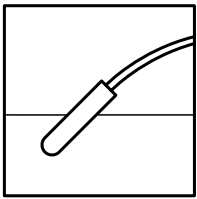
Float switches



Vibration limit switches

LFL1-\*\*-Z\*

Conductive limit switches



Capacitive limit switches



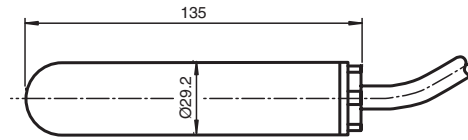
### Features

- Switching element: floating switch with initiator, **mercury-free**
- Electrical connections 2-wire, 6 V DC ... 60 V DC
- Limit value detection for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

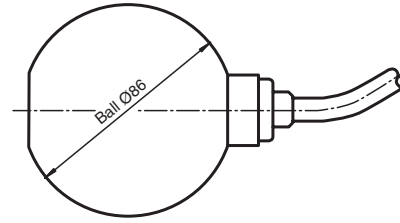
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors



Sleeve design LFL1-CK-Z\*



Ball design LFL1-BK-Z\*

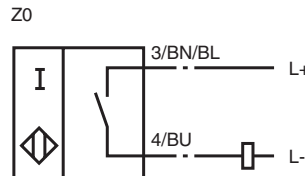
### Function

The initiator is integrated in a PP float and is activated in the event of deviations from the horizontal position. The switching ball in the float, which moves along an axis, activates the switching event in the initiator inductively. The switch output provided by the initiator is a mechanical contact (6 V DC ... 60 V DC).

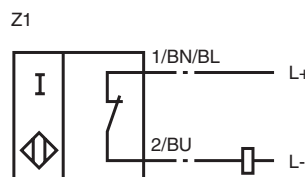
### Electrical connection

Cable colours  
brown or black  
blue

= L+  
= L-



Z0 floating up closing



Z1 floating up opening

<b>Application</b>		Float switches
Description	inductive proximity switch with switching ball Z0 = floating up closing, normally open Z1 = floating up opening, normally closed	
<b>Function and system design</b>		
Equipment architecture	A measuring system consists of a float switch LFL1-**-Z* and a load switched in series.	
<b>Auxiliary energy</b>		
Supply voltage	6 ... 60 V DC	
Current consumption	4 ... 100 mA	
Voltage drop	approx. 4.7 V at 100 mA	
No-load supply current	0.73 mA	
Reverse polarity protection	yes	
Short-circuit protection	no	Vibration limit switches
<b>Operating conditions</b>		
Mounting conditions		
Installation instructions	range of application and minimum length between mounting and float: - PVC version: ≥ 50 mm (2 in), preferred for water, waste water, slightly aggressive liquids - PUR version: ≥ 100 mm (4 in), preferred for fuels, heating oils, oily fluids - CSM/CM version: ≥ 100 mm (4 in), preferred for many acids and lyes  mounting: - The float switch is mounted either from sideways through a cable gland ≥ G1A into the vessel or - by means of a counter weight or rods (e. g. float switch assembly) from the top. - The pivot of the cable should always be horizontal.	
Process conditions		Conductive limit switches
Process temperature	PVC version: 5 ... 70 °C (278 ... 343 K) PUR version: -20 ... 70 °C (253 ... 343 K) CSM/CM version: -20 ... 70 °C (253 ... 343 K)	
Process pressure (static pressure)	sleeve design: ≤ 3 bar at 20 °C (293 K) ball design: ≤ 2 bar at 20 °C (293 K)	
Density	sleeve design: ≥ 0.8 g/cm <sup>3</sup> ball design: ≥ 0.6 g/cm <sup>3</sup>	Capacitive limit switches
<b>Mechanical specifications</b>		
Protection degree	IP68	
<b>Mechanical construction</b>		
Versions	sleeve design: LFL1-CK-Z*-PVC3, LFL1-CK-Z*-PVC5, LFL1-CK-Z*-CSM10 ball design: LFL1-BK-Z*-PVC5, LFL1-BK-Z*-CSM5	
Material	float: PP (polypropylene) cable: - PVC version: PVC cable, highly flexible (2 x 0.75 mm <sup>2</sup> ) - PUR version: PUR cable, highly flexible (2 x 0.50 mm <sup>2</sup> ) - CSM/CM version: CSM/CM cable (chlorinated polyethylene, (2 x 0.75 mm <sup>2</sup> ))	
Switching point	switch angle: upper switching point +12°, lower switching point -12°, measured against the horizontal	Limit value immersion probes
<b>General information</b>		
Directive conformity		
Directive 89/336/EC (EMC)	EN 60947-5-2, EN 60947-5-2 A1	
Conformity		Continuous immersion probes
Protection degree	EN 60529	
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	Hydrostatic pressure sensors

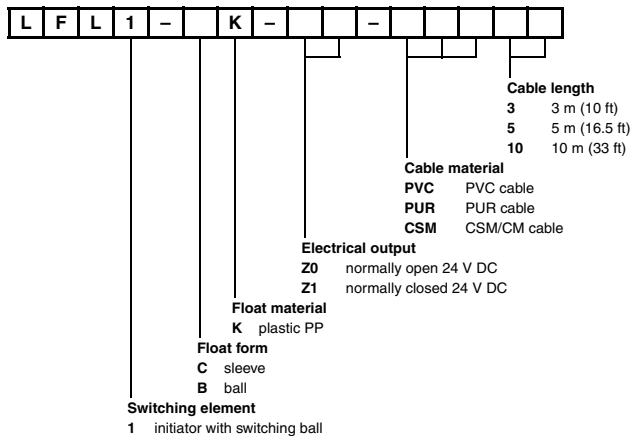
**Accessories**

- LFL-Z231, counter nut, G1A, PVC
- LFL-Z32, counter weight, grey cast iron with plastic coating (Polycarbonate)
- LFL-Z33, counter weight, grey cast iron with ECTFE coating (Halar)



- LFL-Z131, cable gland G1A, PVC
- LFL-Z132, cable gland G1A, brass
- LFL-Z161, cable gland G2A, PVC
- LFL-Z431, cable gland 1 NPT, PVC
- LFL-Z432, cable gland 1 NPT, brass
- LFL-Z461, cable gland 2 NPT, PVC

**Type code/model number**





## Float switch

## Dimensions

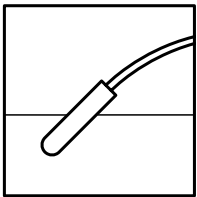
Float switches



Vibration limit switches

LFL2-\*\*-U

Conductive limit switches



Capacitive limit switches



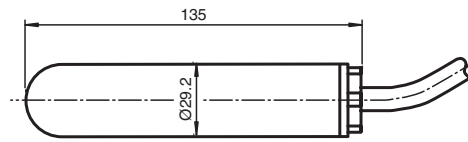
### Features

- Switching element: micro switch, **mercury-free**
- Limit value detection for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

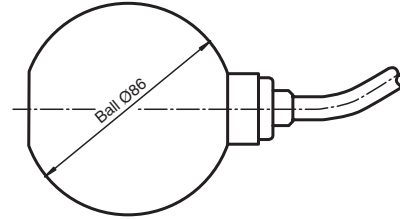
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors



Sleeve design LFL2-CK-U



Ball design LFL2-BK-U

### Function

The microswitch (change-over contact) is integrated in a PP float and is activated in the event of deviations from the horizontal position. The switching ball in the float, which moves along an axis, activates the microswitch.

### Electrical connection

Cable colours	=	when potential-free
black-brown	=	contact open
black-blue	=	contact closed



<b>Application</b>		Float switches
Description	micro switch with switching ball, change-over contact	
<b>Function and system design</b>		
Equipment architecture	This device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements.	
<b>Auxiliary energy</b>		
Supply voltage	max. 250 V AC, 150 V DC	
Current consumption	max. 3 (1) A	
<b>Operating conditions</b>		
<b>Mounting conditions</b>		
Installation instructions	range of application and minimum length between mounting and float: - PVC version: ≥ 50 mm (2 in), preferred for water, waste water, slightly aggressive liquids - PUR version: ≥ 100 mm (4 in), preferred for fuels, heating oils, oily fluids - CSM/CM version: ≥ 100 mm (4 in), preferred for many acids and lyes mounting: - The float switch is mounted either from sideways through a cable gland ≥ G1A into the vessel or - by means of a counter weight or rods (e. g. float switch assembly) from the top. - The pivot of the cable should always be horizontal.	
<b>Process conditions</b>		Vibration limit switches
Process temperature	PVC version: 5 ... 70 °C (278 ... 343 K) PUR version: 5 ... 70 °C (278 ... 343 K) CSM/CM version: -20 ... 90 °C (253 ... 363 K)	
Process pressure (static pressure)	sleeve design: ≤ 3 bar at 20 °C (293 K) ball design: ≤ 2 bar at 20 °C (293 K)	
Density	sleeve design: ≥ 0.8 g/cm <sup>3</sup> ball design: ≥ 0.6 g/cm <sup>3</sup>	
<b>Mechanical specifications</b>		Conductive limit switches
Protection degree	IP68	
<b>Mechanical construction</b>		
Versions	sleeve design: LFL2-CK-U-PVC3, LFL2-CK-U-PUR3, LFL2-CK-U-CSM3 ball design: LFL2-BK-U-PVC3, LFL2-BK-U-PUR3, LFL2-BK-U-CSM3	Capacitive limit switches
Material	float: PP (polypropylene) cable: - PVC version: PVC cable, highly flexible (3 x 0.75 mm <sup>2</sup> ) - PUR version: PUR cable, highly flexible (3 x 0.50 mm <sup>2</sup> ) - CSM/CM version: CSM/CM cable (chlorinated polyethylene, (3 x 0.75 mm <sup>2</sup> ))	
Switching point	switch angle: upper switching point +25° (± 10°), lower switching point -14° (± 6°), measured against the horizontal	
<b>General information</b>		Limit value immersion probes
Directive conformity		
Directive 73/23/EEC (Low Voltage Directive)	EN 50178	
Directive 89/336/EC (EMC)	EN 60947-5-2, EN 60947-5-2 A1	
Conformity		Limit value immersion probes
Protection degree	EN 60529	
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	Hydrostatic pressure sensors

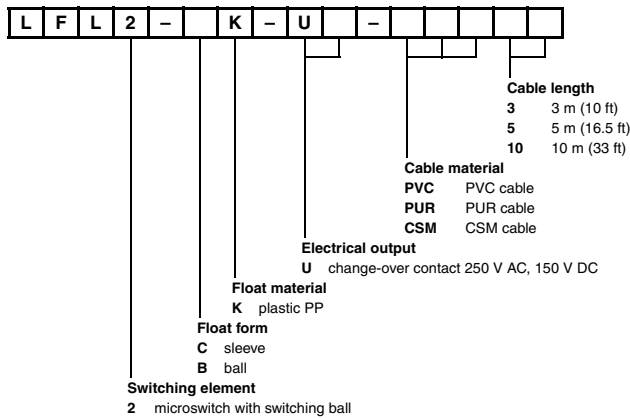
**Accessories**

- LFL-Z231, counter nut, G1A, PVC
- LFL-Z32, counter weight, grey cast iron with plastic coating (Polycarbonate)
- LFL-Z33, counter weight, grey cast iron with ECTFE coating (Halar)



- LFL-Z131, cable gland G1A, PVC
- LFL-Z132, cable gland G1A, brass
- LFL-Z161, cable gland G2A, PVC
- LFL-Z431, cable gland 1 NPT, PVC
- LFL-Z432, cable gland 1 NPT, brass
- LFL-Z461, cable gland 2 NPT, PVC

**Type code/model number**





## Float switch

## Dimensions

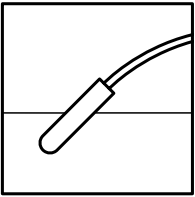
Float switches



Vibration limit switches

LFL3-\*\*-U

Conductive limit switches



Capacitive limit switches



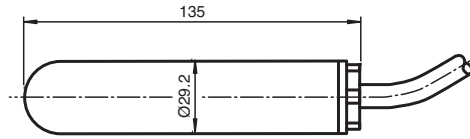
### Features

- Switching element: mercury (Hg) change over contact
- Limit value detection for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

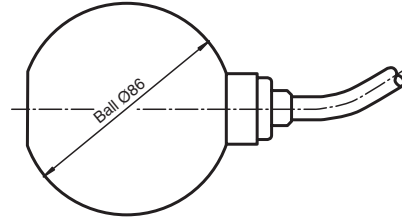
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors



Sleeve design LFL3-CK-U



Ball design LFL3-BK-U

### Function

The mercury (Hg) mechanical contact (change-over contact) is encapsulated in the PP float and is activated in the event of deviations from the horizontal position.

### Electrical connection

Cable colours	=	when potential-free
black-brown	=	contact open
black-blue	=	contact closed

<b>Application</b>		Float switches
Description	mercury (Hg) change-over contact	
<b>Function and system design</b>		
Equipment architecture	This device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements.	
<b>Auxiliary energy</b>		
Supply voltage	max. 250 V AC, 150 V DC	
Current consumption	max. 4 A	
<b>Operating conditions</b>		
<b>Mounting conditions</b>		
Installation instructions	range of application and minimum length between mounting and float: - PVC version: ≥ 50 mm (2 in), preferred for water, waste water, slightly aggressive liquids - PUR version: ≥ 100 mm (4 in), preferred for fuels, heating oils, oily fluids - CSM/CM version: ≥ 100 mm (4 in), preferred for many acids and lyes mounting: - The float switch is mounted either from sideways through a cable gland ≥ G1A into the vessel or - by means of a counter weight or rods (e. g. float switch assembly) from the top. - The pivot of the cable should always be horizontal.	
<b>Process conditions</b>		Vibration limit switches
Process temperature	PVC version: 5 ... 70 °C (278 ... 343 K) PUR version: 5 ... 70 °C (278 ... 343 K) CSM/CM version: -20 ... 90 °C (253 ... 363 K)	
Process pressure (static pressure)	sleeve design: ≤ 3 bar at 20 °C (293 K) ball design: ≤ 2 bar at 20 °C (293 K)	
Density	sleeve design: ≥ 0.8 g/cm <sup>3</sup> ball design: ≥ 0.6 g/cm <sup>3</sup>	
<b>Mechanical specifications</b>		Conductive limit switches
Protection degree	IP68	
<b>Mechanical construction</b>		
Versions	sleeve design: LFL3-CK-U-PVC3, LFL3-CK-U-PUR3, LFL3-CK-U-CSM3 ball design: LFL3-BK-U-PVC3, LFL3-BK-U-PUR3, LFL3-BK-U-CSM3	Capacitive limit switches
Material	float: PP (polypropylene) cable: - PVC version: PVC cable, highly flexible (3 x 0.75 mm <sup>2</sup> ) - PUR version: PUR cable, highly flexible (3 x 0.50 mm <sup>2</sup> ) - CSM/CM version: CSM/CM cable (chlorinated polyethylene, (3 x 0.75 mm <sup>2</sup> ))	
Switching point	switch angle: upper switching point +5°, lower switching point -5°, measured against the horizontal	
<b>General information</b>		
Directive conformity		Limit value immersion probes
Directive 73/23/EEC (Low Voltage Directive)	EN 50178	
Directive 89/336/EC (EMC)	EN 60947-5-2, EN 60947-5-2 A1	
<b>Conformity</b>		Continuous immersion probes
Protection degree	EN 60529	
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	Hydrostatic pressure sensors

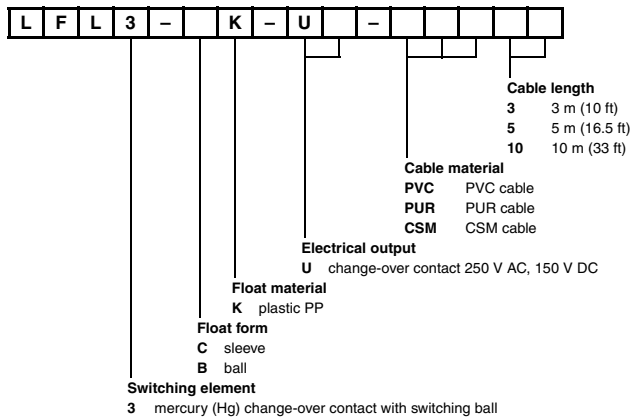
**Accessories**

- LFL-Z231, counter nut, G1A, PVC
- LFL-Z32, counter weight, grey cast iron with plastic coating (Polycarbonate)
- LFL-Z33, counter weight, grey cast iron with ECTFE coating (Halar)



- LFL-Z131, cable gland G1A, PVC
- LFL-Z132, cable gland G1A, brass
- LFL-Z161, cable gland G2A, PVC
- LFL-Z431, cable gland 1 NPT, PVC
- LFL-Z432, cable gland 1 NPT, brass
- LFL-Z461, cable gland 2 NPT, PVC

**Type code/model number**



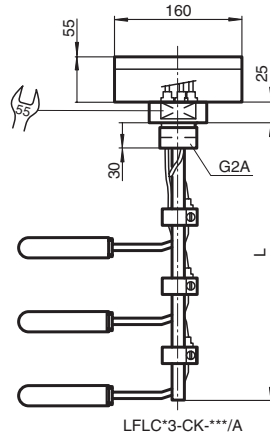


## Float switch

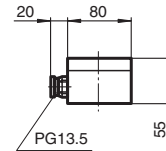


## Dimensions

Terminal box type A

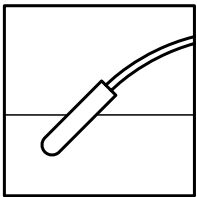


Terminal box type B



When placing your order, please specify the length (L) of the guide tube, which can be cropped by the user if necessary.

## LFLC



## Features

- Full adjustable float switch combination for up to 5 float switches
- Position of the switch points adjustable by the customer
- Various float switch types possible
- CSM cable for aggressive acids and lyes

## Function

This PVC float switch assembly permits the fixing lengths for the float fixing and fixing heights to be modified as required if changes in the operating circumstances require other switching points.

## Electrical connection

The electrical connection is depending on the float switch versions. Information for electrical connections can be found in the datasheets of float switches.



<b>Application</b>	
Description	switching element: LFL1: floating up closing, normally open LFL2: micro switch with switching ball, change-over contact LFL3: mercury (Hg) change-over contact
<b>Function and system design</b>	
Equipment architecture	This device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements.
<b>Auxiliary energy</b>	
Supply voltage	LFL1: 8 V, acc. EN 60947-5-6 (NAMUR) LFL2: max. 250 V AC LFL3: max. 250 V AC, 150 V DC
Current consumption	LFL2: max. 3 (1) A LFL3: max. 4 A
<b>Operating conditions</b>	
Mounting conditions	
Installation instructions	range of application and minimum length between mounting and float: - PVC version: ≥ 50 mm (2 in), preferred for water, waste water, slightly aggressive liquids - PUR version: ≥ 100 mm (4 in), preferred for fuels, heating oils, oily fluids - CSM/CM version: ≥ 100 mm (4 in), preferred for many acids and lyes  Float switches are fastened onto the lower end of the guide pipe in the factory. The position of the switch points required for the application must be adjusted by the user by moving the fastening rings (in some cases, it may be necessary to shorten the float switch wire).
<b>Process conditions</b>	
Process temperature	-10 ... 70 °C (263 ... 343 K), depending on the used cable
Process pressure (static pressure)	≤ 1 bar at 20 °C (293 K)
<b>Mechanical specifications</b>	
Protection degree	IP68
<b>Mechanical construction</b>	
Construction type	sleeve
Dimensions	guide tube: Ø16 mm (0.6 in), L <sub>max</sub> = 3000 mm (10 ft)
Material	float: PP (polypropylene) guide tube: PVC process connection: PVC ring fastener and clamping screw: PVC
Process connection	G2A thread with 5 PG9-cable entries
<b>General information</b>	
Directive conformity	
Directive 73/23/EEC (Low Voltage Directive)	LFL1-**-W*, LFL2-**-U, LFL3-**-U: EN 50178
Directive 89/336/EC (EMC)	EN 60947-5-2, EN 60947-5-2 A1
Directive 94/9 EC (ATEX)	LFL1-**-N: EN 50014, EN 50020
Conformity	
Protection degree	EN 60529
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

Float switches

Vibration limit switches

Conductive limit switches

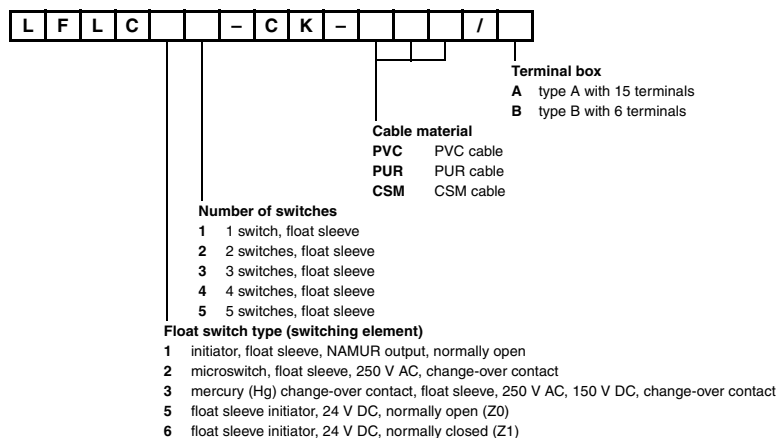
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Type code/model number

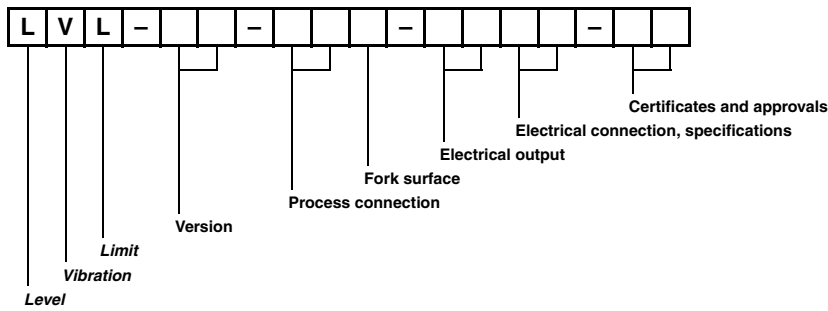


# Type code of vibration limit switches

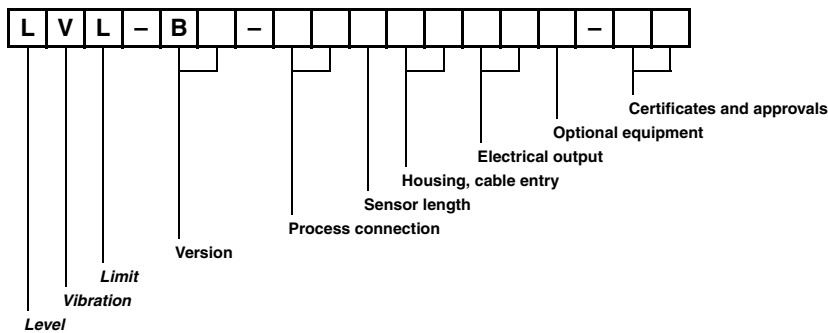
The figure below shows the used characters and numbers of the vibration limit switches type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the vibration limit switches.

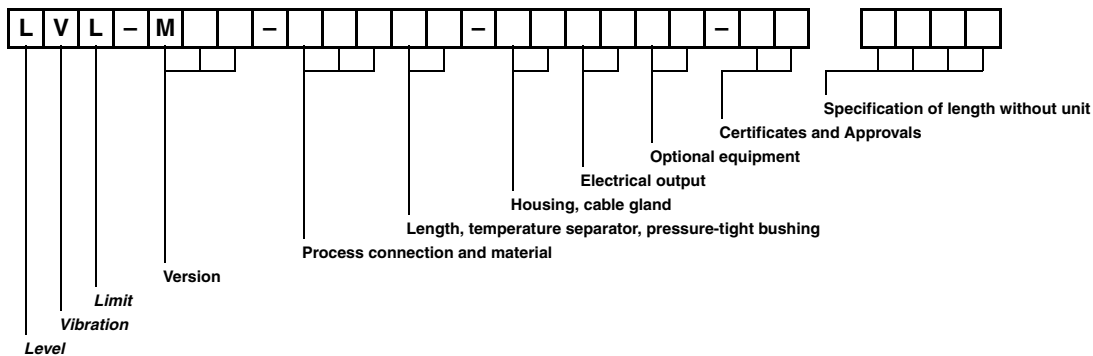
## Product group Vibracon LVL-\*\*



## Product group Vibracon LVL-B\*



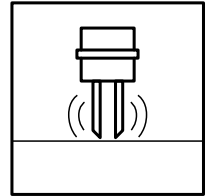
## Product group Vibracon LVL-M\*\*



Float switches  
 Vibration limit switches  
 Conductive limit switches  
 Capacitive limit switches  
 Limit value immersion probes  
 Continuous immersion probes  
 Hydrostatic pressure sensors



The two paddles of a vibrating fork are actuated using a piezoelectric source.  
 In air the vibrating fork vibrates at its resonance frequency.  
 When it is immersed in rising liquid, the frequency and amplitude of the vibration is reduced. The change is evaluated electronically and produces the switching signal.



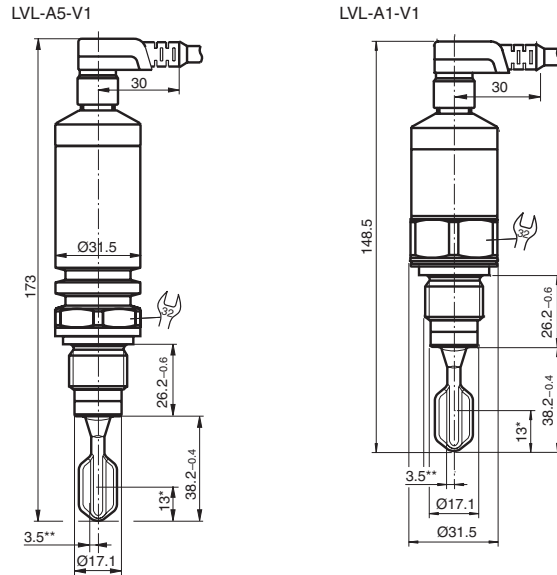
Vibration limit switch Vibracon LVL-A5

**Contents**

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Vibration limit switch Vibracon LVL-AH, hygienic version . . . . .	44
Vibration limit switch Vibracon LVL-B* . . . . .	50
Vibration limit switch Vibracon LVL-S1 . . . . .	58
Vibration limit switch Vibracon LVL-T1 . . . . .	62
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Vibration limit switch Vibracon LVL-M*H, hygienic version . . . . .	80
Vibration limit switch Vibracon LVL-M2C, with coating. . . . .	94

## Vibration limit switch

## Dimensions



Additional dimensions see section dimensions.

\* Switch point for vertical installation  
 \*\* Switch point for horizontal installation  
 Switch points at density 0.7 g/cm<sup>3</sup>, 23 °C (296 K), 0 bar

Float switches

Vibration limit switches

Conductive limit switches

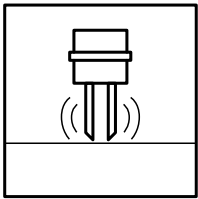
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

### LVL-A\*



### Features

- Level limit switch for liquids
- External test option using test magnet
- On-site function control using external LED display
- Large selection of process connections for hassle-free installation in existing systems
- Easy to install even at points difficult to access due to compact design
- Rugged stainless steel housing
- Suitable for medium temperatures up to 150 °C (423 K)
- Cost-saving plug connections

### Function

The Vibracon LVL-A\* is a level limit switch for all kinds of fluids and is used in tanks, containers and pipelines. It is used in cleaning and filtering systems and coolant and lubricant tanks as an overspill protection or as a pump protector.

The LVL-A\* is ideal for applications which previously used float switches and conductive, capacitive and optical sensors.

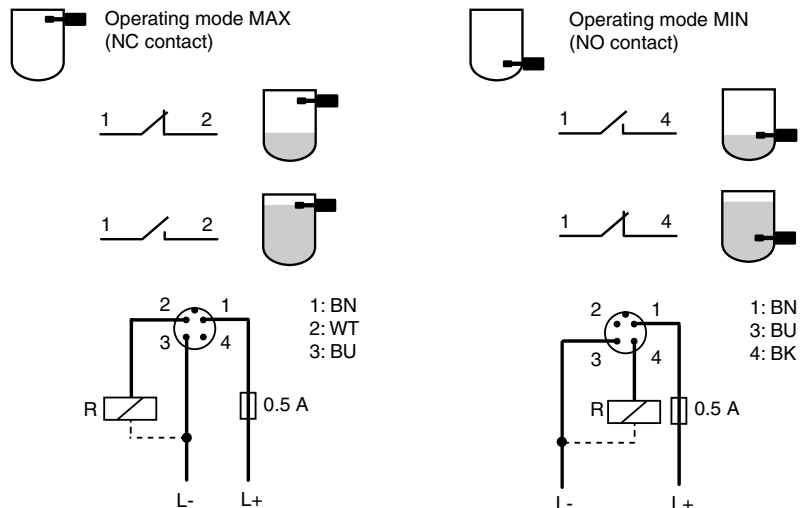
It also works in applications which are unsuitable for these measuring methods due to conductivity, build-ups, turbulence, flows or air bubbles.

The LVL-A\* is not suitable for hazardous areas and areas where the medium temperature is above 150 °C (423 K).

For hygienic areas the use of LVL-AH is recommended.

### Electrical connection

Example: connection E5 (three-wire DC connection) with V1 connector M12 x 1  
 Other connection types see section electrical connections.



<b>Application</b>		Float switches
Function principle	The tuning fork is brought to its resonance frequency by means of a piezoelectric drive. If the tuning fork is covered by liquid, this frequency changes. The electronics monitor the resonance frequency and indicate whether the tuning fork is freely vibrating or is covered by liquid.	
<b>Input characteristics</b>		
Measured variable	density	
Measurement range	min. 0.7 g/cm <sup>3</sup> , other density (e. g. 0.5 g/cm <sup>3</sup> ) settings on request	Vibration limit switches
<b>Output characteristics</b>		
Fail safe mode	<p>minimum/maximum closed circuit safety</p> <p>The level limit switch can be connected in two operating modes, depending on the operating mode selected (MAX or MIN safety). The level limit switch will switch off safely in the event of a fault (e. g. if the power supply line is interrupted).</p> <p>MAX = maximum fail-safe mode: The level limit switch keeps the electronic switch closed as long as the fluid level is below the fork. example application: overspill protection</p> <p>MIN = minimum fail-safe mode: The level limit switch keeps the electronic switch closed as long as the fork is immersed in fluid. example application: dry running protection of pumps</p> <p>The electronic switch opens if the limit is reached, if a fault occurs or in the event of a power failure.</p>	
<b>Auxiliary energy</b>		
Electrical connection	This device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements. output B3: version AS-Interface output E5: version DC-PNP with M12 x 1 connector or valve connector output WA: version AC with valve connector	Conductive limit switches
Supply voltage	output B3: 24.5 ... 31 V DC (AS-Interface) output E5: 10 ... 35 V DC output WA: 19 ... 253 V AC, 50/60 Hz	
Power consumption	output B3: < 825 mW output E5: < 825 mW output WA: < 810 mW	
Current consumption	output B3: < 25 mA output E5: < 15 mA output WA: < 3.8 mA	Capacitive limit switches
Residual ripple	output E5: 5 V <sub>pp</sub> at 0 ... 400 Hz	
<b>Performance characteristics</b>		
Reference operating conditions	ambient temperature: 23 °C (296 K), process pressure: 1 bar, medium: water, medium density: 1, medium temperature: 23 °C (296 K), installation from above/vertical, density setting: > 0.7 g/cm <sup>3</sup>	Limit value immersion probes
Measured value resolution	< 0.5 mm	
Measuring frequency	approx. 1100 Hz in air	
Maximum measured error	13 mm ± 1 mm	
Non-repeatability	± 0.5 mm	
Hysteresis	3 mm ± 0.5 mm	
Influence of ambient temperature	negligible	
Influence of medium temperature	-29.6 x 10 <sup>-3</sup> mm/°C	
Influence of medium pressure	-55.2 x 10 <sup>-3</sup> mm/bar	
Switching time	when covering the sensor approx. 0.5 s, when uncovering the sensor approx. 1.0 s other switching times on request	
Settling time	< 2 s	Continuous immersion probes
<b>Operating conditions</b>		
Mounting conditions		
Installation position	see section mounting position	
<b>Ambient conditions</b>		
Ambient temperature	outputs E5, WA: -40 ... 70 °C (233 ... 343 K) output B3: -25 ... 70 °C (248 ... 343 K)	
Ambient temperature limits	<p>version LVL-A5: - derating from 90 °C (363 K) process temperature: reduction to max. 50 °C (323 K) ambient - derating from 90 °C (363 K) process temperature: reduction to max. 150 mA relay switching capacity</p> <p>version LVL-A1: - derating from 80 °C (353 K) process temperature: reduction to max. 50 °C (323 K) ambient - derating from 80 °C (353 K) process temperature: reduction to max. 150 mA relay switching capacity</p>	
Storage temperature	-40 ... 85 °C (233 ... 358 K)	
Overvoltage protection	overvoltage category III	
<b>Process conditions</b>		
Medium temperature	version LVL-A5: -40 ... 150 °C (233 ... 423 K), see ambient temperature limit version LVL-A1: -40 ... 100 °C (233 ... 273 K), see ambient temperature limit	
Process pressure (static pressure)	-1 ... 40 bar	
State of aggregation	liquid	
Density	min. 0.7 g/cm <sup>3</sup> , other density setting on request	

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## Vibration limit switch LVL-A\*

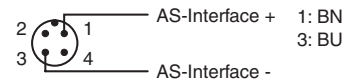
## Technical data

Float switches	Viscosity	max. 10000 mm <sup>2</sup> /s (10000 cSt)
	Gas content	stagnant mineral water
	<b>Mechanical specifications</b>	
Vibration limit switches	Protection degree	IP65 with valve connector IP66/67 with M12 x 1 connector PPSU (plastic)
	<b>Mechanical construction</b>	
	Versions	LVL-A1: version for process temperatures up to 100 °C (373 K) LVL-A5: version for process temperatures up to 150 °C (423 K)
	Dimensions	LVL-A1-V1: diameter 31.5 mm (1.24 in), length 148.5 mm (5.8 in) LVL-A1-P*: diameter 40 mm (1.57 in), length 161 mm (6.3 in) LVL-A1-PS: diameter 40 mm (1.57 in), length 155 mm (6.1 in) LVL-A5-V1: diameter 31.5 mm (1.24 in), length 173 mm (6.8 in) LVL-A5-P*: diameter 40 mm (1.57 in), length 185.5 mm (7.3 in) LVL-A5-PS: diameter 40 mm (1.57 in), length 179.5 mm (7.1 in)
	Mass	LVL-A1: approx. 210 g LVL-A5: approx. 270 g
Conductive limit switches	Material	vibration fork, process connection and housing: Edelstahl 1.4435/316L connection: PSU
	Surface quality	R <sub>a</sub> < 3.2 µm/80 grit
	Process connection	- cylindrical thread G½A, G¾A, G1A to DIN ISO 228/1 - conical thread R½, R¾ to DIN 2999, part 1 - conical thread ½ NPT, ¾ NPT to ANSI B 1.20.1
	Electrical connection	electrical connection V1: pinning according to EN 60947-5-2 electrical connection P*: valve plug, cross section max. 1.5 mm <sup>2</sup> (AWG 16), diameter 6 ... 9 mm (0.24 ... 0.35 in) electrical connection PS: QUICKON valve plug, cross section 0.34 ... 0.75 mm <sup>2</sup> , diameter 3.5 ... 6.5 mm (0.14 ... 0.26 in)
	<b>Indication and operation</b>	
Capacitive limit switches	Display elements	The LED display is on the connection side of the LVL-A*. green LED: indication of ready to operate red LED: fault indication, mode indication yellow LED: mode indication (B3)
	Programming	AS-Interface profile S-3.A.E The address is defaulted to 0 (hex). It is changeable via the bus master or programming unit. Parameter bits (P0 ... P3) are not used.
	Function test	function test with test magnet: Put the testing magnet to the mark of nameplate, the vibration fork reacts with the test magnet as in the case of covering with fluid. outputs E5, WA: on testing, the current state of the electronic switch is reversed output B3: on testing, D0 is inverted
Limit value immersion probes	<b>Certificates and approvals</b>	
	Application	The general authorisation by the board of surveyors must be obtained for the site of installation. It is accessible together with the technical description and the certificate from Pepperl+Fuchs.
	Overspill protection	Z-65.11-314 (overspill protection in acc. with WHG) Z-65.40-315 (leak detection system)
	Marine approval	German Lloyd (GL), approval number: 42855-02HH
	<b>General information</b>	
Continuous immersion probes	Directive conformity	
	Directive 73/23/EEC (Low Voltage Directive)	output WA: EN 50178
	Directive 89/336/EC (EMC)	outputs E5, WA: emitted interference to EN 61326, CLASS B equipment interference immunity to EN 61326, annex A (industrial sector) output B3: EN 50295
	Conformity	
	Electromagnetic compatibility	NE 21
Hydrostatic pressure sensors	Protection degree	EN 60529
	Interface	output B: AS-Interface profile S-3.A.1 as per EN 50295 (limit switch)
	Vibration resistance	EN 60068-2-64
	Shock and impact resistance	EN 60068-2-27, 30 g
	Supplementary documentation	technical information TI364O operating instructions KA213O operating instructions KA141O weld-in adapter G1 (LVL-Z101) operating instructions KA142O weld-in adapter G¾ (LVL-Z100) operating instructions KA186O valve connector PG11 approval ZE247O overspill protection in acc. with WHG (Z-65.11-314) approval ZE248O leak detection system (Z-65.40-315)
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	

Electrical connection

Output B3 (AS-Interface) (only with V1 connector M12 x 1 available)

Two-wire connection for separate switching unit



Programming instruction AS-Interface profile: S-3.A.E

The address is defaulted to 0 (hex). It is changeable via the bus master or programming unit.

Data bit:

D0:1 Sensor covered	D1:1 State = OK
D0:0 Sensor free	D1:0 State = error
D2 and D3 are not used.	

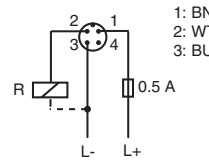
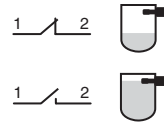
Parameter bits (P0 ... P3) are not used.

Output E5

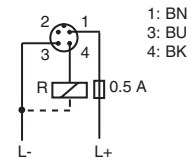
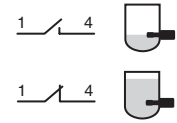
Three-wire DC connection, switching the load via transistor (PNP) and separate connection

V1 connector M12 x 1

Operating mode MAX (NC contact)

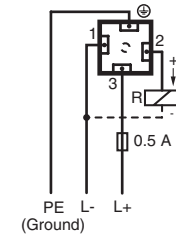
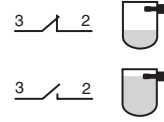


Operating mode MIN (NO contact)

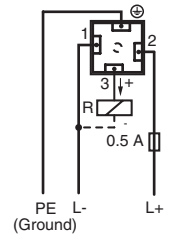
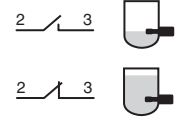


Valve plug

Operating mode MAX



Operating mode MIN

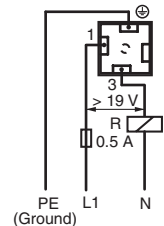
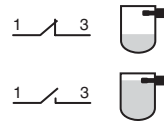


Output WA

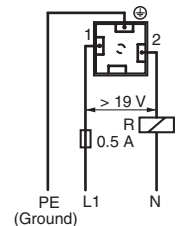
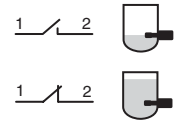
Two-wire AC connection

Valve plug

Operating mode MAX

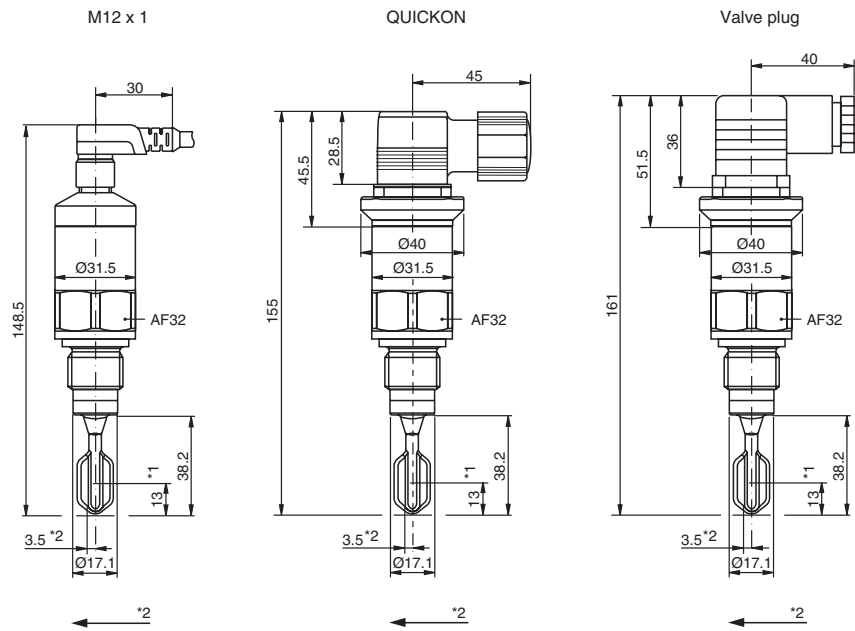


Operating mode MIN

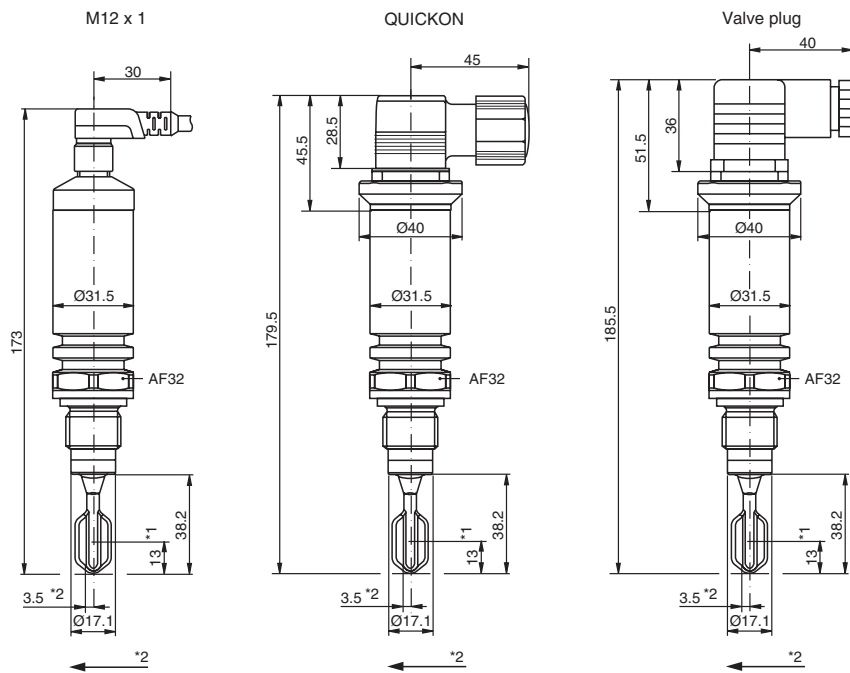


Dimensions

Version A1



Version A5



\*1 Switch point with vertical installation

\*2 Switch point with horizontal installation; the level increases in the direction of the arrow

Switch points at: density 1/23 °C (296 K)/0 bar

Dimensions of the process connections see technical information.

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

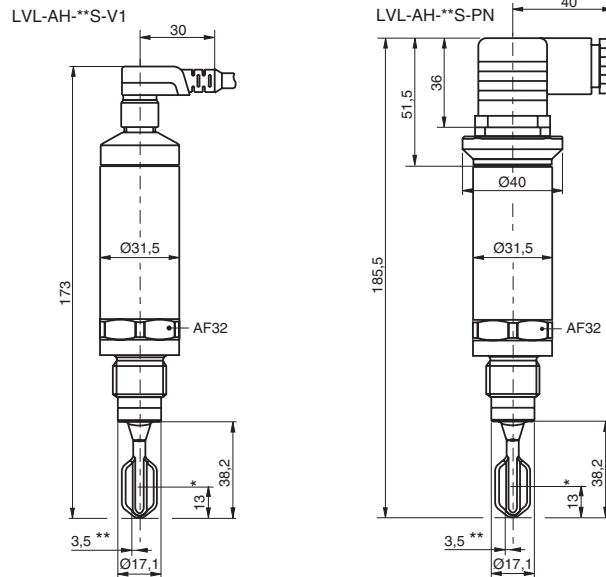
Hydrostatic pressure sensors





## Vibration limit switch

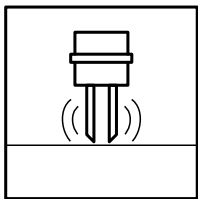
## Dimensions



Additional dimensions see section dimensions.

\* Switch point for vertical installation  
 \*\* Switch point for horizontal installation  
 Switch points at density 1 g/cm<sup>3</sup>, 23 °C (296 K), 0 bar

## LVL-AH



## Features

- Level limit switch in hygienic version for liquids
- External test option using test magnet
- On-site function control using external LED display
- Large selection of process connections for hassle-free installation in existing systems
- Easy to install even at points difficult to access due to compact design
- Rugged stainless steel housing
- Suitable for medium temperatures up to 150 °C (423 K)
- Cost-saving plug connections

## Function

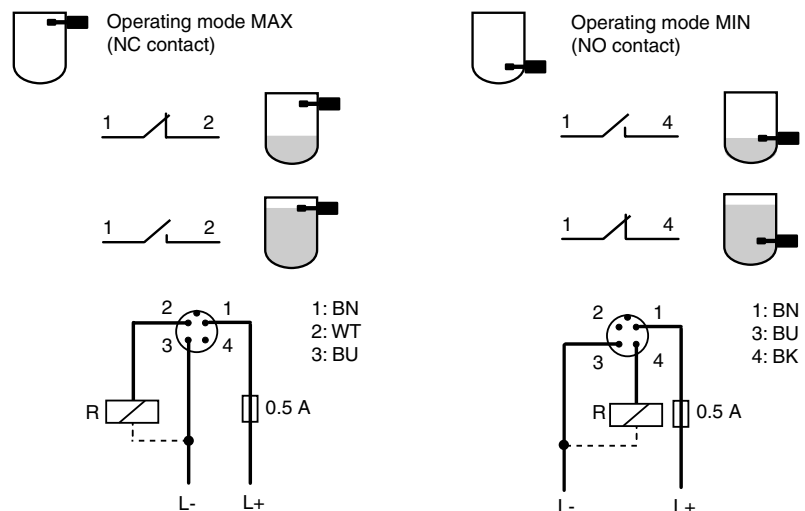
The Vibracon LVL-AH is a level limit switch for liquids in storage tanks, agitators and pipes which have to meet particularly high hygiene standards internally and externally.

It is used in particular in areas where other measurement methods would probably fail: e. g. in the event of viscosity, build-up, turbulences, flows, air bubbles, rash temperature change when cleaning.

The Vibracon LVL-AH is a hygienic version for fluid temperatures up to 150 °C (423 K).

## Electrical connection

Example: connection E5 (three-wire DC connection) with V1 connector M12 x 1  
 Other connection types see section electrical connections.



<b>Application</b>		Float switches
Function principle	The tuning fork is brought to its resonance frequency by means of a piezoelectric drive. If the tuning fork is covered by liquid, this frequency changes. The electronics monitor the resonance frequency and indicate whether the tuning fork is freely vibrating or is covered by liquid.	
<b>Input characteristics</b>		
Measured variable	density	
Measurement range	min. 0.7 g/cm <sup>3</sup> , other density (e. g. 0.5 g/cm <sup>3</sup> ) settings on request	Vibration limit switches
<b>Output characteristics</b>		
Fail safe mode	minimum/maximum closed circuit safety The level limit switch can be connected in two operating modes, depending on the operating mode selected (MAX or MIN safety). The level limit switch will switch off safely in the event of a fault (e. g. if the power supply line is interrupted). MAX = maximum fail-safe mode: The level limit switch keeps the electronic switch closed as long as the fluid level is below the fork. example application: overspill protection MIN = minimum fail-safe mode: The level limit switch keeps the electronic switch closed as long as the fork is immersed in fluid. example application: dry running protection of pumps The electronic switch opens if the limit is reached, if a fault occurs or in the event of a power failure.	
<b>Auxiliary energy</b>		
Electrical connection	This device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements. output B3: version AS-Interface output E5: version DC-PNP with M12 x 1 connector or valve connector output WA: version AC with valve connector	Conductive limit switches
Supply voltage	output B3: 24.5 ... 31 V DC (AS-Interface) output E5: 10 ... 35 V DC output WA: 19 ... 253 V AC, 50/60 Hz	
Power consumption	output B3: < 825 mW output E5: < 825 mW output WA: < 810 mW	
Current consumption	output B3: < 25 mA output E5: < 15 mA output WA: < 3.8 mA	Capacitive limit switches
Residual ripple	output E5: 5 V <sub>pp</sub> at 0 ... 400 Hz	
<b>Performance characteristics</b>		
Reference operating conditions	ambient temperature: 23 °C (296 K), process pressure: 1 bar, medium: water, medium density: 1, medium temperature: 23 °C (296 K), installation from above/vertical, density setting: > 0.7 g/cm <sup>3</sup>	Limit value immersion probes
Measured value resolution	< 0.5 mm	
Measuring frequency	approx. 1100 Hz in air	
Maximum measured error	13 mm ± 1 mm	
Non-repeatability	± 0.5 mm	
Hysteresis	3 mm ± 0.5 mm	
Influence of ambient temperature	negligible	
Influence of medium temperature	-29.6 x 10 <sup>-3</sup> mm/°C	
Influence of medium pressure	-55.2 x 10 <sup>-3</sup> mm/bar	
Switching time	when covering the sensor approx. 0.5 s, when uncovering the sensor approx. 1.0 s other switching times on request	
Settling time	< 2 s	Continuous immersion probes
<b>Operating conditions</b>		
Mounting conditions		
Installation position	see section mounting position	
<b>Ambient conditions</b>		
Ambient temperature	outputs E5, WA: -40 ... 70 °C (233 ... 343 K) output B3: -25 ... 70 °C (248 ... 343 K)	
Ambient temperature limits	derating from 90 °C (363 K) process temperature: reduction to max. 50 °C (323 K) ambient derating from 90 °C (363 K) process temperature: reduction to max. 150 mA relay switching capacity	
Storage temperature	-40 ... 85 °C (233 ... 358 K)	
Overvoltage protection	overvoltage category III	
<b>Process conditions</b>		
Medium temperature	-40 ... 150 °C (233 ... 423 K), see ambient temperature limit	Hydrostatic pressure sensors
Process pressure (static pressure)	-1 ... 40 bar	
State of aggregation	liquid	
Density	min. 0.7 g/cm <sup>3</sup> , other density setting on request	
Viscosity	max. 10000 mm <sup>2</sup> /s (10000 cSt)	
Gas content	stagnant mineral water	
Solid contents	< Ø5 mm	
<b>Mechanical specifications</b>		

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## Vibration limit switch LVL-AH

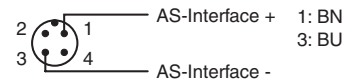
## Technical data

Float switches	Protection degree	IP65 with valve connector IP66/67 with M12 x 1 connector PPSU (plastic) IP66/68 with M12 x 1 connector 1.4435/316L, IP69K with accessory 52018763 (signalling via connector with LEDs)
	<b>Mechanical construction</b>	
	Dimensions	LVL-AH-V1: diameter 31.5 mm (1.24 in), length 173 mm (6.8 in) LVL-AH-P*: diameter 40 mm (1.57 in), length 185.5 mm (7.3 in) LVL-AH-PS: diameter 40 mm (1.57 in), length 179.5 mm (7.1 in)
	Mass	approx. 300 g
Vibration limit switches	Material	vibration fork, process connection and housing: Edelmetall 1.4435/316L connection: PSU
	Surface quality	$R_a < 1.5 \mu\text{m}/120 \text{ grit}$
	Process connection	- cylindrical thread G $\frac{1}{2}$ A, G $\frac{3}{4}$ A, G1A to DIN ISO 228/1 - conical thread R $\frac{1}{2}$ , R $\frac{3}{4}$ to DIN 2999, part 1 - conical thread $\frac{1}{2}$ NPT, $\frac{3}{4}$ NPT to ANSI B 1.20.1 - Triclamp 1 $\frac{1}{2}$ ", 2" to ISO 2852 - flush-mounted with welding adapter 1", sensor can be positioned - screw pipe connection DN25, DN32, DN40 to DIN 1185
	Electrical connection	electrical connection V1: pinning according to EN 60947-5-2 electrical connection P*: valve plug, cross section max. 1.5 mm <sup>2</sup> (AWG 16), diameter 6 ... 9 mm (0.24 ... 0.35 in) electrical connection PS: QUICKON valve plug, cross section 0.34 ... 0.75 mm <sup>2</sup> , diameter 3.5 ... 6.5 mm (0.14 ... 0.26 in)
Conductive limit switches	<b>Indication and operation</b>	
	Display elements	the LED display is on the connection side of the LVL-A* green LED: indication of ready to operate red LED: fault indication, mode indication yellow LED: mode indication (B3)
	Programming	AS-Interface profile S-3.A.E The address is defaulted to 0 (hex). It is changeable via the bus master or programming unit. Parameter bits (P0 ... P3) are not used.
Capacitive limit switches	Function test	function test with test magnet: Put the testing magnet to the mark of nameplate, the vibration fork reacts with the test magnet as in the case of covering with fluid. outputs E5, WA: on testing, the current state of the electronic switch is reversed output B3: on testing, D0 is inverted
	<b>Certificates and approvals</b>	
	Application	The general authorisation by the board of surveyors must be obtained for the site of installation. It is accessible together with the technical description and the certificate from Pepperl+Fuchs.
Limit value immersion probes	Sanitary compatibility	EHEDG, see process connections
	Marine approval	German Lloyd (GL), approval number: 42855-02HH
	<b>General information</b>	
	Directive conformity	
Continuous immersion probes	Directive 73/23/EEC (Low Voltage Directive)	output WA: EN 50178
	Directive 89/336/EC (EMC)	outputs E5, WA: emitted interference to EN 61326, CLASS B equipment interference immunity to EN 61326, annex A (industrial sector) output B3: EN 50295
	Conformity	
	Electromagnetic compatibility	NE 21
Hydrostatic pressure sensors	Protection degree	EN 60529
	Interface	output B: AS-Interface profile S-3.A.1 as per EN 50295 (limit switch)
	Vibration resistance	EN 60068-2-64
	Shock and impact resistance	EN 60068-2-27, 30 g
	Supplementary documentation	technical information TI3790 operating instructions KA2140 operating instructions KA1410 weld-in adapter G1 (LVL-Z101) operating instructions KA1420 weld-in adapter G $\frac{3}{4}$ (LVL-Z100) operating instructions KA1860 valve connector PG11
	Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

Electrical connection

Output B3 (AS-Interface) (only with V1 connector M12 x 1 available)

Two-wire connection for separate switching unit



Programming instruction AS-Interface profile: S-3.A.E

The address is defaulted to 0 (hex). It is changeable via the bus master or programming unit.

Data bit:

D0:1 Sensor covered	D1:1 State = OK
D0:0 Sensor free	D1:0 State = error
D2 and D3 are not used.	

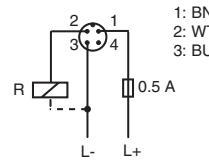
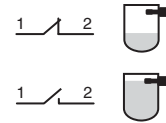
Parameter bits (P0 ... P3) are not used.

Output E5

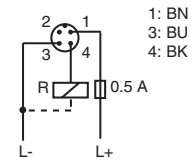
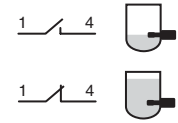
Three-wire DC connection, switching the load via transistor (PNP) and separate connection

V1 connector M12 x 1

Operating mode MAX (NC contact)

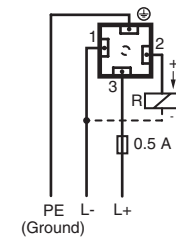
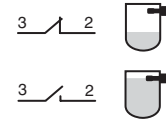


Operating mode MIN (NO contact)

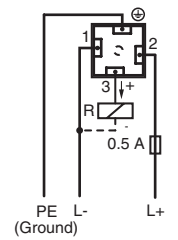
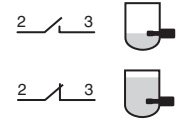


Valve plug

Operating mode MAX



Operating mode MIN

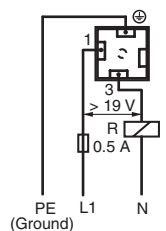
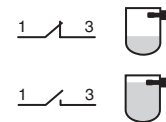


Output WA

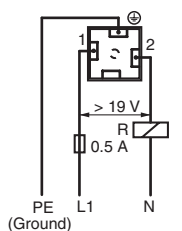
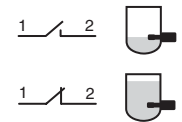
Two-wire AC connection

Valve plug

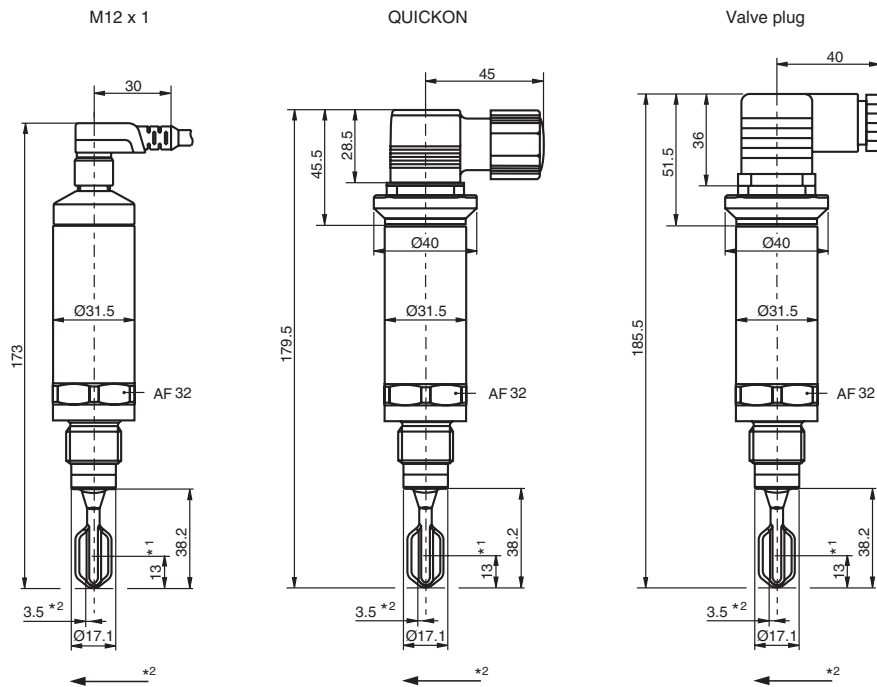
Operating mode MAX



Operating mode MIN



Dimensions



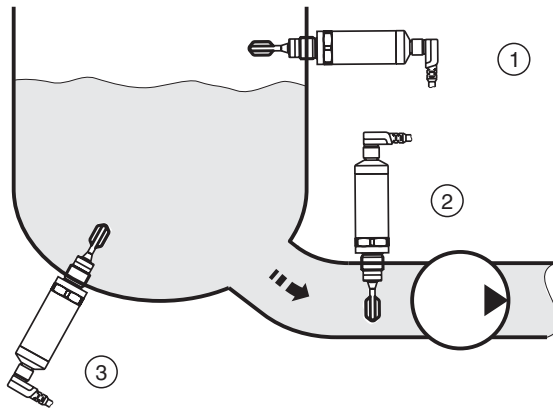
\*1 Switch point with vertical installation  
\*2 Switch point with horizontal installation; the level increases in the direction of the arrow

Switch points at: density 1/23 °C (296 K)/0 bar

Dimensions of process connections see technical information.

Mounting position

The level limit switch can be installed in any position in a container or pipe. The formation of foam does not impair its function.

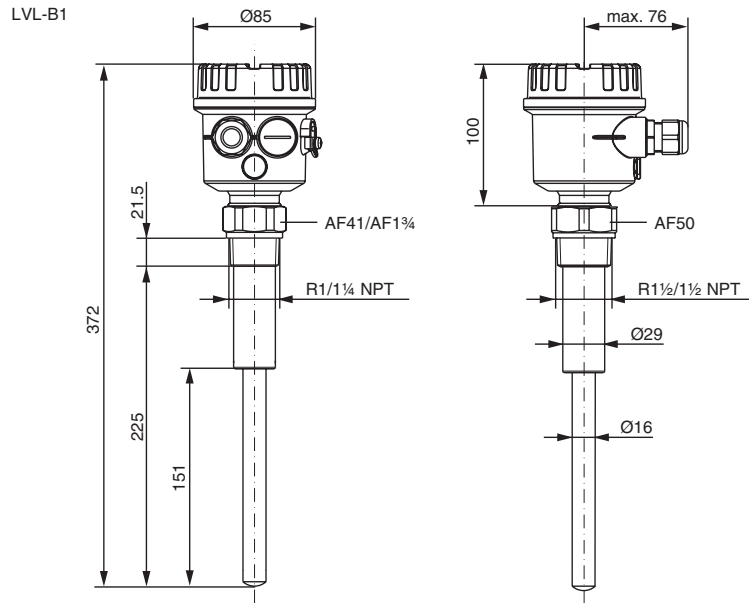


Example 1: overfill protection or top level detection  
Example 2: dry running protection for pump  
Example 3: lower level detection



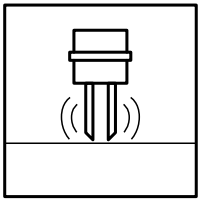
## Vibration limit switch

## Dimensions



Additional dimensions see section dimensions.

### LVL-B\*



### Features

- Level limit switch for bulk solids
- No calibration: easy commissioning (plug and play)
- Insensitive to build-up: maintenance-free operation
- No mechanically moving parts: no wear, long operating life
- Sensor material stainless steel: hardly any abrasion even with building materials
- F16 plastic housing with cover with sight glass: switch status visible from outside
- F18 aluminium housing also available
- Insensitive to external vibration and flow noises

### Function

Vibracon LVL-B\* is a robust level limit switch for silos with fine-grained or coarse-grained, non-fluidised bulk solids.

The various designs means the device has a wide range of applications.

Certificates are also available for use in dust incandive hazard areas.

LVL-B1: compact design (250 mm (10 in)) as vibrating rod for installation in any direction

LVL-B2: vibrating rod with extension pipe (500 mm/1000 mm/1500 mm/20 in/40 in/60 in) for installation in any direction

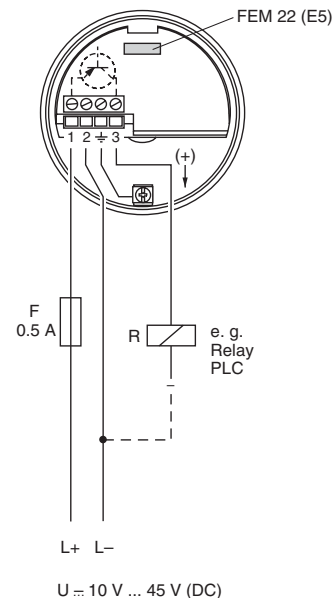
Typical applications:

cereals, coffee beans, sugar, animal feed, rice, detergents, dye powder, chalk, gypsum, cement, sand, plastic granules

### Electrical connection

Connection FEM 22 (E5) 3-wire DC connection (example)

- preferably for use with memory programmable controls (PLC), DI modules as per EN 61131-2
- positive signal at the electronics switch output (PNP)
- Output blocked at level limit.



Other connection types see section electrical connection.



<b>Application</b>		Float switches
Function principle	A piezoelectric drive excites the vibrating rod of Vibracon LVL-B* to its resonance frequency. If medium covers the vibrating rod, the rod's vibrating amplitude changes (the vibration is damped). Vibracons electronics compare the actual amplitude with a target value and indicates whether the vibrating rod is vibrating freely or whether it is covered by medium.	
<b>Function and system design</b>		
Equipment architecture	The measuring system consists of: - Vibracon LVL-B1 or LVL-B2 with FEM22 (E5) or FEM24 (WA) electronic insert - a supply point and - the connected control systems, switching units, signalling systems (e. g. lamps, horns, PCS, PLC, etc.)	Vibration limit switches
<b>Input characteristics</b>		
Measured variable	level (according to the mounting location and the overall length)	
Measurement range	The measuring range depends on the mounting location of Vibracon LVL-B* and the length of the pipe extension selected. The pipe extension is available in the following lengths: 500 mm, 1000 mm, 1500 mm, 20 in, 40 in, 60 in.	Conductive limit switches
Input signal	probe covered - small amplitude probe not covered - large amplitude	
<b>Output characteristics</b>		
Signal on alarm	electronic insert FEM22 (E5): output signal on power failure or in the event of device failure - < 100 µA electronic insert FEM24 (WA): output signal in event of power failure - relay de-energised	Capacitive limit switches
Fail safe mode	minimum/maximum quiescent current safety can be switched at electronic insert.  MAX = maximum safety: When the vibrating rod is covered, the output switches in the direction of the signal on alarm. Used for overspill protection for example.  MIN = minimum safety: When the vibrating rod becomes exposed, the output switches in the direction of the signal on alarm. Used for empty running protection for example.	
Switch behaviour	binary	
Switch-on response	When switching on the power supply the output is set to "signal on alarm". After a maximum of 3 s it switches to the correct output signal.	Limit value immersion probes
Load	electronic insert FEM22 (E5): - load switched via transistor and separate PNP connection - load current: max. 45 V (cyclical overload and short-circuit protection), continuous max. 350 mA - residual current: < 100 µA (for blocked transistor) - capacitive load: max. 0.5 µF for 45 V, max. 1.0 µF for 24 V - residual voltage: < 3 V (for transistor switched through) electronic insert FEM24 (WA): - loads switched via 2 floating change-over contacts - version AC: I max. 6 A, U max. 253 V; P max. 1500 VA, cos Φ = 1, P max. 750 VA, cos Φ > 0.7 - version DC: I max. 6 A to 30 V, I max. 0.2 A to 125 V - the following applies when connecting a functional extra-low voltage circuit with double insulation as per IEC 1010: sum of voltages of relay output and power supply max. 300 V	
Electrical isolation	electronic insert FEM22 (E5): between sensor and power supply electronic insert FEM24 (WA): between sensor, power supply and load	
<b>Auxiliary energy</b>		Continuous immersion probes
Supply voltage	electronic insert FEM22 (E5): 10 ... 45 V DC electronic insert FEM24 (WA): 19 ... 253 V AC, 50/60 Hz or 19 ... 55 V DC	
Power consumption	electronic insert FEM22 (E5): max. 0.68 W electronic insert FEM 24 (WA): max. 1.3 W	
Current consumption	electronic insert FEM22 (E5): max. 15 mA	Hydrostatic pressure sensors
Residual ripple	electronic insert FEM22 (E5): max. 5 V, 0 ... 400 Hz	
Reverse polarity protection	separation voltage 2.2 kV	
<b>Performance characteristics</b>		
Measuring frequency	700 ... 800 Hz	
Switching time	when covering the sensor approx. 0.5 s, when uncovering the sensor approx. 1.0 s	
<b>Operating conditions</b>		
Mounting conditions		
Installation position	see section mounting position	
<b>Ambient conditions</b>		
Ambient temperature	-40 ... 70 °C (233 ... 343 K)	
Storage temperature	-40 ... 85 °C (233 ... 358 K)	
Overvoltage protection	overvoltage category III	
<b>Process conditions</b>		
Process temperature	-40 ... 150 °C (233 ... 423 K)	
Medium pressure limits	-1 ... 25 bar max. working pressure 25 bar, burst pressure 100 bar	
Thermal shock resistance	max. 120 K	
State of aggregation	solids	
Solid contents	≤ Ø25 mm	

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## Vibration limit switch LVL-B\*

## Technical data

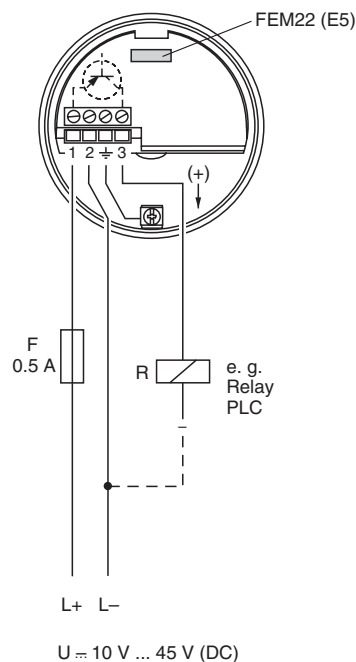
Float switches	Bulk density	≥ 200 g/l, not fluidised
	<b>Mechanical specifications</b>	
	Protection degree	IP66/IP67, Nema 4x
Vibration limit switches	<b>Mechanical construction</b>	
	Versions	LVL-B1: compact version LVL-B2: version with pipe extension
	Dimensions	LVL-B1: diameter max. 85 mm (3.3 in), length 372 mm (14.6 in) LVL-B2: diameter max. 85 mm (3.3 in), length 160 mm (6.3 in) + x (x = 500 mm, 1000 mm, 1500 mm, 20 in, 40 in, 60 in)
Conductive limit switches	Mass	LVL-B1/LVL-B2 with F16 housing, FEM24 (WA) and R1 thread: - compact = approx. 1.0 kg - 500 mm (20 in) = approx. 1.3 kg - 1000 mm (40 in) = approx. 2.0 kg - 1500 mm (60 in) = approx. 2.6 kg
	Material	F16 housing: PTB-FR, cover with transparent glass made of PA12, EPDM cover seal F18 housing: aluminium EN-AC-AISi10Mg, plastic coated cover seal: EPDM process connections, sensor: stainless steel 1.4435/316L
	Process connection	- tapered thread R1, R1½ acc. to DIN 2999 - tapered thread 1¼-11½ NPT, 1½-11½ NPT acc. to ANSI B 1.20.1
Capacitive limit switches	Electrical connection	cable connection M20 x 1.5, ½ NPT, G½
	<b>Indication and operation</b>	
	Display elements	electronic insert FEM22 (E5): - one green LED: operation - one yellow LED: electronic switch closed electronic insert FEM 24(WA): one green LED: - operation - one yellow LED: contact closed (relay energised)
Limit value immersion probes	Operating elements	switch for safety mode - MAX - overspill protection - MIN - dry running protection switch for bulk density/density setting - 400 g/l (high bulk density) - 200 g/l (low bulk density)
	Additional functions	detection of solids under water The system does not detect coverage by liquids similar to water.
	<b>Certificates and approvals</b>	
Continuous immersion probes	Ex approval	KEMA 06 ATEX 0055, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
	Type of protection	⊕ II 1/3D T+19K IP66
	<b>General information</b>	
Hydrostatic pressure sensors	Directive conformity	
	Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1
	Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector)
Hydrostatic pressure sensors	Directive 94/9 EC (ATEX)	EN 50281-1-1
	Conformity	
	Electromagnetic compatibility	NE 21
Hydrostatic pressure sensors	Protection degree	EN 60529
	Climate class	EN 60068, part 2-38, fig. 2a
	Vibration resistance	EN 60068-2-64, 0.01 g²/Hz
Hydrostatic pressure sensors	Shock and impact resistance	EN 60068-2-27, 30 g
	Supplementary documentation	technical information TI389O operating instructions KA227O operating instructions KA237O high pressure sliding sleeve R1½ (LVL-Z200), 1½-11½ NPT (LVL-Z201) operating instructions KA238O sliding sleeve for unpressurised operation R1½ (LVL-Z202), 1½-11½ NPT (LVL-Z203) safety information SI300O (KEMA 06 ATEX 0055)
	Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

Electrical connection

Electronic insert FEM22 (E5)

Three-wire DC connection

- preferred in conjunction with programmable logic controllers (PLC), DI modules as per EN 61131-2
- positive signal at electronics switch output (PNP)
- Output blocked at level limit.



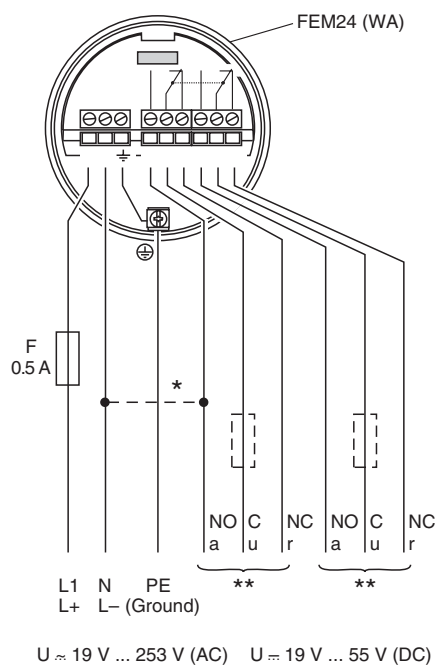
Electronic insert FEM24 (WA)

Universal current connection with relay output

- Power supply: Please note the different voltage ranges for AC and DC.
- When connecting a device with high inductance, provide a spark arrester to protect the relay contact. A fine-wire fuse (depending on the load connected) protects the relay contact in the event of a short-circuit. Both relay contacts switch simultaneously. DPDT (double pole double throw)

\* When jumpered, the relay output works with NPN logic.

\*\* see "Connectable load"



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

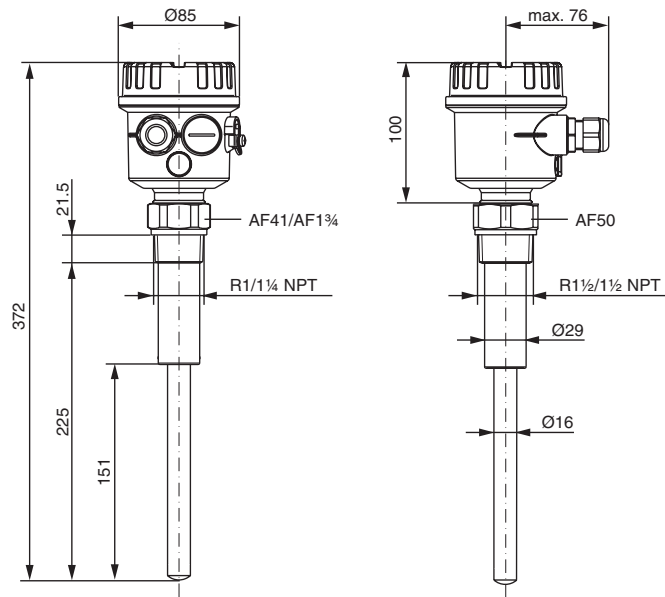
Continuous immersion probes

Hydrostatic pressure sensors

Dimensions

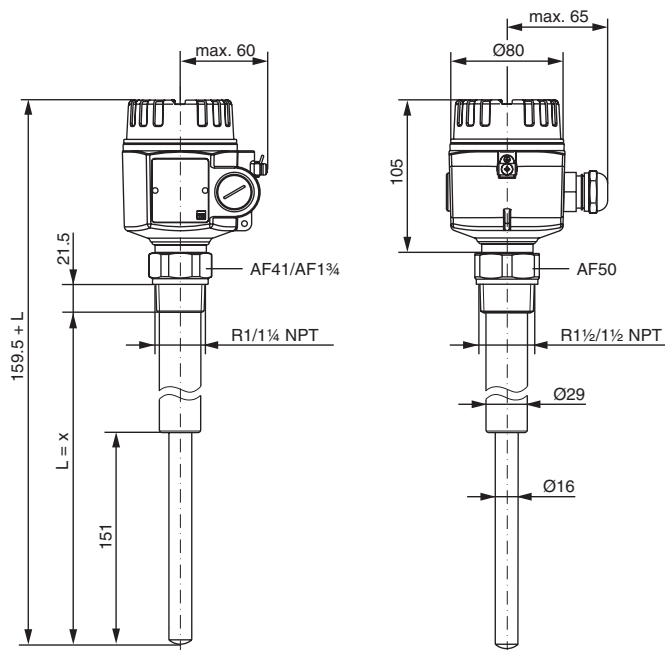
Version LVL-B1

compact version



Version LVL-B2

version with pipe extension



x = 500 mm, 1000 mm, 1500 mm, 20 in, 40 in, 60 in

Float switches

Vibration limit switches

Conductive limit switches

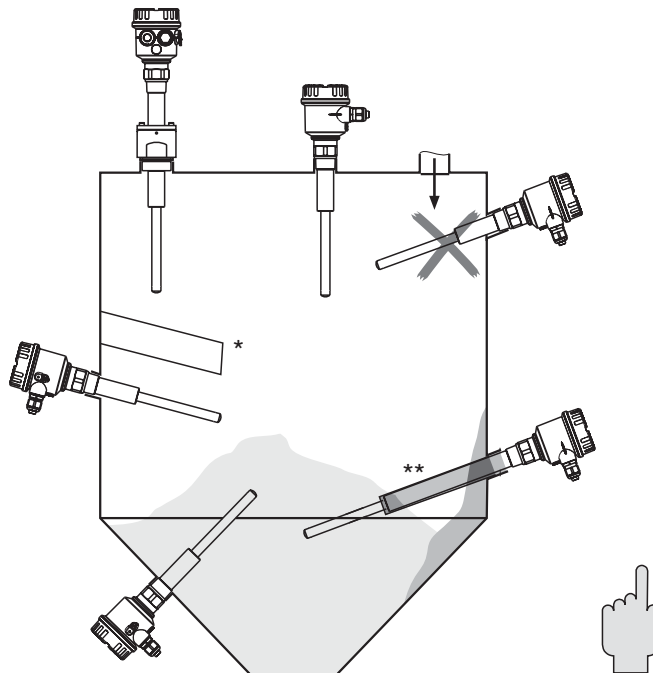
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Mounting position



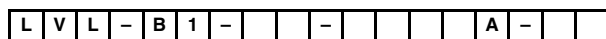
Horizontal installation/vertical installation  
 \* with protective cover (to be provided by customer)  
 \*\* with protecting tube (to be provided by customer)

Accessories

- LVL-Z200, high pressure sliding sleeve R1½, DIN 2999
- LVL-Z201, high pressure sliding sleeve 1½-11½ NPT, ANSI B 1.20.1
- LVL-Z202, sliding sleeve for unpressurised container R1½, DIN 2999
- LVL-Z203, sliding sleeve for unpressurised container 1½-11½ NPT, ANSI B 1.20.1

**Type code/model number**

**Product structure LVL-B1**



**Certificates**  
**NA** version for non-hazardous areas  
**EX** II 1/3D  
**FS** FM, DIP + CSA DIP, Cl. II, III, Div. 1 + 2, Gr. E–G  
**CG** CSA, General Purpose

**Optional equipment**  
**A** with optional equipment

**Electrical output**  
**E5** FEM22, PNP 3-wire, 10 V DC ... 45 V DC  
**WA** FEM24, relay, DPDT, 19 V AC ... 253 V AC, 19 V DC ... 55 V DC

**Housing, cable entry**  
**A6** aluminium housing F18, IP66/IP67, Nema 4x, cable gland M20  
**A7** aluminium housing F18, IP66/IP67, Nema 4x, ¾ NPT  
**A8** aluminium housing F18, IP66/IP67, Nema 4x, entry G½A  
**C** polyester housing F16, IP66/IP67, Nema 4x, cable gland M20  
**Q** polyester housing F16, IP66/IP67, Nema 4x, ½ NPT  
**P** polyester housing F16, IP66/IP67, Nema 4x, entry G½A

**Process connection**  
**N3** 1¼ NPT, ANSI B 1.20.1, 1.4435/316L  
**N5** 1½ NPT, ANSI B 1.20.1, 1.4435/316L  
**R3** R1, DIN 2999, 1.4435/316L  
**R5** R1½, DIN 2999, 1.4435/316L  
**XX** special version

**Design**  
**B1** compact design

**Product structure LVL-B2**



**Certificates**  
**NA** version for non-hazardous areas  
**EX** II 1/3D  
**FS** FM, DIP + CSA DIP, Cl. II, III, Div. 1 + 2, Gr. E–G  
**CG** CSA, General Purpose

**Optional equipment**  
**A** with optional equipment

**Electrical output**  
**E5** FEM22, PNP 3-wire, 10 V DC ... 45 V DC  
**WA** FEM24, relay, DPDT, 19 V AC ... 253 V AC, 19 V DC ... 55 V DC

**Housing, cable entry**  
**A6** aluminium housing F18, IP66/IP67, Nema 4x, cable gland M20  
**A7** aluminium housing F18, IP66/IP67, Nema 4x, ¾ NPT  
**A8** aluminium housing F18, IP66/IP67, Nema 4x, entry G½A  
**C** polyester housing F16, IP66/IP67, Nema 4x, cable gland M20  
**Q** polyester housing F16, IP66/IP67, Nema 4x, ½ NPT  
**P** polyester housing F16, IP66/IP67, Nema 4x, entry G½A

**Sensor length**  
**2** 500 mm  
**3** 1000 mm  
**4** 1500 mm  
**6** 20 in  
**7** 40 in  
**8** 60 in

**Process connection**  
**N3** 1¼ NPT, ANSI B 1.20.1, 1.4435/316L  
**N5** 1½ NPT, ANSI B 1.20.1, 1.4435/316L  
**R3** R1, DIN 2999, 1.4435/316L  
**R5** R1½, DIN 2999, 1.4435/316L  
**XX** special version

**Design**  
**B2** extended design (500 mm/20 in ... 1500 mm/60 in)

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

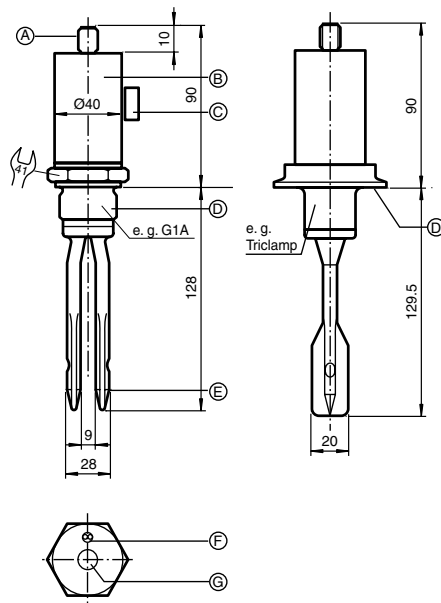
Hydrostatic pressure sensors



## Vibration limit switch

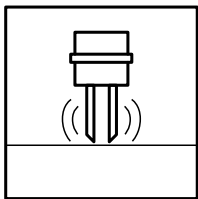


## Dimensions



- A) Electrical connection via a circular device connector M12 x 1 (ignition protection class IP66/68)
- B) Welded housing made of corrosion resistant steel
- C) The switching function can be checked from outside the vessel using a magnet (mounted directly on the housing)
- D) Process connection versions, all made of corrosion resistant steel
- E) Vibration fork made of solid corrosion resistant steel
- F) Red light-emitting diode for switch indicator "circuit cut off"
- G) Green light-emitting diode "ready to operate"

## LVL-S1



## Features

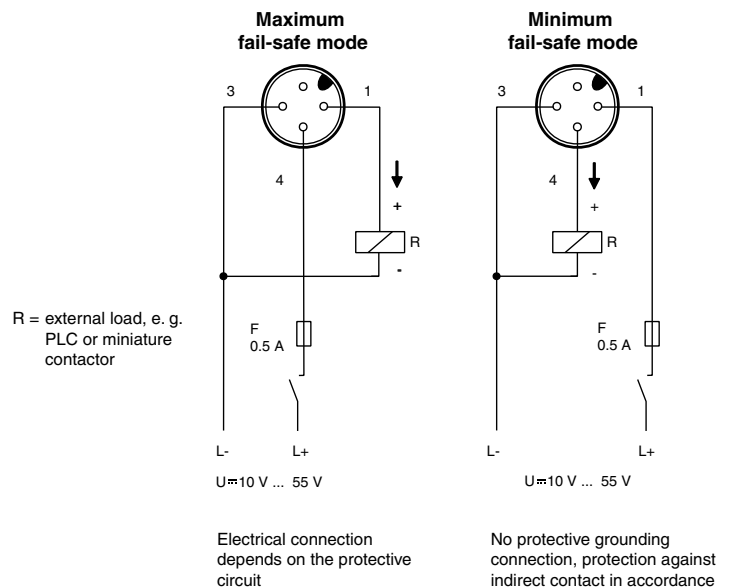
- Level limit switch in hygienic version for liquids
- External test option using test magnet
- On-site function control using external LED display
- Especially used in systems where other measuring principles cannot be used, e. g. for pastes, build-up, turbulence, liquid flow, gas bubbles and rapid temperature variations when cleaning
- Due to its compact construction, it can be directly connected to a miniature contactor, magnet operated valve or programmable logic control (PLC)
- Rugged stainless steel housing

## Function

The symmetrical vibrating probe vibrates at its resonance frequency. If it is submerged in liquid, this frequency changes, and the electronics activate the switching transistor on the PNP output.

The Vibracon LVL-S1 can be operated in minimum or maximum closed circuit safety, i. e. the switching transistor closes in the case of obtaining the limit level, by fault and by power failure.

## Electrical connection



Viewed from the pin of the plug connector.



<b>Application</b>		Float switches
Description	level limit switch for application in storage tank, stirring container and pipeline with liquids	
<b>Output characteristics</b>		
Signal on alarm	output locked	
Fail safe mode	minimum/maximum closed circuit safety, determined by the way of connection	
Switching time	when covering the sensor approx. 0.5 s, when uncovering the sensor approx. 1.0 s	
Load	load switched via PNP transistor - transient: (1 s) max. 1 A, max. 55 V (pulsed overload and short-circuit protection) - continuous: max. 350 mA, max. 0.5 µF at 55 V, max. 1.0 µF at 24 V - residual voltage < 3 V (with closed transistor) - residual current < 100 µA (with open transistor)	
<b>Auxiliary energy</b>		
Electrical connection	output E5: 3-wire DC connection, positive signal on the sensor switch output (PNP)	
Supply voltage	10 ... 55 V DC	
Current consumption	max. 15 mA	
Residual ripple	max. 1.7 V, 0 ... 400 Hz	
Reverse polarity protection	yes	
<b>Performance characteristics</b>		
Hysteresis	approx. 4 mm with vertical mounting	Conductive limit switches
<b>Operating conditions</b>		
Mounting conditions		
Installation position	any position	
Ambient conditions		
Ambient temperature	-40 ... 70 °C (233 ... 343 K)	
Storage temperature	-40 ... 85 °C (233 ... 358 K)	
Process conditions		
Medium temperature	-40 ... 150 °C (233 ... 423 K)	
Process pressure (static pressure)	-1 ... 40 bar	
Density	min. 0.7 g/cm <sup>3</sup>	Capacitive limit switches
Viscosity	up to 10000 mm <sup>2</sup> /s	
<b>Mechanical specifications</b>		
Protection degree	IP66/68 (24 h, 1.5 m), when using the correct connector	
<b>Mechanical construction</b>		
Construction type	compact device	Limit value immersion probes
Versions	see type code	
Dimensions	see dimensions	
Mass	approx. 500 g	
Material	process connection and vibration fork: stainless steel 1.4571/316Ti housing: stainless steel 1.4404/316L, welded plug connector: stainless steel 1.4571/316Ti viewing windows for LEDs: glass	
Surface quality	high polished: R <sub>a</sub> < 0.5 µm/240 grit polished: R <sub>a</sub> < 1.5 µm/120 grit standard: R <sub>a</sub> < 3.2 µm/80 grit	Continuous immersion probes
Process connection	- conical thread 1 NPT in acc. with ANSI B 1.20.1 - cylindrical thread G1A in acc. with DIN ISO 228/1 with flat seal 33 x 39 in acc. with DIN 7603 - flush mounted version for welding adapter in acc. with company standard - Triclamp 1½", 2" acc. to ISO 2852 - dairy coupling DN 50 in acc. with DIN 1185 The specified limits for temperature and pressure apply in each case to the limit switch with special process connection. Also note the limits for the seal and clamping ring used!	
Electrical connection	plug connector M12 x 1, 4-pin (without protective earthing connection)	
<b>Indication and operation</b>		
Display elements	The LED display is on the connection side of the LVL-S1. green LED: indication of ready to operate red LED: switch indication circuit cut off	
Function test	function test with test magnet: Put the testing magnet to the shown location (see graph). The vibration fork reacts with the test magnet as in the case of covering with fluid.	Hydrostatic pressure sensors
<b>General information</b>		
Directive conformity		
Directive 89/336/EC (EMC)	emitted interference to EN 50081-1 and EN 61326, class B equipment interference immunity to EN 50082-2 (field strength 10 V/m) and EN 61326, annex A (industrial sector)	
Conformity		
Electromagnetic compatibility	NE 21	
Protection degree	EN 60529	
Climate class	EN 60068, part 2-38, fig. 2a	

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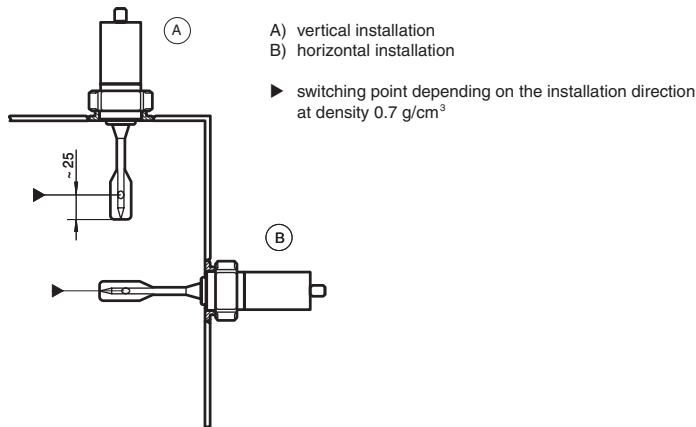
Supplementary documentation

operating instructions KA0810  
operating instructions KA0320 weld-in adapter G1A (LVL-Z70)  
operating instructions KA1510 sliding sleeve for unpressurised operation G1A, 1 NPT (LVL-Z120, LVL-Z122)  
operating instructions KA1530 high pressure sliding sleeve G1A, 1 NPT (LVL-Z124, LVL-Z125, LVL-Z128, LVL-Z129)  
operating instructions electrical connection LVL-S1

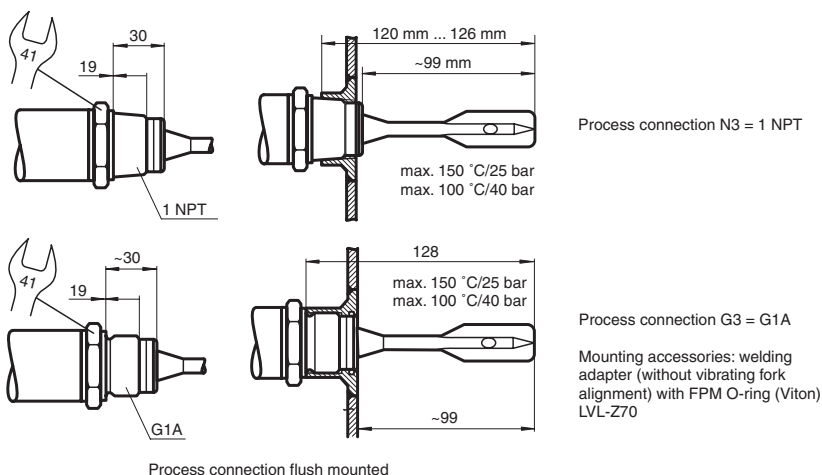
Supplementary information

Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

**Mounting position**



**Dimensions process connections**



**Accessories**

- LVL-Z15, test magnet
- LVL-Z64, socket spanner
- LVL-Z70, welding bushing for vessels G1, viton sealing
- LVL-Z120, sliding sleeve for unpressurised operation G1A
- LVL-Z122, sliding sleeve for unpressurised operation 1 NPT
- LVL-Z124, high pressure sliding sleeve G1A
- LVL-Z125, high pressure sliding sleeve G1A
- LVL-Z128, high pressure sliding sleeve 1 NPT
- LVL-Z129, high pressure sliding sleeve 1 NPT
- V1-G, mating connector, straight
- V1-G-2M-PVC, mating connector, straight, with 2 m (6.6 ft) cable
- V1-W, mating connector, 90° angled
- V1-W-2M-PVC, mating connector, 90° angled, with 2 m (6.6 ft) cable

Type code/model number

L V L - S 1 - - - - E 5 V 1 - N A

- Approvals**  
NA no approval
- Special features**  
V1 connector M12 x 1; V1
- Electrical output**  
E5 10 V DC ... 55 V DC, PNP, 3-wire
- Fork surface**  
S standard surface,  $R_a < 3.2 \mu\text{m}$   
O polished version,  $R_a < 1.5 \mu\text{m}$   
G high-polished version,  $R_a < 0.5 \mu\text{m}$
- Process connection**  
G3 G1A BSP, DIN ISO 228/1, 1.4571/316Ti  
N3 1 NPT, ANSI B 1.20.1, 1.4571/316Ti  
M7 DN50, sanitary coupling DIN 1185, 1.4571/316Ti  
S1 flush mounted for welding sleeve, 1.4571/316Ti  
T5 1½", Triclamp ISO 2852, 1.4571/316Ti  
T6 2", Triclamp ISO 2852, 1.4571/316Ti

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

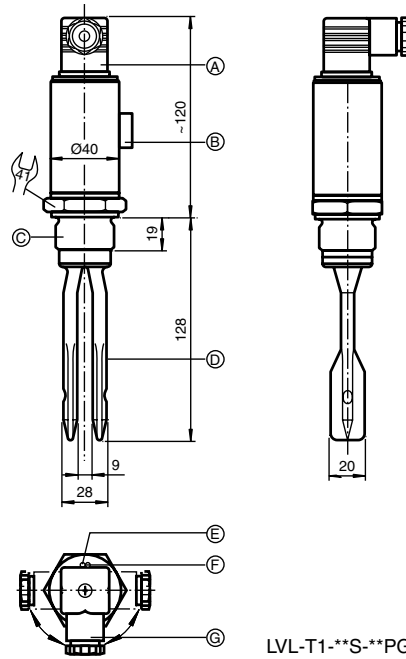
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

## Vibration limit switch

## Dimensions



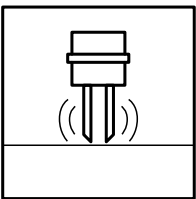
LVL-T1-\*\*-S-\*\*-PG-\*\*-\*\*

## Function

The symmetrical vibrating probe vibrates at its resonance frequency. If it is submerged in liquid, this resonance frequency changes, and the electronics activate an electronic switch.

The Vibracon LVL-T1 can be operated in minimum or maximum closed circuit safety, i. e. the electronic switch closes by obtaining the limit level, by fault and by power failure.

## LVL-T1



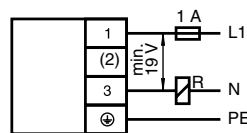
## Features

- Level limit switch for liquids
- External test option using test magnet
- On-site function control using external LED display
- Easy to install even at points difficult to access due to compact design
- Due to its compact construction, it can be directly connected to a miniature contactor, magnet operated valve or programmable logic control (PLC)
- Rugged stainless steel housing
- Cost-saving plug connections

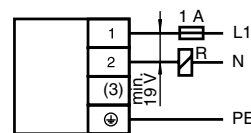
## Electrical connection

### Connection output WA

#### Maximum fail-safe mode

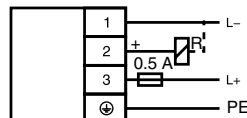


#### Minimum fail-safe mode

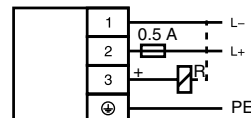


### Connection output E5

#### Maximum



#### Minimum



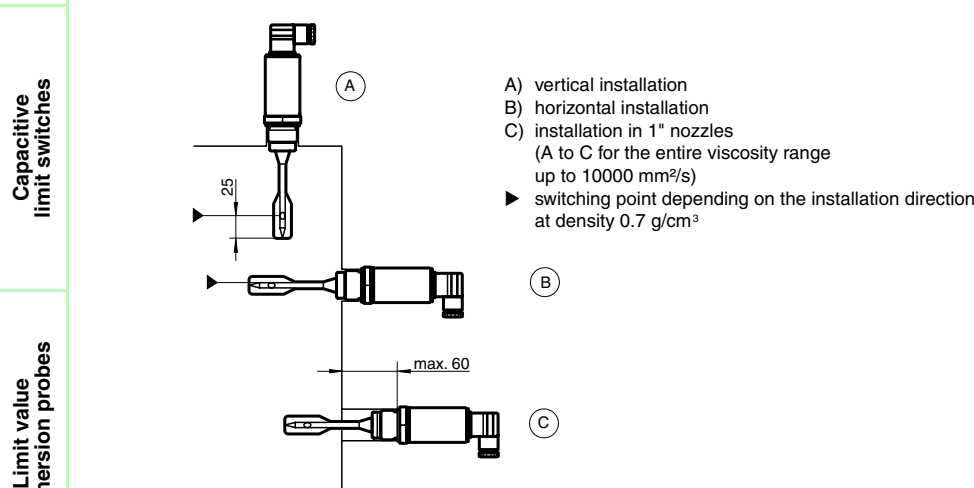
R = external

<b>Application</b>		Float switches
Description	level limit switch for application in storage tank, stirring container and pipeline with liquids	
<b>Output characteristics</b>		
Signal on alarm	output locked	
Fail safe mode	minimum/maximum closed circuit safety, determined by the way of connection	
Switching time	when covering the sensor approx. 0.5 s, when uncovering the sensor approx. 1.0 s	
Load	output WA (load switched across thyristor directly in power supply circuit): - transient (40 ms): max. 1.5 A, max. 375 VA at 250 V or max. 36 VA at 24 V (not short-circuit proof) - continuous: max. 87 VA at 250 V, max. 8.4 VA at 24 V; min. 2.5 VA at 250 V (10 mA), min. 0.5 VA at 24 V (20 mA) - residual current max. 4 mA with blocked thyristor output E5 (the load is switched via a transistor and a separate connection): - transient (1 s): max. 1 A, max. 55 V (overload and short-circuit protection) - continuous: max. 350 mA max. 0.5 µF at 55 V, max. 1 µF at 24 V - residual voltage < 3 V (with closed transistor) - residual current < 100 µA (with open transistor)	
<b>Auxiliary energy</b>		
Electrical connection	output WA: Always connect the LVL-T1 in series with a load! Take into account the voltage drop via the LVL-T1 when switched in circuit and the residual current when isolated (see technical data, output) and, for low supply voltages, take into account the voltage drop via the load, in order to ensure that the terminal voltage on the LVL-T1 does not fall below the permissible value.  output E5: Should be used in conjunction with programmable logic controllers (PLC), positive signal on the sensor switch output (PNP).  The protective circuit is implemented in the connection.	
Supply voltage	output WA: 19 ... 253 V AC, 50/60 Hz, output E5: 10 ... 55 V DC	
Current consumption	output WA: max. 4 mA (stand by), output E5: max. 15 mA	
Residual ripple	output E5: max. 1.7 V, 0 ... 400 Hz	
Voltage drop	output WA: max. 12 V	
Reverse polarity protection	yes	
<b>Performance characteristics</b>		Capacitive limit switches
Hysteresis	approx. 4 mm with vertical mounting	
<b>Operating conditions</b>		
Mounting conditions		
Installation position	any position	
Ambient conditions		Limit value immersion probes
Ambient temperature	-40 ... 70 °C (233 ... 343 K)	
Storage temperature	-40 ... 85 °C (233 ... 358 K)	
Process conditions		
Medium temperature	-40 ... 150 °C (233 ... 423 K)	
Process pressure (static pressure)	-1 ... 40 bar	Continuous immersion probes
Density	min. 0.7 g/cm <sup>3</sup>	
Viscosity	max. 10000 mm <sup>2</sup> /s (10000 cSt)	
<b>Mechanical specifications</b>		
Protection degree	IP65/IP67 with connector (cable gland PG11)	
<b>Mechanical construction</b>		Hydrostatic pressure sensors
Construction type	compact device	
Versions	- LVL-T1-G3S-E5PG-NA, process connection G1, 10 ... 55 V DC, PNP 3-wire, connector PG11 - LVL-T1-G3S-E5PG-WH, process connection G1, 10 ... 55 V DC, PNP 3-wire, connector PG11, overspill protection WHG - LVL-T1-G3S-WAPG-WH, process connection G1, 19 ... 253 V AC, 3-wire, connector PG11, overspill protection WHG All above-mentioned versions are also available with thread 1 NPT.	
Dimensions	see dimensions	
Mass	approx. 450 g	
Material	process connection and vibration fork: stainless steel 1.4571/316Ti housing: stainless steel 1.4404/316L housing cover: PPSU connector: PA plug seal: elastomer flat seal ring for process connection G1A: elastomer fibre, asbestos-free, unaffected by oils, solvents, vapour, weak acids and alkalis	
Surface quality	R <sub>a</sub> < 3.2 µm/80 grit	
Process connection	- cylindrical thread G1A in acc. with DIN ISO 228/1 with flat seal 33 x 39 in acc. with DIN 7603 - conical thread 1 NPT in acc. with ANSI B 1.20.1 - conical thread R1 in acc. with DIN 2999, part 1	
Electrical connection	4-pin plug connection in acc. with DIN 43650-A, ISO 4400 with cable gland PG11, for cable diameter 6 ... 9 mm (0.24 ... 0.35 in), max. conductor cross section 1.5 mm <sup>2</sup>	

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Float switches	<b>Indication and operation</b>	
	Display elements	The LED display is on the connection side of the LVL-S1. green LED: indication of ready to operate red LED: switch indication circuit cut off
	Function test	function test with test magnet: Put the testing magnet to the shown location (see graph). The vibration fork reacts with the test magnet as in the case of covering with fluid.
	<b>Certificates and approvals</b>	
Vibration limit switches	Overspill protection	Z-65.11-302 (overspill protection in acc. with WHG)
	<b>General information</b>	
	Directive conformity	
	Directive 73/23/EEC (Low Voltage Directive)	output WA: EN 50178
	Directive 89/336/EC (EMC)	emitted interference to EN 50081-1 and EN 61326, class B equipment interference immunity to EN 50082-2 (field strength 10 V/m) and EN 61326, annex A (industrial sector)
	Conformity	
	Electromagnetic compatibility	NE 21
	Protection degree	EN 60529
	Climate class	EN 60068, part 2-38, fig. 2a
	Supplementary documentation	operating instructions KA035O operating instructions KA032O weld-in adapter G1A (LVL-Z70) operating instructions KA151O sliding sleeve for unpressurised operation G1A, 1 NPT (LVL-Z120, LVL-Z122) operating instructions KA153O high pressure sliding sleeve G1A, 1 NPT (LVL-Z124, LVL-Z125, LVL-Z128, LVL-Z129) approval ZE186O overspill protection in acc. with WHG (Z-65.11-302)
Conductive limit switches	Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

**Mounting position**



**Accessories**

- LVL-Z15, test magnet
- LVL-Z64, socket spanner
- LVL-Z70, welding bushing for vessels G1, viton sealing
- LVL-Z120, sliding sleeve for unpressurised operation G1A
- LVL-Z122, sliding sleeve for unpressurised operation 1 NPT
- LVL-Z124, high pressure sliding sleeve G1A
- LVL-Z125, high pressure sliding sleeve G1A
- LVL-Z128, high pressure sliding sleeve 1 NPT
- LVL-Z129, high pressure sliding sleeve 1 NPT

Type code/model number



- Approvals**
  - NA no approval
  - WH overspill protection WHG
  - CG CSA general purpose
- Electrical connection**
  - PG PG11 connector, ISO 4400, IP65/IP67
  - PN connector ½ NPT, ISO 4400, IP65
- Electrical output**
  - WA 19 V AC ... 253 V AC, 3-wire
  - E5 10 V DC ... 55 V DC, PNP 2-wire
- Fork surface**
  - S standard surface,  $R_a < 3.2 \mu\text{m}$
- Process connection**
  - G3 G1A, BSP, DIN ISO 228/1, 1.4571/316Ti
  - N3 1 NPT, ANSI B 1.20.1, 1.4571/316Ti
  - R3 R1, BSP, DIN 2999, 1.4571/316Ti

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

## Vibration limit switch

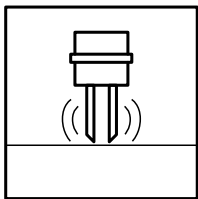
## Dimensions

Float switches



Vibration limit switches

### LVL-M\*



Conductive limit switches

Capacitive limit switches



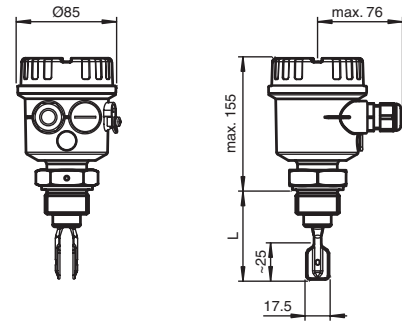
### Features

- Level limit switch for liquids
- Large number of process connections to choose from: universal usage
- Wide variety of electronic modules: the right connection for every process control system
- No calibration: quick and low-cost start-up
- No mechanically moving parts: maintenance-free, no wear, long operating life
- Monitoring of the vibrating fork for damage: guaranteed function
- PROFIBUS PA protocol: commissioning and maintenance quick and easy
- Up to SIL2 acc. to IEC 61508

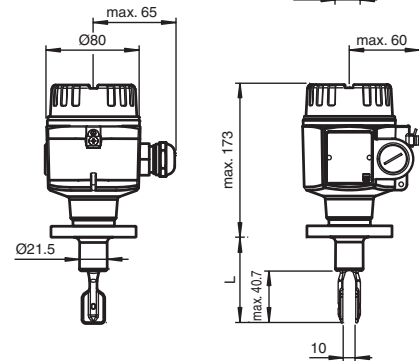
Continuous immersion probes

Hydrostatic pressure sensors

Vibracon LVL-M\* with plastic housing and process connection G\*\*



Vibracon LVL-M\* with aluminium housing and process connection with flange



Additional dimensions see section dimensions.  
Length L see process connections.

### Function

The Vibracon is a level limit switch for use in all liquids.

- for temperature of  $-50\text{ }^{\circ}\text{C}$  (223 K) to  $+150\text{ }^{\circ}\text{C}$  (423 K)
- for pressures up to 64 bar
- for viscosities up to  $10000\text{ mm}^2/\text{s}$
- for densities up to  $0.5\text{ g/cm}^3$  or  $0.7\text{ g/cm}^3$  (other settings available on request)

The function is not affected by flow, turbulence, bubbles, foam, vibration, bulk solids content or build-up, the Vibracon is thus the ideal substitute for float switches.

The compact version is ideal for mounting in pipes (LVL-M1). In addition there is a version with extension tube up to 6 m (20 ft) (LVL-M2).

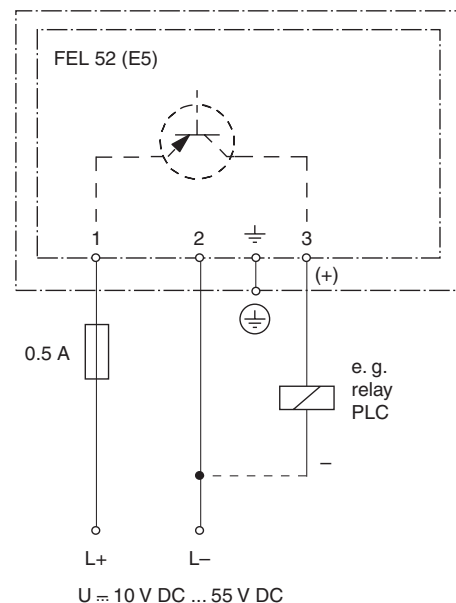
High corrosion-resistant Alloy C4 (2.4610) is available for the vibration fork and process connection for applications in very aggressive liquids.

Ex ia, Ex de and Ex d protection enable it to be used in hazardous areas.

### Electrical connection

Connection FEL 52 (E5) 3-wire DC connection (example)

- preferably for use with memory programmable controls (PLC)
- positive signal at the switch output of the electronics (PNP)
- Output blocked on reaching limit level.
- also in compact housing with plug connection available



Other connection types see section electrical connection.



<b>Application</b>		Float switches	
Function principle	limit detection maximum or minimum detection in tanks or pipelines containing all types of liquids including use in explosion hazardous areas		
<b>Function and system design</b>			
Measuring principle	The forks of the sensors vibrate at their intrinsic frequency, this frequency is reduced when covered with liquid. The change in frequency then activates the limit switch.		
<b>Input characteristics</b>			
Measured variable	limit level (limit value)		
Measurement range	LVL-M1: depends on mounting point LVL-M2: depends on mounting point and pipe extension up to 6000 mm (20 ft)		
Medium density	adjustment on the electronic insert > 0.5 g/cm <sup>3</sup> or > 0.7 g/cm <sup>3</sup> (other on request)		
<b>Output characteristics</b>			
Fail safe mode	switch-over for minimum/maximum residual current safety on electronic insert MAX = maximum safety: The output switches to the power fail response when the fork is covered. for use with overspill protection for example MIN = minimum safety: The output switches to the power fail response when the fork is exposed. for use with dry running protection for example		
Switching time	when fork is covered: approx. 0.5 s, when fork is exposed: approx. 1.0 s (other switching times on request) additionally configurable for PROFIBUS PA (electronic insert FEL50A (PA)): 0.5 ... 60 s	Vibration limit switches	
Switch-on response	when switching on the power supply the output assumes the alarm signal, after max. 3 s it assumes the correct switching mode		
<b>Auxiliary energy</b>			
Supply voltage	electronic insert FEL50A (PA): 9 ... 32 V DC electronic insert FEL51 (AC): 253 V AC, 50/60 Hz electronic insert FEL52 (E5): 10 ... 55 V DC electronic insert FEL54 (WA): 19 ... 253 V AC, 50/60 Hz or 19 ... 55 V DC electronic insert FEL55 (SI): 11 ... 36 V DC, PLC electronic insert FEL56 (N1), FEL58 (N2): isolating amplifier acc. to EN 60947-5-6 (NAMUR)		
Connecting cable	electronic inserts: cross section max. 2.5 mm <sup>2</sup> , strand in ferrule in acc. to DIN 46228 protective earth in housing: cross section max. 2.5 mm <sup>2</sup> external equipotential bonding connection on housing: cross section 4 mm <sup>2</sup>		
Power consumption	electronic insert FEL52 (E5): max. 0.83 W electronic insert FEL54 (WA): max. 1.3 W		
Current consumption	electronic insert FEL52 (E5): max. 15 mA		
<b>Performance characteristics</b>			
Reference operating conditions	ambient temperature: 23 °C (296 K), medium temperature: 23 °C (296 K), product density: 1 g/cm <sup>3</sup> (water), viscosity: 1 mm <sup>2</sup> /s, medium pressure p <sub>e</sub> : 0 bar, sensor mounting: vertical from above, density switch: to > 0.7 g/cm <sup>3</sup>		
Maximum measured error	max. ± 1 mm, specified by mounting position		Conductive limit switches
Non-repeatability	0.1 mm		
Hysteresis	approx. 2 mm (0.08 in)		
Influence of medium density	max. +4.8 ... -3.5 mm (+0.19 ... -0.14 in) (0.5 ... 1.5 g/cm <sup>3</sup> )		
Influence of medium temperature	max. +1.4 ... -2.8 mm (+0.05 ... -0.11 in) (-40 ... +150 °C (233 ... 423 K))		
Influence of medium pressure	max. 0 ... -2.5 mm (0 ... -0.1 in) (-1 ... 64 bar)		
<b>Operating conditions</b>			
<b>Mounting conditions</b>			
Installation position	LVL-M1: any position LVL-M2: with short pipe (up to 500 mm (19.7 in)) any position, with long pipe vertical		
<b>Ambient conditions</b>		Capacitive limit switches	
Ambient temperature	-50 ... 70 °C (223 ... 343 K), function with reduced data values see section ambient temperature		
Storage temperature	-50 ... 80 °C (223 ... 353 K)		
Overvoltage protection	electronic insert FEL51 (AC), electronic insert FEL52 (E5), electronic insert FEL54 (WA), electronic insert FEL55 (SI): overvoltage category III		
<b>Process conditions</b>			
Medium temperature	-50 ... 150 °C (223 ... 423 K), for exceptions see process connections		
Medium pressure	p <sub>e</sub> = -1 ... 64 bar over the entire temperature range, exceptions see process connections		
Test pressure	max. 100 bar (1.5 times the medium pressure p <sub>e</sub> ), no function during test pressure, burst pressure of diaphragm 200 bar		
Thermal shock resistance	max. 120 °C/s (max. 120 K/s)		
State of aggregation	liquid		
Density	min. 0.5 g/cm <sup>3</sup> (compact housing 0.7 g/cm <sup>3</sup> ), other density settings on request	Limit value immersion probes	
Viscosity	max. 10000 mm <sup>2</sup> /s (max. 10000 cSt)		
Solid contents	max. Ø 5 mm		
<b>Mechanical specifications</b>			
			Continuous immersion probes
		Hydrostatic pressure sensors	

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## Vibration limit switch LVL-M\*

## Technical data

Float switches	Protection degree	polyester, steel and aluminium housing: IP66/IP67 compact housing: - IP65 with valve connector PG11 or ½ NPT - IP66/IP68 with M12 x 1 connector without LEDs (1.4435/316L) - IP69K with M12 x 1 connector with LEDs (1.4435/316L)
	<b>Mechanical construction</b>	
	Construction type	LVL-M1: compact design LVL-M2: version with extension tube
Vibration limit switches	Dimensions	housing: diameter max. 85 mm (3.3 in), height max. 173 mm (6.8 in) temperature separator, pressure-tight bushing: additional length L 140 mm (5.5 in) process connection: length L 66.5 ... 80 mm (2.6 ... 3.1 in) extension: any length L from 148 ... 6000 mm (6 in ... 20 ft), depending on the process connection extension: length type II, for vertical installation from above same switching point as Vibracon LVL1, LVL2 vibration fork: width 17.5 mm (0.7 in), fork width 10 mm (0.4 in), length 25 mm (1 in)
	Mass	600 g, basic weight: compact sensor, electronic insert, stainless steel housing, process connection G2*, additional weight is dependent on extension tube, housing and process connection
Conductive limit switches	Additional weight	process connections: - A3* 1000 g, A4* 1200 g, A5* 1500 g, A6* 2400 g, A72 4800 g, A81 4900 g, A82 6800 g, A91 7000 g, A92 11.5 kg, A93 17.3 kg - C45 1400 g, C51 1200 g, C71 1600 g, C75 3200 g, C95 5900 g, CA3 5600 g - D45 1400 g, D51 1200 g, D71 1600 g, D75 3200 g, D7A 300 g, D7D 300 g, D95 5900 g, DA3 5600 g - F45 1400 g, F51 1200 g, F55 2000 g, F61 1400 g, F65 2400 g, F71 1600 g, F75 3200 g, F7F 2600 g, F81 2400 g, F85 4300 g, F93 4800 g, F95 5900 g, FA3 5600 g, FA5 7500 g - G3* 200 g - J13 no information, J16 no information, J17 1700 g, J19 no information, J1A no information, J1C 1700 g - N3* 200 g, N75 2900 g - R3* 200 g - T51 no information, T61 100 g length, spacers, bushings: - B* 900 g/m, C* 2300 g/100 in - D* 100 g - I* 600 g - J* 900 g/m and 600 g, K* 2300 g/100 in and 600 g - L*, Q* 700 g - R* 900 g/m and 700 g, S* 2300 g/100 in and 700 g - T* 800 g
	Material	wetted parts: - process connection and extension pipe: 1.4435/316L or 2.4610/Alloy C4 - vibration fork: 1.4435/316L or 2.4610/Alloy C4 - flat seal for process connection G2* or G3*: elastomer fibre, asbestos-free housings: - polyester housing: PBT-FR with PBT-FR cover or with PA12 cover with sight glass, cover seal: EPDM - stainless steel housing: 1.4301/304, cover seal: silicone - aluminium housing: EN-AC-AISi10Mg, plastic-coated, cover seal: EPDM - compact housing with valve connector or M12 connector: 1.4435/316L cable gland: polyamide or brass, nickel-plated temperature spacer: 1.4435/316L pressure-tight bushing: 1.4435/316L
Limit value immersion probes	Surface quality	R <sub>a</sub> < 3.2 µm/80 grit: length, spacer, bushings *A, *B, *E
	Switching point	see section switch point
Continuous immersion probes	Process connection	- cylindrical thread G¾A, G1A to DIN ISO 228/1 with flat seal to DIN 7603 - conical thread R¾, R1 to DIN 2999, part 1 - conical thread ¾ -14 NPT, 1 - 1½ NPT to ANSI B 1.20.1 - flush-mounted with welding sleeve to factory standard (G¾A, G1A) - flush-mounted with welding neck to factory standard (1"), sensor can be positioned - Triclamp 1½", 2" to ISO 2852 - flanges to EN 1092-1 from DN25, to ANSI B 16.5 from 1", to JIS B 2238 (RF) from DN25 for additional information see type code
	<b>Indication and operation</b>	
Hydrostatic pressure sensors	Display elements	electronic inserts: - electronic inserts FEL50 A (PA), FEL58 (N2): green LED, yellow LED - electronic inserts FEL51 (AC), FEL52 (E5), FEL54 (WA), FEL55 (SI), FEL56 (N1): green LED, red LED compact housings: compact housing with valve connector - electronic version FEL51 (AC), FEL52 (E5): green LED, red LED - electronic version FEL58 (N2): green LED, yellow LED compact housing with M12 x 1 round connector without LEDs - electronic version FEL52 (E5): green LED, yellow LED, red LED - electronic version FEL58 (N2): green LED, yellow LED compact housing with M12 x 1 round connector with LEDs - electronic version FEL52 (E5): green LED, two yellow LEDs

Technical data		Vibration limit switch LVL-M*
Operating elements	<p>electronic insert FEL50A (PA): 8 switches for device address setting</p> <p>electronic inserts FEL51 (AC), FEL52 (E5), FEL54 (WA), FEL55 (SI), FEL56 (N1): two switches for fail-safe mode and density change</p> <p>electronic insert FEL58 (N2): two switches for fail-safe mode and density change and one test button interrupts lead</p>	Float switches
Function test	compact housing: function test with test magnet electronic versions FEL51 (AC), FEL52 (E5) and FEL58 (N2): During the test, the current state of the electronic switch is reversed.	
<b>Certificates and approvals</b>		
Ex approval	KEMA 01 ATEX 1089, KEMA 01 ATEX 1147 X, KEMA 01 ATEX 2117, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	Vibration limit switches
Type of protection	<p>⊕ II 1/2G EEx ia IIC T3 ... T6 or EEx ia IIB T3 ... T6 and ⊕ II 1/2D T80°C (KEMA 01 ATEX 1089)</p> <p>⊕ II 1G EEx ia IIC T3 ... T6 or EEx ia IIB T3 ... T6 (KEMA 01 ATEX 1147 X)</p> <p>⊕ II 1/2G EEx d IIC T3 ... T6 or EEx d IIB T3 ... T6 (KEMA 01 ATEX 2117)</p> <p>⊕ II 3G EEx nA/nC II T6 and ⊕ II 3D T85°C</p>	
SIL classification	up to SIL2 acc. to IEC 61508	
Overspill protection	Z-65.11-306 (overspill protection in acc. with WHG)	
<b>General information</b>		Conductive limit switches
Directive conformity		
Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1	
Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector) If the fork tines are joined together on account of build-up, the useful signal is attenuated to such an extent that the original EMC values can no longer be completely observed (EN 61000-4-3 electromagnetic fields, EN 61000-4-6 HF coupling).	
Directive 94/9 EC (ATEX)	EN 50014, EN 50018, EN 500020, EN 500021, EN 50284, EN 50281-1-1	
Conformity		
Electromagnetic compatibility	NE 21	
Protection degree	EN 60529	
Climate class	EN 60068, part 2-38, fig. 2a	
Vibration resistance	EN 60068-2-6, 10 ... 50 Hz, 0.15 mm, 100 cycles	
Supplementary documentation	<p>technical information TI3280</p> <p>operating instructions KA1430 (LVL-M*)</p> <p>operating instructions KA2200 (LVL-M** with compact housing)</p> <p>operating instructions BA1410 (electronic insert FEL50A (PA))</p> <p>operating instructions KA1400 weld-in socket G1 (LVL-Z102)</p> <p>operating instructions KA1410 weld-in adapter G1 (LVL-Z101)</p> <p>operating instructions KA1420 weld-in adapter G¾ (LVL-Z100)</p> <p>operating instructions KA1510 sliding sleeve for unpressurised operation G1A, 1 NPT (LVL-Z120, LVL-Z122)</p> <p>operating instructions KA1520 sliding sleeve for unpressurised operation G1½A, 1½ NPT (LVL-Z121, LVL-Z123)</p> <p>operating instructions KA1530 high pressure sliding sleeve G1A, 1 NPT (LVL-Z124, LVL-Z125, LVL-Z128, LVL-Z129)</p> <p>operating instructions KA1540 high pressure sliding sleeve G1A, 1 NPT (LVL-Z126, LVL-Z127, LVL-Z130, LVL-Z131)</p> <p>safety information SI0310 (KEMA 01 ATEX 2117)</p> <p>safety information SI0630 (KEMA 01 ATEX 1089)</p> <p>safety information SI0640 (KEMA 01 ATEX 1147 X)</p> <p>safety information SI1540 (KEMA 01 ATEX 1089), PROFIBUS PA version</p> <p>safety information SI1590 (KEMA 01 ATEX 11147 X), PROFIBUS PA version</p> <p>safety information SI1820 (⊕ II 3G EEx nA/nC II T6 and ⊕ II 3D T85°C)</p> <p>approval ZE2330 overspill protection acc. to WHG (Z-65.11-306)</p> <p>FM installation drawing ZD0410</p> <p>CSA control drawing ZD0420</p>	Capacitive limit switches
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	
		Limit value immersion probes
		Continuous immersion probes
		Hydrostatic pressure sensors

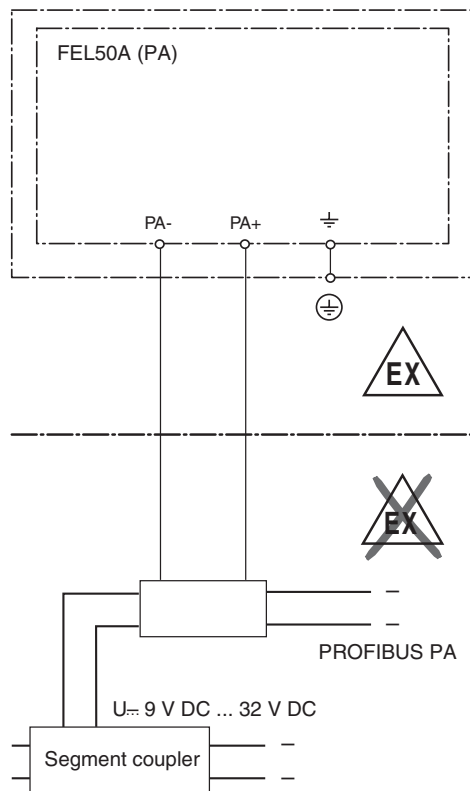
**Electrical connection**

**Electronic insert FEL50A (PA)**

Two-wire connection for power supply and data transfer for connecting to PROFIBUS PA

Additional functions:

- Digital communication enables the representation, reading and editing of the following parameters: fork frequency, switch-on frequency, switch-off frequency, switch-on time and switch-off time, status, measured value, density switch.
- Matrix locking possible.
- Switch to WHG mode possible (WHG approval).
- You can also visit [www.profibus.com](http://www.profibus.com) for more information.



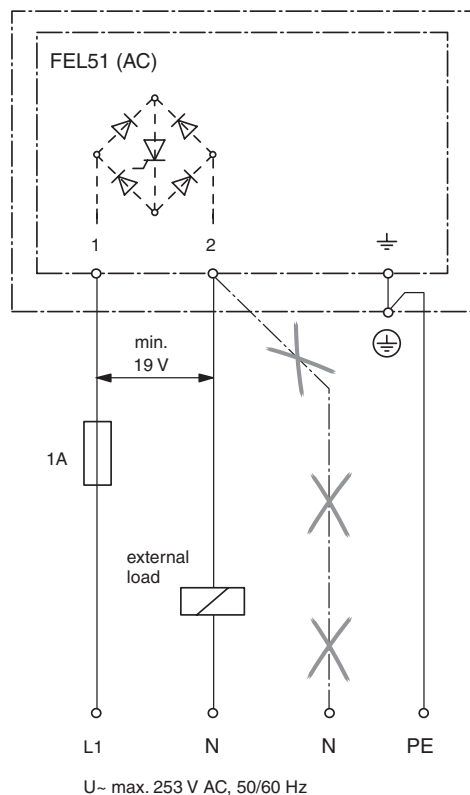
**Electronic insert FEL51 (AC)**

Two-wire AC connection

Always connect in series with a load!

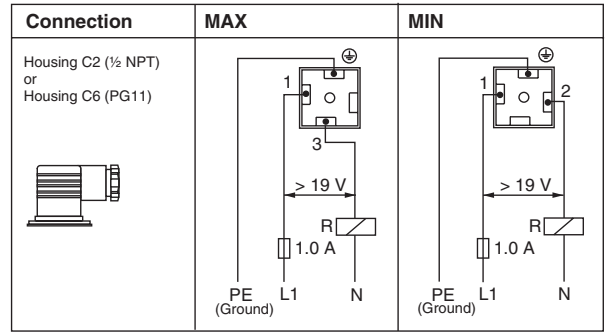
Check the following:

- the residual current in blocked state (up to 3.8 mA)
- that for low voltage
  - The voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
  - The voltage drop across the electronics when switched through is observed (up to 12 V).
- that a relay cannot de-energise with holding power below 3.8 mA. If this is the case, a resistor should be connected parallel to the relay (RC module available on request).
- When selecting the relay, pay attention to the holding power/rated power (see connectable load).



Electrical connection

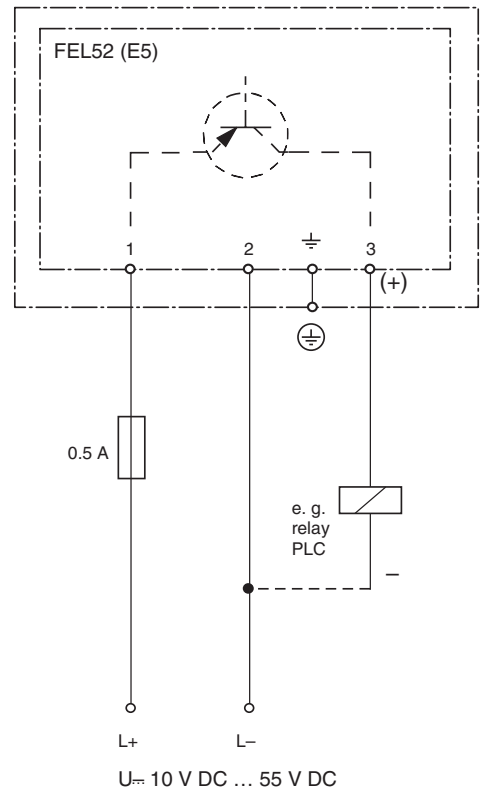
Electronic FEL51 (AC) in compact housing



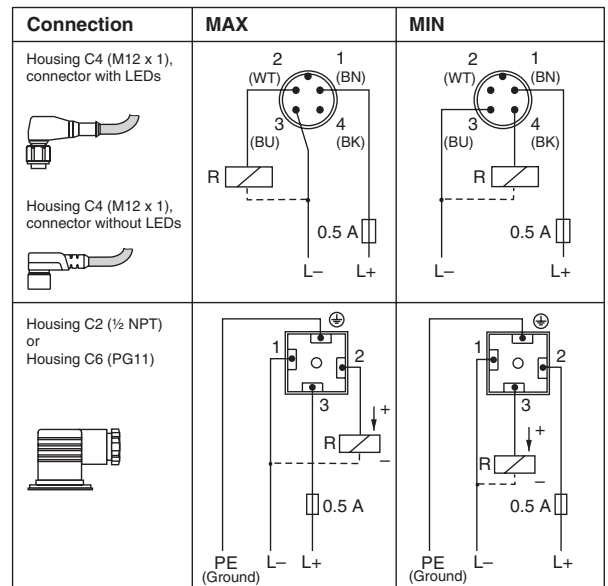
Electronic insert FEL52 (E5)

Three-wire DC connection

- preferably used with programmable logic controllers (PLC), DI module as per EN 61131-2.
- positive signal at switching output of the electronics (PNP)
- Output blocked on reaching limit.



Electronic FEL52 (E5) in compact housing



Float switches  
 Vibration limit switches  
 Conductive limit switches  
 Capacitive limit switches  
 Limit value immersion probes  
 Continuous immersion probes  
 Hydrostatic pressure sensors

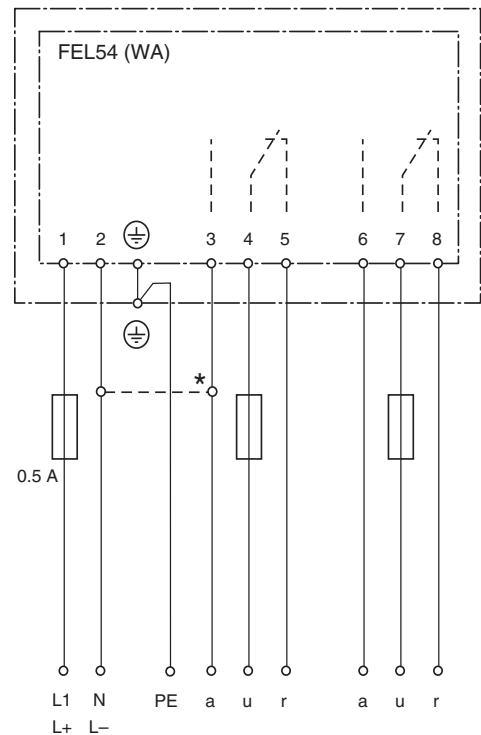
Electrical connection

Electronic insert FEL54 (WA)

Universal current connection with relay output

- Power supply:  
Please note the different voltage ranges for AC and DC.
- Output:  
When connecting an instrument with high inductance, provide a spark arrester to protect the relay contact.  
A fine-wire fuse (depending on the load connected) protects the relay contact on short-circuiting.  
Both relay contacts switch simultaneously.

\* When jumpered, the relay output works with NPN logic.

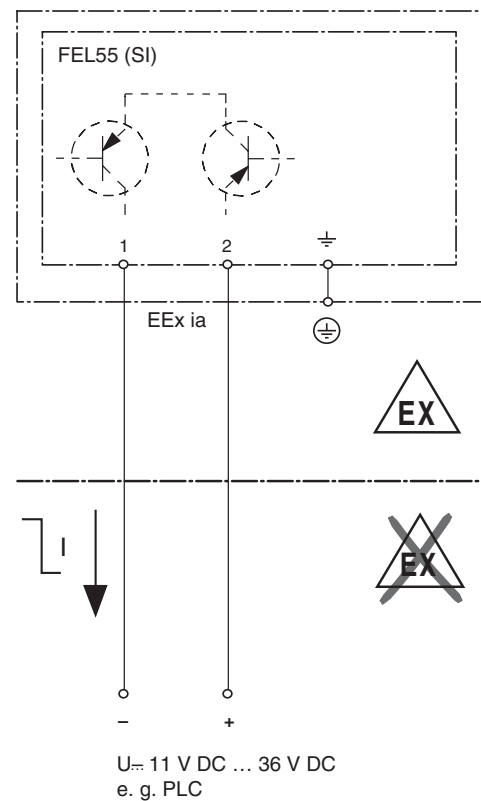


U~ 19 V AC ... 253 V AC, 50/60 Hz  
U- 19 V DC ... 55 V DC

Electronic insert FEL55 (SI)

Two-wire connection for separate switching unit

- for connecting to programmable logic controllers (PLC) for example, AI module 4 mA ... 20 mA to EN 61131-2
- Output signal jump from high to low current on limit (**H-L edge**)



U= 11 V DC ... 36 V DC  
e. g. PLC

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

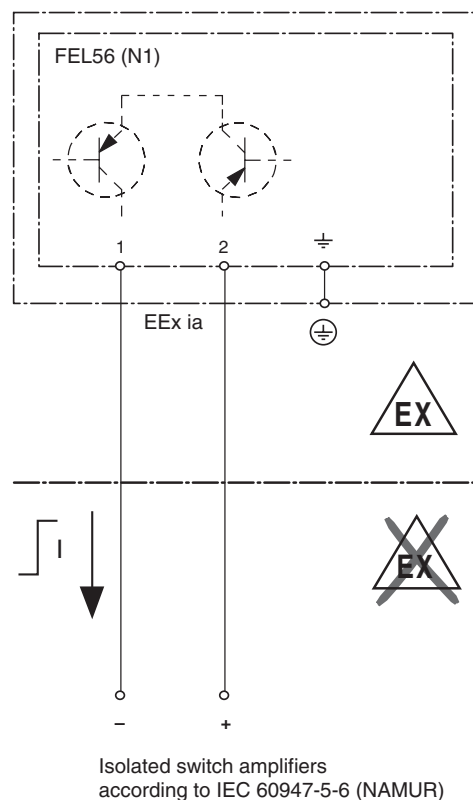
Electrical connection

Electronic insert FEL56 (N1)

Two-wire connection for separate switching unit

- for connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e. g. isolating amplifier KFD2-SR2-Ex1.W or remote process interface KSD-BI-Ex2 from Pepperl+Fuchs
- Output signal jump from low to high current on limit (**L-H edge**)

Connecting to multiplexer: set clock time to min. 2 s.



Float switches

Vibration limit switches

Conductive limit switches

Electronic insert FEL58 (N2)

Two-wire connection for separate switching unit

- for connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e. g. Isolating amplifier KFD2-SR2-Ex1.W or remote process interface KSD-BI-Ex2 from Pepperl+Fuchs
- Output signal jump from high to low current on limit (**H-L edge**)

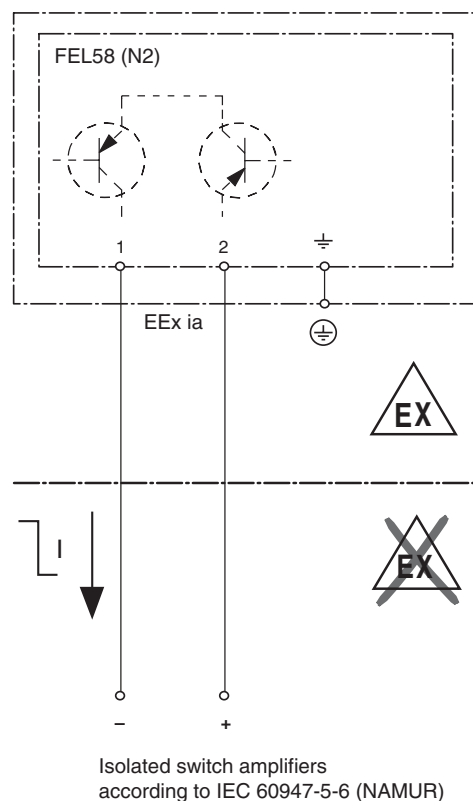
Additional function:

Test key on the electronic insert. Pressing the key breaks the connection to the isolating amplifier.

Connecting to multiplexer: set clock time to min. 2 s.

Note

For Ex-d applications, the additional function can only be used if the housing is not exposed to an explosive atmosphere.



Capacitive limit switches


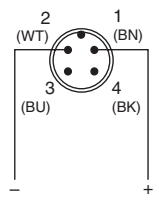
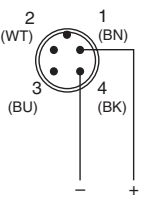
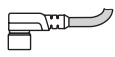



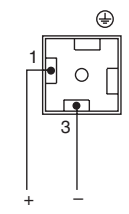
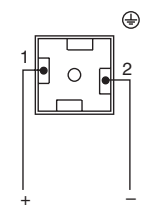
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Electrical connection

Electronic FEL58 (N2) in compact housing

Connection	MAX	MIN
Housing C4 (M12 x 1), connector with LEDs 		
Housing C4 (M12 x 1), connector without LEDs 		
Housing C2 (½ NPT) or Housing C4 (PG11) 		

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

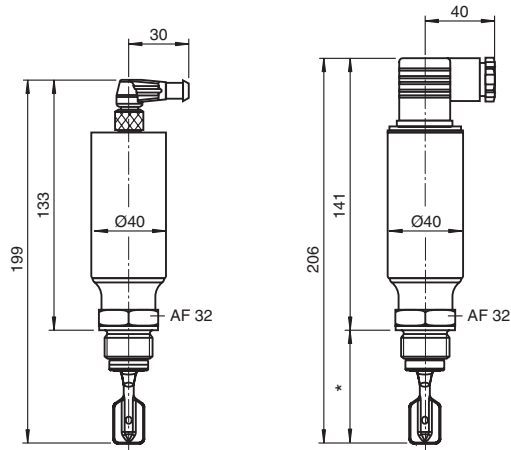
Continuous immersion probes

Hydrostatic pressure sensors

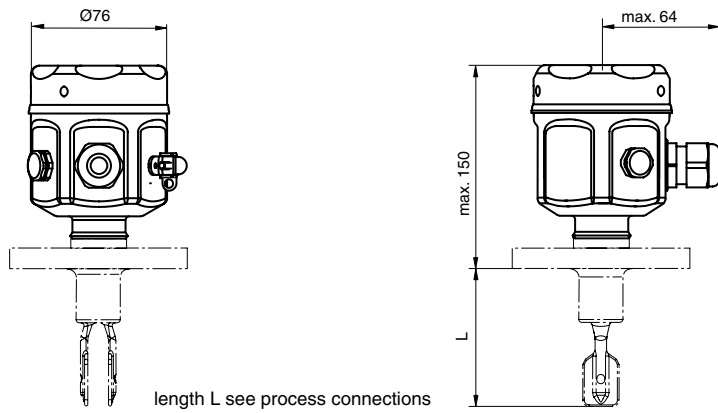


Dimensions

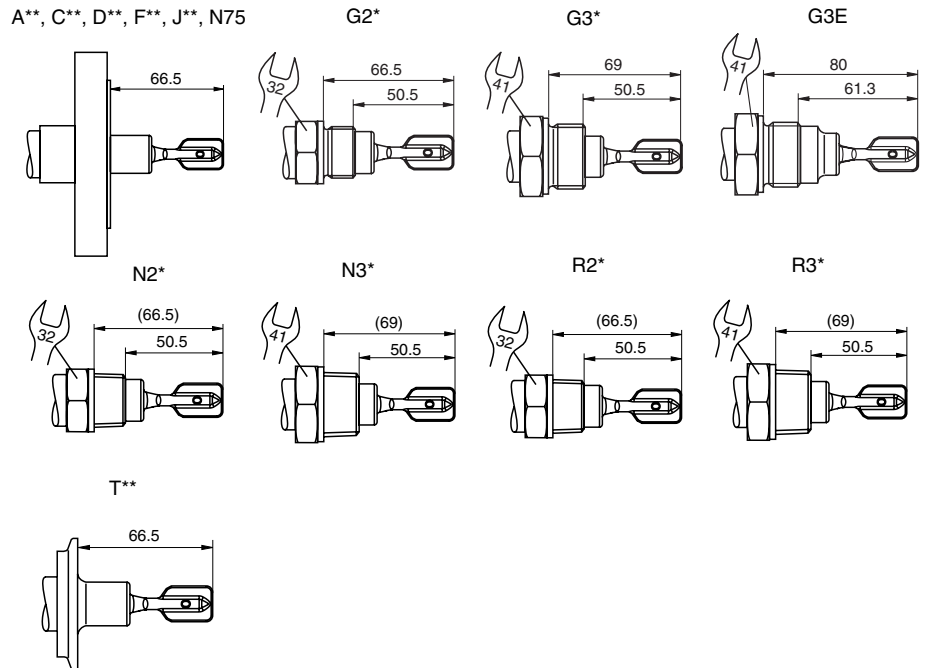
Compact housing C\*



Stainless steel housing E\*



Process connections



Float switches

Vibration  
limit switches

Conductive  
limit switches

Capacitive  
limit switches

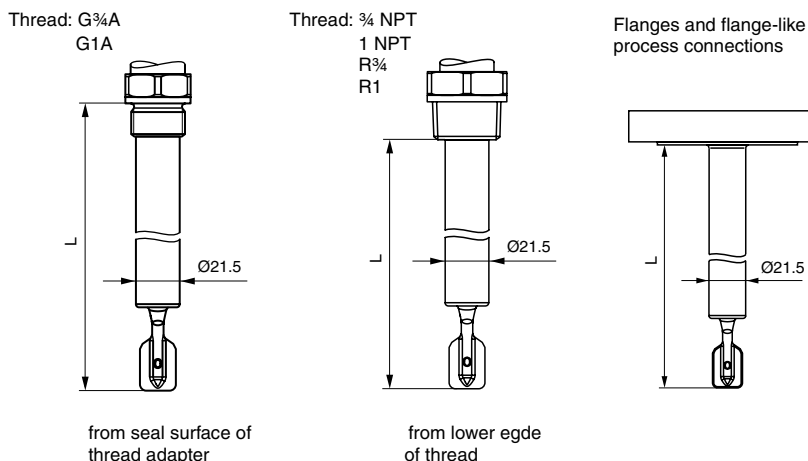
Limit value  
immersion probes

Continuous  
immersion probes

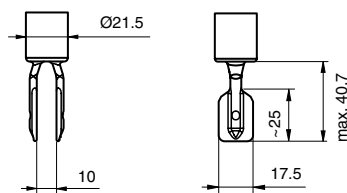
Hydrostatic  
pressure sensors

Dimensions

Extension tube

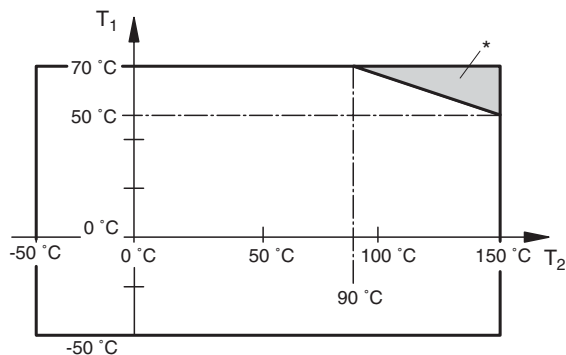
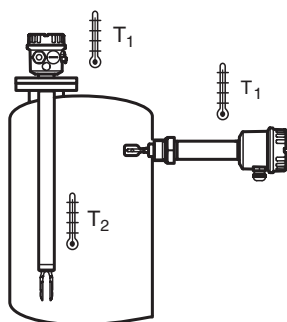


Vibration fork



Ambient temperature

Permissible ambient temperature  $T_1$  at the housing depends on the product temperature  $T_2$  in the vessel:



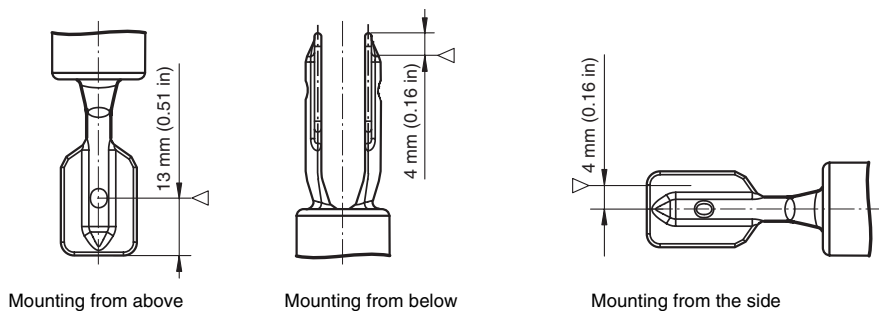
\* additional temperature range for sensors with a temperature separator or pressure-tight bushing

Switch point

Switch point  $\triangleright$  on the sensor depend on the mounting position, with reference to water, density 1 g/cm $^3$ , 23 °C (296 K),  $p_e$  0 bar.

Note:

The switch points of the Vibracon LVL-M2C are at other positions to those of the previous versions LVL1, LVL2.



Hydrostatic pressure sensors

Accessories

Welding sleeves

- LVL-Z100, welding sleeve G $\frac{3}{4}$  for flush mounting for process connection G21
- LVL-Z101, welding sleeve G1 for flush mounting for process connection G3E
- LVL-Z102, welding sleeve G1 for flush mounting for process connection G3E

Flanges

- LVL-Z105, lap joint round flange DN50 PN40 form A with G1 thread for process connection G31
- LVL-Z106, lap joint round flange ANSI 2" with G1 thread for process connection G31
- LVL-Z107, lap joint square flange with G1 thread for process connection G31

Sliding sleeves

- LVL-Z120, sliding sleeve for unpressurised operation G1A
- LVL-Z121, sliding sleeve for unpressurised operation G1 $\frac{1}{2}$ A
- LVL-Z122, sliding sleeve for unpressurised operation 1 NPT
- LVL-Z123, sliding sleeve for unpressurised operation 1 $\frac{1}{2}$  NPT
- LVL-Z124, high pressure sliding sleeve G1A
- LVL-Z125, high pressure sliding sleeve G1A, Alloy C4/2.4610
- LVL-Z126, high pressure sliding sleeve G1 $\frac{1}{2}$ A
- LVL-Z127, high pressure sliding sleeve G1 $\frac{1}{2}$ A, Alloy C4/2.4610
- LVL-Z128, high pressure sliding sleeve 1 NPT
- LVL-Z129, high pressure sliding sleeve 1 NPT, Alloy C4/2.4610
- LVL-Z130, high pressure sliding sleeve 1 $\frac{1}{2}$  NPT
- LVL-Z131, high pressure sliding sleeve 1 $\frac{1}{2}$  NPT, Alloy C4/2.4610

Further accessories

- LVL-Z108, cover with glass sight glass for stainless steel housing E\*
- LVL-Z109, cover with PC sight glass for stainless steel housing E\*
- LVL-Z110, transparent cover for polyester housing P\*
- V1-G, mating connector, straight
- V1-W, mating connector, 90° angled

Float switches

Vibration limit switches

Conductive limit switches

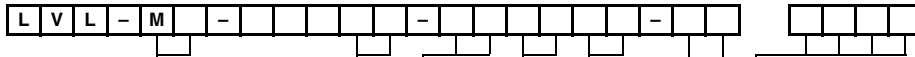
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Type code/model number



Specification of length without unit for design M2

Certificates

- NA for non-hazardous areas
- WH WHG overspill protection
- E1 II 1G EEx ia IIC T6
- E2 II 1/2G EEx ia IIC T6
- E3 II 1/2G EEx d IIC T6
- EA II 1G EEx ia IIC T6, WHG
- EB II 1/2G EEx ia IIC T6, WHG
- EC II 1/2G EEx d IIC T6, WHG
- EN II 3G EEx nC IIC T6, WHG
- EM II 3G EEx nA IIC T6, WHG
- FI FM, IS, CI I, II, III, Div1, Group A-G
- FN FM, NI, CI I, Div2, Group A-D
- FX FM, XP, CI I, II, III, Div1, Group A-G
- CG CSA, General Purpose
- CI CSA, IS, CI I, II, III, Div1, Group A-G
- CX CSA, XP, CI I, II, III, Div1, Group A-G

Optional equipment

- NA without optional equipment
- Z3 3.1.B material, wetted parts 1.4435, inspection certificate to EN 10204

Electronic insert

- PA FEL50 A, PROFIBUS PA
- AC FEL51, contactless 2-wire switch, 19 V AC ... 253 V AC
- E5 FEL52, PNP 3-wire, 10 V DC ... 55 V DC
- WA FEL54, potential-free change-over contact, DPDT, 19 V AC ... 253 V AC, 19 V DC ... 55 V DC
- SI FEL55, 8/16 mA, 11 V DC ... 36 V DC
- N1 FEL56, NAMUR, L-H edge
- N2 FEL58, NAMUR with push button, H-L edge

Housing, cable entry

- A1 aluminium housing, IP66, cable gland M20
- A2 aluminium housing, Nema 4x, ¾ NPT
- A3 aluminium housing, IP66, entry G½A
- A4 aluminium housing, IP66, plug connector M12 x 1
- A5 aluminium housing, IP66, PA plug connector M12 x 1
- C2 compact housing, Nema 4x, ½ NPT plug connector, 1.4435/316L
- C4 compact housing, IP66, plug connector M12 x 1, 1.4435/316L
- C6 compact housing, IP66, PG11 plug connector, 1.4435/316L
- E1 stainless steel housing, IP66, cable gland M20
- E2 stainless steel housing, Nema 4x, ½ NPT
- E3 stainless steel housing, IP66, entry G½A
- E4 stainless steel housing, IP66, plug connector M12 x 1
- E5 stainless steel housing, IP66, PA plug connector M12 x 1
- P1 polyester housing, IP66, cable gland M20
- P2 polyester housing, Nema 4x, ½ NPT
- P3 polyester housing, IP66, entry G½A
- P4 polyester housing, IP66, plug connector M12 x 1
- P5 polyester housing, IP66, PA plug connector M12 x 1

Length, temperature spacer, pressure-tight bushing

- design M1 AA 66 mm/2.6 in, R<sub>a</sub> < 3.2 µm/80 grit
- design M1 IA 66 mm/2.6 in, R<sub>a</sub> < 3.2 µm/80 grit, with temperature spacer
- design M1 QA 66 mm/2.6 in, R<sub>a</sub> < 3.2 µm/80 grit, with pressure-tight bushing
- design M2 BB mm L 1.4435/316L, R<sub>a</sub> < 3.2 mm/80 grit
- design M2 BE mm L 2.4610/Alloy C4, R<sub>a</sub> < 3.2 mm/80 grit
- design M2 CB in L 1.4435/316L, R<sub>a</sub> < 3.2 mm/80 grit
- design M2 CE in L 2.4610/Alloy C4, R<sub>a</sub> < 3.2 mm/80 grit
- design M2 DB special length L II, 1.4435/316L, R<sub>a</sub> < 3.2 mm/80 grit, switch point = Vibracon compact
- design M2 DE special length L II, 2.4610/Alloy C4, R<sub>a</sub> < 3.2 mm/80 grit, switch point = Vibracon compact
- design M2 JB mm L 1.4435/316L, with temperature spacer
- design M2 JE mm L 2.4610/Alloy C4, with temperature spacer
- design M2 KB in L 1.4435/316L, with temperature spacer
- design M2 KE in L 2.4610/Alloy C4, with temperature spacer
- design M2 LB special length L II, 1.4435/316L, with temperature spacer, switch point = Vibracon compact
- design M2 LE special length L II, 2.4610/Alloy C4, with temperature spacer, switch point = Vibracon compact
- design M2 RB mm L 1.4435/316L, with pressure-tight bushing
- design M2 RE mm L 2.4610/Alloy C4, with pressure-tight bushing
- design M2 SB in L 1.4435/316L, with pressure-tight bushing
- design M2 SE in L 2.4610/Alloy C4, with pressure-tight bushing
- design M2 TB special length L II, 1.4435/316L, with pressure-tight bushing, switch point = Vibracon compact
- design M2 TE special length L II, 2.4610/Alloy C4, with pressure-tight bushing, switch point = Vibracon compact

Design

- M1 compact design
- M2 extended design (148 mm/6 in ... 6,000 mm/20 ft)

Continued on next page.

Type code/model number



Process connection and material

<b>A31</b>	1", ANSI B 16.5, 150 lbs RF, 1.4435/316L	
<b>A41</b>	1¼", ANSI B 16.5, 150 lbs RF, 1.4435/316L	
<b>A42</b>	1¼", ANSI B 16.5, 300 lbs RF, 1.4435/316L	design M2
<b>A51</b>	1½", ANSI B 16.5, 150 lbs RF, 1.4435/316L	
<b>A52</b>	1½", ANSI B 16.5, 350 lbs RF, 1.4435/316L	design M2
<b>A61</b>	2", ANSI B 16.5, 150 lbs RF, 1.4435/316L	
<b>A6C</b>	2", ANSI B 16.5, 150 lbs RF, Alloy C4, platinised	
<b>A62</b>	2", ANSI B 16.5, 300 lbs RF, 1.4435/316L	design M2
<b>A63</b>	2", ANSI B 16.5, 600 lbs RF, 1.4435/316L	design M2
<b>A72</b>	2½", ANSI B 16.5, 300 lbs RF, 1.4435/316L	design M2
<b>A81</b>	3", ANSI B 16.5, 150 lbs RF, 1.4435/316L	
<b>A82</b>	3", ANSI B 16.5, 300 lbs RF, 1.4435/316L	design M2
<b>A91</b>	4", ANSI B 16.5, 150 lbs RF, 1.4435/316L	
<b>A92</b>	4", ANSI B 16.5, 300 lbs RF, 1.4435/316L	design M2
<b>A93</b>	4", ANSI B 16.5, 600 lbs RF, 1.4435/316L	design M2
<b>F45</b>	DN25 PN40, EN 1092-1 form B, 1.4435/316L	
<b>F51</b>	DN32 PN6, EN 1092-1 form B, 1.4435/316L	
<b>F55</b>	DN32 PN40, EN 1092-1 form B, 1.4435/316L	
<b>F61</b>	DN40 PN6, EN 1092-1 form B, 1.4435/316L	
<b>F65</b>	DN40 PN40, EN 1092-1 form B, 1.4435/316L	
<b>F71</b>	DN50 PN6, EN 1092-1 form B, 1.4435/316L	
<b>F75</b>	DN50 PN40, EN 1092-1 form B, 1.4435/316L	
<b>F81</b>	DN65 PN6, EN 1092-1 form B, 1.4435/316L	
<b>F85</b>	DN65 PN40, EN 1092-1 form B, 1.4435/316L	
<b>F93</b>	DN80 PN16, EN 1092-1 form B, 1.4435/316L	
<b>F95</b>	DN80 PN40, EN 1092-1 form B, 1.4435/316L	
<b>FA3</b>	DN100 PN16, EN 1092-1 form B, 1.4435/316L	
<b>FA5</b>	DN100 PN40, EN 1092-1 form B, 1.4435/316L	
<b>D45</b>	DN25 PN40, EN 1092-1 form C, 1.4435/316L, sealing strip	
<b>C45</b>	DN25 PN40, EN 1092-1 form C, 2.4610/Alloy C4, platinised	
<b>D51</b>	DN32 PN6, EN 1092-1 form C, 1.4435/316L, sealing strip	
<b>C51</b>	DN32 PN6, EN 1092-1 form C, 2.4610/Alloy C4, platinised	
<b>D71</b>	DN50 PN6, EN 1092-1 form C, 1.4435/316L, sealing strip	
<b>C71</b>	DN50 PN6, EN 1092-1 form C, 2.4610/Alloy C4, platinised	
<b>D75</b>	DN50 PN40, EN 1092-1 form C, 1.4435/316L, sealing strip	
<b>C75</b>	DN50 PN40, EN 1092-1 form C, 2.4610/Alloy C4, platinised	
<b>D95</b>	DN80 PN40, EN 1092-1 form C, 1.4435/316L, sealing strip	
<b>C95</b>	DN80 PN40, EN 1092-1 form C, 2.4610/Alloy C4, platinised	
<b>DA3</b>	DN100 PN16, EN 1092-1 form C, 1.4435/316L, sealing strip	
<b>CA3</b>	DN100 PN16, EN 1092-1 form C, 2.4610/Alloy C4, platinised	
<b>F7F</b>	DN50 PN40, EN 1092-1, spring, 1.4435/316L	
<b>R21</b>	R¾ BSP, DIN 2999, 1.4435/316L	
<b>R2C</b>	R¾ BSP, DIN 2999, 2.4610/Alloy C4, platinised	
<b>R31</b>	R1 BSP, DIN 2999, 1.4435/316L	
<b>R3C</b>	R1 BSP, DIN 2999, 2.4610/Alloy C4	
<b>N21</b>	¾ NPT, ANSI B 1.20.1, 1.4435/316L	
<b>N2C</b>	¾ NPT, ANSI B 1.20.1, 2.4610/Alloy C4	
<b>N31</b>	1 NPT, ANSI B 1.20.1, 1.4435/316L	
<b>N3C</b>	1 NPT, ANSI B 1.20.1, 2.4610/Alloy C4	
<b>G21</b>	G¾, DIN ISO 228/1, BSP, 1.4435/316L, mounting for welded sleeve	design M1
<b>G2C</b>	G¾, DIN ISO 228/1, BSP, 2.4610/Alloy C4	
<b>G31</b>	G1, DIN ISO 228/1, BSP, 1.4435/316L	
<b>G3C</b>	G1, DIN ISO 228/1, BSP, 2.4610/Alloy C4	
<b>G3E</b>	G1, DIN ISO 228/1, BSP, 1.4435/316L, mounting for welded sleeve	
<b>J13</b>	10K 25A, JIS B 2238 (RF), 1.4435/316L	
<b>J16</b>	10K 40A, JIS B 2238 (RF), 1.4435/316L	
<b>J17</b>	10K 50A, JIS B 2238 (RF), 1.4435/316L	
<b>J1C</b>	10K 50A, JIS B 2238 (RF), 2.4610/Alloy C4, platinised	
<b>J19</b>	10K 80A, JIS B 2238 (RF), 1.4435/316L	
<b>J1A</b>	10K 100A, JIS B 2238 (RF), 1.4435/316L	
<b>N75</b>	DN50 PN40, EN 1092-1, groove, 1.4435/316L	
<b>T51</b>	1½", DN25-38, Triclamp ISO 2852, 1.4435/316L	
<b>T61</b>	2", DN40-51, Triclamp ISO 2852, 1.4435/316L	
<b>XXX</b>	special version	

Design

- M1** compact design
- M2** extended design (148 mm/6 in ... 6,000 mm/20 ft)

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

## Vibration limit switch

## Dimensions

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

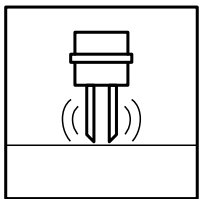
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors



### LVL-M\*H



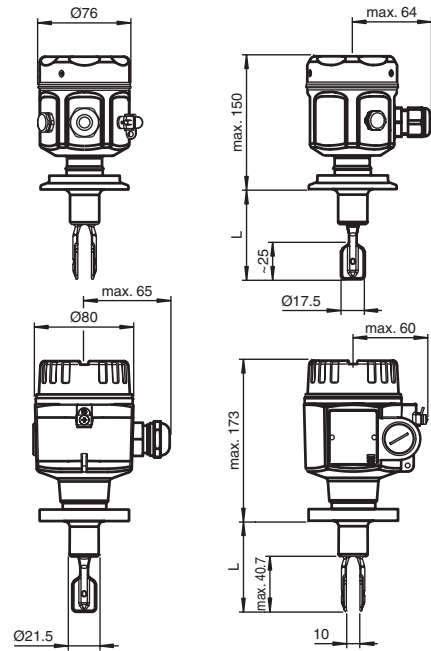
### Features

- Level limit switch in hygienic version for liquids
- Large number of process connections to choose from: universal usage
- Wide variety of electronic modules: the right connection for every process control system
- No calibration: quick and low-cost start-up
- No mechanically moving parts: maintenance-free, no wear, long operating life
- Monitoring of the vibrating fork for damage: guaranteed function
- PROFIBUS PA protocol: commissioning and maintenance quick and easy
- Process connections acc. to EHEDG
- Up to SIL2 acc. to IEC 61508

Vibracon LVL-M\*H with stainless steel housing and process connection T\*\*

Vibracon LVL-M\*H with aluminium housing and process connection with flange

Additional dimensions see section dimensions.  
Length L see process connections.



## Function

The Vibracon is a level limit switch for use in all liquids

- for temperature of -50 °C (223 K) to +150 °C (423 K)
- for pressures up to 64 bar
- for viscosities up to 10000 mm<sup>2</sup>/s
- for densities up to 0.5 g/cm<sup>3</sup> or 0.7 g/cm<sup>3</sup> (other settings available on request)

The function is not affected by flow, turbulence, bubbles, foam, vibration, bulk solids content or build-up, the Vibracon is thus the ideal replacement for float switches.

The compact version is ideal for mounting in pipes (LVL-M1H). In addition there is a version with extension tube up to 6 m (20 ft) (LVL-M2H).

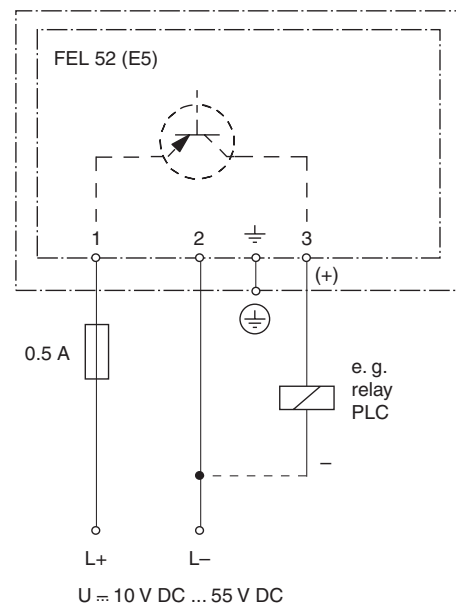
With polished fork and easy-to-clean process connections and housings is the level limit switch usable for food and pharmaceutical applications.

Instruments with protection EEx ia and EEx d are available for use in explosion hazardous areas.

## Electrical connection

Connection FEL 52 (E5) 3-wire DC connection (example)

- preferably for use with memory programmable controls (PLC)
- positive signal at the switch output of the electronics (PNP)
- Output blocked on reaching limit level.
- also in compact housing with plug connection available



Other connection types see section electrical connection.

<b>Application</b>		Float switches
Function principle	limit detection maximum or minimum detection in tanks or pipelines containing all types of liquids including use in explosion hazardous areas and in foodstuff and pharmaceutical industries	
<b>Function and system design</b>		
Measuring principle	The forks of the sensors vibrate at their intrinsic frequency, this frequency is reduced when covered with liquid. The change in frequency then activates the limit switch.	
<b>Input characteristics</b>		
Measured variable	limit level (limit value)	
Measurement range	LVL-M1H: depends on mounting point LVL-M2H: depends on mounting point and pipe extension up to 6000 mm (20 ft)	
Medium density	adjustment on the electronic insert > 0.5 g/cm <sup>3</sup> or > 0.7 g/cm <sup>3</sup> (other on request)	
<b>Output characteristics</b>		
Fail safe mode	switch-over for minimum/maximum residual current safety on electronic insert MAX = maximum safety: The output switches to the power fail response when the fork is covered. for use with overspill protection for example MIN = minimum safety: The output switches to the power fail response when the fork is exposed. for use with dry running protection for example	
Switching time	when fork is covered: approx. 0.5 s, when fork is exposed: approx. 1.0 s (other switching times on request) additionally configurable for PROFIBUS PA (electronic insert FEL50A (PA)): 0.5 ... 60 s	
Switch-on response	when switching on the power supply the output assumes the alarm signal, after max. 3 s it assumes the correct switching mode	
<b>Auxiliary energy</b>		
Supply voltage	electronic insert FEL50A (PA): 9 ... 32 V DC electronic insert FEL51 (AC): 253 V AC, 50/60 Hz electronic insert FEL52 (E5): 10 ... 55 V DC electronic insert FEL54 (WA): 19 ... 253 V AC, 50/60 Hz or 19 ... 55 V DC electronic insert FEL55 (SI): 11 ... 36 V DC, PLC electronic insert FEL56 (N1), FEL58 (N2): isolating amplifier acc. to EN 60947-5-6 (NAMUR)	Conductive limit switches
Connecting cable	electronic inserts: cross section max. 2.5 mm <sup>2</sup> , strand in ferrule in acc. to DIN 46228 protective earth in housing: cross section max. 2.5 mm <sup>2</sup> external equipotential bonding connection on housing: cross section 4 mm <sup>2</sup>	
Power consumption	electronic insert FEL52 (E5): max. 0.83 W electronic insert FEL54 (WA): max. 1.3 W	
Current consumption	electronic insert FEL52 (E5): max. 15 mA	Capacitive limit switches
<b>Performance characteristics</b>		
Reference operating conditions	ambient temperature: 23 °C (296 K), medium temperature: 23 °C (296 K), product density: 1 g/cm <sup>3</sup> (water), viscosity: 1 mm <sup>2</sup> /s, medium pressure p <sub>e</sub> : 0 bar, sensor mounting: vertical from above, density switch: to > 0.7 g/cm <sup>3</sup>	Limit value immersion probes
Maximum measured error	max. ± 1 mm, specified by mounting position	
Non-repeatability	0.1 mm	
Hysteresis	approx. 2 mm	
Influence of medium density	max. +4.8 ... -3.5 mm (+0.19 ... -0.14 in) (0.5 ... 1.5 g/cm <sup>3</sup> )	
Influence of medium temperature	max. +1.4 ... -2.8 mm (+0.05 ... -0.11 in) (-40 ... +150 °C (233 ... 423 K))	
Influence of medium pressure	max. 0 ... -2.5 mm (0 ... -0.1 in) (-1 ... 64 bar)	
<b>Operating conditions</b>		Continuous immersion probes
Mounting conditions		
Installation position	LVL-M1H: any position LVL-M2H: with short pipe (up to 500 mm (19.7 in)) any position, with long pipe vertical	
<b>Ambient conditions</b>		
Ambient temperature	-50 ... 70 °C (223 ... 343 K), function with reduced data values see section ambient temperature	
Storage temperature	-50 ... 80 °C (223 ... 353 K)	
Overvoltage protection	electronic insert FEL51 (AC), electronic insert FEL52 (E5), electronic insert FEL54 (WA), electronic insert FEL55 (SI): overvoltage category III	
<b>Process conditions</b>		
Medium temperature	-50 ... 150 °C (223 ... 423 K), for exceptions see process connections	
Medium pressure	p <sub>e</sub> = -1 ... 64 bar over the entire temperature range, exceptions see process connections	
Test pressure	max. 100 bar (1.5 times the medium pressure p <sub>e</sub> ), no function during test pressure, burst pressure of diaphragm 200 bar	
Thermal shock resistance	max. 120 °C/s (max. 120 K/s)	Hydrostatic pressure sensors
State of aggregation	liquid	
Density	min. 0.5 g/cm <sup>3</sup> (compact housing 0.7 g/cm <sup>3</sup> ), other density settings on request	
Viscosity	max. 10000 mm <sup>2</sup> /s (max. 10000 cSt)	
Solid contents	max. Ø 5 mm	
<b>Mechanical specifications</b>		

Date of issue 09/22/06 – Catalog Field Devices



## Vibration limit switch LVL-M\*H

## Technical data

Float switches	Protection degree	polyester, steel and aluminium housing: IP66/IP67 compact housing: - IP65 with valve connector PG11 or ½ NPT - IP66/IP68 with M12 x 1 connector without LEDs (1.4435/316L) - IP69K with M12 x 1 connector with LEDs (1.4435/316L)
	<b>Mechanical construction</b>	
	Construction type	LVL-M1H: compact design LVL-M2H: version with extension tube
Vibration limit switches	Dimensions	housing: diameter max. 85 mm (3.3 in), height max. 173 mm (6.8 in) temperature separator, pressure-tight bushing: additional length L 140 mm (5.5 in) process connection: length L 55.5 ... 80 mm (2.2 ... 3.1 in) extension: any length L from 148 ... 6000 mm (6 in ... 20 ft), depending on the process connection extension: length type II, for vertical installation from above same switching point as Vibracon LVL1, LVL2 vibration fork: width 17.5 mm (0.7 in), fork width 10 mm (0.4 in), length 25 mm (1 in)
	Mass	700 g, basic weight: compact sensor, electronic insert, stainless steel housing, process connection G2*, additional weight is dependent on extension tube, housing and process connection
	Additional weight	process connections: - A31 1000 g, A41 1200 g, A51 1500 g, A6* 2400 g, A72 4800 g, A81 4900 g, A82 6800 g, A91 7000 g, A92 11.5 kg - D75 3200 g, D95 5900 g, DA3 5600 g, D7A 300 g, D7D 300 g - F45 1400 g, F51 1200 g, F55 2000 g, F61 1400 g, F65 2400 g, F71 1600 g, F75 3200 g, F81 2400 g, F85 4300 g, F93 4800 g, F95 5900 g, FA3 5600 g, FA5 7500 g - G3E 200 g - R*R no information - S13 300 g, S61 200 g, SV1 no information - T51 no information, T61 100 g length, spacers, bushings: - B* 900 g/m, C* 2300 g/100 in - D* 100 g - I* 600 g - J* 900 g/m and 600 g, K* 2300 g/100 in and 600 g - L*, Q* 700 g - R* 900 g/m and 700 g, S* 2300 g/100 in and 700 g - T* 800 g
Conductive limit switches		
Capacitive limit switches	Material	wetted parts: - process connection and extension pipe: 1.4435/316L or 2.4610/Alloy C4 - vibration fork: 1.4435/316L or 2.4610/Alloy C4 - flat seal for process connection G2* or G3*: elastomer fibre, asbestos-free housings: - polyester housing: PBT-FR with PBT-FR cover or with PA12 cover with sight glass, cover seal: EPDM - stainless steel housing: 1.4301/304, cover seal: silicone - aluminium housing: EN-AC-AISI10Mg, plastic-coated, cover seal: EPDM - compact housing with valve connector or M12 connector: 1.4435/316L cable gland: polyamide or brass, nickel-plated temperature spacer: 1.4435/316L pressure-tight bushing: 1.4435/316L
	Surface quality	R <sub>a</sub> < 1.5 µm/120 grit: length, spacer, bushings *C R <sub>a</sub> < 0.3 µm/320 grit: length, spacer, bushings *D
	Switching point	see section switch point
Limit value immersion probes	Process connection	- cylindrical thread G¾A, G1A to DIN ISO 228/1 with flat seal to DIN 7603 - flush-mounted with welding sleeve to factory standard (G¾A, G1A) - flush-mounted with welding neck to factory standard (1"), sensor can be positioned - Triclamp 1½", 2" to ISO 2852 - threaded pipe joint DN32, DN40, DN50 to DIN 1185 - aseptic connection DN50 to DIN 11864-1 form A for pipe DIN 11850 - SMS connection 2" (DN51) - DRD flange, 65 mm - Varivent® DN50 (50/40) to factory standard Tuchenhagen - flanges to EN 1092-1 from DN25, to ANSI B 16.5 from 1"
Continuous immersion probes	<b>Indication and operation</b>	
	Display elements	electronic inserts: - electronic inserts FEL50 A (PA), FEL58 (N2): green LED, yellow LED - electronic inserts FEL51 (AC), FEL52 (E5), FEL54 (WA), FEL55 (SI), FEL56 (N1): green LED, red LED compact housings: compact housing with valve connector - electronic version FEL51 (AC), FEL52 (E5): green LED, red LED - electronic version FEL58 (N2): green LED, yellow LED compact housing with M12 x 1 round connector without LEDs - electronic version FEL52 (E5): green LED, yellow LED, red LED - electronic version FEL58 (N2): green LED, yellow LED compact housing with M12 x 1 round connector with LEDs - electronic version FEL52 (E5): green LED, two yellow LEDs
Hydrostatic pressure sensors		



Technical data		Vibration limit switch LVL-M*H
Operating elements	electronic insert FEL50A (PA): 8 switches for device address setting electronic inserts FEL51 (AC), FEL52 (E5), FEL54 (WA), FEL55 (SI), FEL56 (N1): two switches for fail-safe mode and density change electronic insert FEL58 (N2): two switches for fail-safe mode and density change and one test button interrupts lead	Float switches
Function test	compact housing: function test with test magnet electronic versions FEL51 (AC), FEL52 (E5) and FEL58 (N2): During the test, the current state of the electronic switch is reversed.	
<b>Certificates and approvals</b>		
Ex approval	KEMA 01 ATEX 1089, KEMA 01 ATEX 1147 X, KEMA 01 ATEX 2117, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	Vibration limit switches
Type of protection	$\text{Ex}$ II 1/2G EEx ia IIC T3 ... T6 or EEx ia IIB T3 ... T6 and $\text{Ex}$ II 1/2D T80°C (KEMA 01 ATEX 1089) $\text{Ex}$ II 1G EEx ia IIC T3 ... T6 or EEx ia IIB T3 ... T6 (KEMA 01 ATEX 1147 X) $\text{Ex}$ II 1/2G EEx d IIC T3 ... T6 or EEx d IIB T3 ... T6 (KEMA 01 ATEX 2117) $\text{Ex}$ II 3G EEx nA/nC II T6 and $\text{Ex}$ II 3D T85°C	
SIL classification	up to SIL2 acc. to IEC 61508	
Overspill protection	Z-65.11-306 (overspill protection in acc. with WHG)	
<b>General information</b>		Conductive limit switches
Directive conformity		
Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1	
Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector) If the fork tines are joined together on account of build-up, the useful signal is attenuated to such an extent that the original EMC values can no longer be completely observed (EN 61000-4-3 electromagnetic fields, EN 61000-4-6 HF coupling).	
Directive 94/9 EC (ATEX)	EN 50014, EN 50018, EN 500020, EN 500021, EN 50284, EN 50281-1-1	
Conformity		
Electromagnetic compatibility	NE 21	
Protection degree	EN 60529	
Climate class	EN 60068, part 2-38, fig. 2a	
Vibration resistance	EN 60068-2-6, 10 ... 50 Hz, 0.15 mm, 100 cycles	
Supplementary documentation	technical information TI3280 operating instructions KA144O (LVL-M*H) operating instructions KA220O (LVL-M** with compact housing) operating instructions BA141O (electronic insert FEL50A (PA)) operating instructions KA140O weld-in socket G1 (LVL-Z102) operating instructions KA141O weld-in adapter G1 (LVL-Z101) operating instructions KA142O weld-in adapter G $\frac{3}{4}$ (LVL-Z100) operating instructions KA151O sliding sleeve for unpressurised operation G1A, 1 NPT (LVL-Z120, LVL-Z122) (LVL-Z121, LVL-Z123) operating instructions KA153O high pressure sliding sleeve G1A, 1 NPT (LVL-Z124, LVL-Z125, LVL-Z128, LVL-Z129) operating instructions KA154O high pressure sliding sleeve G1A, 1 NPT (LVL-Z126, LVL-Z127, LVL-Z130, LVL-Z131) safety information SI031O (KEMA 01 ATEX 2117) safety information SI063O (KEMA 01 ATEX 1089) safety information SI064O (KEMA 01 ATEX 1147 X) safety information SI154O (KEMA 01 ATEX 1089), PROFIBUS PA version safety information SI159O (KEMA 01 ATEX 11147 X), PROFIBUS PA version safety information SI182O ( $\text{Ex}$ II 3G EEx nA/nC II T6 and $\text{Ex}$ II 3D T85°C) approval ZE233O overspill protection acc. to WHG (Z-65.11-306) FM installation drawing ZD041O CSA control drawing ZD042O	Capacitive limit switches
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	
		Limit value immersion probes
		Continuous immersion probes
		Hydrostatic pressure sensors

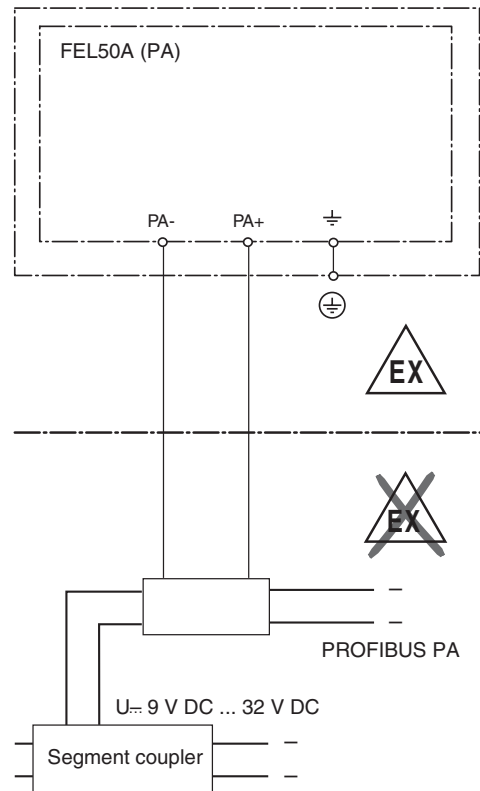
**Electrical connection**

**Electronic insert FEL50A (PA)**

Two-wire connection for power supply and data transfer for connecting to PROFIBUS PA

Additional functions:

- Digital communication enables the representation, reading and editing of the following parameters: fork frequency, switch-on frequency, switch-off frequency, switch-on time and switch-off time, status, measured value, density switch.
- Matrix locking possible.
- Switch to WHG mode possible (WHG approval).
- You can also visit [www.profibus.com](http://www.profibus.com) for more information.



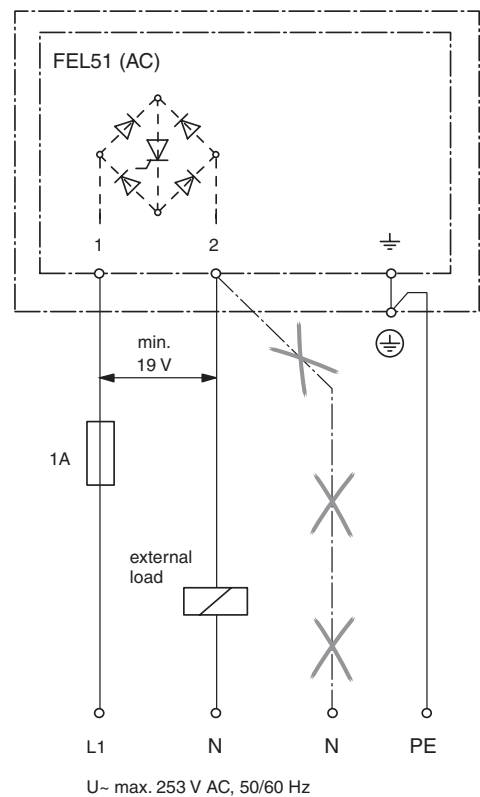
**Electronic insert FEL51 (AC)**

Two-wire AC connection

Always connect in series with a load!

Check the following:

- the residual current in blocked state (up to 3.8 mA)
- that for low voltage
  - The voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
  - The voltage drop across the electronics when switched through is observed (up to 12 V).
- that a relay cannot de-energise with holding power below 3.8 mA. If this is the case, a resistor should be connected parallel to the relay (RC module available on request).
- When selecting the relay, pay attention to the holding power/rated power (see connectable load).



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

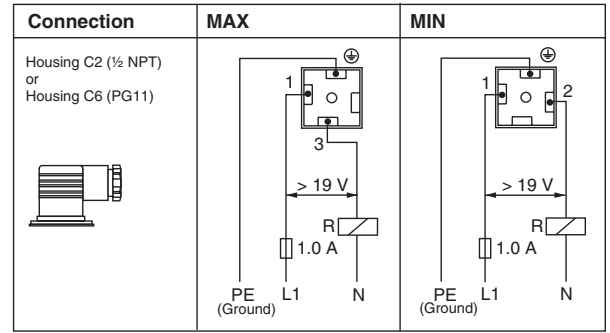
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Electrical connection

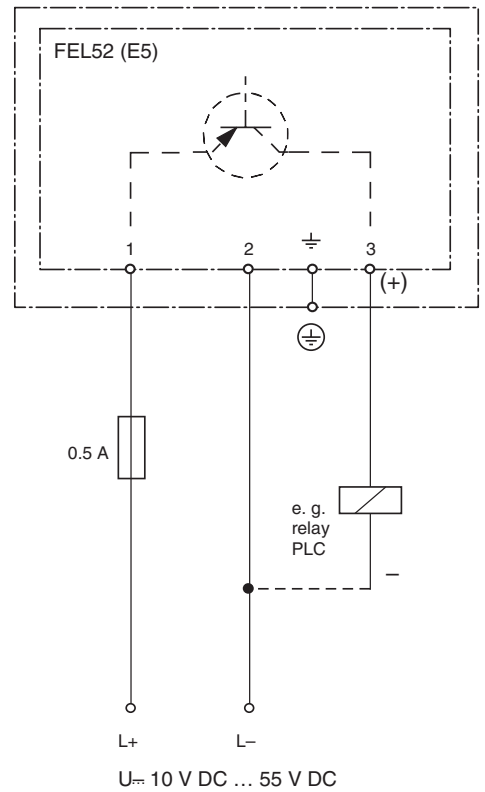
Electronic FEL51 (AC) in compact housing



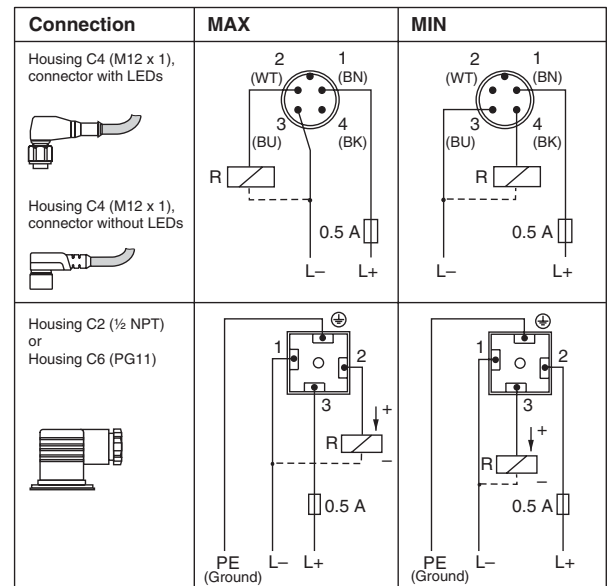
Electronic insert FEL52 (E5)

Three-wire DC connection

- preferably used with programmable logic controllers (PLC), DI module as per EN 61131-2.
- positive signal at switching output of the electronics (PNP)
- Output blocked on reaching limit.



Electronic FEL52 (E5) in compact housing



Float switches  
 Vibration limit switches  
 Conductive limit switches  
 Capacitive limit switches  
 Limit value immersion probes  
 Continuous immersion probes  
 Hydrostatic pressure sensors

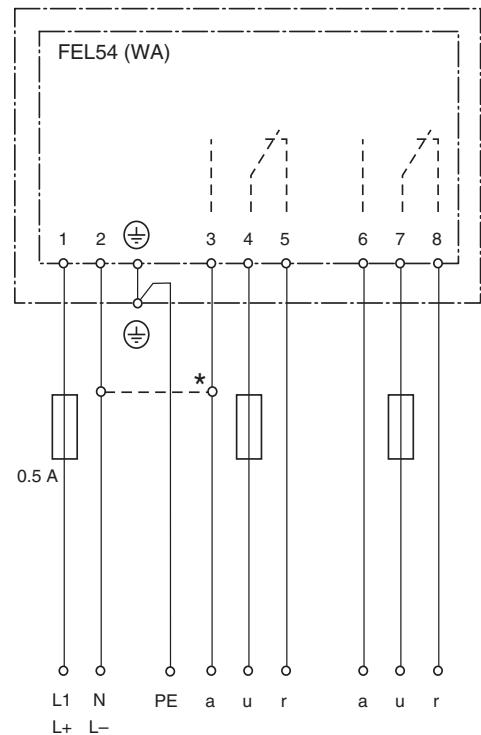
Electrical connection

Electronic insert FEL54 (WA)

Universal current connection with relay output

- Power supply:  
Please note the different voltage ranges for AC and DC.
- Output:  
When connecting an instrument with high inductance, provide a spark arrester to protect the relay contact.  
A fine-wire fuse (depending on the load connected) protects the relay contact on short-circuiting.  
Both relay contacts switch simultaneously.

\* When jumpered, the relay output works with NPN logic.

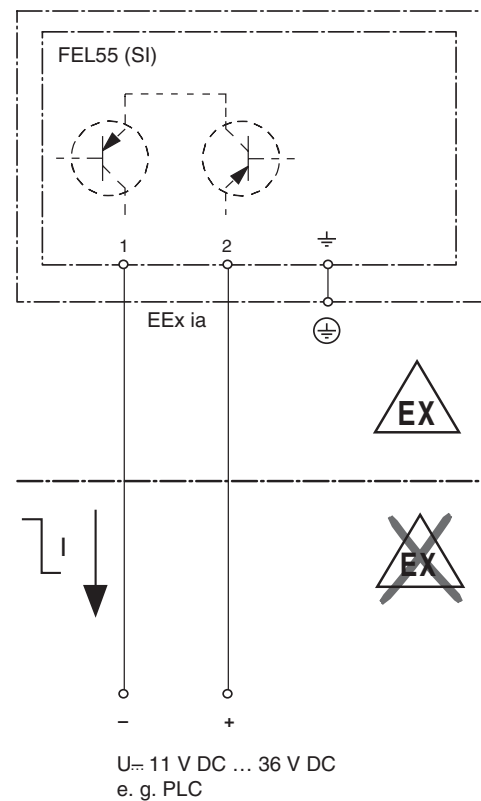


U~ 19 V AC ... 253 V AC, 50/60 Hz  
U- 19 V DC ... 55 V DC

Electronic insert FEL55 (SI)

Two-wire connection for separate switching unit

- for connecting to programmable logic controllers (PLC) for example, AI module 4 mA ... 20 mA to EN 61131-2
- Output signal jump from high to low current on limit (**H-L edge**)



U= 11 V DC ... 36 V DC  
e. g. PLC

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

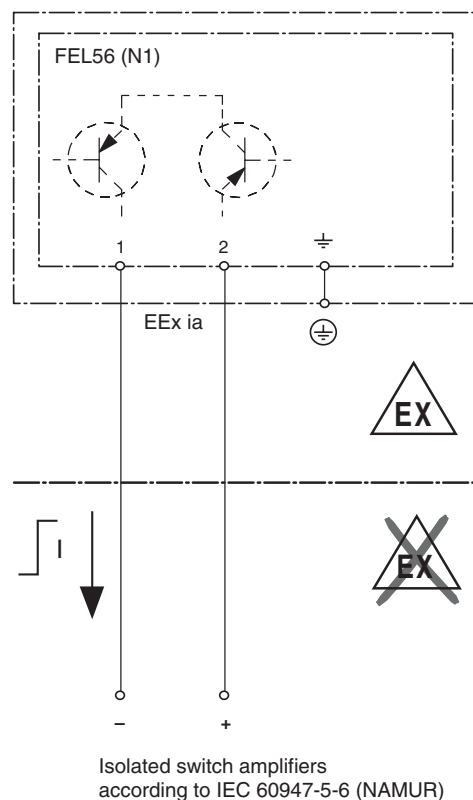
Electrical connection

Electronic insert FEL56 (N1)

Two-wire connection for separate switching unit

- for connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e. g. isolating amplifier KFD2-SR2-Ex1.W or remote process interface KSD-BI-Ex2 from Pepperl+Fuchs
- Output signal jump from low to high current on limit (**L-H edge**)

Connecting to multiplexer: set clock time to min. 2 s.



Float switches

Vibration limit switches

Conductive limit switches

Electronic insert FEL58 (N2)

Two-wire connection for separate switching unit

- for connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e. g. Isolating amplifier KFD2-SR2-Ex1.W or remote process interface KSD-BI-Ex2 from Pepperl+Fuchs
- Output signal jump from high to low current on limit (**H-L edge**)

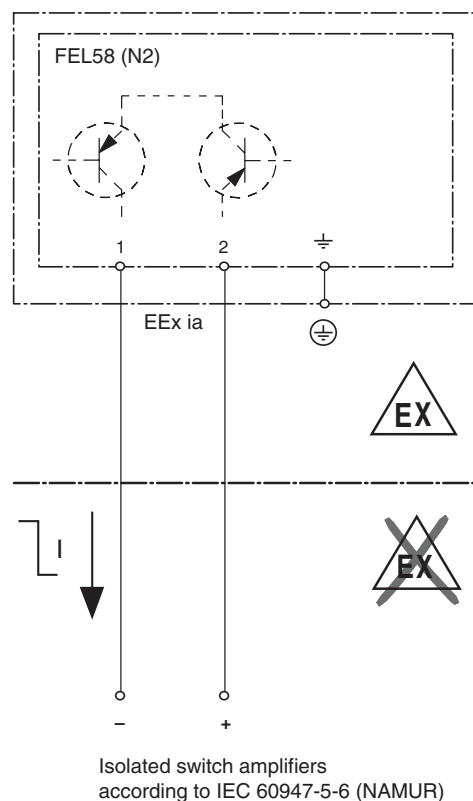
Additional function:

Test key on the electronic insert. Pressing the key breaks the connection to the isolating amplifier.

Connecting to multiplexer: set clock time to min. 2 s.

Note

For Ex-d applications, the additional function can only be used if the housing is not exposed to an explosive atmosphere.



Capacitive limit switches


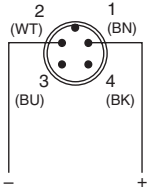
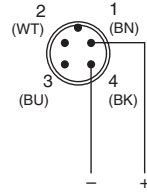
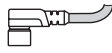



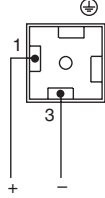
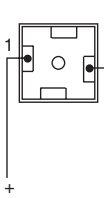
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Electrical connection

Electronic FEL58 (N2) in compact housing

Connection	MAX	MIN
Housing C4 (M12 x 1), connector with LEDs 		
Housing C4 (M12 x 1), connector without LEDs 		
Housing C2 (½ NPT) or Housing C4 (PG11) 		

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

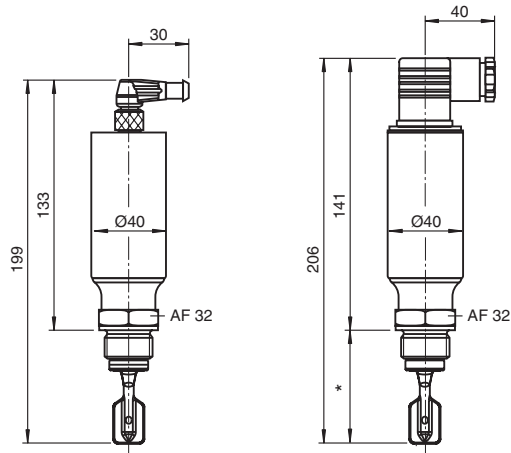
Limit value immersion probes

Continuous immersion probes

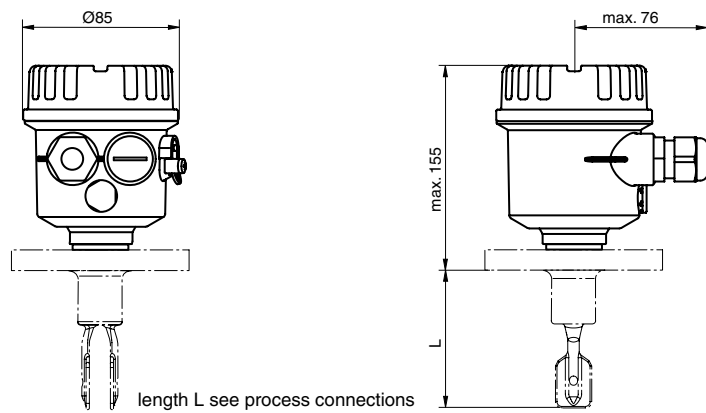
Hydrostatic pressure sensors

Dimensions

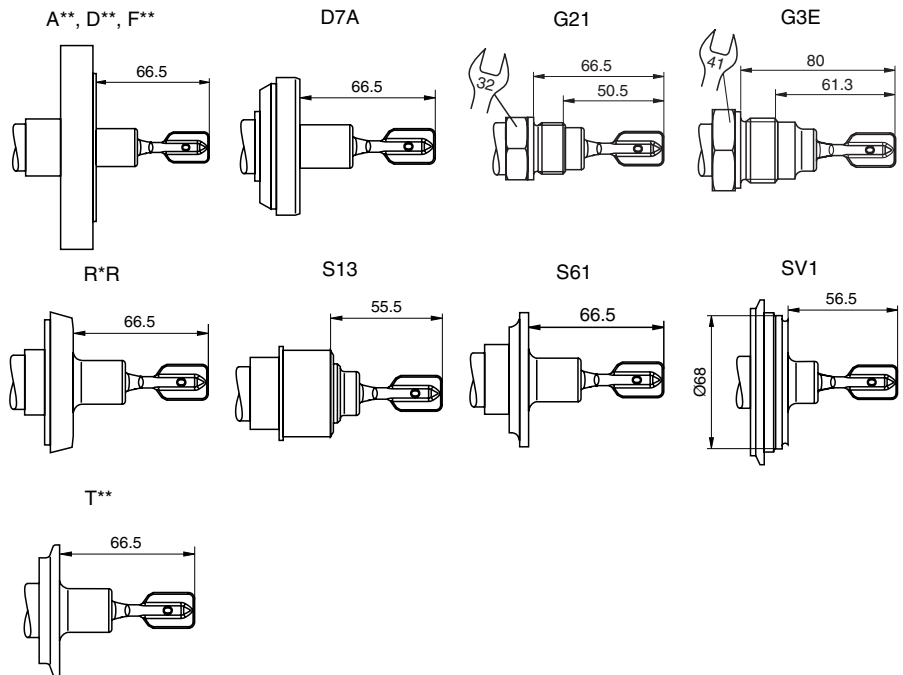
Compact housing C\*



Plastic housing P\*



Process connections

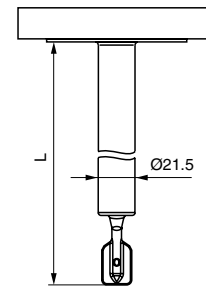
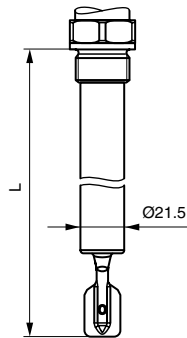


Dimensions

Extension tube

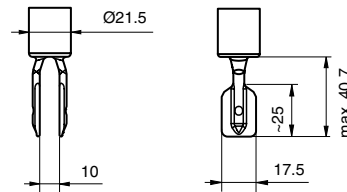
Thread: G $\frac{3}{4}$ A  
G1A

Flanges and flange-like  
process connections



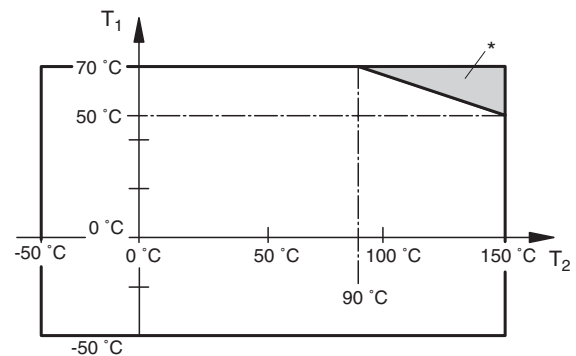
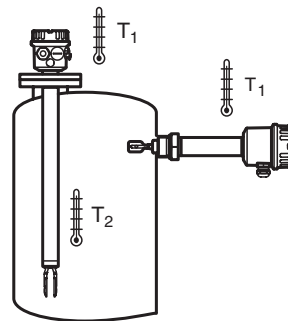
from seal surface of  
thread adapter

Vibration fork



Ambient temperature

Permissible ambient temperature  $T_1$  at the housing depends on the product temperature  $T_2$  in the vessel:



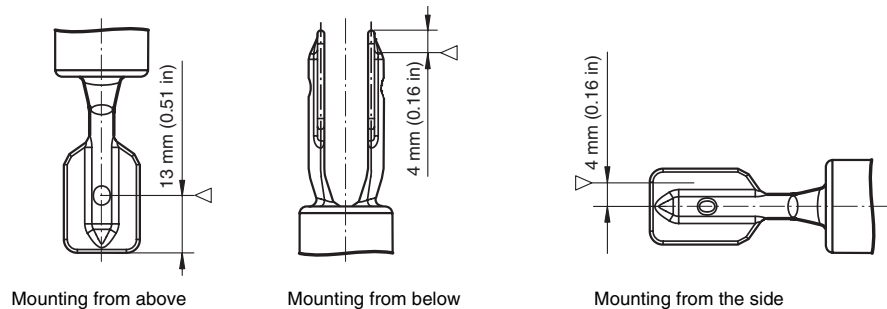
\* additional temperature range for sensors with a temperature separator or pressure-tight bushing

Switch point

Switch point  $\triangleright$  on the sensor depend on the mounting position, with reference to water, density 1 g/cm $^3$ , 23 °C (296 K),  $p_e$  0 bar.

Note:

The switch points of the Vibracon LVL-M2C are at other positions to those of the previous versions LVL1, LVL2.



Hydrostatic pressure sensors



**Accessories**

Welding sleeves

- LVL-Z100, welding sleeve G $\frac{3}{4}$  for flush mounting for process connection G21
- LVL-Z101, welding sleeve G1 for flush mounting for process connection G3E
- LVL-Z102, welding sleeve G1 for flush mounting for process connection G3E
- LVL-Z103, welding adapter G1 for flush mounting for process connection S13
- LVL-Z104, DRD welding flange for flush mounting for process connection D7D

Further accessories

- LVL-Z108, cover with glass sight glass for stainless steel housing E\*
- LVL-Z109, cover with PC sight glass for stainless steel housing E\*
- LVL-Z110, transparent cover for polyester housing P\*
- V1-G, mating connector, straight
- V1-W, mating connector, 90° angled

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Type code/model number



Specification of length without unit version M2

Certificates

- NA** for non-hazardous areas
- WH** WHG overspill protection
- E1** II 1G EEx ia IIC T6
- E2** II 1/2G EEx ia IIC T6
- E3** II 1/2G EEx d IIC T6
- EA** II 1G EEx ia IIC T6, WHG
- EB** II 1/2G EEx ia IIC T6, WHG
- EC** II 1/2G EEx d IIC T6, WHG
- EN** II 3G EEx nC IIC T6, WHG
- EM** II 3G EEx nA IIC T6, WHG
- FI** FM, IS, CI I, II, III, Div1, Group A-G
- FN** FM, NI, CI I, Div2, Group A-D
- FX** FM, XP, CI I, II, III, Div1, Group A-G
- CG** CSA, General Purpose
- CI** CSA, IS, CI I, II, III, Div1, Group A-G
- CX** CSA, XP, CI I, II, III, Div1, Group A-G

Optional equipment

- NA** without optional equipment
- Z3** 3.1.B material, wetted parts 1.4435, inspection certificate to EN 10204

Electronic insert

- PA** FEL50A, PROFIBUS PA
- AC** FEL51, contactless 2-wire switch, 19 V AC ... 253 V AC
- E5** FEL52, PNP 3-wire, 10 V DC ... 55 V DC
- WA** FEL54, potential-free change-over contact, DPDT, 19 V AC ... 253 V AC, 19 V DC ... 55 V DC
- SI** FEL55, 8/16 mA, 11 V DC ... 36 V DC
- N1** FEL56, NAMUR, L-H edge
- N2** FEL58, NAMUR with push button, H-L edge

Housing, cable entry

- A1** aluminium housing, IP66, cable gland M20
- A2** aluminium housing, Nema 4x, ¾ NPT
- A3** aluminium housing, IP66, entry G½A
- A4** aluminium housing, IP66, plug connector M12 x 1
- A5** aluminium housing, IP66, PA plug connector M12 x 1
- C2** compact housing, Nema 4x, ½ NPT plug connector, 1.4435/316L
- C4** compact housing, IP66, plug connector M12 x 1, 1.4435/316L
- C6** compact housing, IP66, PG11 plug connector, 1.4435/316L
- E1** stainless steel housing, IP66, cable gland M20
- E2** stainless steel housing, Nema 4x, ½ NPT
- E3** stainless steel housing, IP66, entry G½A
- E4** stainless steel housing, IP66, plug connector M12 x 1
- E5** stainless steel housing, IP66, PA plug connector M12 x 1
- P1** polyester housing, IP66, cable gland M20
- P2** polyester housing, Nema 4x, ½ NPT
- P3** polyester housing, IP66, entry G½A
- P4** polyester housing, IP66, plug connector M12 x 1
- P5** polyester housing, IP66, PA plug connector M12 x 1

Length, temperature spacer, pressure-tight bushing

- AC** 66 mm/2,6 in, R<sub>a</sub> < 1.5 µm/120 grit
- AD** 66 mm/2,6 in, R<sub>a</sub> < 0.3 µm/320 grit/3 A
- IC** 66 mm/2,6 in, R<sub>a</sub> < 1.5 µm/120 grit, with temperature spacer
- ID** 66 mm/2,6 in, R<sub>a</sub> < 0.3 µm/320 grit, with temperature spacer
- QC** 66 mm/2,6 in, R<sub>a</sub> < 1.5 µm/120 grit, with pressure-tight bushing
- QD** 66 mm/2,6 in, R<sub>a</sub> < 0.3 µm/320 grit/3 A, with pressure-tight bushing
- BC** mm L, R<sub>a</sub> < 1.5 µm/120 grit
- BD** mm L, R<sub>a</sub> < 0.3 µm/320 grit/3 A
- CC** in L, R<sub>a</sub> < 1.5 µm/120 grit
- CD** in L, R<sub>a</sub> < 0.3 µm/320 grit/3 A
- DC** special length L II, R<sub>a</sub> < 1.5 µm/120 grit, switch point = Vibracon compact
- DD** special length L II, R<sub>a</sub> < 0.3 µm/320 grit/3 A, switch point = Vibracon compact
- JC** mm L, R<sub>a</sub> < 1.5 µm/120 grit, with temperature spacer
- JD** mm L, R<sub>a</sub> < 0.3 µm/320 grit/3 A, with temperature spacer
- KC** in L, R<sub>a</sub> < 1.5 µm/120 grit, with temperature spacer
- KD** in L, R<sub>a</sub> < 0.3 µm/320 grit/3 A, with temperature spacer
- LC** special length L II, R<sub>a</sub> < 1.5 µm/120 grit, with temperature spacer, switch point = Vibracon compact
- LD** special length L II, R<sub>a</sub> < 0.3 µm/320 grit/3 A, with temperature spacer, switch point = Vibracon compact
- RC** mm L, R<sub>a</sub> < 1.5 µm/120 grit, with pressure-tight bushing
- RD** mm L, R<sub>a</sub> < 0.3 µm/320 grit/3 A, with pressure-tight bushing
- SC** in L, R<sub>a</sub> < 1.5 µm/120 grit, with pressure-tight bushing
- SD** in L, R<sub>a</sub> < 0.3 µm/320 grit/3 A, with pressure-tight bushing
- TC** special length L II, R<sub>a</sub> < 1.5 µm/120 grit, with pressure-tight bushing, switch point = Vibracon compact
- TD** special length L II, R<sub>a</sub> < 0.3 µm/320 grit/3 A, with pressure-tight bushing, switch point = Vibracon compact

Design

- H** hygienic version

Design

- M1** compact version
- M2** extended version (148 mm/6 in ... 6.000 mm/20 ft)

Continued on next page.

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

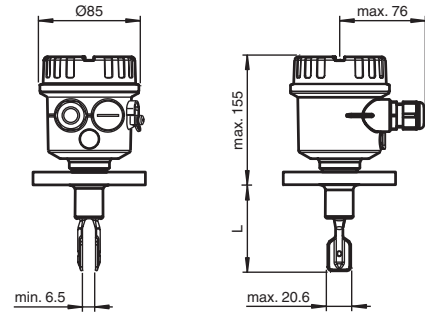


## Vibration limit switch

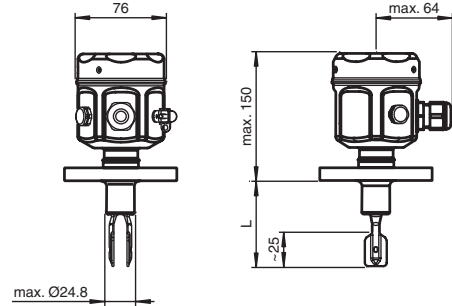
## Dimensions



Vibracon LVL-M2C with plastic housing and process connection with flange

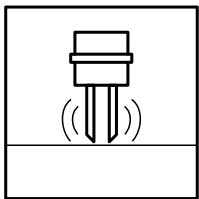


Vibracon LVL-M2C with stainless steel housing and process connection with flange



Additional dimensions see section dimensions.  
Length L see process connections.

### LVL-M2C



### Features

- Level limit switch for liquids
- Corrosion resistant coating (HALAR): ideal suited for the process
- Large number of process connections to choose from: universal usage
- Wide variety of electronic modules: the right connection for every process control system
- No calibration: quick and low-cost start-up
- No mechanically moving parts: maintenance-free, no wear, long operating life
- Monitoring of the vibrating fork for damage: guaranteed function
- PROFIBUS PA protocol: commissioning and maintenance quick and easy
- Up to SIL2 acc. to IEC 61508

### Function

The Vibracon is a level limit switch for use in all liquids

- for temperature of -50 °C (223 K) to +120 °C (393 K)
- for pressures up to 40 bar
- for viscosities up to 10000 mm<sup>2</sup>/s
- for density up to 0.5 g/cm<sup>3</sup> (other settings available on request)

The function is not affected by flow, turbulence, bubbles, foam, vibration, bulk solids content or build-up, the Vibracon is thus the ideal replacement for float switches.

The coating of all sensor wetted parts (process connections, extension pipe and vibration fork) is made of synthetic material to ensure it can be used for highly aggressive liquids.

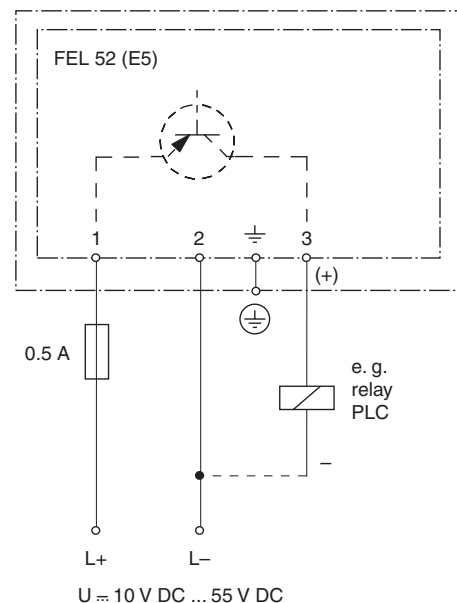
The level limit switch is available with extension tube up to 6 m (20 ft).

Instruments with protection EEx ia and EEx d are available for use in explosion hazardous areas.

### Electrical connection

Connection FEL 52 (E5) 3-wire DC connection (example)

- preferably for use with memory programmable controls (PLC)
- positive signal at the switch output of the electronics (PNP)
- Output blocked on reaching limit level.
- also in compact housing with plug connection available



Other connection types see section electrical connection.

<b>Application</b>		Float switches
Function principle	limit detection Maximum or minimum detection in tanks or pipelines containing all types of liquids including use in explosion hazardous areas. Particularly suited to very aggressive liquids thanks to high degree of corrosion protection.	
<b>Function and system design</b>		
Measuring principle	The forks of the sensors vibrate at their intrinsic frequency, this frequency is reduced when covered with liquid. The change in frequency then activates the limit switch.	
<b>Input characteristics</b>		
Measured variable	limit level (limit value)	
Measurement range	depends on mounting point and pipe extension up to 6000 mm (20 ft)	
Medium density	adjustment on the electronic insert > 0.5 g/cm <sup>3</sup> (other on request)	
<b>Output characteristics</b>		
Fail safe mode	switch-over for minimum/maximum residual current safety on electronic insert  MAX = maximum safety: The output switches to the power fail response when the fork is covered. for use with overspill protection for example  MIN = minimum safety: The output switches to the power fail response when the fork is exposed. for use with dry running protection for example	
Switching time	when fork is covered: approx. 0.5 s, when fork is exposed: approx. 1.0 s (other switching times on request) additionally configurable for PROFIBUS PA (electronic insert FEL50A (PA)): 0.5 ... 60 s	
Switch-on response	when switching on the power supply the output assumes the alarm signal, after max. 3 s it assumes the correct switching mode	Conductive limit switches
<b>Auxiliary energy</b>		
Supply voltage	electronic insert FEL50A (PA): 9 ... 32 V DC electronic insert FEL51 (AC): 253 V AC, 50/60 Hz electronic insert FEL52 (E5): 10 ... 55 V DC electronic insert FEL54 (WA): 19 ... 253 V AC, 50/60 Hz or 19 ... 55 V DC electronic insert FEL55 (SI): 11 ... 36 V DC, PLC electronic insert FEL56 (N1), FEL58 (N2): isolating amplifier acc. to EN 60947-5-6 (NAMUR)	
Connecting cable	electronic inserts: cross section max. 2.5 mm <sup>2</sup> , strand in ferrule in acc. to DIN 46228 protective earth in housing: cross section max. 2.5 mm <sup>2</sup> external equipotential bonding connection on housing: cross section 4 mm <sup>2</sup>	Capacitive limit switches
Power consumption	electronic insert FEL52 (E5): max. 0.83 W electronic insert FEL54 (WA): max. 1.3 W	
Current consumption	electronic insert FEL52 (E5): max. 15 mA	
<b>Performance characteristics</b>		Limit value immersion probes
Reference operating conditions	ambient temperature: 23 °C (296 K), medium temperature: 23 °C (296 K), product density: 1 g/cm <sup>3</sup> (water), viscosity: 1 mm <sup>2</sup> /s, medium pressure p <sub>e</sub> : 0 bar, sensor mounting: vertical from above, density switch: to > 0.7 g/cm <sup>3</sup>	
Maximum measured error	max. ± 1 mm, specified by mounting position	
Non-repeatability	0.1 mm	
Hysteresis	approx. 2 mm	
Influence of medium density	max. +4.8 ... -3.5 mm (+0.19 ... -0.14 in) (0.5 ... 1.5 g/cm <sup>3</sup> )	
Influence of medium temperature	max. 1.4 ... -2.8 mm (-40 ... +120 °C (233 ... 393 K))	
Influence of medium pressure	max. 0 ... -2 mm (0 ... 40 bar)	
<b>Operating conditions</b>		Continuous immersion probes
<b>Mounting conditions</b>		
Installation position	with short pipe (up to 500 mm (19.7 in)) any position, with long pipe vertical	
<b>Ambient conditions</b>		
Ambient temperature	-50 ... 70 °C (223 ... 343 K), function with reduced data values see section ambient temperature	
Storage temperature	-50 ... 80 °C (223 ... 353 K)	
Overvoltage protection	electronic insert FEL51 (AC), electronic insert FEL52 (E5), electronic insert FEL54 (WA), electronic insert FEL55 (SI): overvoltage category III	
<b>Process conditions</b>		
Medium temperature	-50 ... 120 °C (223 ... 393 K), for exceptions see process connections	
Medium pressure	p <sub>e</sub> = -1 ... 40 bar over the entire temperature range, exceptions see process connections	
Test pressure	max. 100 bar (1.5 times the medium pressure p <sub>e</sub> ), no function during test pressure, burst pressure of diaphragm 200 bar	
Pressure surge	max. 20 bar/s	Hydrostatic pressure sensors
Thermal shock resistance	max. 120 °C/s	
State of aggregation	liquid	
Density	min. 0.5 g/cm <sup>3</sup> , other density settings on request	
Viscosity	max. 10000 mm <sup>2</sup> /s	
Solid contents	max. Ø 5 mm	
<b>Mechanical specifications</b>		
Protection degree	polyester, steel and aluminium housing: IP66/IP67	

Date of issue 09/22/06 – Catalog Field Devices

## Vibration limit switch LVL-M2C

## Technical data

Float switches	<b>Mechanical construction</b>	
	Construction type	LVL-M2C: with extension tube, coated with ECTFE
	Dimensions	housing: diameter max. 85 mm (3.3 in), height max. 173 mm (6.8 in) temperature separator, pressure-tight bushing: additional length L 140 mm (5.5 in) process connection: length L min. 115 (4.5 in) extension: any length L from 148 ... 6000 mm (6 in ... 20 ft) extension: length type II, for vertical installation from above same switching point as Vibracon LVL2 vibration fork: width 20.6 mm (0.81 in), fork width 6.5 mm (0.25 in), length 25 mm (1 in)
Vibration limit switches	Mass	800 g, basic weight: compact version (length type II), electronic insert, plastic housing, without flange, additional weight is dependent on extension tube, housing and process connection
	Additional weight	process connection: - A3H 1000 g, A5H 1500 g, A6H 2400 g, A6I 3200 g, A8H 4900 g - H35 1400 g, H65 2400 g, H71 1600 g, H75 3200 g, H95 5900 g, HA3 5600 g - J1H 1700 g length, spacer, bushings: - BK* 900 g/m - CK* 2300 g/100 in - DKA 100 g, DKB 700 g, DKC 800 g
	Material	wetted parts: - process connection and extension pipe: 1.4435/316L with ECTFE coating - vibration fork: 1.4435/316L with ECTFE coating housings: - polyester housing: PBT-FR with PBT-FR cover or with PA12 cover with sight glass, cover seal: EPDM - stainless steel housing: 1.4301/304, cover seal: silicone - aluminium housing: EN-AC-AISi10Mg, plastic-coated, cover seal: EPDM cable gland: polyamide or brass, nickel-plated temperature spacer: 1.4435/316L pressure-tight bushing: 1.4435/316L
Conductive limit switches	Surface quality	$R_a < 3.2 \mu\text{m}/80$ grit: length, spacer, bushings B**, C**, D**
	Switching point	see section switch point
	Process connection	flanges to EN 1092-1 from DN25, to ANSI B 16.5 from 1", to JIS B 2238 (RF) from DN50 for additional information see type code
	<b>Indication and operation</b>	
Capacitive limit switches	Display elements	electronic inserts: - electronic inserts FEL50 A (PA), FEL58 (N2): green LED, yellow LED - electronic inserts FEL51 (AC), FEL52 (E5), FEL54 (WA), FEL55 (SI), FEL56 (N1): green LED, red LED
	Operating elements	electronic insert FEL50A (PA): 8 switches for device address setting electronic inserts FEL51 (AC), FEL52 (E5), FEL54 (WA), FEL55 (SI), FEL56 (N1): two switches for fail-safe mode and density change electronic insert FEL58 (N2): two switches for fail-safe mode and density change and one test button interrupts lead
	<b>Certificates and approvals</b>	
Limit value immersion probes	Ex approval	KEMA 01 ATEX 1089, KEMA 01 ATEX 1147 X, KEMA 01 ATEX 1148 X, KEMA 01 ATEX 2117, KEMA 01 ATEX 2118 X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
	Type of protection	II 1/2G EEx ia IIC T3 ... T6 or EEx ia IIB T3 ... T6 and  II 1/2D T80°C (KEMA 01 ATEX 1089) II 1G EEx ia IIC T3 ... T6 or EEx ia IIB T3 ... T6 (KEMA 01 ATEX 1147 X) II 1/2G EEx ia IIC T3 ... T6 (KEMA 01 ATEX 1148 X) II 1/2G EEx d IIC T3 ... T6 or EEx d IIB T3 ... T6 (KEMA 01 ATEX 2117) II 1/2G EEx d IIC T3 ... T6 (KEMA 01 ATEX 2118 X) II 3G EEx nA/nC II T6 and  II 3D T85°C
	SIL classification	up to SIL2 acc. to IEC 61508
	Overspill protection	Z-65.11-306 (overspill protection in acc. with WHG)
	<b>General information</b>	
Continuous immersion probes	Directive conformity	
	Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1
	Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector) If the fork tines are joined together on account of build-up, the useful signal is attenuated to such an extent that the original EMC values can no longer be completely observed (EN 61000-4-3 electromagnetic fields, EN 61000-4-6 HF coupling).
	Directive 94/9 EC (ATEX)	EN 50014, EN 50018, EN 500020, EN 500021, EN 50284, EN 50281-1-1
Hydrostatic pressure sensors	Conformity	
	Electromagnetic compatibility	NE 21
	Protection degree	EN 60529
	Climate class	EN 60068, part 2-38, fig. 2a
	Vibration resistance	EN 60068-2-6, 10 ... 50 Hz, 0.15 mm, 100 cycles

Supplementary documentation

technical information TI3470  
 operating instructions KA1620 (LVL-M2C)  
 operating instructions BA1410 (electronic insert FEL50A (PA))  
 safety information SI0310 (KEMA 01 ATEX 2117)  
 safety information SI0630 (KEMA 01 ATEX 1089)  
 safety information SI0640 (KEMA 01 ATEX 1147 X)  
 safety information SI1130 (KEMA 01 ATEX 1148 X)  
 safety information SI1140 (KEMA 01 ATEX 2118 X)  
 safety information SI1540 (KEMA 01 ATEX 1089), PROFIBUS PA version  
 safety information SI1580 (KEMA 01 ATEX 1148 X), PROFIBUS PA version  
 safety information SI1590 (KEMA 01 ATEX 1147 X), PROFIBUS PA version  
 safety information SI1820 (Ex II 3G EEx nA/nC II T6 and Ex II 3D T85°C)  
 approval ZE2330 overspill protection acc. to WHG (Z-65.11-306)

Supplementary information

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

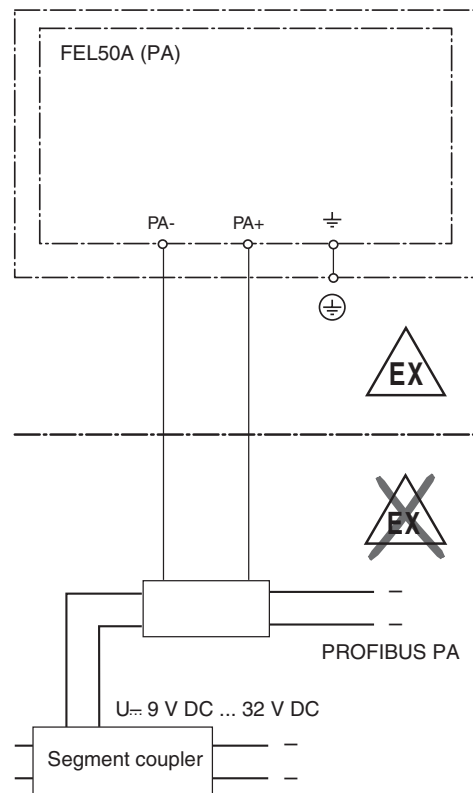
Electrical connection

Electronic insert FEL50A (PA)

Two-wire connection for power supply and data transfer for connecting to PROFIBUS PA

Additional functions:

- Digital communication enables the representation, reading and editing of the following parameters: fork frequency, switch-on frequency, switch-off frequency, switch-on time and switch-off time, status, measured value, density switch.
- Matrix locking possible.
- Switch to WHG mode possible (WHG approval).
- You can also visit [www.profibus.com](http://www.profibus.com) for more information.



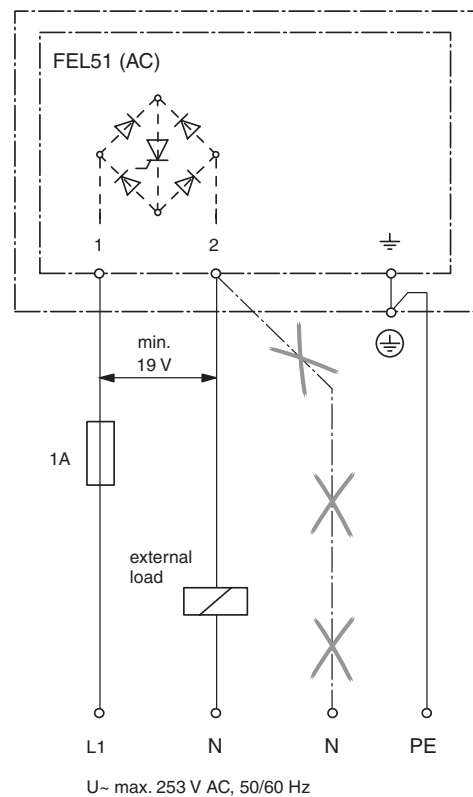
Electronic insert FEL51 (AC)

Two-wire AC connection

Always connect in series with a load!

Check the following:

- the residual current in blocked state (up to 3.8 mA)
- that for low voltage
  - The voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
  - The voltage drop across the electronics when switched through is observed (up to 12 V).
- that a relay cannot de-energise with holding power below 3.8 mA. If this is the case, a resistor should be connected parallel to the relay (RC module available on request).
- When selecting the relay, pay attention to the holding power/rated power (see connectable load).



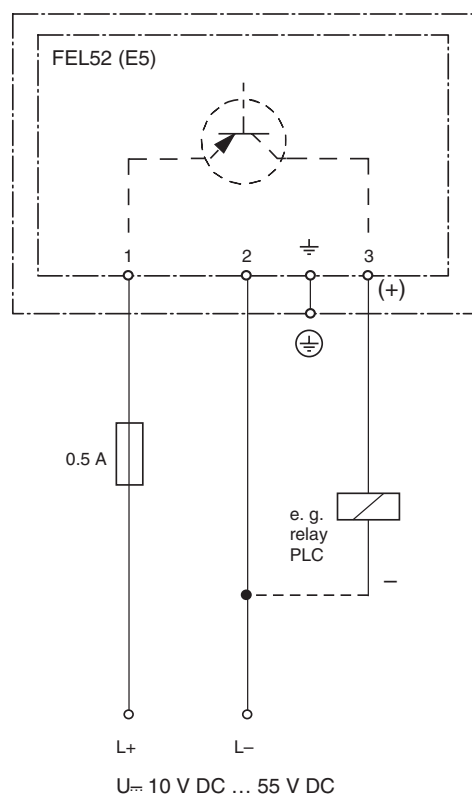


Electrical connection

Electronic insert FEL52 (E5)

Three-wire DC connection

- preferably used with programmable logic controllers (PLC), DI module as per EN 61131-2.
- positive signal at switching output of the electronics (PNP)
- Output blocked on reaching limit.

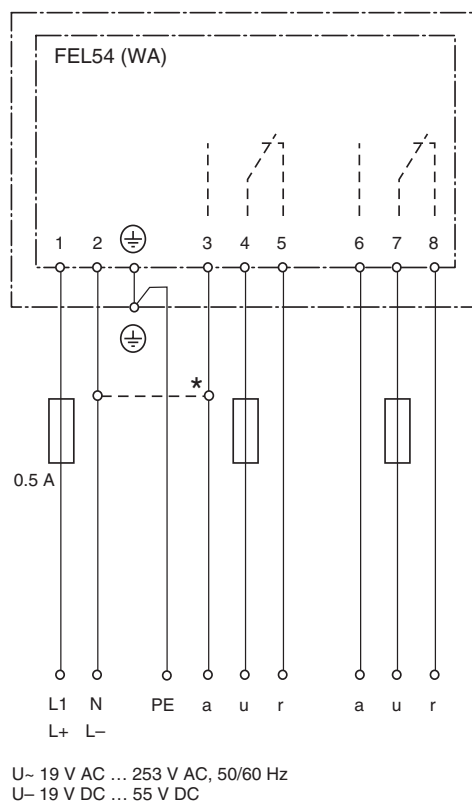


Electronic insert FEL54 (WA)

Universal current connection with relay output

- Power supply: Please note the different voltage ranges for AC and DC.
- Output: When connecting an instrument with high inductance, provide a spark arrester to protect the relay contact. A fine-wire fuse (depending on the load connected) protects the relay contact on short-circuiting. Both relay contacts switch simultaneously.

\* When jumpered, the relay output works with NPN logic.

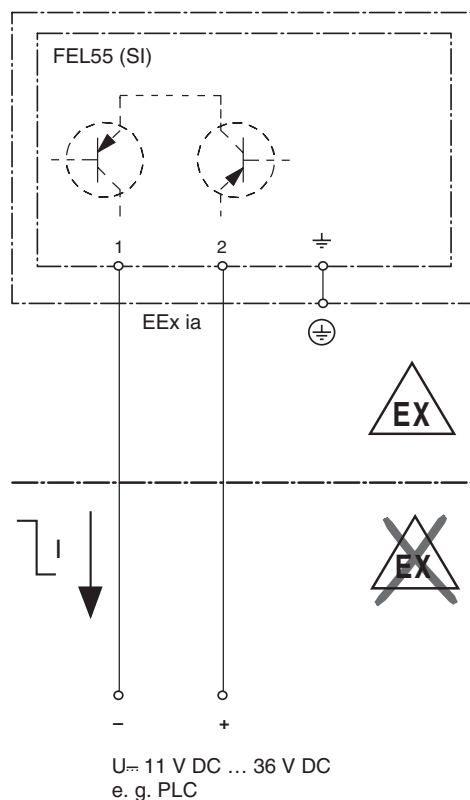


Electrical connection

Electronic insert FEL55 (SI)

Two-wire connection for separate switching unit

- for connecting to programmable logic controllers (PLC) for example, AI module 4 mA ... 20 mA to EN 61131-2
- Output signal jump from high to low current on limit (**H-L edge**)

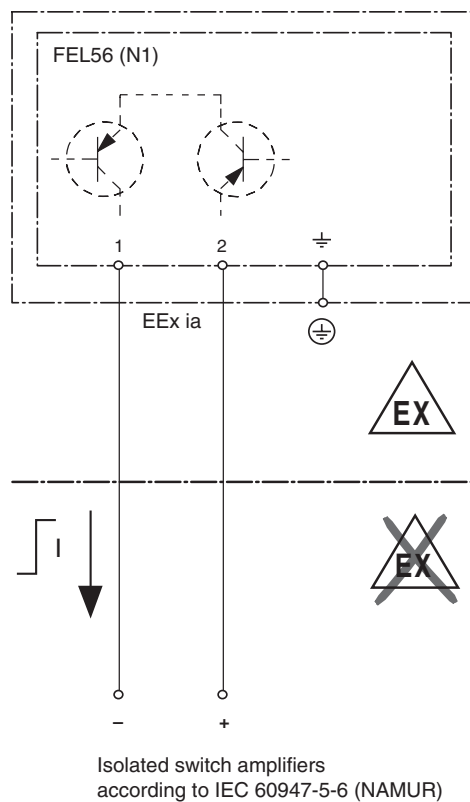


Electronic insert FEL56 (N1)

Two-wire connection for separate switching unit

- for connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e. g. isolating amplifier KFD2-SR2-Ex1.W or remote process interface KSD-BI-Ex2 from Pepperl+Fuchs
- Output signal jump from low to high current on limit (**L-H edge**)

Connecting to multiplexer: set clock time to min. 2 s.



Electrical connection

Electronic insert FEL58 (N2)

Two-wire connection for separate switching unit

- for connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e. g. Isolating amplifier KFD2-SR2-Ex1.W or remote process interface KSD-BI-Ex2 from Pepperl+Fuchs
- Output signal jump from high to low current on limit (**H-L edge**)

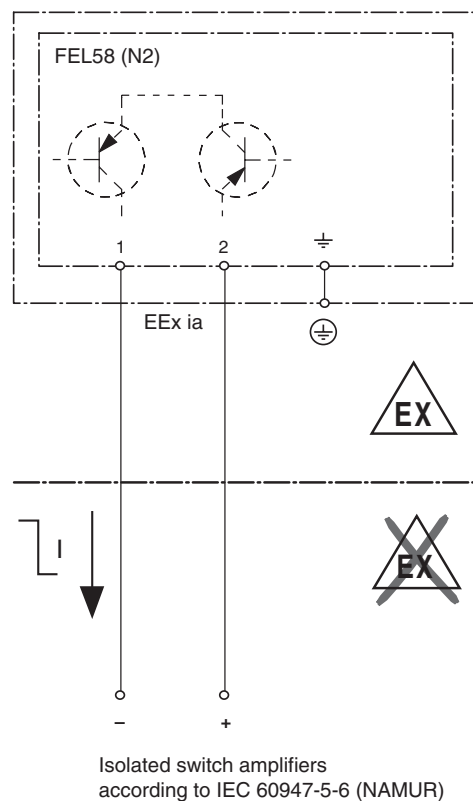
Additional function:

Test key on the electronic insert. Pressing the key breaks the connection to the isolating amplifier.

Connecting to multiplexer: set clock time to min. 2 s.

Note

For Ex-d applications, the additional function can only be used if the housing is not exposed to an explosive atmosphere.



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

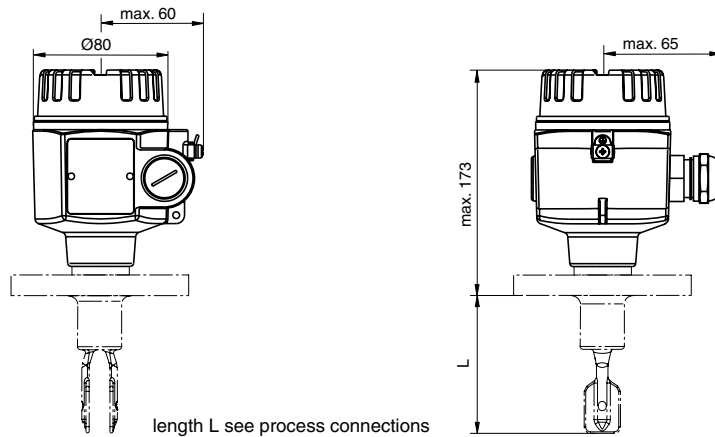
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

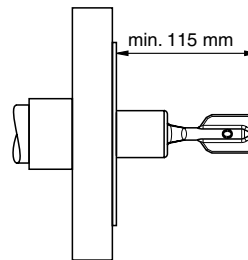
Dimensions

Aluminium housing A\*



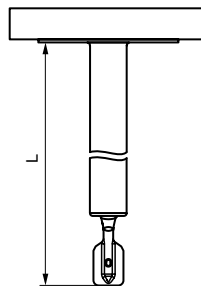
Process connections

A\*\*, J\*\*, H\*\*

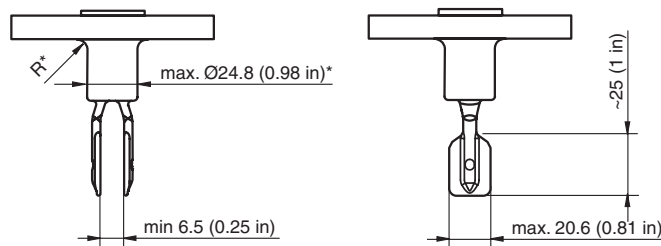


Extension tube

Flanges and flange-like process connections



Vibration fork



\*The following applies to DN25/ANSI 1":  
max. pipe diameter  
24.2 mm (0.95 in)  
radius R max. 4 mm  
(0.16 in)  
This is important when  
selecting the counter flange!

Float switches

Vibration  
limit  
switches

Conductive  
limit  
switches

Capacitive  
limit  
switches

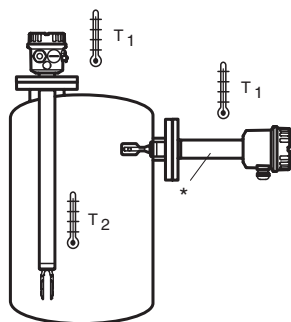
Limit value  
immersion probes

Continuous  
immersion probes

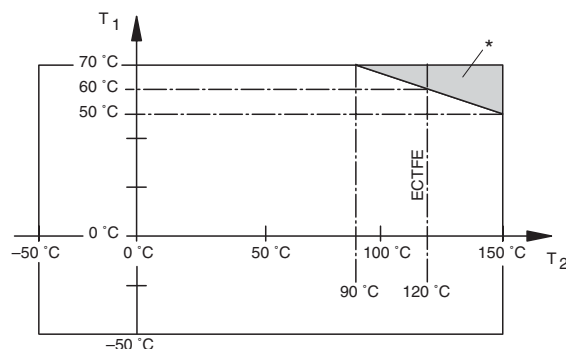
Hydrostatic  
pressure sensors

**Ambient temperature**

Permissible ambient temperature  $T_1$  at the housing depends on the product temperature  $T_2$  in the vessel:



\* additional temperature range for sensors with a temperature separator or pressure-tight bushing



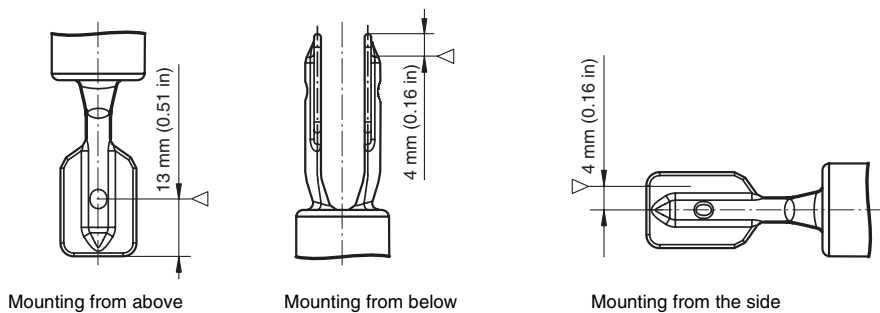
The temperature difference between the process side and the ambient side ( $T_2 - T_1$ ) of the flange may not exceed max. 60 °C (333 K). For this reason, the flange may have to be included in the tank insulation if necessary.

**Switch point**

Switch point  $\triangleright$  on the sensor depend on the mounting position, with reference to water, density 1 g/cm<sup>3</sup>, 23 °C (296 K),  $p_e$  0 bar.

**Note:**

The switch points of the Vibracon LVL-M2C are at other positions to those of the previous version LVL2.



**Accessories**

- V1-G, mating connector, straight
- V1-W, mating connector, 90° angled



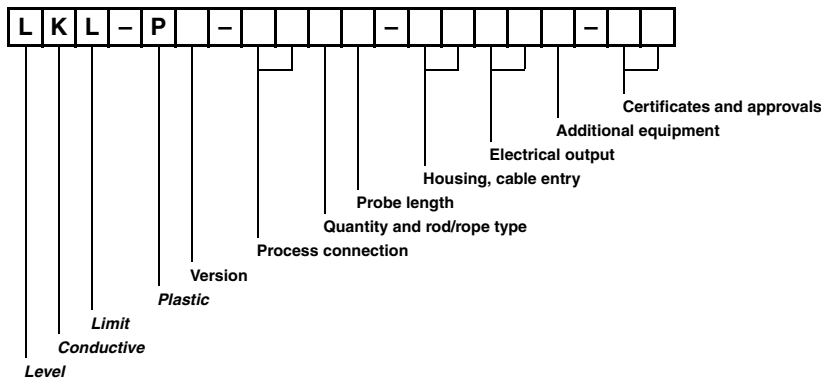


# Type code of conductive limit switches

The figure below shows the used characters and numbers of the conductive limit switches type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the conductive limit switches.

## Product group LKL-P\*



- Float switches
- Vibration limit switches
- Conductive limit switches
- Capacitive limit switches
- Limit value immersion probes
- Continuous immersion probes
- Hydrostatic pressure sensors





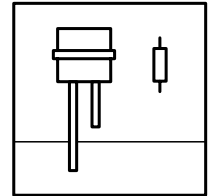
Two electrodes are installed above the surface of a conductive liquid which is to be monitored. If the liquid level rises to the point where both electrodes are in contact with the liquid, the current circuit of a connected relay is completed via the two electrodes and the liquid, causing a switching signal to be activated.

The minimum conductivity of the liquid must be 10  $\mu\text{S}/\text{cm}$ . These conditions are fulfilled by practically all conductive liquids, such as water, acids and lyes, with the exception of pure solvents.

If several switching points are needed, the corresponding multiple electrodes should be used.

In order to avoid electrical effects in the liquid, a DC-free alternating current is used for measuring. This is generated by an electrode relay or a converter.

Interfacial level detection can be easily and economically realised with this measuring method. Particularly with oil and petrol separators, the limit value between the water and the non-conductive liquid is easy to detect.



Conductive limit switch LKL-P1

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

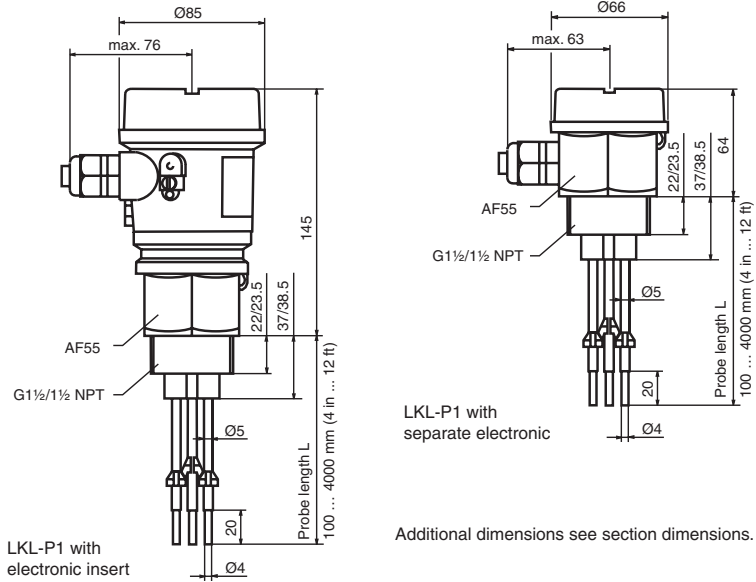
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## Conductive limit switch

## Dimensions



**⚠** When placing your order, please specify the length (L) of the electrode rod. The electrode rod can be cropped by the user if necessary.

## Function

The LKL-P sensor is used in conductive liquids (as of 10 µs/cm) for determining level limits.

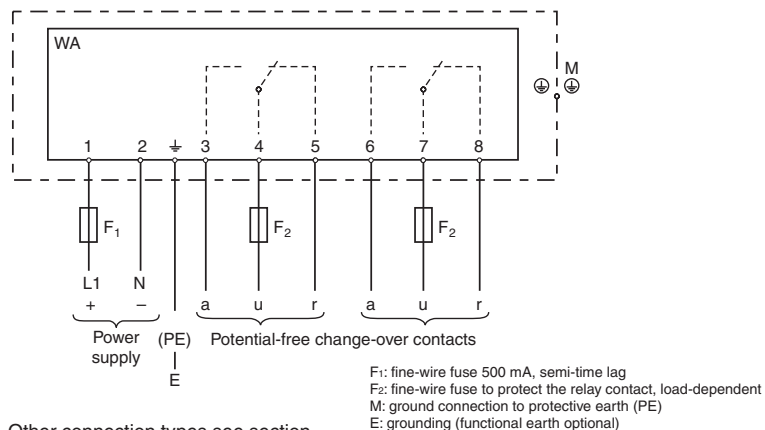
Depending on the number of measuring points (up to 5 rods or ropes), measuring tasks such as overspill protection, dry running protection, two-point control of pumps or multiple point detection can be implemented for an existing process connection.

- Flexible instrumentation: with built-in electronic insert, either transistor or relay output for 2 or 3 rod/rope probes and for connection to a separate transmitter power supply unit
- No calibration required: standard setting for the most common conductive liquids
- No moving parts in the tank: long service life and reliable operation with no wear or blockages

## Electrical connection

Example:  
Output WA (FEW54), compact instrument version, AC/DC connection with relay output

Relay contact circuit for load  
The connected load is switched via potential-free relay contacts (change-over contact). In the event of a level alarm or a power failure, the relay contacts break the connections between terminals 3 and 4 and terminals 6 and 7. The relays always switch simultaneously.

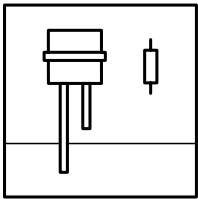


Other connection types see section electrical connection.

Float switches

Vibration limit switches

## LKL-P\*



Conductive limit switches

Capacitive limit switches



## Features

- Level limit switch for conductive liquids
- Detect up to five level limits with one probe
- Flexible instrumentation
- No moving parts in the tank
- No calibration: quick and low-cost start-up
- Option between rod or rope version for optimum adaptation to the application
- Two-point control and additional maximum and minimum detection
- Approval as overflow protection and leak detection system

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

<b>Function and system design</b>		<p>Measuring principle</p> <p>An alternating voltage exists between the rod probes in an empty tank. As soon as the conductive liquid in the tank creates a connection between the ground probe rod and, for example, the maximum probe rod, a measurable current flows and the LKL-P* switches. With level limit detection, the LKL-P* switches back as soon as the liquid clears the maximum probe. With two-point control, the LKL-P* does not switch back until the max and min probe is cleared.</p> <p>Using alternating voltage prevents corrosion of the probe rods and electrolytic destruction of the product. The material used for the tank walls is not important for measurement because the system is designed as a closed potential-free circuit between the probe rods and the electronics. There is absolutely no danger if the probe rods are touched during operation.</p>	Float switches		
Equipment architecture				<p>probe with integrated electronic insert (compact instrument version)</p> <p>probe without integrated electronic insert (separate instrument version) for one or two point detection respectively, see section measuring system</p>	
<b>Input characteristics</b>				<p>resistance change between two conductors caused by the presence or absence of a conductive product.</p> <p>The measuring range is dependent on the mounting location of the probes. Rod probes can have a max. length of 4000 mm (13 ft) and rope probes up to 15000 mm (49 ft).</p> <p>probes covered - A measurable current is flowing between the probes.</p> <p>probes uncovered - There is no measurable current flowing between the probes.</p>	
Measured variable					
Measurement range					
Input signal					
<b>Output characteristics</b>				<p>see section electrical connection</p> <p>A total of four measuring ranges (100 Ω, 1 kΩ, 10 kΩ, 100 kΩ) can be set via two DIL switches (SENS). The setting on delivery is 100 kΩ.</p> <p>output E5 (FEW52): in the event of a power failure or a damaged probe: &lt; 100 μA.</p> <p>output WA (FEW54): output signal in the event of a power failure or a damaged probe: relay de-energised.</p> <p>Selecting the correct fail-safe mode ensures that the relay always runs in quiescent current fail-safe.</p> <ul style="list-style-type: none"> <li>- maximum fail-safe: The relay de-energises when the switch point is exceeded (probe covered), a fault occurs or the power supply fails.</li> <li>- minimum fail-safe: The relay de-energises when the switch point is undershot (probe uncovered), a fault occurs or the power supply fails.</li> </ul>	Conductive limit switches
Output signal					
Measurement range					
Signal on alarm					
Fail safe mode		<p>output E5 (FEW52):</p> <p>The load is switched via a transistor (PNP). cycled overload and short-circuit protection, continuous ≤ 200 mA (short-circuit proof), residual voltage at transistor at <math>I_{max} &lt; 2.9 V</math></p> <p>output WA (FEW54):</p> <p>Loads are switched via 2 potential-free change-over contacts.</p> <p>I~ max. 4 A, U~ max. 253 V</p> <p>P~ max. 1000 VA, cos Φ = 1, P~ max. 700 VA, cos Φ &gt; 0.7</p> <p>I- max. 4 A to 30 V, I- max. 0.2 A to 150 V.</p> <p>When connecting a functional extra-low voltage circuit with double insulation in accordance with IEC 1010: The sum of the relay output and power supply voltages is max. 300 V.</p> <p>output N1 (FEW58): refer to data sheet of the connected isolating amplifier acc. to NAMUR (IEC 60947-5-6)</p>	Capacitive limit switches		
Load					
Switching delay					
Electrical isolation					
Lead monitoring		<p>output WA (FEW54): All input channels, output channels and relay contacts are galvanically isolated from each other.</p> <p>For probes without an electronic insert, an additional printed circuit board must be installed in the housing, which enables cable monitoring. It is always switched or connected between rod/rope 1 and 2.</p> <p>Note!</p> <p>When using switching units (transmitters) that do not support cable monitoring, these must be removed.</p>	Limit value immersion probes		
<b>Auxiliary energy</b>					
Electrical connection					
Supply voltage					
Power consumption		<p>output E5 (FEW52): P &lt; 1.1 W</p> <p>output WA (FEW54): P &lt; 2.0 W</p> <p>output E5 (FEW52): I &lt; 25 mA (without load)</p> <p>output WA (FEW54): 60 mA</p> <p>output E5 (FEW52)</p> <p>output WA (FEW54): 253 V AC/4 A; 30 V DC/4 A; 150 V/0.2 A</p> <p>output N1 (FEW58): output signal with damaged sensor &lt; 1 mA</p>	Continuous immersion probes		
Current consumption					
Reverse polarity protection					
Contact loading					
Signal on alarm		<p>ambient temperature: 23 °C (296 K), medium temperature: 23 °C (296 K), medium viscosity: medium must release the probe again (drain off), medium pressure pe: 0 bar, probe installation: vertically from above</p>	Hydrostatic pressure sensors		
<b>Performance characteristics</b>					
Reference operating conditions					

Date of issue 09/22/06 – Catalog Field Devices

## Conductive limit switch LKL-P\*

## Technical data

Float switches	Maximum measured error	± 10 % at 0.1 ... 100 kΩ ± 5 % at 1 ... 10 kΩ
	Non-repeatability	± 5 % at 0.1 ... 100 kΩ ± 1 % at 1 ... 10 kΩ
	Hysteresis	-10 % for the max probe, in reference to the switch point, Δs function deactivated
	Influence of ambient temperature	< 0.05 %/K
	Switching time	< 3 s
Vibration limit switches	<b>Operating conditions</b>	
	Mounting conditions	
	Mounting location	The rod and rope probes are mounted predominantly in tanks made of plastic or metal.
	Mounting examples	see section example applications
	Ambient conditions	
	Ambient temperature	-40 ... 70 °C (233 ... 343 K) -40 ... 60 °C (233 ... 333 K) for output N1 (FEW58)
	Storage temperature	-40 ... 80 °C (233 ... 353 K)
	Climate class	tropicalised
	Shock resistance	practical test
	Vibration resistance	20 ... 2000 Hz, 1 (m/s <sup>2</sup> )/Hz
Conductive limit switches	Electromagnetic compatibility	Use for separate-instrumented probes a screened cable between the probe and the switching unit.
	Process conditions	
	Medium temperature	-40 ... 100 °C (233 ... 373 K)
	Medium pressure	-1 ... 10 bar
	Conductivity	≥ 10 μS
	<b>Mechanical specifications</b>	
	Protection degree	IP66
	<b>Mechanical construction</b>	
	Construction type	LKL-P1: rod version LKL-P2: rope version
	Dimensions	LKL-P1: - housing: max. Ø85 mm (3.3 in), height max. 145 mm (5.7 in) - rod: length 100 ... 4000 mm (4 in ... 13 ft) LKL-P2: - housing: max. Ø85 mm (3.3 in), height max. 145 mm (5.7 in) - rope: length 250 ... 15000 mm (10 in ... 49 ft)
Capacitive limit switches	Mass	separate instrument version: - rod, 1 m (3 ft) long, LKL-P1 with 2, 3 or 5 rods (415 g/530 g/760 g) - rope, 1 m (3 ft) long, LKL-P2 with 2, 3 or 5 ropes (390 g/470 g/640 g) compact instrument version: - rod, 1 m (3 ft) long, LKL-P1 with 2 or 3 rods (600 g/720 g) - rope, 1 m (3 ft) long, LKL-P2 with 2 or 3 ropes (710 g/800 g)
	Material	probes: - rods: rod 1.4404/316L, insulation: PP - ropes: rope 1.4571/316Ti, insulation FEP, weight 1.4435/316L housing: - output NA (separate instrument version): housing PPS, cover PBT - output E5/WA/N1 (compact instrument version): housing PBT, cover PBT, adapter PBT process connections: PPS
Limit value immersion probes	Process connection	- cylindrical thread G1½A to DIN ISO 228/1 - conical thread 1½ NPT to ANSI B 1.20.1
	Probe	rod probes: compact instrument version 2 or 3 rods, separate instrument version 2, 3 or 5 rods - diameter without insulation: Ø4 mm (0.16 in) - rod length: 100 ... 4000 mm (4 in ... 13 ft) - thickness of insulation: 0.5 mm (0.02 in) - length of non-insulated area (tip of rod): 20 mm (0.8 in) - extraction forces (parallel probe rod): 1000 N rope probes: compact instrument version 2 or 3 ropes, separate instrument version 2, 3 or 5 ropes - diameter without insulation: Ø1 mm (0.04 in) - rope length: 250 ... 15000 mm (10 in ... 49 ft) - thickness of insulation: 0.75 mm (0.03 in) - weight length: 100 mm (4 in) (not insulated) - weight diameter: Ø10 mm (0.4 in) - extraction forces (parallel probe rope): 500 N
Continuous immersion probes	Electrical connection	cable connection M20 x 1.5, ½ NPT, G½
	<b>Indication and operation</b>	
Hydrostatic pressure sensors		

Display elements	<p>separate instrument version: dependent on the connected switching unit compact instrument version:</p> <ul style="list-style-type: none"> <li>- one red light emitting diode: fault message, switching status</li> <li>- one green light emitting diode: operation</li> </ul> <p>Note for output E5 (FEW52) and output WA (FEW54) If the probe is covered and the red LED flashes continuously, the next more sensitive measuring range has to be set. This ensures a safe switch point even if the conductivity of the medium varies slightly.</p>	Float switches
Operating elements	<ul style="list-style-type: none"> <li>- one DIL switch for min/max position</li> <li>- one DIL switch for 0 s or 2 s switching delay</li> <li>- two DIL switches for setting the measuring ranges 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ</li> </ul>	
<b>Certificates and approvals</b>		
Ex approval	TÜV 03 ATEX 2295, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	Vibration limit switches
Type of protection	<p>⊕ II 2G EEx ia/ib IIC T6 (TÜV 03 ATEX 2295)</p> <p>⊕ II 3G or nC [L] IIC T6</p>	
Overspill protection	<p>Z-65.13-378 (overspill protection in acc. with WHG)</p> <p>Z-65.40-379 (leak detection system)</p>	
<b>General information</b>		
Directive conformity		Conductive limit switches
Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1	
Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector)	
Directive 94/9 EC (ATEX)	EN 50014, EN 50020	
Conformity		
Electromagnetic compatibility	NE 21	Capacitive limit switches
Protection degree	EN 60529	
Climate class	EN 60068, part 2-38	
Vibration resistance	EN 60068-2-64	
Supplementary documentation	<p>operating instructions KA203O (LKL-P* without electronic insert)</p> <p>operating instructions KA204O (LKL-P* with integrated electronic insert)</p> <p>safety information SI230O (TÜV 03 ATEX 2295)</p> <p>safety information SI226O (⊕ II 3G EEx nA [L] IIC T6 or nC [L])</p> <p>approval ZE043O overspill protection acc. to WHG (Z-65.13-378)</p> <p>approval ZE257O leak detection system (Z-65.40-379)</p>	
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

**Electrical connection**

**Output WA (FEW54)  
compact instrument version**

Relay contact circuit for load:  
The connected load is switched via potential-free relay contacts (change-over contact).

In the event of a level alarm or a power failure, the relay contacts break the connections between terminals 3 and 4 and terminals 6 and 7. The relays always switch simultaneously

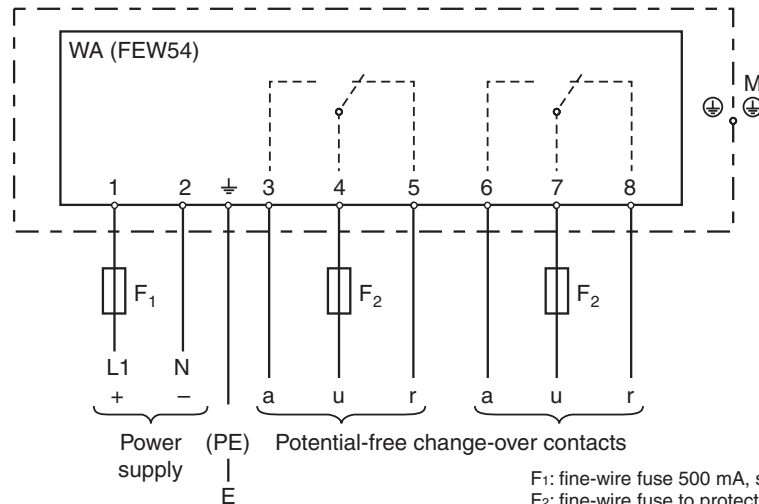
Protection against voltage peaks and short-circuits:

When connecting a device with high inductance, fit a spark barrier to protect the relay contact. A fine-wire fuse (load-dependent) can protect the relay contact in the event of a short-circuit.

**Output signal:**

When connecting a device with high inductance, a spark barrier must be fitted to protect the relay contact. A fine-wire fuse (load-dependent) protects the relay contact in the event of a short-circuit. Both relay contacts switch simultaneously.

If the probe is covered and the red LED flashes continuously, the next more sensitive measuring range has to be set. This ensures a safe switch point even if the conductivity of the medium varies slightly.



F1: fine-wire fuse 500 mA, semi-time lag  
F2: fine-wire fuse to protect the relay contact, load-dependent  
M: ground connection to protective earth (PE)  
E: grounding (functional earth optional)

Fail-safe mode	Switch point	Output signal	rd
Max. 		*1	*3
		*2	*4
Min. 		*1	*3
		*2	*4

\*1 = relay energised; \*2 relay de-energised; \*3 LED not lit; \*4 LED lit

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Electrical connection

Output E5 (FEW52)  
compact instrument version

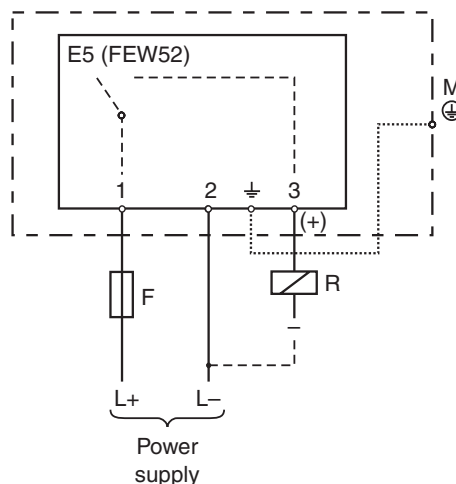
Transistor circuit for load:

The load connected to terminal 3 is switched by a transistor, contactless and therefore without bouncing.

In normal switching status, terminal 3 has a positive signal. The transistor is blocked in the event of a level alarm or a power failure.

Protection against voltage peaks:

When connecting a device with high inductance, always connect a voltage limiter.



F: fine-wire fuse 500 mA, semi-time lag  
M: ground connection to protective earth

Output signal:

Preferred in conjunction with programmable logic controllers (PLC). Positive signal at the switch output of the electronics (PNP). The output is blocked after the level limit is reached.

If the probe is covered and the red LED flashes continuously, the next more sensitive measuring range has to be set. This ensures a safe switch point even if the conductivity of the medium varies slightly.

Fail-safe mode	Switch point	Output signal	rd
Max. 		*1 L+ → I <sub>L</sub> → 3	*3 ●
		*2 1 → < 100 μA → 3	*4 ☀
Min. 		L+ → I <sub>L</sub> → 3	●
		+ → < 100 μA → 3	☀

\*1 = load current (connected); \*2 residual current (disconnected); \*3 LED not lit; \*4 LED lit

**Electrical connection**

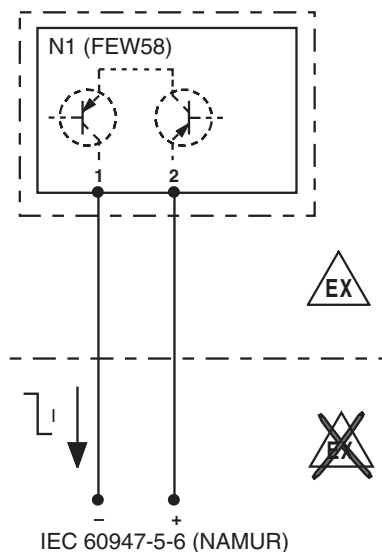
**Output N1 (FEW58)**  
**compact instrument version**

To be used with isolating amplifiers acc. to NAMUR (IEC 60947-5-6):

Output signal jump from high to low current on limit (H-L edge).

Signal transmission on a two-wire line: H-L edge 2.2 mA ... 6.5 mA / 0.4 mA ... 1.0 mA

When using a multiplex the cycle time must be set to a minimum of 2 s.



Output signal:

For connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6)

Fail-safe mode	Level	Output signal	LEDs	
			green	yellow
Max.		+ 2.2 mA ... 6.5 mA 2 → 1		
		+ 0.4 mA ... 1.0 mA 2 → 1		
Min.		+ 2.2 mA ... 6.5 mA 2 → 1		
		+ 0.4 mA ... 1.0 mA 2 → 1		

= lit      = flashes      = unlit

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

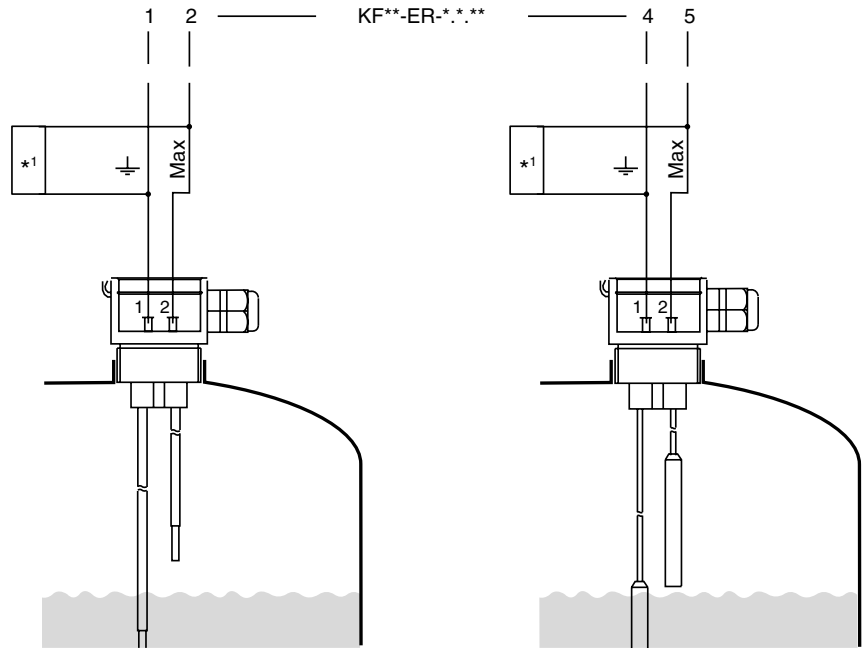
Hydrostatic pressure sensors



Electrical connection

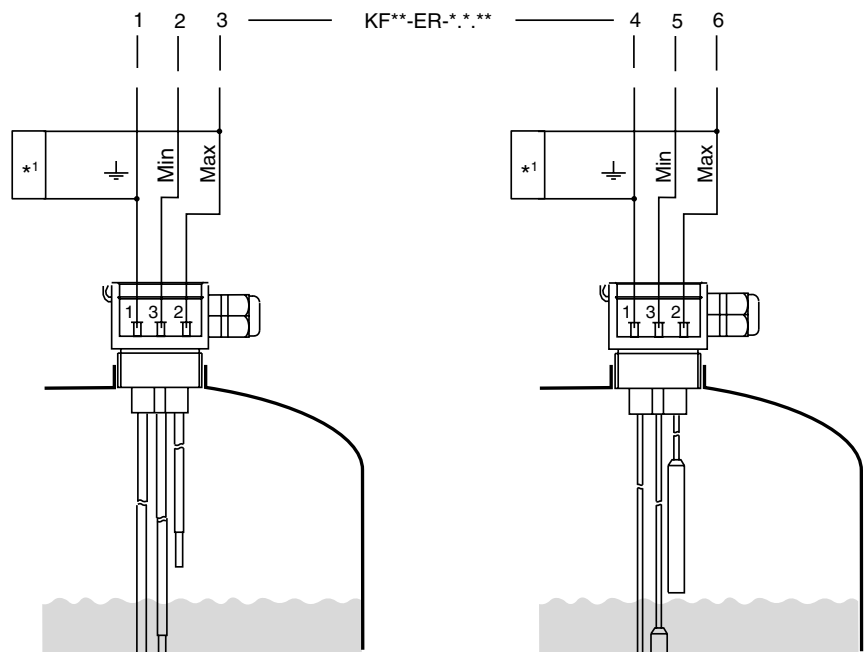
Output NA  
separate instrument version

Separate instrumentation for 2-rod  
or 2-rope probes with cable  
monitoring



\*1 Printed circuit board for cable monitoring  
The power supply and evaluation are provided by switching units.

Separate instrumentation for 3-rod  
or 3-rope probes with cable  
monitoring



\*1 Printed circuit board for cable monitoring  
The power supply and evaluation are provided by switching units.

Float switches

Vibration  
limit switches

Conductive  
limit switches

Capacitive  
limit switches

Limit value  
immersion probes

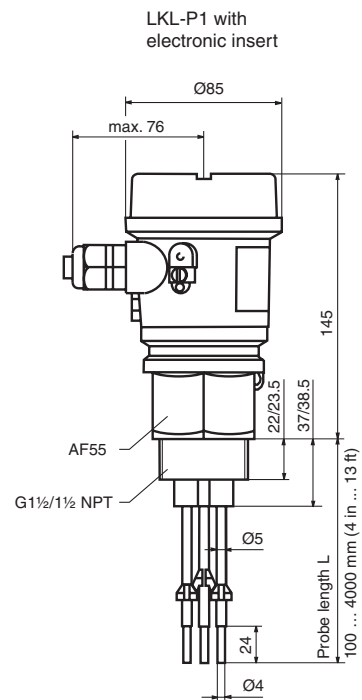
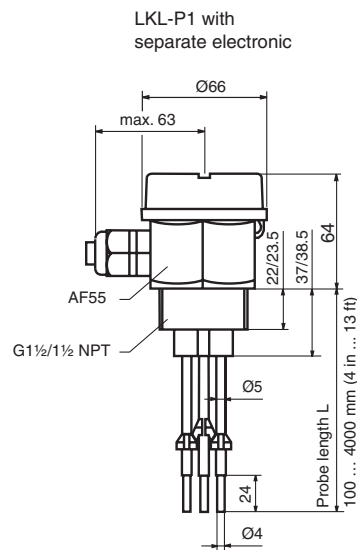
Continuous  
immersion probes

Hydrostatic  
pressure sensors

Dimensions

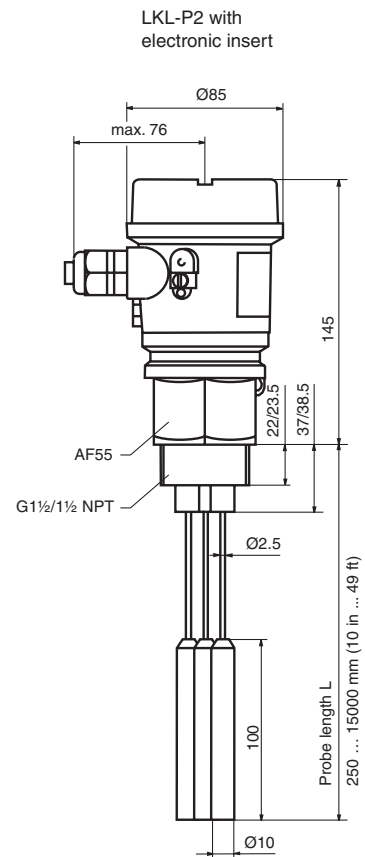
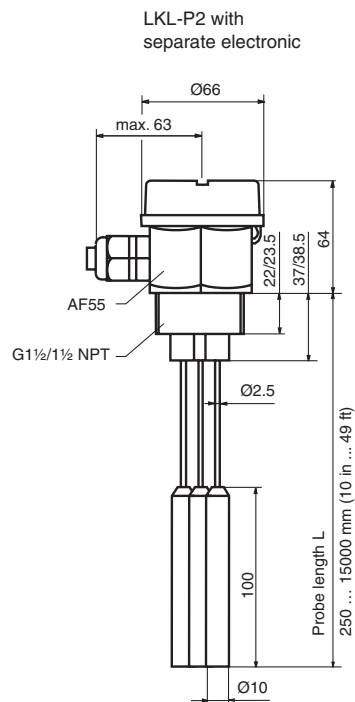
Version LKL-P1

Rod version



Version LKL-P2

Rope version

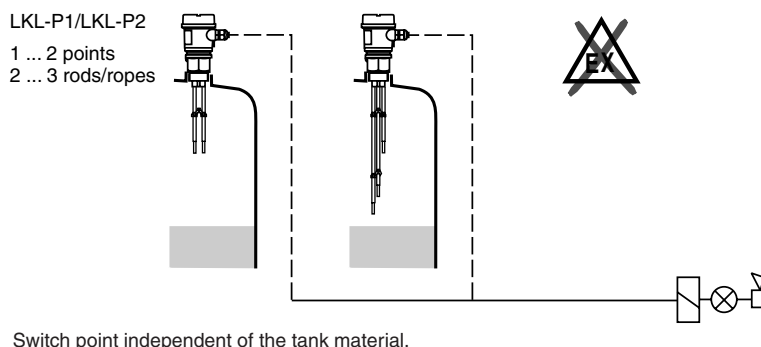


Measuring system

Probes with integrated electronic insert (compact instrument version)

The measuring system consists of:

- LKL-P1, LKL-P2 with two/three rods or ropes and an electronic insert
- Control units, switches or signal transmitters, e. g. process control systems PLC, relays, etc.

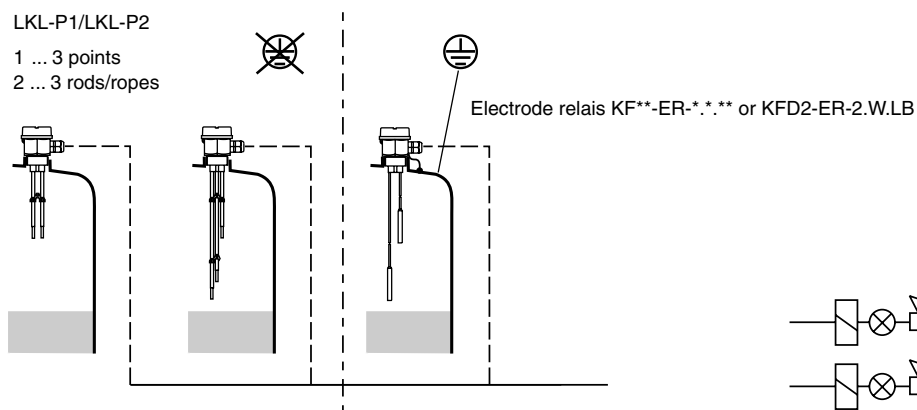


Switch point independent of the tank material.

Probes without integrated electronic insert (separate instrument version)

The measuring system consists of:

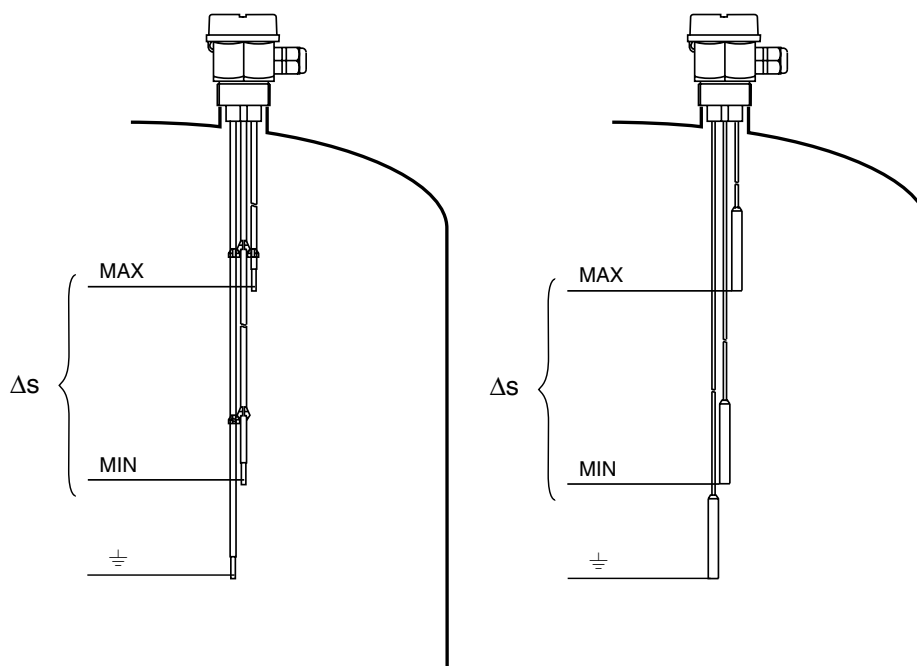
- LKL-P1, LKL-P2 with two/three rods or ropes
- Electrode relays KF\*\*-ER-\*.\*\*.\*\*\*
- Control units, switches or signal transmitters, e. g. process control systems PLC, relays, etc.



Switch points dependent of the tank material.

Example applications

Level limit detection (standard applications)



Two-point control ( $\Delta s$ ) e. g. pump control



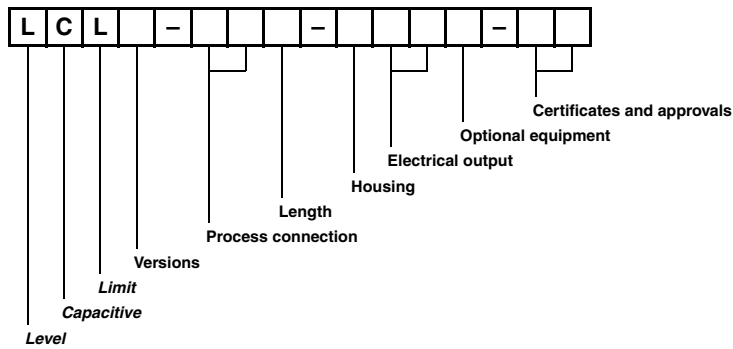


# Type code of capacitive limit switches

The figure below shows the used characters and numbers of the capacitive limit switches type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the capacitive limit switches.

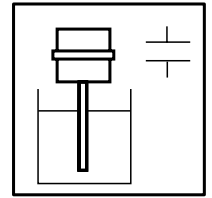
## Product group LCL\*



- Float switches
- Vibration limit switches
- Conductive limit switches
- Capacitive limit switches
- Limit value immersion probes
- Continuous immersion probes
- Hydrostatic pressure sensors



The metal container wall and measuring sensor form the two electrodes of a capacitor. The capacitance changes as the level increases due to the dielectric constant  $\epsilon_r$  of the medium.



Capacitive limit switch LCL1

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

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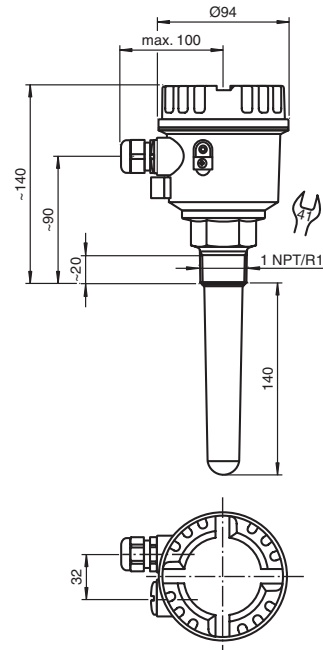
Type code of capacitive limit switches . . . . . 120  
 Capacitive limit switch LCL\* . . . . . 122

## Capacitive limit switch

## Dimensions



LCL1, compact version with rod probe



Additional dimensions see section dimensions.

Float switches

Vibration limit switches

Conductive limit switches

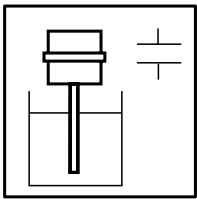
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

### LCL\*



### Features

- Complete unit consisting of the probe and electronic insert
- Integrated active build-up compensation: exact switch point, even when strong build-up
- Mechanically rugged: no wearing parts, long operating life, maintenance-free
- Rope probe of the LCL2 can be shortened for optimum matching to the measuring point
- ATEX approval for zone 20 (dust)

### Function

The capacitive limit switch is designed for limit detection of light bulk solids, e. g. grain products, flour, milk powder, animal feed, cement, chalk or plaster.

Versions:

- LCL1 with 140 mm (5.5 in) rod probe, for bulk solids and liquids
- LCL2 with rope probe up to 6 m (20 ft), for bulk solids
- Relay output (potential-free change-over contact) with AC or DC connection
- PNP output with 3-wire DC connection

### Electrical connection

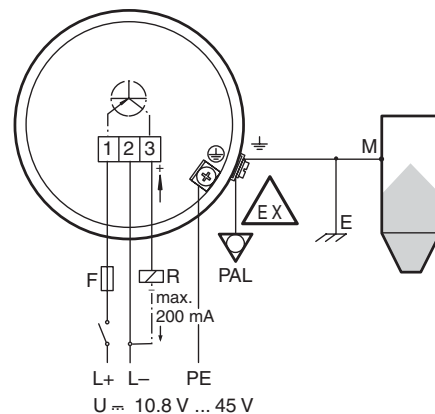
Connection type E5, 3-wire DC connection (example)

3-wire DC connection

F: Fine-wire fuse, 500 mA  
 R: connected load, e. g. PLC, DCS, relay  
 M: Connection to ground, silo or metal parts silo  
 E: Grounding

The LCL is protected against reverse polarity. In case of mixing up the connections, the green LED does not illuminate "ready to operate".

PE-connection and PAL-connection for LCL1 are unnecessary.



Other connection types see section electrical connection.



<b>Application</b>			Float switches
Function principle	limit detection maximum or minimum detection in silos with all types of solid granulates, even in dust explosion hazardous areas		
<b>Function and system design</b>			Vibration limit switches
Measuring principle	A metal plate at the end of the probe, within the insulation, and the surroundings (e. g. the silo walls) combine to form the two electrodes of a capacitor. If the probe is covered or free of material, then the capacitance changes and the LCL switches.		
<b>Input characteristics</b>			Conductive limit switches
Measured variable	limit level (limit value)		
Measurement range	LCL1: dielectric constant $\geq 1.6$ LCL2: dielectric constant $\geq 1.5$		
Medium	bulk solids, grain size max. 30 mm (1.2 in), density min. 200 g/l, dielectric constant $\geq 1.6$		Capacitive limit switches
<b>Output characteristics</b>			
Output signal	connection E5: switching PNP, $I_{max} = 200$ mA - overload and short circuit protection - residual voltage at transistor at $I_{max} < 2.9$ V connection WA: contact change-over, potential-free - $U_{max} = 253$ V - $I_{max} = 4$ A (AC) - $P_{max} = 1000$ VA, $\cos \Phi = 1$ , $P_{max} = 500$ VA, $\cos \Phi > 0.7$		
Signal on alarm	connection E5: $< 100$ $\mu$ A connection WA: relay de-energised		Limit value immersion probes
Fail safe mode	minimum/maximum quiescent current safety can be switched at electronic insert connection E5 with PNP output: maximum fail-safe mode: The switch output is blocked when the probe is covered or the power supply fails. minimum fail-safe mode: The switch output is blocked when the probe is free or the power supply fails. connection WA with relay output (potential-free change-over contact): maximum fail-safe mode: The relay is de-energised when the probe is covered or the power supply fails. minimum fail-safe mode: The relay is de-energised when the probe is free or the power supply fails.		
Switching time	LCL1: approx. 0.5 s when covering and uncovering LCL2: approx. 0.8 s when covering and uncovering		
Switch-on response	LCL1: correct switching after max. 1.5 s LCL2: correct switching after max. 2 s		Continuous immersion probes
<b>Auxiliary energy</b>			
Electrical connection	see section electrical connection		Hydrostatic pressure sensors
Supply voltage	electrical connection E5: 10.8 ... 45 V DC, short-term pulse on 55 V DC electrical connection WA: 20 ... 235 V AC, 50/60 Hz or 20 ... 55 V DC		
Connecting cable	terminal connection: lace max. 1.5 mm <sup>2</sup> in end splice, wire max. 2.5 mm <sup>2</sup>		
Current consumption	electrical connection E5: max. 30 mA, reverse-polarity-proof electrical connection WA: max. 130 mA		
<b>Performance characteristics</b>			
Reference operating conditions	vessel type: plastic vessel, ambient temperature: 23 °C (296 K), medium temperature: 23 °C (296 K) medium pressure $p_g$ : 0 bar, medium: dielectric constant = 2.6, conductivity: $< 1$ $\mu$ S sensitivity setting: C		
Hysteresis	LCL1: horizontal 4 mm (0.16 in), vertical 7 mm (0.28 in) LCL2: vertical 5 mm (0.2 in)		
Long-term drift	LCL1: horizontal 3 mm (0.12 in), vertical 6 mm (0.24 in) LCL2: vertical 6 mm (0.24 in)		
Influence of medium temperature	depending on the filling material		
<b>Operating conditions</b>			
Mounting conditions			
Installation position	LCL1: optional LCL2: vertically down Note the angle of the material mounds and the outlet funnel when determining the mounting point or probe length. The limit switch switches when the probe tip is covered by a few centimetres of material or when it is free material flow should not be directed at the probe.		
Mounting location	The capacitive limit switch can be installed in silos made of different materials (e. g. metal, plastic, concrete).		
Ambient conditions			
Ambient temperature	-40 ... 70 °C (233 ... 343 K) (-40 ... 60 °C (233 ... 333 K), dust-Ex version) see section temperature ranges		
Ambient temperature limits	-40 ... 80 °C (-40 ... 60 °C (233 ... 333 K), dust-Ex version) see section temperature ranges, grey background		
Storage temperature	-40 ... 80 °C (233 ... 353 K)		
Shock resistance	probe: 7J		
Overvoltage protection	overvoltage category III		

Date of issue 09/22/06 – Catalog Field Devices

## Capacitive limit switch LCL\*

## Technical data

Float switches	Process conditions	
	Process temperature	LCL1: -40 ... 120 °C (233 ... 393 K) (-40 ... 80 °C (233 ... 353 K), dust-Ex version) LCL2: -20 ... 70 °C (253 ... 343 K) see section temperature ranges
	Process temperature limits	LCL1: -40 ... 130 °C (233 ... 403 K) (-40 ... 80 °C (233 ... 353 K), dust-Ex version) LCL2: -40 ... 80 °C (233 ... 353 K) see section temperature ranges, grey background
Vibration limit switches	Medium pressure limits	LCL1: -1 ... 25 bar LCL2: -1 ... 6 bar
	<b>Mechanical specifications</b>	
	Protection degree	IP66
Conductive limit switches	<b>Mechanical construction</b>	
	Construction type	LCL1: compact version with rod probe LCL2: compact version with rope probe
	Dimensions	housing: LCL1 Ø94 x 140 mm (3.7 x 5.5 in), LCL2 Ø94 x 145 mm (3.7 x 5.7 in) process connections: see section dimensions probe: LCL1 length 140 mm (5.5 in), LCL2 length 500 ... 6000 mm (1.7 ... 20 ft)
	Mass	LCL1: 560 g LCL2: 1230 g (basic weight for 500 mm probe length)
Capacitive limit switches	Material	housing: PBT-FR with cover in PBT-FR or with transparent cover in PA12, seal of cover: EPDM cable gland: polyamide or brass, nickel-plated wetted parts: - rod probe: PPS polyphenylenesulphide (glass fibre content 40 %) - rope probe: armoured steel with HD-PE coating - other probe components: PPS polyphenylenesulphide (glass fibre content 40 %)
	Mechanical loading	LCL1: flexural strength 1400 N (at probe tip) LCL2: tensile strength max. 3000 N up to 40 °C (313 K), max. 2800 N at 80 °C (353 K)
	Switching point	sensor switch points depend on the mounting location, in relation to the reference operating conditions LCL1: horizontal centre of probe -5 mm (-0.2 in), vertical 40 mm (1.6 in) above tip of the probe LCL2: vertical 35 mm (1.4 in) above tip of the probe
	Process connection	- conical thread R1, R1½ to DIN 2999, part 1 - conical thread 1 NPT, 1½ NPT to ANSI B 1.20.1
Limit value immersion probes	<b>Indication and operation</b>	
	Display elements	green LED: standby indication red LED: switch status indication
	Operating elements	switch on electronic insert - switching between minimum and maximum fail-safe mode - sensitivity setting (depends on the dielectric constant and build-up). A sensitivity adjustment is normally not required.
Continuous immersion probes	<b>Certificates and approvals</b>	
	Ex approval	LCL1: DMT 01 ATEX E 122, LCL2: KEMA 01 ATEX 1149, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
	Type of protection	⊕ II 1/3D IP66 T97°C (DMT 01 ATEX E122) ⊕ II 1/3D [EEx ia] IIB T97°C (KEMA 01 ATEX 1149)
	Overspill protection	LCL1: Z-65.13-313 (overspill protection in acc. with WHG)
Hydrostatic pressure sensors	<b>General information</b>	
	Directive conformity	
	Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1
	Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector)
Hydrostatic immersion probes	Directive 94/9 EC (ATEX)	EN 50014, EN 50020, EN 50281-1-1
	Conformity	
	Electromagnetic compatibility	NE 21
	Protection degree	EN 60529
Hydrostatic pressure sensors	Climate class	EN 60068, part 2-38, fig. 2a
	Vibration resistance	EN 60068-2-64, 20 ... 2000 Hz, spectral rate of velocity 0.5, 100 min per axis
	Supplementary documentation	technical information TI-LCL operating instructions KA0930 (LCL1) operating instructions KA0940 optimising performance (LCL1) operating instructions KA0980 adapter for LCL1 (LCL-Z11, LCL-Z12) operating instructions KA0990 transparent cover (LCL-Z10) operating instructions KA1550 (LCL2) operating instructions KA1560 fail-safe mode (LCL2) operating instructions KA1570 rope shortening for LCL2 (LCL-Z14) safety information SI0920 (LCL2, KEMA 01 ATEX 1149) safety information SI0110 (LCL1, DMT 01 ATEX E 122) approval ZE232O overspill protection (Z-65.13-313)
	Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

Electrical connection

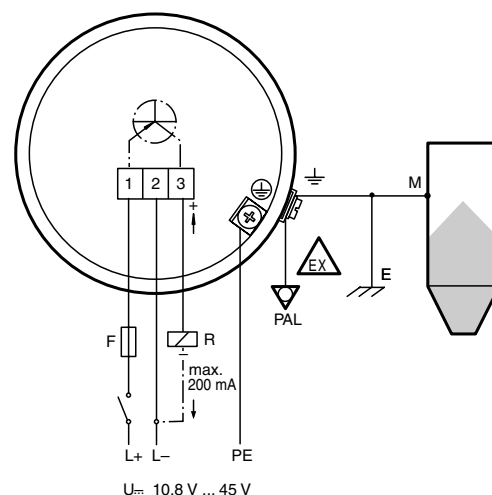
Electronic insert E5

3-wire DC connection

- F: fine-wire fuse, 500 mA
- R: connected load, e. g. PLC, DCS, relay
- M: connection to ground, silo or metal parts silo
- E: grounding

The LCL is protected against reverse polarity. In case of mixing up the connections, the green LED does not illuminate "ready to operate".

PE-connection and PAL-connection for LCL1 are unnecessary.

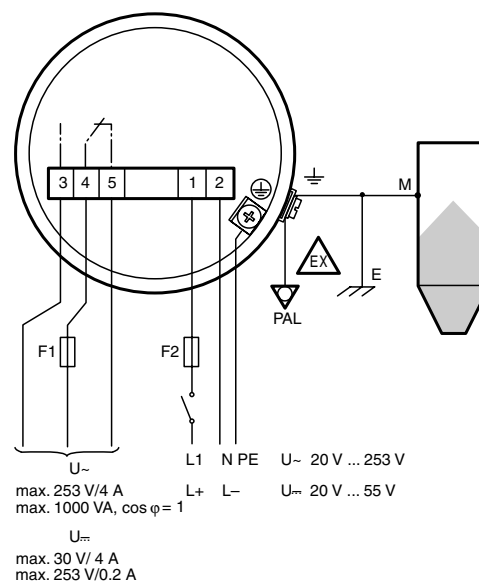


Electronic insert WA

AC/DC connection with relay output

- F1: fine-wire fuse for the protection of the relay contact, dependent on the connected load
- F2: fine-wire fuse, 500 mA
- M: connection to ground, silo or metal parts silo
- E: grounding

PE-connection and PAL-connection for LCL1 are unnecessary.



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

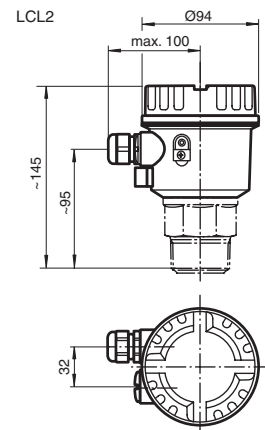
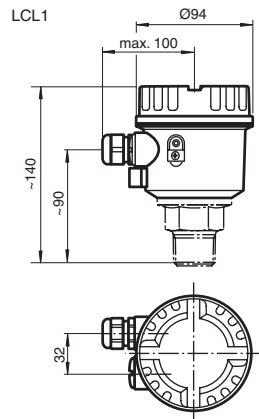
Limit value immersion probes

Continuous immersion probes

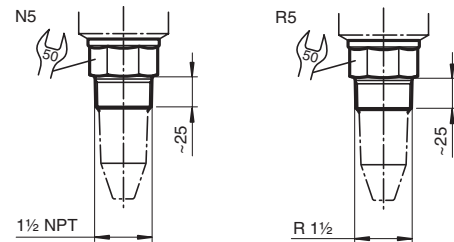
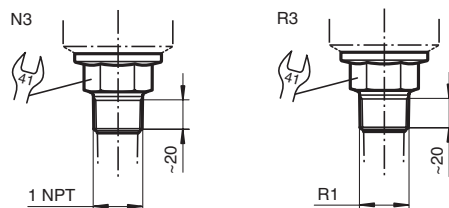
Hydrostatic pressure sensors

Dimensions

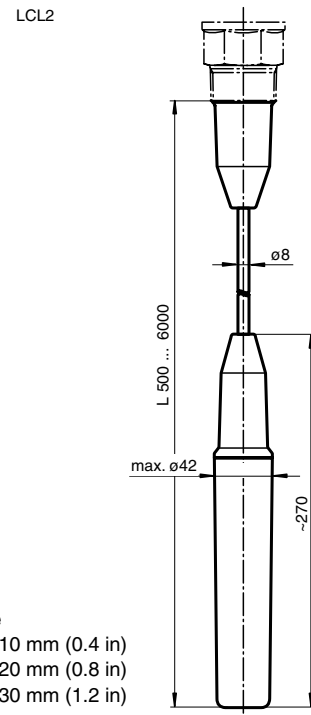
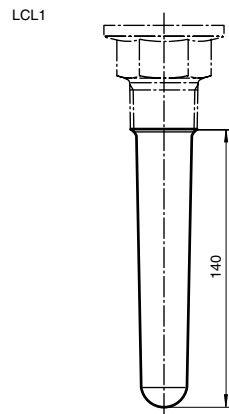
Housing



Process connections



Probe length



probe length tolerances LCL2:

probe length L  
up to 1000 mm (3 ft)  
up to 3000 mm (10 ft)  
up to 6000 mm (20 ft)

tolerance  
+0 mm, -10 mm (0.4 in)  
+0 mm, -20 mm (0.8 in)  
+0 mm, -30 mm (1.2 in)

Float switches

Vibration  
limit switches

Conductive  
limit switches

Capacitive  
limit switches

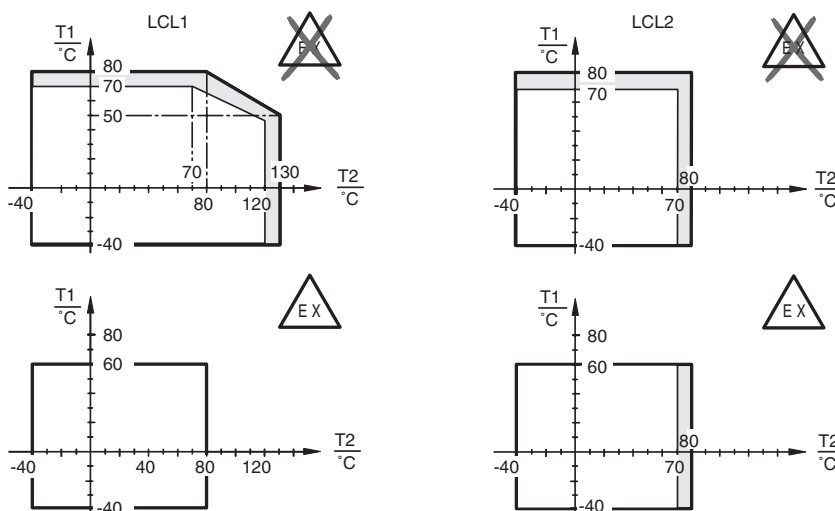
Limit value  
immersion probes

Continuous  
immersion probes

Hydrostatic  
pressure sensors

Temperature ranges

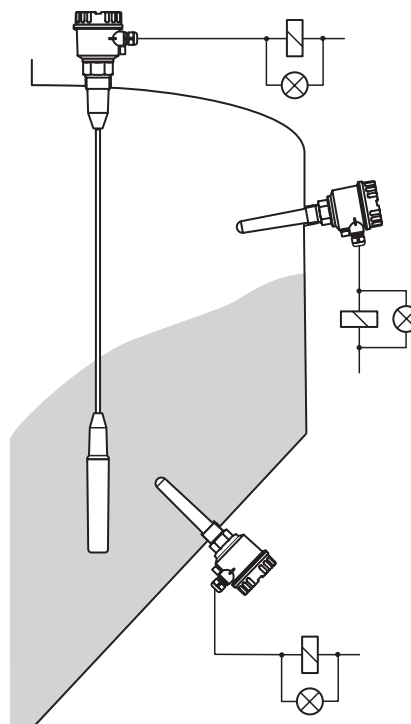
T1 = ambient temperature range  
T2 = process temperature range



Measuring system

The capacitive limit switch LCL is an electronic switch. The complete measuring system consists of:

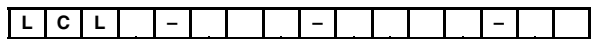
- the limit switch LCL1 or LCL2
- a voltage supply and
- the connected controllers, switching units, signal transmitters (e. g. lamps, horns, DCS, PLC, etc.)



Accessories

- LCL-Z10, transparent cover for polyester housing
- LCL-Z11, adapter for process connection R3 (R1½)
- LCL-Z12, adapter for process connection R3 (G1½)
- LCL-Z13, adapter for process connection N3 (1¼ NPT)
- LCL-Z14, rope shortening set for limit switch LCL2
- LCL-Z15, adapter for process connection N3 (1¼ NPT)

Type code/model number



Certificates

- NA** version for non-explosion hazardous areas
- EX** II 1/3D, zone 20
- WH** WHG overspill protection LCL1 only
- FS** FM, DIP, Cl. II, III, Gr. E - G, T5
- CS** CSA, DIP, Cl. II, Gr. E - G, Cl. III
- CG** CSA General Purpose

Optional equipment

- N** without optional equipment
- D** with transparent cover

Electrical output

- E5** PNP, 10.8 V DC ... 45 V DC
- WA** potential-free change-over contact, relay 20 V AC ... 253 V AC/20 V DC ... 55 V DC

Housing

- C** polyester housing F14, IP66, ½ NPT
- P** polyester housing F14, IP66, M20 x 1.5
- Q** polyester housing F14, IP66, G½

Length and material

- K** 140 mm (5.5 in), compact version, PPS (Polyphenylsulphide) LCL1 only
- 3** 1500 mm (5 ft), steel, HD-PE coated LCL2 only
- 4** 2500 mm (8 ft), steel, HD-PE coated LCL2 only
- 6** 6000 mm (20 ft), steel, HD-PE coated LCL2 only

Process connection

- R3** R1, DIN 2999
- N3** 1 NPT, ANSI B 1.20.1
- R5** R1½, DIN 2999
- N5** 1½ NPT, ANSI B 1.20.1

Versions

- 1** compact version
- 2** rod probe with extension

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

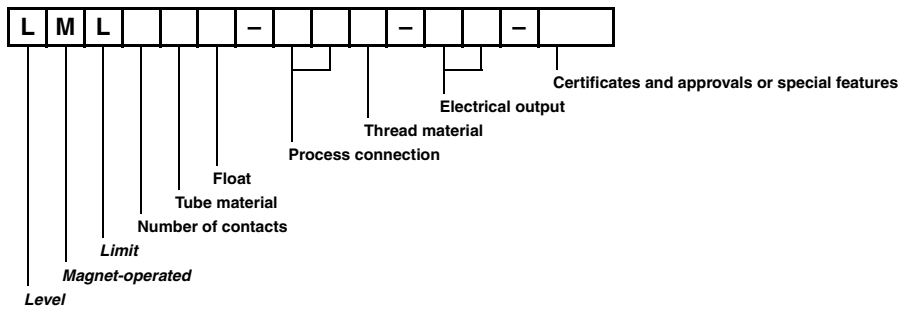
Hydrostatic pressure sensors



# Type code of limit value magnet-operated immersion probes

The figure below shows the used characters and numbers of the limit value magnet-operated immersion probes type code. Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the limit value magnet-operated immersion probes.

## Product group LML



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

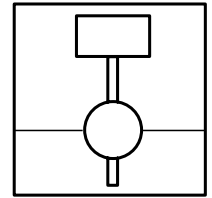




Limit value magnet-operated immersion probes are designed for use in clean fluids, such as water, solvents, oils and fuels. Various versions are available depending on the fluids.

- Plastic for aggressive acids and lyes.
- Stainless steel for water, oils etc.
- Stainless steel in Ex version for flammable fluids such as fuels, solvents, alcohols.

To give the reed contact a bi-stable switching characteristic, the magnet-operated immersion probe with 3 contacts has 2 floats and corresponding adjustment rings.



Limit value magnet-operated immersion probe LML3S2-G5S-DO-Ex

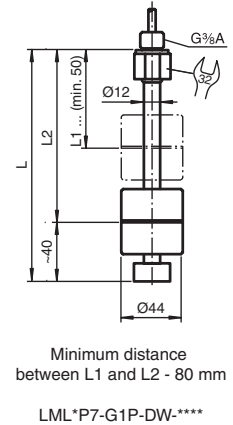
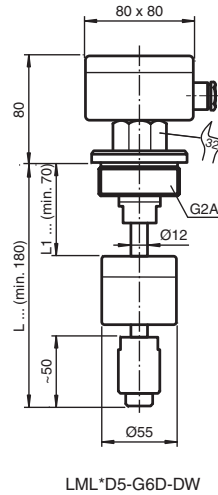
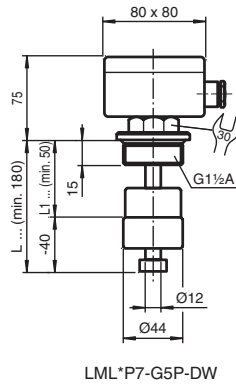
## Contents

	Page
Type code of limit value magnet-operated immersion probes . . . . .	130
Limit value magnet-operated immersion probe LML-Plastic . . . . .	132
Limit value magnet-operated immersion probe LML-Stainless steel . . . . .	134
Limit value magnet-operated immersion probe LML-Ex . . . . .	136

## Limit value immersion probe



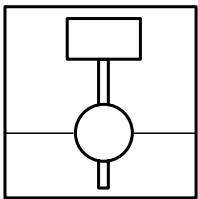
## Dimensions



Float switches

Vibration limit switches

## LML-P



Conductive limit switches



Capacitive limit switches

## Features

- Limit value detection in liquids
- Media contacting parts of plastic
- Mounting without de-mounting of the float (G5 and G6)

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

**⚠** When placing your order specify the location of the contacts.  
The pipe length L will be accordingly amended corresponding to the bottom of contact location.

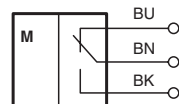
## Function

A ring magnet integrated in the float activates the contacts inside the probe tube via its magnetic field. If the probe strays outside the range of the mechanical contact, it reverts to the output status.

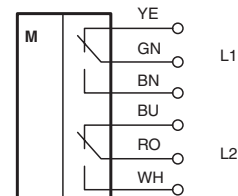
The skipping of switching points caused by abrupt level changes can be avoided using snap-on set collars on the probe tube. The same set collars are also used for latching contact operation.

## Electrical connection

1 contact



2 contacts



<b>Application</b>	
Description	ring magnet as switching element in the float, reed contact, change-over contact number of contacts: - version LML1: 1 contact - version LML2: 2 contacts
<b>Auxiliary energy</b>	
Electrical connection	This device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements.
Supply voltage	250 V AC/DC
Power consumption	40 VA
Current consumption	1 A
<b>Operating conditions</b>	
Ambient conditions	
Ambient temperature	-20 ... 70 °C (253 ... 343 K)
Process conditions	
Process temperature	version PP: -20 ... 80 °C (253 ... 353 K) version PVDF: -20 ... 100 °C (253 ... 373 K)
Process pressure (static pressure)	≤ 3 bar
Density	≥ 0.8 g/cm <sup>3</sup>
<b>Mechanical specifications</b>	
Protection degree	IP68
<b>Mechanical construction</b>	
Versions	float Ø44 mm (1.73 in), PP, thread G5, terminal box - LML1P7-G5P-DW, LML2P7-G5P-DW float Ø55 mm (2.16 in), PVDF, thread G6, terminal box - LML1D5-G6D-DW, LML2D5-G6D-DW float Ø44 mm (1.73 in), PP, thread G1, cable connector 1 m (3.3 ft) - LML1P7-G1P-DW-PVC1, LML2P7-G1P-DW-PVC1
Dimensions	float: - version PP: cylinder Ø44 mm (1.73 in), height 44 mm (1.73 in) - version PVDF: cylinder Ø55 mm (2.16 in), height 70 mm (2.75 in) guide tube: Ø12 mm (0.47 in), max. length 500 mm (1.65 ft) terminal box: 80 x 80 x 55 mm (3.15 x 3.15 x 2.16 in)
Material	float, guide tube, process connection: - version PP: PP (polypropylene) - version PVDF: PVDF (polyvinylidenfluoride) connection cable: PVC terminal box: polyester
Switching point	distance min. 80 mm
Process connection	cylindrical thread G3/8A, G1½A, G2A to DIN ISO 228/1
Electrical connection	version LML: terminal box, max. 9 terminals version LML-PVC1: connection cable 1 m (3.3 ft), 0.75 mm <sup>2</sup>
<b>General information</b>	
Conformity	
Protection degree	EN 60529
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

Float switches

Vibration limit switches

Conductive limit switches

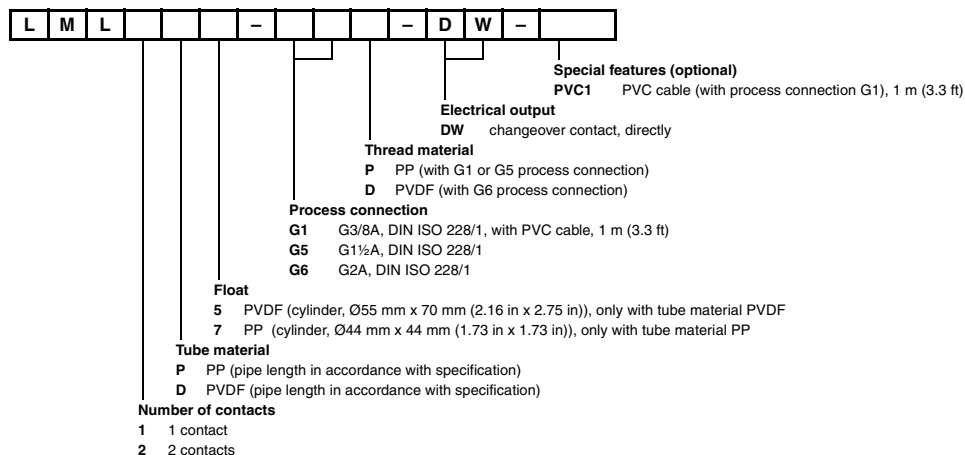
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

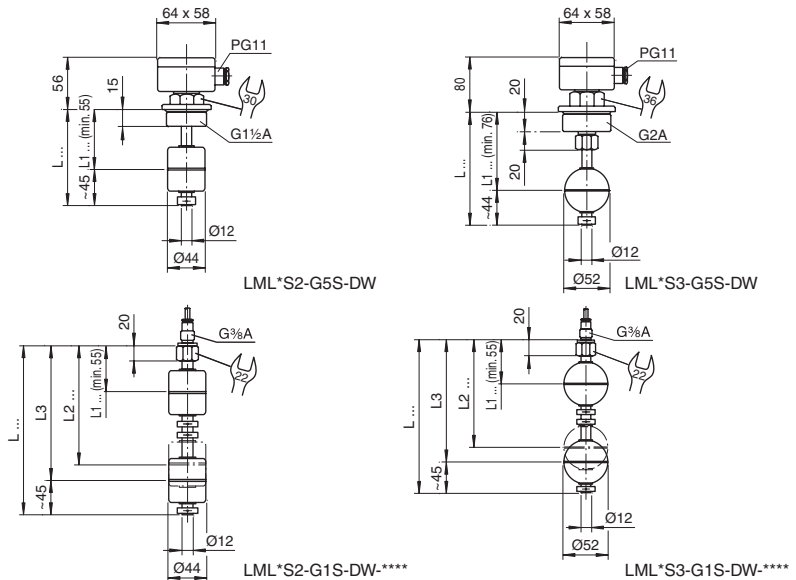
Type code/model number



## Limit value immersion probe



## Dimensions



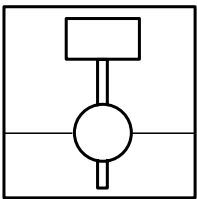
**⚠** When placing your order, please specify the location of the contacts. The pipe length L will be accordingly amended corresponding to the bottom of contact location. If you are using 3 contacts, please note: minimum distance between L1 and L2 - 100 mm and between L2 and L3 - 20 mm.

Float switches

Vibration limit switches

## LML-S

Conductive limit switches



Capacitive limit switches



Limit value immersion probes

## Features

- Limit value detection in liquids
- Media contacting parts of stainless steel
- Mounting without de-mounting of the float (G5 and G6)

Continuous immersion probes

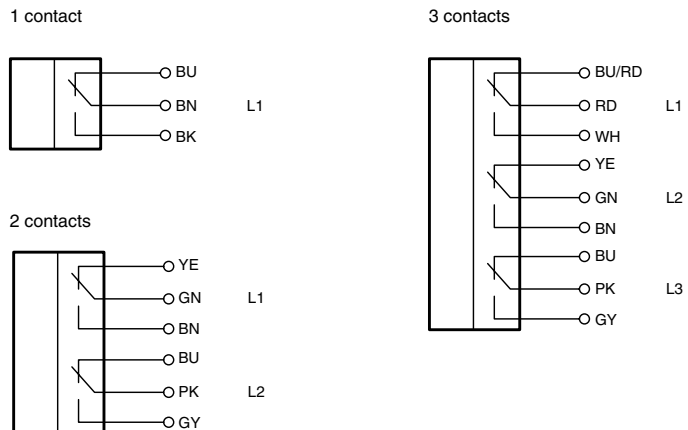
Hydrostatic pressure sensors

## Function

A ring magnet integrated in the float activates the contacts inside the probe tube via its magnetic field. If the probe strays outside the range of the mechanical contact, it reverts to the output status.

The skipping of switching points caused by abrupt level changes can be avoided using snap-on set collars on the probe tube. The same set collars are also used for latching contact operation.

## Electrical connection



<b>Application</b>	
Description	ring magnet as switching element in the float, reed contact, change-over contact number of contacts: - version LML1: 1 contact - version LML2: 2 contacts - version LML3: 3 contacts
<b>Auxiliary energy</b>	
Electrical connection	This device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements.
Supply voltage	250 V AC/DC
Power consumption	40 VA
Current consumption	1 A
<b>Operating conditions</b>	
Ambient conditions	
Ambient temperature	-20 ... 70 °C (253 ... 343 K)
Process conditions	
Process temperature	version LML: -20 ... 150 °C (253 ... 423 K) version LML-PVC1: -20 ... 90 °C (253 ... 363 K)
Process pressure (static pressure)	≤ 25 bar
Density	version S2: ≥ 0.8 g/cm <sup>3</sup> version S3: ≥ 0.7 g/cm <sup>3</sup>
<b>Mechanical specifications</b>	
Protection degree	IP68
<b>Mechanical construction</b>	
Versions	float Ø44 mm (1.73 in), thread G5, terminal box - LML1S2-G5S-DW, LML2S2-G5S-DW, LML3S2-G5S-DW float Ø52 mm (2.05 in), thread G6, terminal box - LML1S3-G6S-DW, LML2S3-G6S-DW, LML3S3-G6S-DW float Ø44 mm (1.73 in), thread G1, cable connector 1 m (3.3 ft) - LML1S2-G1S-DW-PVC1, LML2S2-G1S-DW-PVC1, LML3S2-G1S-DW-PVC1 float Ø52 mm (2.05 in), thread G1, cable connector 1 m (3.3 ft) - LML1S3-G1S-DW-PVC1, LML2S3-G1S-DW-PVC1, LML3S3-G1S-DW-PVC1
Dimensions	float: - version S2: cylinder Ø44 mm (1.73 in), height 52 mm (2.05 in) - version S3: ball Ø52 mm (2.05 in) guide tube: Ø12 mm (0.47 in), max. length 3 m (10 ft) terminal box: 64 x 58 x 55 mm (2.52 x 2.28 x 2.16 in)
Material	float, guide tube, process connection: stainless steel 1.4571/316Ti connection cable: PVC terminal box: aluminium die-casting
Switching point	L1 ... L2 ≥ 100 mm (3.93 in) L2 ... L3 ≥ 20 mm (0.78 in)
Process connection	cylindrical thread G3/8A, G1½A, G2A to DIN ISO 228/1
Electrical connection	version LML: terminal box, max. 9 terminals version LML-PVC1: connection cable 1 m (3.3 ft), 0.75 mm <sup>2</sup>
<b>General information</b>	
Conformity	
Protection degree	EN 60529
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

Float switches

Vibration limit switches

Conductive limit switches

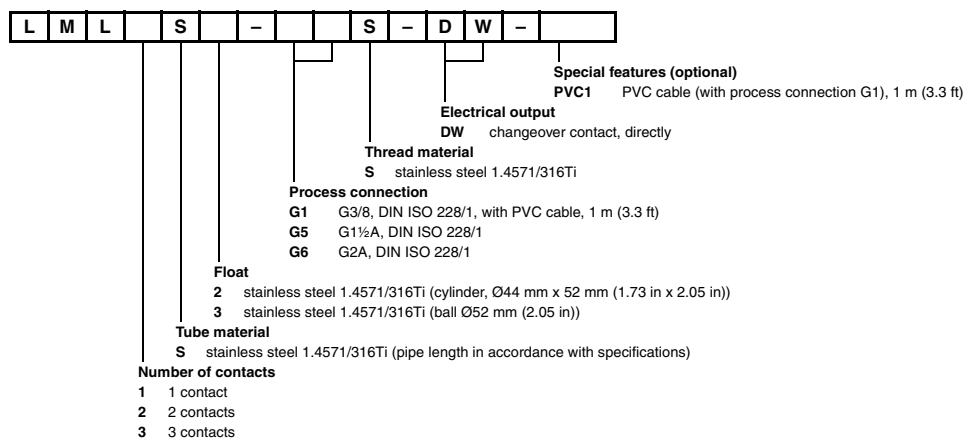
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

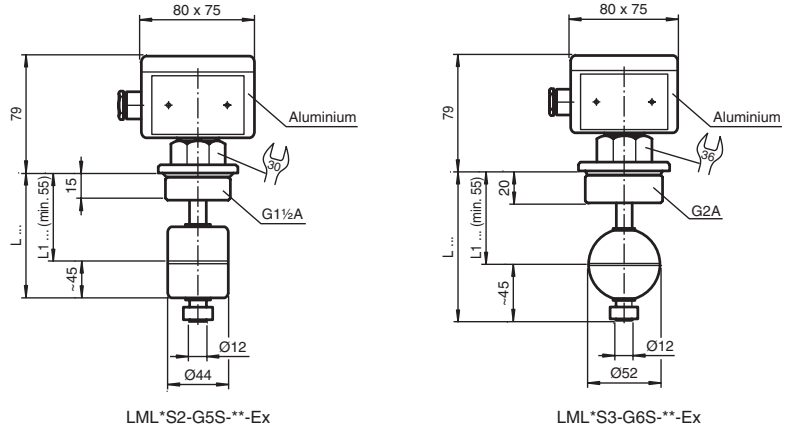
Type code/model number



## Limit value immersion probe

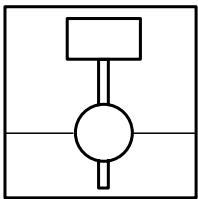


## Dimensions



**⚠** When placing your order, please specify the location of the contacts. The pipe length L will be accordingly amended corresponding to the bottom of contact location. If you are using 3 contacts, please note: minimum distance between L1 and L2 - 100 mm and between L2 and L3 - 20 mm.

## LML-Ex



## Function

A ring magnet integrated in the float activates the contacts inside the probe tube via its magnetic field. If the probe strays outside the range of the mechanical contact, it reverts to the output status.

The skipping of switching points caused by abrupt level changes can be avoided using snap-on set collars on the probe tube. The same set collars are also used for latching contact operation.

If used in hazardous areas, the requirements of the certificate of conformity should be observed.

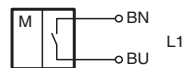
## Features

- Approved for hazardous areas zone 0
- Limit value detection in liquids
- Media contacting parts of stainless steel
- Mounting without de-mounting of the float

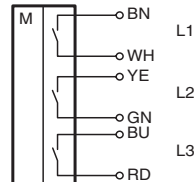
## Electrical connection

NO

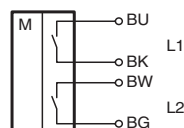
1 contact



3 contacts

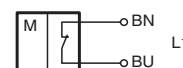


2 contacts

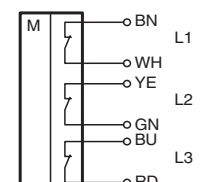


NC

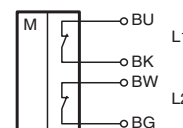
1 contact



3 contacts



2 contacts



<b>Application</b>		Float switches
Description	ring magnet as switching element in the float, reed contact number of contacts: - version LML1: 1 contact - version LML2: 2 contacts - version LML3: 3 contacts switching function: - version DO: with rising level: normally closed - version DS: with rising level: normally open	
<b>Function and system design</b>		Vibration limit switches
Equipment architecture	A measuring system consists of a magnet-operated immersion probe LML*S*-*S**-*Ex and a (up to 3) transformer isolated barrier with certified intrinsically safe circuit, for example KFD2-SR2-Ex1.W.	
<b>Operating conditions</b>		Conductive limit switches
Ambient conditions		
Ambient temperature	terminal box: -50 ... 60 °C (223 ... 333 K)	
Process conditions		
Process temperature	for T6: ≤ 80 °C (353 K) for T5: ≤ 95 °C (368 K) for T4: ≤ 130 °C (403 K) for T3: ≤ 180 °C (453 K)	
Process pressure (static pressure)	≤ 25 bar	Capacitive limit switches
Density	version S2: ≥ 0.8 g/cm <sup>3</sup> version S3: ≥ 0.7 g/cm <sup>3</sup>	
<b>Mechanical specifications</b>		Limit value immersion probes
Protection degree	IP68	
<b>Mechanical construction</b>		
Versions	float Ø44 mm (1.73 in), normally closed, thread G5 - LML1S2-G5S-DO-Ex, LML2S2-G5S-DO-Ex, LML3S2-G5S-DO-Ex float Ø44 mm (1.73 in), normally open, thread G5 - LML1S2-G5S-DS-Ex, LML2S2-G5S-DS-Ex, LML3S2-G5S-DS-Ex float Ø52 mm (2.05 in), normally closed, thread G6 - LML1S3-G6S-DO-Ex, LML2S3-G6S-DO-Ex, LML3S3-G6S-DO-Ex float Ø52 mm (2.05 in), normally open, thread G6 - LML1S3-G6S-DS-Ex, LML2S3-G6S-DS-Ex, LML3S3-G6S-DS-Ex	
Dimensions	float: - version S2: cylinder Ø44 mm (1.73 in), height 52 mm (2.05 in) - version S3: ball Ø52 mm (2.05 in) guide tube: Ø12 mm (0.47 in), max. length 3 m (10 ft) terminal box: 80 x 75 x 57 mm (3.15 x 2.95 x 2.24 in)	
Material	float, guide tube, process connection: stainless steel 1.4571/316Ti terminal box: aluminium die-casting	
Switching point	position of the contacts min. 45 mm (1.77 in) across the pipe end	
Process connection	cylindrical thread G1½A, G2A to DIN ISO 228/1	
Electrical connection	max. 6 terminals, max. 2.5 mm <sup>2</sup>	
<b>Certificates and approvals</b>		
Ex approval	KEMA 03 ATEX 1496 X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	
Type of protection	⊕ II 1/2G EEx ia IIC T3 ... T6	
<b>General information</b>		Continuous immersion probes
Directive conformity		
Directive 94/9 EC (ATEX)	EN 50014, EN 50020, EN 50284	
Conformity		
Protection degree	EN 60529	
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	

Type code/model number

L M L S - S - - E x

Float switches

Vibration limit switches


Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

**Certificates and approvals**  
Ex  II 1/2G EEx ia IIC T3 ... T6

**Electrical output**  
**DO** normally closed, directly  
**DS** normally open, directly

**Thread material**  
**S** stainless steel 1.4571/316Ti

**Process connection**  
**G5** G1½A, DIN ISO 228/1  
**G6** G2A, DIN ISO 228/1

**Float**  
**2** stainless steel 1.4571/316Ti (cylinder, Ø44 mm x 52 mm (1.73 in x 2.05 in))  
**3** stainless steel 1.4571/316Ti (ball Ø52 mm (2.05 in))

**Tube material**  
**S** stainless steel 1.4571/316Ti (pipe length in accordance with specifications)

**Number of contacts**  
**1** 1 contact  
**2** 2 contacts  
**3** 3 contacts



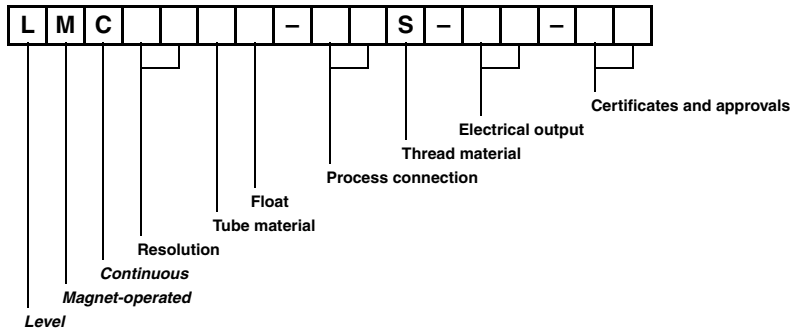
Hydrostatic pressure sensors
Continuous immersion probes
Limit value immersion probes
Capacitive limit switches
Conductive limit switches
Vibration limit switches
Float switches

# Type code of continuous magnet-operated immersion probes

The figure below shows the used characters and numbers of the continuous magnet-operated immersion probes type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the continuous magnet-operated immersion probes.

## Product group LMC



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

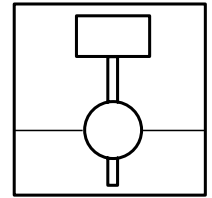
Continuous immersion probes

Hydrostatic pressure sensors



The permanent magnet located inside the float actuates the reed switches inside the guide tube.  
 When actuated, these reed switches switch between a series of resistors in the guide tube, thus changing the total resistance quasi-continuously, depending on the resolution.

In addition to the 3-wire potentiometer circuit, 4 mA ... 20 mA and 2-wire PLM signals are also available as electrical outputs.



Continuous magnet-operated immersion probe LMC8S3-G6S-I-Ex

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

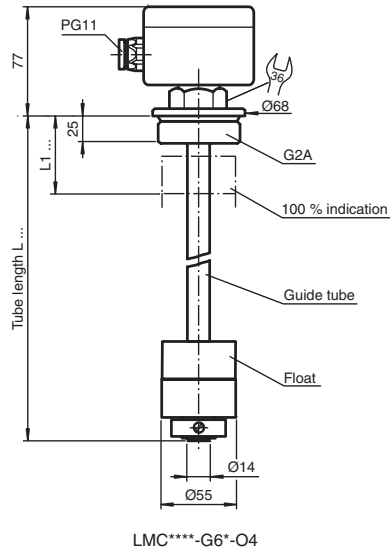
Hydrostatic pressure sensors

## Contents

	<b>Page</b>
Type code of continuous magnet-operated immersion probes .....	140
Continuous magnet-operated immersion probe, LMC-Plastic .....	142
Continuous magnet-operated immersion probe, LMC-Stainless steel .....	144
Continuous magnet-operated immersion probe, LMC-Ex .....	146

## Continuous immersion probe

## Dimensions



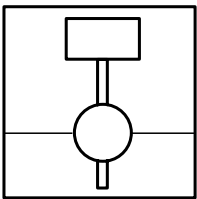
When placing your order, please specify the tube length (L).

Float switches

Vibration limit switches

### LMC-P

Conductive limit switches



Capacitive limit switches



### Features

- Resolution 10 mm (0.4 in)
- Sensor for continuous level measurement in liquids
- Media contacting parts of plastic
- Mounting without de-mounting of the float

Limit value immersion probes

Continuous immersion probes

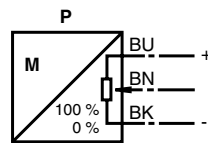
Hydrostatic pressure sensors

## Function

A ring magnet integrated in the float activates a reed contact resistance chain inside the probe tube via its magnetic field.

If the level changes, the resistance chain changes its total resistance by closing the contact at the float level. The resistance is converted into a standardised output signal by the isolated transformer. This output signal is proportional to the level of the measured medium.

## Electrical connection



<b>Application</b>	
Description	sensor for continuous level measurement in liquids
<b>Function and system design</b>	
Equipment architecture	A measuring system consists of a magnet-operated immersion probe LMC***-G6*-O4 and an isolated transformer KFD2-PT2-Ex1.
<b>Auxiliary energy</b>	
Electrical connection	3-wire-potentiometer connection approx. 40 kΩ for connection to an isolated transformer
<b>Performance characteristics</b>	
Accuracy	resolution: 10 mm (0.4 in)
<b>Operating conditions</b>	
Ambient conditions	
Ambient temperature	-20 ... 70 °C (253 ... 343 K)
Process conditions	
Process temperature	version PP: -20 ... 80 °C (253 ... 353 K) version PVDF: -20 ... 100 °C (253 ... 373 K)
Process pressure (static pressure)	≤ 3 bar at 20 °C (293 K)
Density	≥ 0.8 g/cm <sup>3</sup>
<b>Mechanical specifications</b>	
Protection degree	IP68
<b>Mechanical construction</b>	
Versions	LMC10P6-G6P-O4 LMC10D5-G6D-O4
Dimensions	float: - version PP: cylinder Ø55 mm (2.16 in), height 54 mm (2.12 in) - version PVDF: cylinder Ø55 mm (2.16 in), height 70 mm (2.76 in) guide tube: Ø14 mm (0.47 in), max. length 3 m (10 ft) terminal box: 80 x 80 x 55 mm (3.15 x 3.15 x 2.17 in)
Material	float, guide tube, process connection: - version PP: PP (polypropylene) - version PVDF: PVDF (polyvinylidenfluoride) terminal box: polyester
Process connection	cylindrical thread G2A to DIN ISO 228/1
Electrical connection	3 terminals, max. 2.5 mm <sup>2</sup>
<b>General information</b>	
Conformity	
Protection degree	EN 60529
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

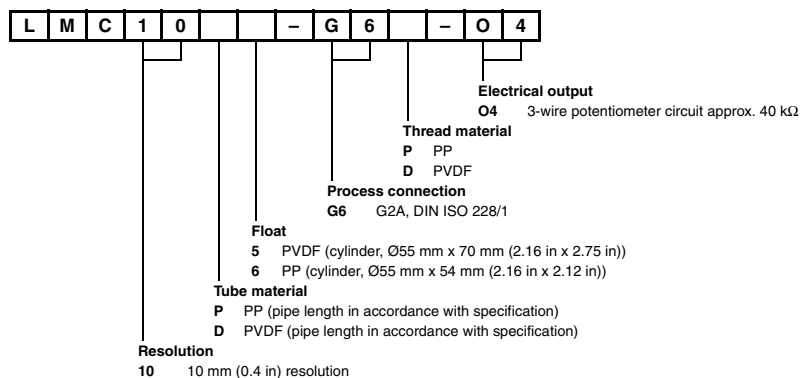
Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Type code/model number



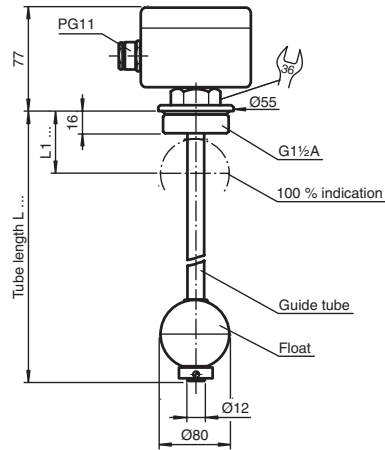
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

## Continuous immersion probe

## Dimensions



LMC\*\*S\*-G2S\*\*

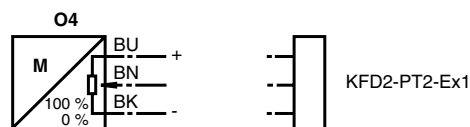
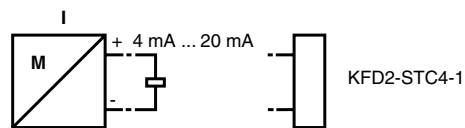
When placing your order, please specify the tube length (L).

## Function

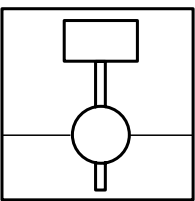
A ring magnet integrated in the float activates a reed contact resistance chain inside the probe tube via its magnetic field.

If the level changes, the resistance chain changes its total resistance by closing the contact at the float level. The resistance is converted into a standardised output signal by the isolated transformer. This output signal is proportional to the level of the measured medium.

## Electrical connection



## LMC-S



## Features

- Resolution 5 mm (0.2 in) or 15 mm (0.6 in)
- Sensor for continuous level measurement in liquids
- Media contacting parts of stainless steel
- Mounting without de-mounting of the float

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

<b>Application</b>	
Description	sensor for continuous level measurement in liquids
<b>Function and system design</b>	
Equipment architecture	A measuring system consists of a magnet-operated immersion probe LMC****-***-I with built-in converter and a transmitter power supply KFD2-STC4-Ex.1 or of a magnet-operated immersion probe LMC****-***-O4 and an isolated transformer KFD2-PT2-Ex1.
<b>Auxiliary energy</b>	
Electrical connection	version I: 2-wire connection 4 ... 20 mA version O4: 3-wire-potentiometer connection approx. 40 kΩ for connection to an isolated transformer
<b>Performance characteristics</b>	
Accuracy	resolution: - version LMC5: 5 mm (0.2 in) - version LMC15: 15 mm (0.6 in)
<b>Operating conditions</b>	
Ambient conditions	
Ambient temperature	-20 ... 70 °C (253 ... 343 K)
Process conditions	
Process temperature	-20 ... 120 °C (253 ... 393 K)
Process pressure (static pressure)	≤ 16 bar
Density	version S1: ≥ 0.6 g/cm <sup>3</sup> version S2: ≥ 0.8 g/cm <sup>3</sup> version S3: ≥ 0.7 g/cm <sup>3</sup>
<b>Mechanical specifications</b>	
Protection degree	IP68
<b>Mechanical construction</b>	
Dimensions	float: - version S1: ball Ø80 mm (3.15 in) - version S2: cylinder Ø44 mm (1.73 in), height 52 mm (2.05 in) - version S3: ball Ø52 mm (2.05 in) guide tube: - version LMC5: Ø14 mm (0.55 in), max. length 3 m (10 ft) - version LMC15: Ø12 mm (0.47 in), max. length 3 m (10 ft) terminal box: 64 x 58 x 55 mm (2.52 x 2.28 x 2.16 in)
Material	float, guide tube, process connection: stainless steel 1.4571/316Ti terminal box: aluminium die-casting
Process connection	cylindrical thread G½A, G1½A to DIN ISO 228/1
Electrical connection	version I: 2 terminals, max. 2.5 mm <sup>2</sup> version O4: 3 terminals, max. 2.5 mm <sup>2</sup>
<b>General information</b>	
Conformity	
Protection degree	EN 60529
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

Float switches

Vibration limit switches

Conductive limit switches

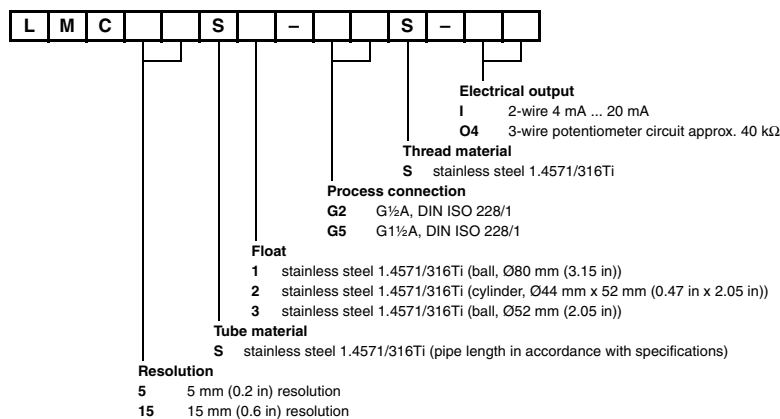
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

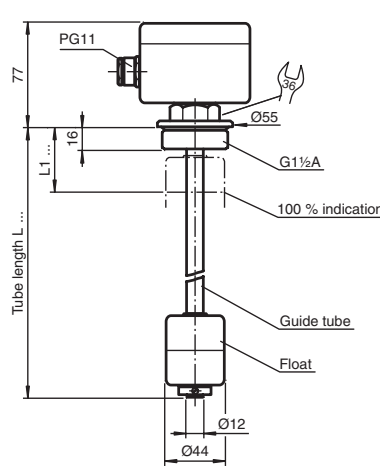
Hydrostatic pressure sensors

Type code/model number

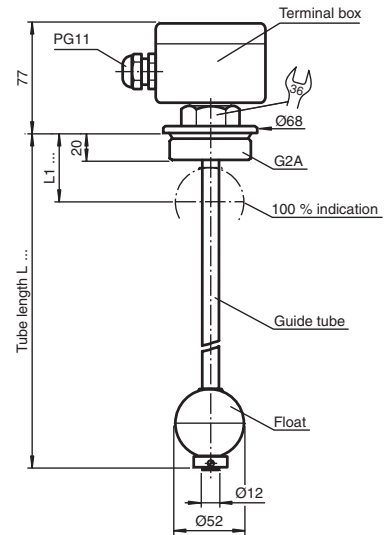


# Continuous immersion probe

# Dimensions



LMC\*\*S\*-G5S-\*\*-Ex

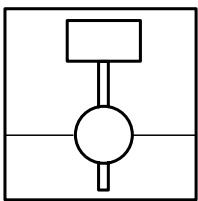


LMC\*\*S\*-G6S-\*\*-Ex

**⚠** When placing your order, specify the length (L) of the guide tube.

Float switches  
Vibration limit switches  
Conductive limit switches  
Capacitive limit switches  
Limit value immersion probes  
Continuous immersion probes  
Hydrostatic pressure sensors

## LMC-Ex



## Features

- Resolution 5 mm (0.2 in) or 15 mm (0.6 in)
- Approved for hazardous areas zone 0
- Sensor for continuous level measurement in liquids
- Media contacting parts of stainless steel
- Mounting without de-mounting of the float

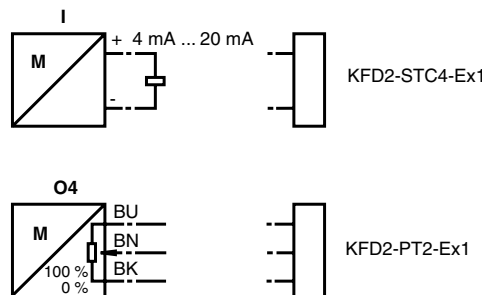
## Function

A ring magnet integrated in the float activates a reed contact resistance chain inside the probe tube via its magnetic field.

If the level changes, the resistance chain changes its total resistance by closing the contact at the float level. The resistance is converted into a standardised output signal for interface units by the electronic transformer in the terminal housing or an isolated transformer. This output signal is proportional to the level of the measured medium.

If used in hazardous areas, the requirements of the certificate of conformity, approval or test certificate should be observed.

## Electrical connection





<b>Application</b>	
Description	sensor for continuous level measurement in liquids
<b>Function and system design</b>	
Equipment architecture	A measuring system consists of a magnet-operated immersion probe LMC****-I-Ex with built-in converter and a transmitter power supply KFD2-STC4-Ex.1 or of a magnet-operated immersion probe LMC****-O4-Ex and an isolated transformer KFD2-PT2-Ex1.
<b>Auxiliary energy</b>	
Electrical connection	version I: 2-wire connection 4 ... 20 mA version O4: 3-wire-potentiometer connection approx. 40 kΩ
<b>Performance characteristics</b>	
Accuracy	resolution: - version LMC5: 5 mm (0.2 in) - version LMC15: 15 mm (0.6 in)
<b>Operating conditions</b>	
Ambient conditions	
Ambient temperature	terminal box: -50 ... 60 °C (223 ... 333 K)
Process conditions	
Process temperature	for T6: ≤ 50 °C (323 K) for T5: ≤ 65 °C (338 K) for T4: ≤ 100 °C (373 K)
Process pressure (static pressure)	≤ 16 bar
Density	version S1: ≥ 0.6 g/cm <sup>3</sup> version S2: ≥ 0.8 g/cm <sup>3</sup> version S3: ≥ 0.7 g/cm <sup>3</sup>
<b>Mechanical specifications</b>	
Protection degree	IP68
<b>Mechanical construction</b>	
Dimensions	float: - version S1: ball Ø80 mm (3.15 in) - version S2: cylinder Ø44 mm (1.73 in), height 52 mm (2.05 in) - version S3: ball Ø52 mm (2.05 in) guide tube: - version LMC5: Ø14 mm (0.55 in), max. length 3 m (10 ft) - version LMC15: Ø12 mm (0.47 in), max. length 3 m (10 ft) terminal box: 80 x 75 x 57 mm (3.15 x 2.95 x 2.24 in)
Material	float, guide tube, process connection: stainless steel 1.4571/316Ti terminal box: aluminium die-casting
Process connection	cylindrical thread G1½A, G2A to DIN ISO 228/1
Electrical connection	version I: 2 terminals, max. 2.5 mm <sup>2</sup> version O4: 3 terminals, max. 2.5 mm <sup>2</sup>
<b>Certificates and approvals</b>	
Ex approval	KEMA 03 ATEX 1497 X, for additional certificates see www.pepperl-fuchs.com
Type of protection	⊕ II 1/2G EEx ia IIC T4 ... T6
<b>General information</b>	
Directive conformity	
Directive 94/9 EC (ATEX)	EN 50014, EN 50020, EN 50284
Conformity	
Protection degree	EN 60529
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see www.pepperl-fuchs.com.

Float switches

Vibration limit switches

Conductive limit switches

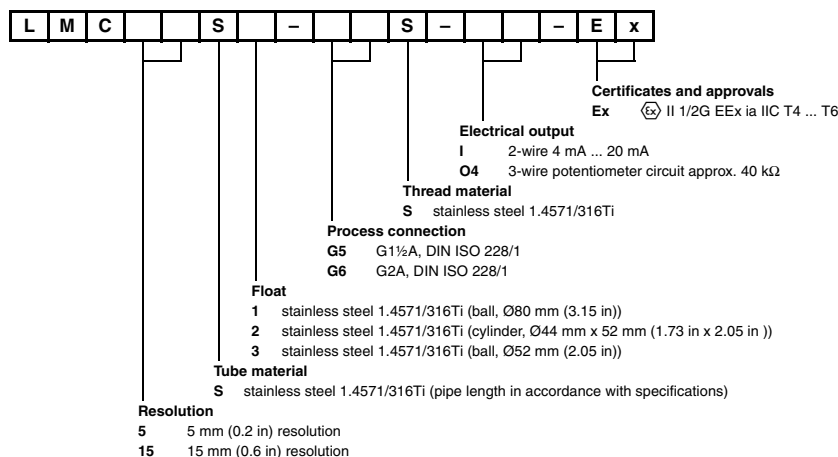
Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Type code/model number



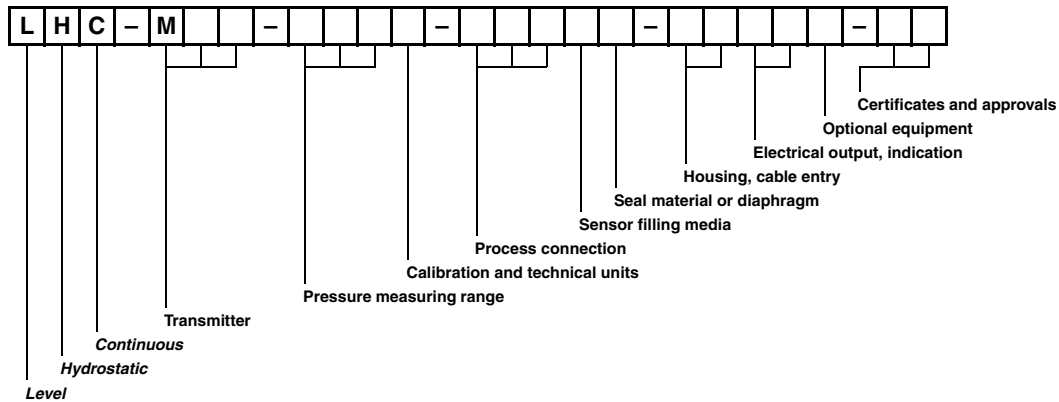
Date of issue 09/22/06 – Catalog Field Devices

# Type code of hydrostatic pressure sensors

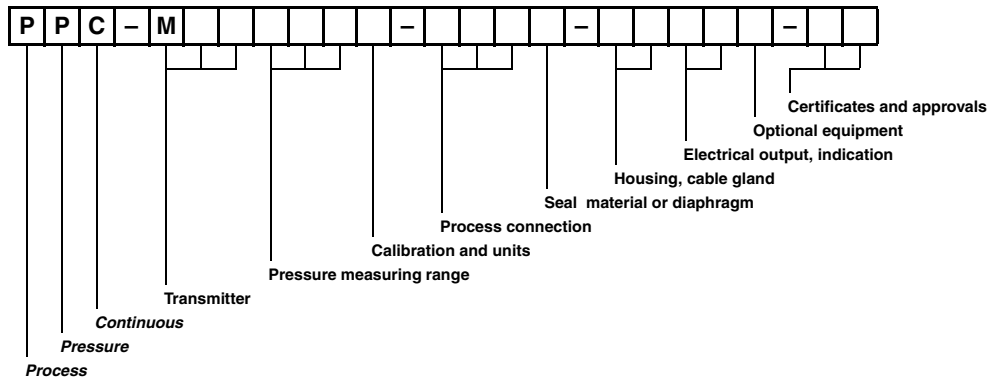
The figure below shows the used characters and numbers of the hydrostatic pressure sensors type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the hydrostatic pressure sensors/process pressure transmitters.

## Product group Barcon LHC-M\*\* (hydrostatic pressure sensors)



## Product group Barcon PPC-M\*\* (process pressure transmitter)



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors



The fill level  $h$  of a liquid can be determined by the hydrostatic pressure  $p$  if the density  $\rho$  is known:

$$h = \frac{p}{\rho \cdot g}, \text{ where } g = 9.81 \text{ m/s}^2.$$

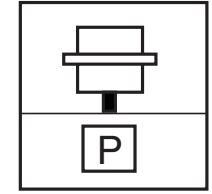
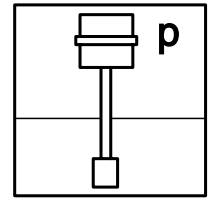
The piezoresistive measuring cell is coupled to a measuring liquid via a stainless steel isolation membrane and a diaphragm seal.

The output signal of the measuring cell is converted via a signal conditioner into a:

- 4 mA ... 20 mA analogue signal or
- pulse-length-modulated current pulse (PLM)

The pressure sensors are available in the following versions:

- externally mounted type,
- rod type,
- suspended type.



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Hydrostatic pressure sensor Barcon LHC-M20

## Contents

	Page
Type code of hydrostatic pressure sensors .....	148
Hydrostatic pressure sensor Barcon LHC-M** .....	150
Process pressure transmitter Barcon PPC-M** .....	164

# Hydrostatic pressure sensor

# Dimensions

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

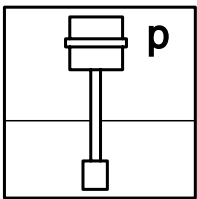
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors



## LHC-M\*\*

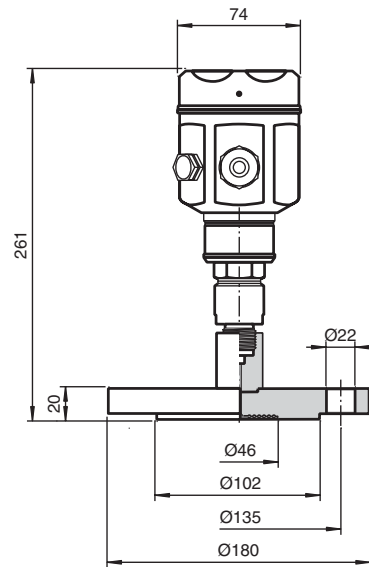
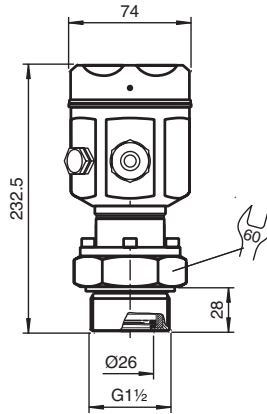


## Features

- Hydrostatic pressure sensor for gases, vapours, liquids and dusts
- High accuracy of measurement
- Housing fulfils the special hygienic requirements of the foodstuff and pharmaceutical industries
- Large number of process connections to choose from: universal usage
- Dry capacitive ceramic sensor up to 40 bar
- Piezoresistive metal sensor for measuring ranges up to 400 bar
- Wide variety of electronic modules: the right connection for every process control system
- Process connections acc. to EHEDG
- Up to SIL2 acc. to IEC 61508

LHC-M20 with process connection G51

LHC-M40 with process connection F76



Additional dimensions see section dimensions.

## Function

The hydrostatic pressure sensor LHC-M\*\* measure absolute and relative pressure in gases, vapours, liquids and dusts.

The sensor can be used in all process engineering areas. The modular design of the BARCON pressure transmitter enables it to be used in all industrial environments. All process connections are available as hygienic connections, threaded connections, separators and flanges.

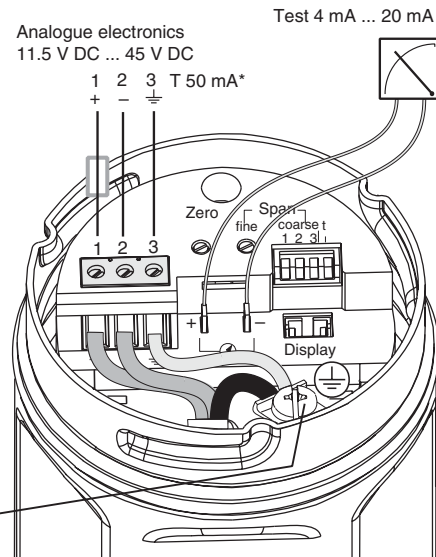
A characteristic material or a special connection method depending on the process have to be used, for example,

- mounting without dead volume for special hygienic applications
- flush mounted installation for solidified or crystallising media
- special material for aggressive media

## Electrical connection

Connection I2/IB analogue electronic (example)

\* For analogue electronics versions with certificate ATEX  $\text{Ex}$  II 1/3D (non Ex supply voltage) the device must always be protected by a 50 mA (slow-blow) fuse.



More connection types see section electrical connection.

internal ground terminal

<b>Application</b>		Float switches
Function principle	<p>sensor for absolute and relative pressure measuring in gases, vapours, liquids and dusts</p> <p>ceramic sensor (LHC-M20) The pressure causes a slight deflection of the ceramic diaphragm of the sensor. The change in the capacitance is proportional to the pressure and is measured by the electrodes of the ceramic sensor, volume of chamber: approx. 2 mm<sup>3</sup>.</p> <p>metal sensor (LHC-M40) The process pressure acting on the metallic separating diaphragm of the sensor is transmitted via a fill liquid to a resistance bridge. The change in the output voltage of the bridge is proportional to the pressure and is then measured, volume of chamber: smaller than 1 mm<sup>3</sup>.</p>	
<b>Function and system design</b>		Vibration limit switches
Equipment architecture	<ul style="list-style-type: none"> <li>- with analogue electronics I2/IB 4 ... 20 mA and auxiliary energy, e. g. via transmitter power pack, calibration across potentiometer for lower range value and upper range value, optionally analogue display for measuring value indication</li> <li>- with HART electronics IA/IH with current output 4 ... 20 mA, HART communication signal and auxiliary energy, e. g. via transmitter power pack, calibration via two keys on the device, handheld terminal or PC with operating program, optional digital display for measured variable indication</li> <li>- with PROFIBUS PA electronics PA/PB with digital communication signal PROFIBUS PA and segment coupler for connection to PLC or PC with operating program, optional digital display for measured variable indication</li> </ul>	
<b>Input characteristics</b>		Conductive limit switches
Measured variable	absolute or relative pressure	
Measurement range	see section measuring range	
<b>Output characteristics</b>		Capacitive limit switches
Output signal	<p>analogue electronics I2/IB: 4 ... 20 mA</p> <p>HART electronics IA/IH: 4 ... 20 mA with HART protocol</p> <p>PROFIBUS PA electronics PA/PB: digital communication signal</p>	
Signal range	analogue electronics I2/IB and HART electronics IA/IH: 3.8 ... 20.5 mA	
Signal on alarm	<p>analogue electronics I2/IB: signal overrun &gt; 20.5 mA or signal underrun &lt; 3.6 mA</p> <p>HART electronics IA/IH: optional 3.6 mA, 22 mA or last current value will be hold</p> <p>PROFIBUS PA electronics PA/PB: can be set in the analog input block, options: last good value (factory setting), FSAFE value, wrong value</p>	Limit value immersion probes
Response time	PROFIBUS PA: cyclic: approx. 10 ms per request, acyclic: < 50 ms	
Output damping	<p>analogue electronics I2/IB:</p> <ul style="list-style-type: none"> <li>- directly on device using DIP switches, switch position "On" = 2 s, "Off" = 0 s</li> </ul> <p>HART electronics IA/IH:</p> <ul style="list-style-type: none"> <li>- directly on device using DIP switches, switch position "On" = set value, "Off" = 0 s</li> <li>- with handheld terminal or using operating program: 0 ... 40 s</li> <li>- factory setting: 2 s</li> </ul> <p>PROFIBUS PA electronics PA/PB:</p> <ul style="list-style-type: none"> <li>- with handheld terminal or using operating program: 0 ... 40 s</li> <li>- factory setting: 0.0 s</li> </ul>	
Load	<p>analogue electronics I2/IB and HART electronics IA/IH:</p> <ul style="list-style-type: none"> <li>- max. 1522 Ω at power supply 11.5 ... 45 V DC for devices for non-hazardous areas, 1/3D, EEx d, EEx nA, FM XP, FM DIP, CSA XP and CSA dust-Ex</li> <li>- max. 840 Ω at power supply 11.5 ... 30 V DC for EEx ia, 1D, 1/2D, 1/2G, FM IS and CSA IS</li> </ul>	Continuous immersion probes
Resolution	<p>analogue electronics I2/IB:</p> <ul style="list-style-type: none"> <li>- current output &lt; 1 μA, onsite display 30 segments</li> </ul> <p>HART electronics IA/IH:</p> <ul style="list-style-type: none"> <li>- current output typ. 1 μA, max. 6 μA, onsite display 28 segments, display value with resolution 1 per thousand</li> </ul> <p>PROFIBUS PA electronics PA/PB:</p> <ul style="list-style-type: none"> <li>- onsite display 28 segments, display value with resolution 1 per thousand</li> </ul>	
Read cycles	<p>HART commands: on average 3 to 4 per s</p> <p>PROFIBUS PA: cyclic: on average 100/s, acyclic: on average 20/s</p>	
Cycle time	<p>PROFIBUS PA:</p> <ul style="list-style-type: none"> <li>- The cycle time in a bus segment in cyclic data communication depends on the number of devices, the segment coupler used and the internal PLC cycle time.</li> <li>- The minimum cycle time is approx. 20 ms per device.</li> </ul>	Hydrostatic pressure sensors
<b>Auxiliary energy</b>		
Electrical connection	<p>connection cable:</p> <ul style="list-style-type: none"> <li>- shielded, twisted pair two-wire cable</li> <li>- terminals for wire cross-sections 0.14 ... 2.5 mm<sup>2</sup></li> <li>- cable outer diameter: 5 ... 9 mm (0.2 ... 0.35 in)</li> </ul> <p>M12 plug Harting plug (Han7D)</p>	
Supply voltage	<p>analogue electronics I2/IB: 11.5 ... 45 V DC</p> <p>HART electronics IA/IH: 11.5 ... 45 V DC</p> <p>PROFIBUS PA electronics PA/PB: 9 ... 32 V DC</p> <p>Version for hazardous area see safety information.</p>	
Current consumption	PROFIBUS PA electronics PA/PB: 11 mA ± 1 mA	

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## Hydrostatic pressure sensor LHC-M\*\*

## Technical data

Float switches	Residual ripple	analogue electronics I2/IB and HART electronics IA/IH: - without influence on 4 ... 20 mA signal up to $\pm 5\%$ residual ripple within the permitted voltage range (acc. to HART hardware specification HCF_SPEC-54 (DIN IEC 60381-1)) - with HART handheld terminal: max. ripple (measured at 500 $\Omega$ ) 47 ... 125 Hz: $U_{pp} = 200$ mV, max. noise (measured at 500 $\Omega$ ) 500 ... 10 kHz: $U_{eff} = 2.2$ mV
	<b>Performance characteristics</b>	
Vibration limit switches	Reference operating conditions	- as per IEC 60770 - ambient temperature range $T_{amb} = \text{constant}$ , in range: 21 ... 33 °C (294 ... 307 K) - humidity = constant, in range: 20 ... 80 % relative humidity - ambient pressure $p_{amb} = \text{constant}$ , in range: 860 ... 1060 mbar - position of measuring cell = constant, in range: horizontal $\pm 1^\circ$ - input of Low Sensor Calibration and High Sensor Calibration for lower range value and upper range value - membrane material ceramic (aluminium oxide ceramic) or stainless steel 1.4435/316L - filling oil: mineral oil - supply voltage: 24 V DC $\pm 3$ V DC - load for HART: 250 $\Omega$ - Turn down: 1:1 to 10:1
	Maximum measured error	$\pm 0.2\%$ of set span, optional $\pm 0.1\%$ non-linearity of set span
	Long-term drift	with reference to the span $\pm 0.1\%$ per year, $\pm 0.25\%$ per 3 years
Conductive limit switches	Influence of vibrations	without any effects up to 5 ... 15 Hz: $\pm 4$ mm (0.16 in) 15 ... 150 Hz: 2 g 150 ... 2000 Hz: 1 g
	Rise time	analogue electronics I2/IB: 60 ms HART electronics IA/IH: 220 ms PROFIBUS PA electronics PA/PB: 220 ms
	Warming-up time	analogue electronics I2/IB: 200 ms HART electronics IA/IH: 1 s PROFIBUS PA electronics PA/PB: 1 s
	Adjustment time	analogue electronics I2/IB: 180 ms HART electronics IA/IH: 600 ms PROFIBUS PA electronics PA/PB: 600 ms
Capacitive limit switches	<b>Operating conditions</b>	
	Mounting conditions	
	Installation position	any position, zero point shift due to position can be corrected see technical information
	Ambient conditions	
Limit value immersion probes	Ambient temperature	-40 ... 85 °C (233 ... 358 K) onsite display with analogue electronics I2/IB: -30 ... 80 °C (243 ... 353 K) onsite display with HART electronics IA/IH or PROFIBUS PA electronics PA/PB: -25 ... 70 °C (248 ... 343 K) Lower temperatures minimise the display speed.
	Storage temperature	-40 ... 100 °C (233 ... 373 K) onsite display: -40 ... 80 °C (233 ... 353 K)
	Climate class	4K4H, air temperature: -20 ... 55 °C (253 ... 328 K), relative humidity: 4 ... 100 %, condensation possible
	Electromagnetic compatibility	- maximum deviation: $< 0.5\%$ of span - maximum deviation for 100 mbar sensors: $< 1.25\%$ of span - In the event of surge influence (EN 61000-4-5), deviations greater than the specified measured error can occur briefly. - All measurements were performed with a Turn down = 1:1.
Continuous immersion probes	Process conditions	
	Medium temperature	LHC-M20: -40 ... 125 °C (233 ... 398 K), up to 150 °C (423 K) for 1 hour LHC-M40: up to 350 °C (623 K)
	Medium pressure limits	see section measuring range
	Overload resistance	LHC-M20: up to 40 times the nominal pressure (max. 60 bar) LHC-M40: up to 4 times the nominal pressure (max. 600 bar)
Hydrostatic pressure sensors	<b>Mechanical specifications</b>	
	Protection degree	IP66 for devices with cable gland, cable entry IP68 for devices with assembled cable or M12 plug
	<b>Mechanical construction</b>	
Hydrostatic pressure sensors	Construction type	LHC-M20: version with ceramic sensor LHC-M40: version with metal sensor
	Dimensions	housings: stainless steel housing 74 x 97 mm (2.9 x 3.8 in), aluminium housing 74 x 117 mm (2.9 x 4.6 in), length depends on process connection and cover process connections see section dimensions
Hydrostatic pressure sensors	Mass	LHC-M20: stainless steel 1.8 kg, aluminium 2.1 kg LHC-M40: 1.5 ... 16.8 kg, depends from process connection









Material	<p>housing:</p> <ul style="list-style-type: none"> <li>- stainless steel 1.4404/316L or cast aluminium housing with protective polyester based powder coating</li> </ul> <p>nameplates:</p> <ul style="list-style-type: none"> <li>- stainless steel housing: engraved on housing with laser</li> <li>- aluminium housing: 1.4301/304</li> </ul> <p>process connections (in contact with the medium):</p> <ul style="list-style-type: none"> <li>- stainless steel 1.4435/316L</li> </ul> <p>process diaphragm (in contact with the medium):</p> <ul style="list-style-type: none"> <li>- LHC-M20: Al<sub>2</sub>O<sub>3</sub> aluminium oxide ceramic (FDA listed), 96 %, extremely clean 99.9 %</li> <li>- LHC-M40: stainless steel 1.4435/316L, Hastelloy C276, tantalum, PTFE folio 0.09 mm on 1.4435/316L (not for vacuum), PTFE folio 0.25 mm on 1.4435/316L (not for vacuum)</li> </ul> <p>seals:</p> <ul style="list-style-type: none"> <li>- FKM Viton (also in versions grease-free and for oxygen use), NBR, FFKM Kalrez, FFKM Chemraz, EPDM</li> </ul> <p>O-ring for cover sealing:</p> <ul style="list-style-type: none"> <li>- stainless steel housing: silicone</li> <li>- aluminium housing: NBR</li> </ul> <p>mounting accessories for pipe and wall mounting:</p> <ul style="list-style-type: none"> <li>- stainless steel 1.4301/304</li> </ul> <p>measurement cell:</p> <ul style="list-style-type: none"> <li>- LHC-M20: without oil filling, dry sensor,</li> <li>- LHC-M40: oil filling: optional silicone oil, vegetable oil, glycerine, high temperature oil, fluorolube grease-free for oxygen use</li> </ul> <p>capillary:</p> <ul style="list-style-type: none"> <li>- 1.4571/316Ti</li> </ul> <p>protective hose for capillary:</p> <ul style="list-style-type: none"> <li>- 1.4301/304</li> </ul>	Float switches
Surface quality	standard surface roughness of parts in contact with the medium $R_a \leq 0.8 \mu\text{m}$ , reduces surface roughness on request.	Vibration limit switches
Process connection	<ul style="list-style-type: none"> <li>- cylindrical thread G1A, G1½A, G2A to DIN ISO 228/1 with flat seal to DIN 7603</li> <li>- conical thread 1 NPT, 1½ NPT, 2 NPT to ANSI B 1.20.1</li> <li>- Triclamp 2" to ISO 2852</li> <li>- threaded pipe joint DN40 and DN50 to DIN 1185</li> <li>- aseptic connection DN40 and DN50 to DIN 11864-1 form A for pipe DIN 11850</li> <li>- SMS connection 1½" and 2"</li> <li>- Varivent® D = 68 mm (2.7 in) for pipes DN40 ... DN125 to factory standard Tuchenhagen</li> <li>- DRD flange, D = 65 mm (2.6 in)</li> <li>- APV inline PN40</li> <li>- flanges to EN 1092-1 from DN25, to ANSI B 16.5 from 1", optional with Halar or PVDF coating or tubus for additional information see type code</li> </ul>	Conductive limit switches
Electrical connection	<p>housing *1: cable gland M20 x 1.5</p> <p>housing *2: cable gland ½ NPT</p> <p>housing *3: cable gland G½</p> <p>housing *4: Harting plug (Han7D)</p> <p>housing *5: M12 x 1 plug</p> <p>housing *6: assembled cable with pressure compensation, 5 m (197 in)</p>	Capacitive limit switches
<b>Indication and operation</b>		
Display elements	<p>analogue electronics I2/IB:</p> <ul style="list-style-type: none"> <li>- The analogue display gives the current pressure value related to the measuring range in the form of a bar graph (30 segments).</li> </ul> <p>HART electronics IA/IH:</p> <ul style="list-style-type: none"> <li>- The digital display gives the pressure in the form of a four-digit number. The appropriate current value from 4 ... 20 mA is shown as a bar graph (28 segments) underneath.</li> </ul> <p>PROFIBUS PA electronics PA/PB:</p> <ul style="list-style-type: none"> <li>- The digital display gives the pressure in the form of a four-digit number. The digital display shows the current pressure value in the form of a bar graph (28 segments).</li> </ul> <p>display resolution:</p> <ul style="list-style-type: none"> <li>- analogue display: bar graph, 1 segment equals 3.33 % of the set span</li> <li>- digital display: 0.1 %, bar graph, 1 segment equals 3.57 % of the set span</li> </ul>	Limit value immersion probes
Operating elements	<p>analogue electronics I2/IB:</p> <ul style="list-style-type: none"> <li>- operation directly at the measuring point with one potentiometer each for lower range value and upper range value</li> <li>- a three-step range switch</li> <li>- as well as an on/off switch for damping</li> </ul> <p>HART electronics IA/IH with HART protocol: operation mode at the measuring point via</p> <ul style="list-style-type: none"> <li>- two push buttons for lower range value and upper range value as well as an on/off switch for damping</li> <li>- the handheld terminal at any point along the 4 ... 20 mA line</li> <li>- a PC with operating program</li> </ul> <p>PROFIBUS PA electronics PA/PB: operation mode via</p> <ul style="list-style-type: none"> <li>- two keys for lower-range value and upper-range value</li> <li>- using a PC with operating program</li> </ul>	Continuous immersion probes
<b>Certificates and approvals</b>		
Ex approval	DMT 02 ATEX E 137, DMT 02 ATEX E 138, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	Hydrostatic pressure sensors

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## Hydrostatic pressure sensor LHC-M\*\*

## Technical data

Float switches	Type of protection	 II 1G EEx ia IIC T4/T6 (DMT 02 ATEX E 137)  II 1/2G EEx ia IIC T4/T6 (DMT 02 ATEX E 137)  II 2G EEx ia IIC T4/T6 (DMT 02 ATEX E 137)  II 1/2D IP66 T50/82°C (DMT 02 ATEX E 137)  II 1/2D IP66 T85°C (DMT 02 ATEX E 137)  II 1/3D IP66 T110°C (DMT 02 ATEX E 138)  II 3 G EEx nA II T5
	SIL classification	up to SIL2 acc. to IEC 61508
Vibration limit switches	<b>General information</b>	
	Directive conformity	
	Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1
	Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector)
	Directive 94/9 EC (ATEX)	EN 50014, EN 50020, EN 50021, EN 50284, EN 50281-1-1
	Conformity	
	Electromagnetic compatibility	NE 21
Conductive limit switches	Protection degree	EN 60529
	Climate class	EN 60721-3-4
	Supplementary documentation	technical information LHC-M operating instructions BA200O (version with analogue electronics) operating instructions BA201O (version with HART electronics) operating instructions BA222O (version with PROFIBUS PA electronics) operating instructions KA224O M12 plug with new PIN assignment operating instructions KA525O welded nozzle (LHC-Z21, LHC-Z23, LHC-Z24, LHC-Z25) safety information SI038O (DMT 02 ATEX E 137) safety information SI039O (DMT 02 ATEX E 137) safety information SI040O (DMT 02 ATEX E 138) safety information SI052O (  II3 G EEx nA II T5) safety information SI096O (DMT 02 ATEX E 137), PROFIBUS PA version safety information SI097O (DMT 02 ATEX E 137), PROFIBUS PA version safety information SI098O (DMT 02 ATEX E 138), PROFIBUS PA version FM control drawing ZD039O (version with HART electronics) CSA control drawing ZD040O (version with HART electronics) CSA control drawing ZD051O (version with PROFIBUS PA electronics) FM control drawing ZD052O (version with PROFIBUS PA electronics)
	Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .
Capacitive limit switches		
Limit value immersion probes		
Continuous immersion probes		
Hydrostatic pressure sensors		

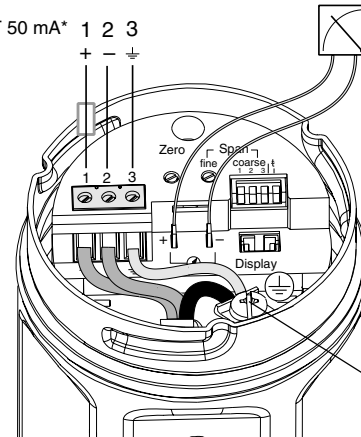


Electrical connection

Connection I2/IB with analogue electronics

11.5 V DC ... 45 V DC      Test 4 mA ... 20 mA

T 50 mA\*    1 2 3



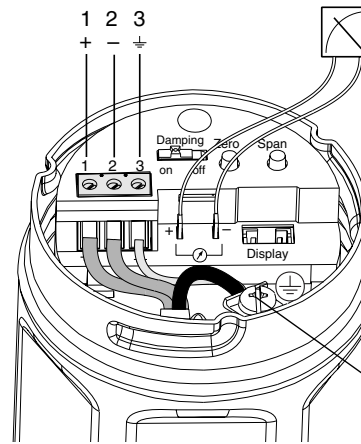
\* For analogue electronics versions with certificate ATEX (Ex) II 1/3D (non Ex supply voltage) the device must always be protected by a 50 mA (slow-blow) fuse.

internal ground terminal

Connection IA/IH with HART electronics

11.5 V DC ... 45 V DC      Test 4 mA ... 20 mA  
11.5 V DC ... 30 V DC (Ex i)

1 2 3

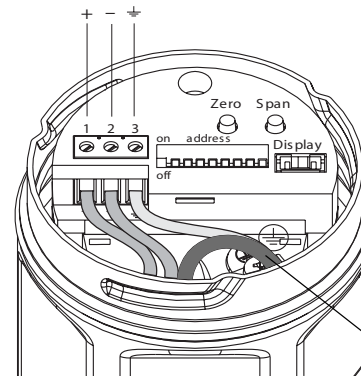


internal ground terminal

Connection PA/PB with PROFIBUS PA electronics

9 V DC ... 32 V DC  
9 V DC ... 24 V DC (Ex i)

1 2 3



internal ground terminal

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

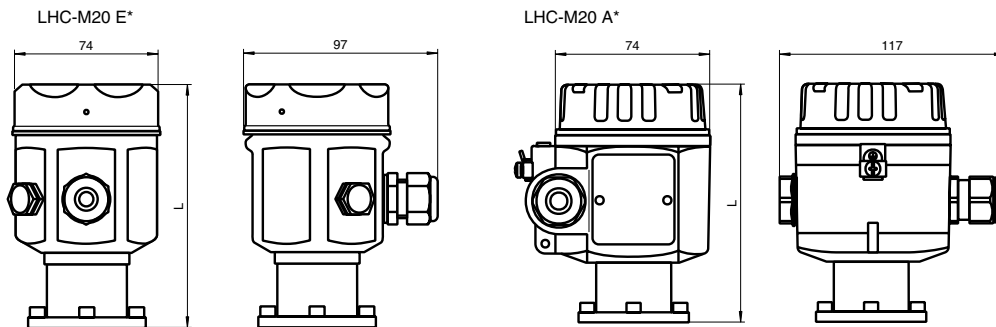
Continuous immersion probes

Hydrostatic pressure sensors

Dimensions

Housing LHC-M20

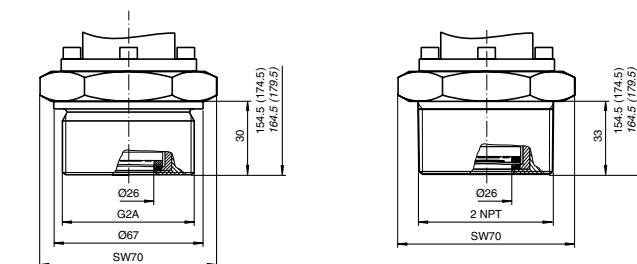
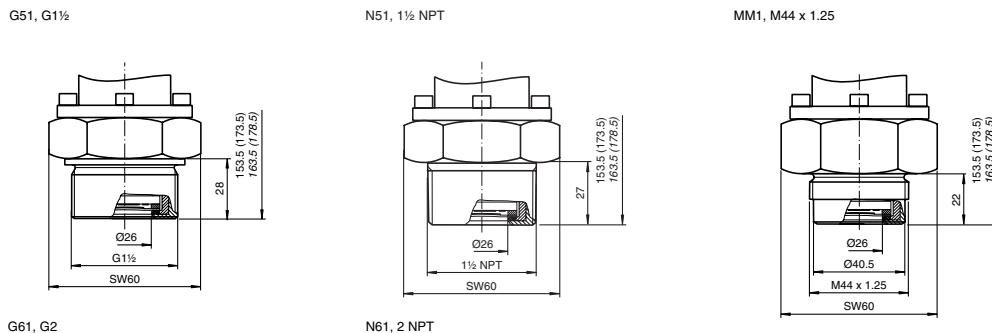
Measure L depends on process connection and lid.



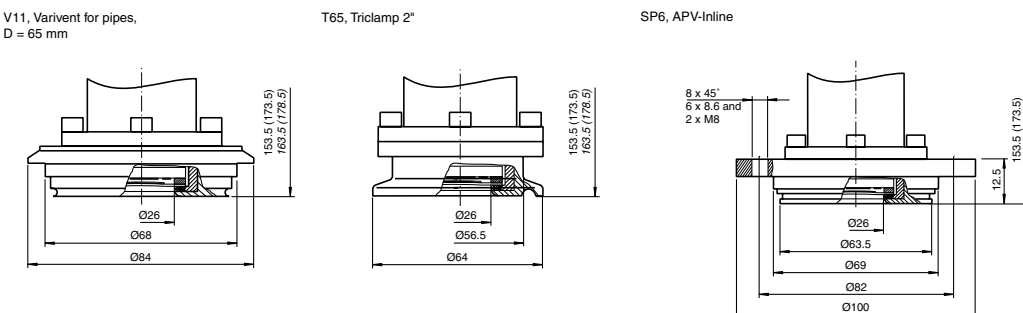
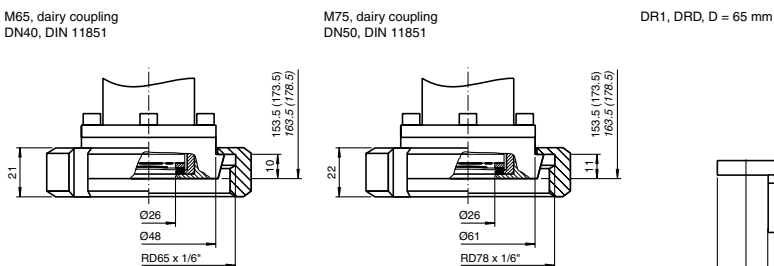
Process connections with threads

Values in brackets apply for housings with raised cover.

Values in italics apply to devices with an aluminium housing.



Process connections with sanitary couplings



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

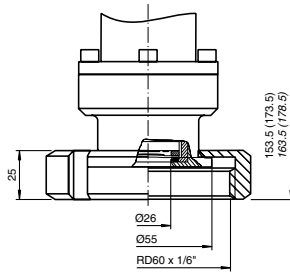
Dimensions

Process connections with sanitary couplings

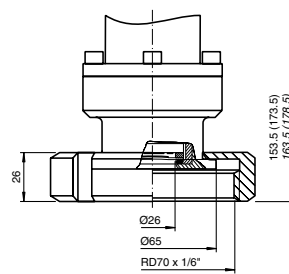
Values in brackets apply for housings with raised cover.

Values in italics apply to devices with an aluminium housing.

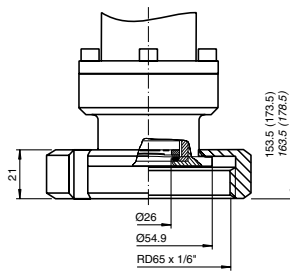
S55, SMS 1 1/2", PN40



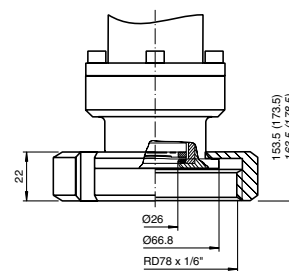
S65, SMS 1 1/2", PN40



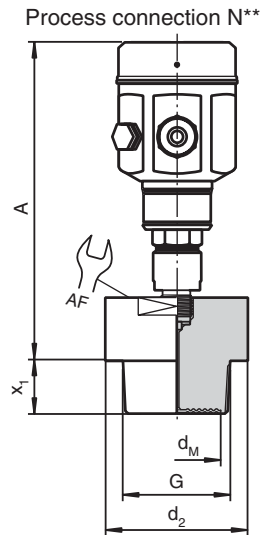
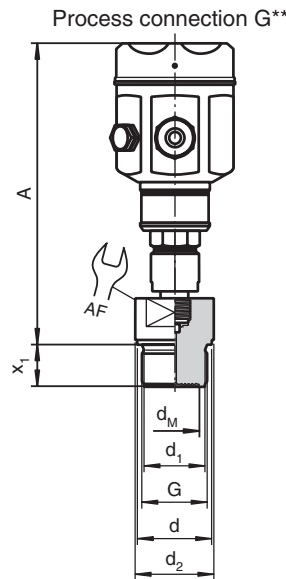
SA6, DN40, aseptic, DIN 11864-1-A



SA7, DN50, aseptic, DIN 11864-1-A



Housing and process connections with threads LHC-M40



Process connection	Threads						Housing		
	threads	diameter	diameter	diameter	thread length	key distance	diaphragm diameter	installation height stainless steel	installation height aluminium
		d <sub>1</sub>	d	d <sub>2</sub>	x <sub>1</sub>	AF	d <sub>M</sub>	max. A	max. A
	in	mm	mm	mm	mm	mm	mm	mm	mm
G31	G1	29	39	39	21	41	28	231.5	236.5
G51	G1½	44	55	58	30	41	38	232.5	237.5
G61	G2	56	68	78	30	60	46	237.5	242.5
N31	1 NPT	-	-	-	23	41	23	235.5	240.5
N51	1½ NPT	-	-	52	30	46	32	233.5	238.5
N61	2 NPT	-	-	78	30	65	36	233.5	238.5

Process connections with flange

see type code

**Measuring range**

<b>LHC-M20</b>				<b>LHC-M40</b>			
pressure type	meas. limits in bar	min. span in bar	overload in bar	pressure type	meas. limits in bar	min. span in bar	overload in bar
gauge pressure	0 ... 0.1	0.01	4	rel. pressure	0 ... 1	0.1	4
gauge pressure	0 ... 0.4	0.04	8	rel. pressure	0 ... 4	0.4	16
gauge pressure	0 ... 1	0.1	10	rel. pressure	0 ... 10	1	40
gauge pressure	0 ... 4	0.4	25	rel. pressure	0 ... 40*	4	160
gauge pressure	0 ... 10	1	40	rel. pressure	0 ... 100*	10	400
gauge pressure	0 ... 40	4	60	rel. pressure	0 ... 400*	40	600
gauge pressure	-0.1 ... 0.1	0.02	4	rel. pressure	-1 ... 1	0.2	4
gauge pressure	-0.4 ... 0.4	0.08	8	rel. pressure	-1 ... 4	0.5	16
gauge pressure	-1 ... 1	0.2	10	rel. pressure	-1 ... 10	1.1	40
gauge pressure	-1 ... 4	0.5	25				
gauge pressure	-1 ... 10	1.1	40				
abs. pressure	0 ... 0.4	0.04	8	abs. pressure	0 ... 1	0.1	4
abs. pressure	0 ... 1	0.1	10	abs. pressure	0 ... 4	0.4	16
abs. pressure	0 ... 4	0.4	25	abs. pressure	0 ... 10	1	40
abs. pressure	0 ... 10	1	40	abs. pressure	0 ... 40	4	160
abs. pressure	0 ... 40	4	60	abs. pressure	0 ... 100	10	400
				abs. pressure	0 ... 400	40	600

\*absolute pressure sensors

The given overload will apply for the sensor. Please note the permissible maximum gauge pressure of the diaphragm seals.

Vacuum resistance: up to 10 mbar<sub>abs</sub>

**Accessories**

- LHC-Z10, transparent cover with glass for intrinsically safe units
- LHC-Z11, transparent cover with polycarbonate for standard units
- LHC-Z12, transparent cover with glass for intrinsically safe units
- LHC-Z21, dummy for pressure sensors G1A
- LHC-Z23, welded nozzle G1A
- LHC-Z24, welded nozzle G1½A
- LHC-Z25, dummy for pressure sensors G1½A
- LHC-Z30, set for wall and pipe mounting LHC-M20
- LHC-Z31, set for wall and pipe mounting LHC-M40
- LHC-Z40, digital display for electrical outputs IA and PB
- LHC-Z41, analogue display for electrical output IB













## Process pressure transmitter

## Dimensions

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

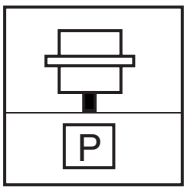
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

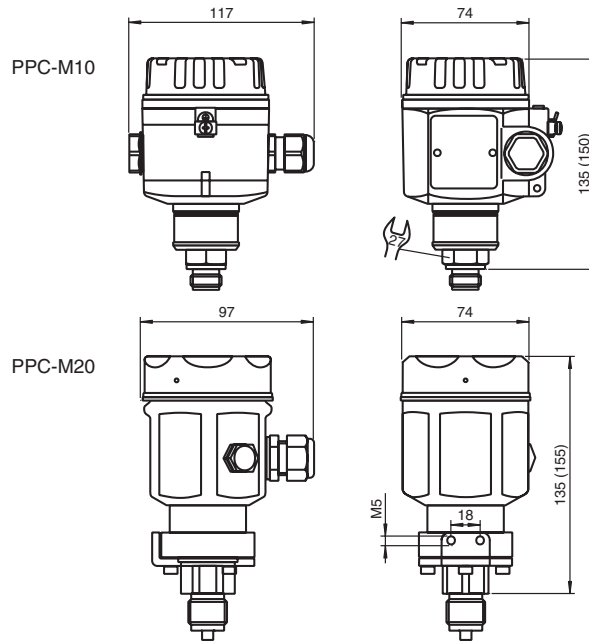


### PPC-M\*\*



### Features

- Process pressure sensor for gases, vapours, liquids and dusts
- High accuracy of measurement
- Housing fulfils the special hygienic requirements of the foodstuff and pharmaceutical industries
- Large number of process connections to choose from: universal usage
- Dry capacitive ceramic sensor up to 40 bar
- Piezoresistive metal sensor for measuring ranges up to 400 bar
- Wide variety of electronic modules: the right connection for every process control system
- Process connections acc. to EHEDG
- Up to SIL2 acc. to IEC 61508



The values in brackets apply for housings with raised cover.

Additional dimensions see section dimensions.

### Function

The process pressure sensor PPC-M\*\* measure absolute and relative pressure in gases, vapours, liquids and dusts.

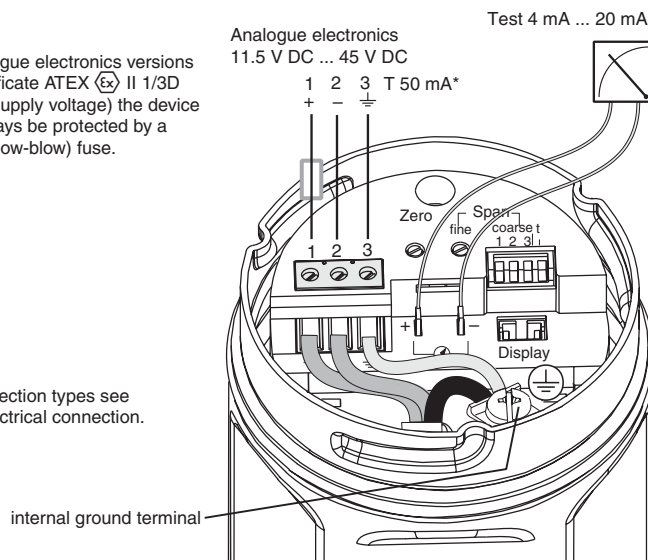
The sensor can be used in all process engineering areas. The modular design of the BARCON pressure transmitter enables it to be used in all industrial environments. All process connections are available as hygienic connections, threaded connections, separators and flanges.

### Electrical connection

Connection I2/IB analogue electronic (example)

\* For analogue electronics versions with certificate ATEX  $\text{Ex}$  II 1/3D (non Ex supply voltage) the device must always be protected by a 50 mA (slow-blow) fuse.

More connection types see section electrical connection.



<b>Application</b>		Float switches
Function principle	<p>sensor for absolute and relative pressure measuring in gases, vapours, liquids and dusts</p> <p>metal sensor (PPC-M10) The process pressure acting on the metallic separating diaphragm of the sensor is transmitted via a fill liquid to a resistance bridge. The change in the output voltage of the bridge is proportional to the pressure and is then measured, volume of chamber: smaller than 1 mm<sup>3</sup>.</p> <p>ceramic sensor (PPC-M20) The pressure causes a slight deflection of the ceramic diaphragm of the sensor. The change in the capacitance is proportional to the pressure and is measured by the electrodes of the ceramic sensor, volume of chamber: approx. 2 mm<sup>3</sup>.</p>	
<b>Function and system design</b>		Vibration limit switches
Equipment architecture	<ul style="list-style-type: none"> <li>- with analogue electronics I2/IB 4 ... 20 mA and auxiliary energy, e. g. via transmitter power pack, calibration across potentiometer for lower range value and upper range value, optionally analogue display for measuring value indication</li> <li>- with HART electronics IA/IH with current output 4 ... 20 mA, HART communication signal and auxiliary energy, e. g. via transmitter power pack, calibration via two keys on the device, handheld terminal or PC with operating program, optional digital display for measured variable indication</li> <li>- with PROFIBUS PA electronics PA/PB with digital communication signal PROFIBUS PA and segment coupler for connection to PLC or PC with operating program, optional digital display for measured variable indication</li> </ul>	
<b>Input characteristics</b>		Conductive limit switches
Measured variable	absolute or relative pressure	
Measurement range	see section measuring range	
<b>Output characteristics</b>		
Output signal	<p>analogue electronics I2/IB: 4 ... 20 mA</p> <p>HART electronics IA/IH: 4 ... 20 mA with HART protocol</p> <p>PROFIBUS PA electronics PA/PB: digital communication signal</p>	Capacitive limit switches
Signal range	analogue electronics I2/IB and HART electronics IA/IH: 3.8 ... 20.5 mA	
Signal on alarm	<p>analogue electronics I2/IB: signal overrun &gt; 20.5 mA or signal underrun &lt; 3.6 mA</p> <p>HART electronics IA/IH: optional 3.6 mA, 22 mA or last current value will be hold</p> <p>PROFIBUS PA electronics PA/PB: can be set in the analog input block, options: last good value (factory setting), FSAFE value, wrong value</p>	
Response time	PROFIBUS PA: cyclic: approx. 10 ms per request, acyclic: < 50 ms	Limit value immersion probes
Output damping	<p>analogue electronics I2/IB:</p> <ul style="list-style-type: none"> <li>- directly on device using DIP switches, switch position "On" = 2 s, "Off" = 0 s</li> </ul> <p>HART electronics IA/IH:</p> <ul style="list-style-type: none"> <li>- directly on device using DIP switches, switch position "On" = set value, "Off" = 0 s</li> <li>- with handheld terminal or using operating program: 0 ... 40 s</li> <li>- factory setting: 2 s</li> </ul> <p>PROFIBUS PA electronics PA/PB:</p> <ul style="list-style-type: none"> <li>- with handheld terminal or using operating program: 0 ... 40 s</li> <li>- factory setting: 0.0 s</li> </ul>	
Load	<p>analogue electronics I2/IB and HART electronics IA/IH:</p> <ul style="list-style-type: none"> <li>- max. 1522 Ω at power supply 11.5 ... 45 V DC for devices for non-hazardous areas, 1/3D, EEx d, EEx nA, FM XP, FM DIP, CSA XP and CSA dust-Ex</li> <li>- max. 840 Ω at power supply 11.5 ... 30 V DC for EEx ia, 1D, 1/2D, 1/2G, FM IS and CSA IS</li> </ul>	Continuous immersion probes
Resolution	<p>analogue electronics I2/IB:</p> <ul style="list-style-type: none"> <li>- current output &lt; 1 µA, onsite display 30 segments</li> </ul> <p>HART electronics IA/IH:</p> <ul style="list-style-type: none"> <li>- current output typ. 1 µA, max. 6 µA, onsite display 28 segments, display value with resolution 1 per thousand</li> </ul> <p>PROFIBUS PA electronics PA/PB:</p> <ul style="list-style-type: none"> <li>- onsite display 28 segments, display value with resolution 1 per thousand</li> </ul>	
Read cycles	<p>HART commands: on average 3 to 4 per s</p> <p>PROFIBUS PA: cyclic: on average 100/s, acyclic: on average 20/s</p>	
Cycle time	<p>PROFIBUS PA:</p> <ul style="list-style-type: none"> <li>- The cycle time in a bus segment in cyclic data communication depends on the number of devices, the segment coupler used and the internal PLC cycle time.</li> <li>- The minimum cycle time is approx. 20 ms per device.</li> </ul>	Hydrostatic pressure sensors
<b>Auxiliary energy</b>		
Electrical connection	<p>connection cable:</p> <ul style="list-style-type: none"> <li>- shielded, twisted pair two-wire cable</li> <li>- terminals for wire cross-sections 0.14 ... 2.5 mm<sup>2</sup></li> <li>- cable outer diameter: 5 ... 9 mm (0.2 ... 0.35 in)</li> </ul> <p>M12 plug Harting plug (Han7D)</p>	
Supply voltage	<p>analogue electronics I2/IB: 11.5 ... 45 V DC</p> <p>HART electronics IA/IH: 11.5 ... 45 V DC</p> <p>PROFIBUS PA electronics PA/PB: 9 ... 32 V DC</p> <p>Version for hazardous area see safety information.</p>	
Current consumption	PROFIBUS PA electronics PA/PB: 11 mA ± 1 mA	

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## Process pressure transmitter PPC-M\*\*

## Technical data

Float switches	Residual ripple	analogue electronics I2/IB and HART electronics IA/IH: - without influence on 4 ... 20 mA signal up to $\pm 5\%$ residual ripple within the permitted voltage range (according to HART hardware specification HCF_SPEC-54 (DIN IEC 60381-1)) - with HART handheld terminal: max. ripple (measured at 500 $\Omega$ ) 47 ... 125 Hz: $U_{pp} = 200$ mV, max. noise (measured at 500 $\Omega$ ) 500 ... 10 kHz: $U_{eff} = 2.2$ mV
	<b>Performance characteristics</b>	
Vibration limit switches	Reference operating conditions	- as per IEC 60770 - ambient temperature range $T_{amb} = \text{constant}$ , in range: 21 ... 33 °C (294 ... 307 K) - humidity = constant, in range: 20 ... 80 % relative humidity - ambient pressure $p_{amb} = \text{constant}$ , in range: 860 ... 1060 mbar - position of measuring cell = constant, in range: horizontal $\pm 1^\circ$ - input of Low Sensor Calibration and High Sensor Calibration for lower range value and upper range value - membrane material ceramic (aluminium oxide ceramic) or stainless steel 1.4435/316L - filling oil: mineral oil - supply voltage: 24 V DC $\pm 3$ V DC - load for HART: 250 $\Omega$ - Turn down: 1:1 to 10:1
	Maximum measured error	$\pm 0.2\%$ of set span, optional $\pm 0.1\%$ non-linearity of set span
	Long-term drift	with reference to the span $\pm 0.1\%$ per year, $\pm 0.25\%$ per 3 years
Conductive limit switches	Influence of vibrations	without any effects up to 5 ... 15 Hz: $\pm 4$ mm (0.16 in) 15 ... 150 Hz: 2 g 150 ... 2000 Hz: 1 g
	Rise time	analogue electronics I2/IB: 60 ms HART electronics IA/IH: 220 ms PROFIBUS PA electronics PA/PB: 220 ms
	Warming-up time	analogue electronics I2/IB: 200 ms HART electronics IA/IH: 1 s PROFIBUS PA electronics PA/PB: 1 s
	Adjustment time	analogue electronics I2/IB: 180 ms HART electronics IA/IH: 600 ms PROFIBUS PA electronics PA/PB: 600 ms
Capacitive limit switches	<b>Operating conditions</b>	
	Mounting conditions	
	Installation position	any position, zero point shift due to position can be corrected see technical information
	Ambient conditions	
	Ambient temperature	-40 ... 85 °C (233 ... 358 K) onsite display with analogue electronics I2/IB: -30 ... 80 °C (243 ... 353 K) onsite display with HART electronics IA/IH or PROFIBUS PA electronics PA/PB: -25 ... 70 °C (248 ... 343 K) Lower temperatures minimise the display speed.
Limit value immersion probes	Storage temperature	-40 ... 100 °C (233 ... 373 K) onsite display: -40 ... 80 °C (233 ... 353 K)
	Climate class	4K4H, air temperature: -20 ... 55 °C (253 ... 328 K), relative humidity: 4 ... 100 %, condensation possible
	Electromagnetic compatibility	- maximum deviation: $< 0.5\%$ of span - maximum deviation for 100 mbar sensors: $< 1.25\%$ of span - In the event of surge influence (EN 61000-4-5), deviations greater than the specified measured error can occur briefly. - All measurements were performed with a Turn down = 1:1.
	Process conditions	
	Medium temperature	-40 ... 100 °C (233 ... 373 K)
Continuous immersion probes	Medium pressure limits	see section measuring range
	Overload resistance	PPC-M10: up to 4 times the nominal pressure (max. 600 bar) PPC-M20: up to 40 times the nominal pressure (max. 60 bar)
	<b>Mechanical specifications</b>	
	Protection degree	IP66 for devices with cable gland, cable entry IP68 for devices with assembled cable or M12 plug
	<b>Mechanical construction</b>	
Hydrostatic pressure sensors	Construction type	PPC-M10: version with metal sensor PPC-M20: version with ceramic sensor
	Dimensions	housings: stainless steel housing 74 x 97 mm (2.9 x 3.8 in), aluminium housing 74 x 117 mm (2.9 x 4.6 in), length depends on process connection and cover process connections see section dimensions
	Mass	PPC-M10: stainless steel 0.9 kg, aluminium 1.2 kg PPC-M20: stainless steel 1.4 kg, aluminium 1.6 kg

<p>Material</p>	<p>housing: - stainless steel 1.4404/316L or cast aluminium housing with protective polyester based powder coating nameplates: - stainless steel housing: engraved on housing with laser - aluminium housing: 1.4301/304 process connections (in contact with the medium): - PPC-M10: stainless steel 1.4435/316L - PPC-M20: 1.4435/316L or 2.4819 (Hastelloy C276) slotted nuts: - stainless steel 1.4307/304L) process diaphragm (in contact with the medium): - PPC-M10: stainless steel 1.4435/316L, Hastelloy C276, tantalum, PTFE folio 0.09 mm on 1.4435/316L (not for vacuum), PTFE folio 0.25 mm on 1.4435/316L (not for vacuum) - PPC-M20: Al<sub>2</sub>O<sub>3</sub> aluminium oxide ceramic (FDA listed), 96 %, extremely clean 99.9 % seals: - FKM Viton (also in versions grease-free and for oxygen use), NBR, FFKM Kalrez, FFKM Chemraz, EPDM O-ring for cover sealing: - stainless steel housing: silicone - aluminium housing: NBR mounting accessories for pipe and wall mounting: - stainless steel 1.4301/304 measurement cell: - PPC-M10: oil filling: optional mineral oil, inert oil (Voltalef) for oxygen use or vegetable oil - PPC-M20: without oil filling, dry sensor capillary: - 1.4571/316Ti protective hose for capillary: - 1.4301/304</p>	<p>Float switches</p>
<p>Surface quality</p>	<p>standard surface roughness of parts in contact with the medium R<sub>a</sub> ≤ 0.8 µm, reduces surface roughness on request.</p>	<p>Vibration limit switches</p>
<p>Process connection</p>	<p>PPC-M10: - cylindrical thread G½A to EN 837 and JIS B0202 - cylindrical thread M20 x 1,5 to EN 837 - conical thread ½ MNPT or ½ FNPT to ANSI - conical thread R½A to JIS B0203 PPC-M20: - cylindrical thread G½A to EN 837 - cylindrical thread G½A with bore 11.4 mm (0.45 in) to DIN ISO 228 - cylindrical thread G½A G¼ (female) to DIN ISO 228 - cylindrical thread M20 x 1.5 with bore 3 mm (0.12 in) to EN 837 - conical thread ½ MNPT with bore 11.4 mm (0.45 in) to ANSI - conical thread ½ MNPT ¼ FNPT to ANSI - cylindrical thread G½A to JIS B0202 - conical thread R½A to JIS B0203</p>	<p>Conductive limit switches</p>
<p>Electrical connection</p>	<p>housing *1: cable gland M20 x 1.5 housing *2: cable gland ½ NPT housing *3: cable gland G½ housing *4: Harting plug (Han7D) housing *5: M12 x 1 plug housing *6: assembled cable with pressure compensation, 5 m (197 in)</p>	<p>Capacitive limit switches</p>
<p>Indication and operation</p>	<p>analogue electronics I2/IB: - The analogue display gives the current pressure value related to the measuring range in the form of a bar graph (30 segments). HART electronics IA/IH: - The digital display gives the pressure in the form of a four-digit number. The appropriate current value from 4 ... 20 mA is shown as a bar graph (28 segments) underneath. PROFIBUS PA electronics PA/PB: - The digital display gives the pressure in the form of a four-digit number. The digital display shows the current pressure value in the form of a bar graph (28 segments). display resolution: - analogue display: bar graph, 1 segment equals 3.33 % of the set span - digital display: 0.1 %, bar graph, 1 segment equals 3.57 % of the set span</p>	<p>Limit value immersion probes</p>
<p>Display elements</p>	<p>analogue electronics I2/IB: - operation directly at the measuring point with one potentiometer each for lower range value and upper range value - a three-step range switch - as well as an on/off switch for damping HART electronics IA/IH with HART protocol: operation mode at the measuring point via - two push buttons for lower range value and upper range value as well as an on/off switch for damping - the handheld terminal at any point along the 4 ... 20 mA line - a PC with operating program PROFIBUS PA electronics PA/PB: operation mode via - two keys for lower-range value and upper-range value - using a PC with operating program</p>	<p>Continuous immersion probes</p>
<p>Operating elements</p>	<p>Certificates and approvals</p>	<p>Hydrostatic pressure sensors</p>

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**Process pressure transmitter  
PPC-M\*\***

**Technical data**

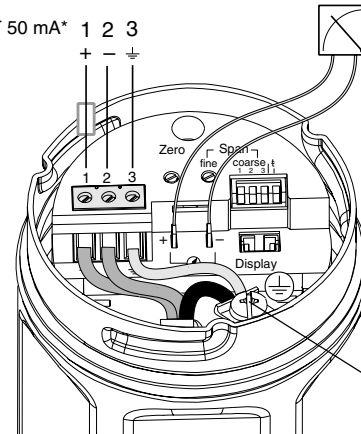
Float switches	Ex approval	DMT 02 ATEX E 137, DMT 02 ATEX E 138, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
	Type of protection	<p>⊕ II 1G EEx ia IIC T4/T6 (DMT 02 ATEX E 137)</p> <p>⊕ II 1/2G EEx ia IIC T4/T6 (DMT 02 ATEX E 137)</p> <p>⊕ II 2G EEx ia IIC T4/T6 (DMT 02 ATEX E 137)</p> <p>⊕ II 1/2D IP66 T50/82°C (DMT 02 ATEX E 137)</p> <p>⊕ II 1/2D IP66 T85°C (DMT 02 ATEX E 137)</p> <p>⊕ II 1/3D IP66 T110°C (DMT 02 ATEX E 138)</p> <p>⊕ II 3 G EEx nA II T5</p>
	SIL classification	up to SIL2 acc. to IEC 61508
	<b>General information</b>	
Vibration limit switches	Directive conformity	
	Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1
	Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector)
	Directive 94/9 EC (ATEX)	EN 50014, EN 50020, EN 50021, EN 50284, EN 50281-1-1
	Conformity	
	Electromagnetic compatibility	NE 21
	Protection degree	EN 60529
	Climate class	EN 60721-3-4
Conductive limit switches	Supplementary documentation	<p>technical information PPC-M</p> <p>operating instructions BA200O (version with analogue electronics)</p> <p>operating instructions BA201O (version with HART electronics)</p> <p>operating instructions BA222O (version with PROFIBUS PA electronics)</p> <p>operating instructions KA224O M12 plug with new PIN assignment</p> <p>operating instructions KA525O welded nozzle (LHC-Z20, LHC-Z21, LHC-Z22, LHC-Z23)</p> <p>safety information SI038O (DMT 02 ATEX E 137)</p> <p>safety information SI039O (DMT 02 ATEX E 137)</p> <p>safety information SI040O (DMT 02 ATEX E 138)</p> <p>safety information SI052O (⊕ II 3 G EEx nA II T5)</p> <p>safety information SI096O (DMT 02 ATEX E 137), PROFIBUS PA version</p> <p>safety information SI097O (DMT 02 ATEX E 137), PROFIBUS PA version</p> <p>safety information SI098O (DMT 02 ATEX E 138), PROFIBUS PA version</p> <p>FM control drawing ZD039O (version with HART electronics)</p> <p>CSA control drawing ZD040O (version with HART electronics)</p> <p>CSA control drawing ZD051O (version with PROFIBUS PA electronics)</p> <p>FM control drawing ZD052O (version with PROFIBUS PA electronics)</p>
	Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .
Limit value immersion probes		
Continuous immersion probes		
Hydrostatic pressure sensors		

Electrical connection

Connection I2/IB with analogue electronics

11.5 V DC ... 45 V DC      Test 4 mA ... 20 mA

T 50 mA\*    1 2 3



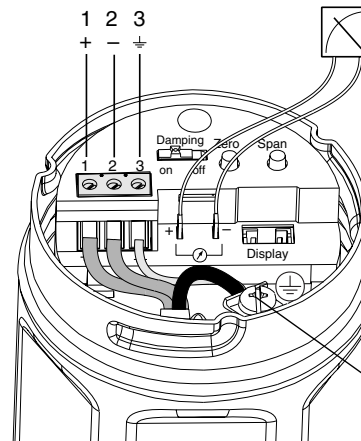
\* For analogue electronics versions with certificate ATEX (Ex) II 1/3D (non Ex supply voltage) the device must always be protected by a 50mA (slow-blow) fuse.

internal ground terminal

Connection IA/IH with HART electronics

11.5 V DC ... 45 V DC      Test 4 mA ... 20 mA  
11.5 V DC ... 30 V DC (Ex i)

1 2 3

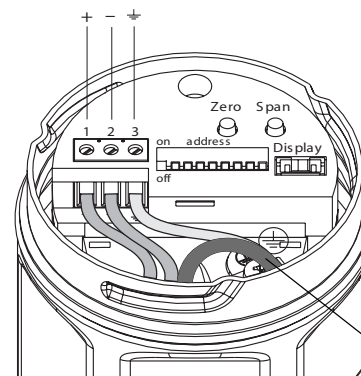


internal ground terminal

Connection PA/PB with PROFIBUS PA electronics

9 V DC ... 32 V DC  
9 V DC ... 24 V DC (Ex i)

1 2 3



internal ground terminal

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

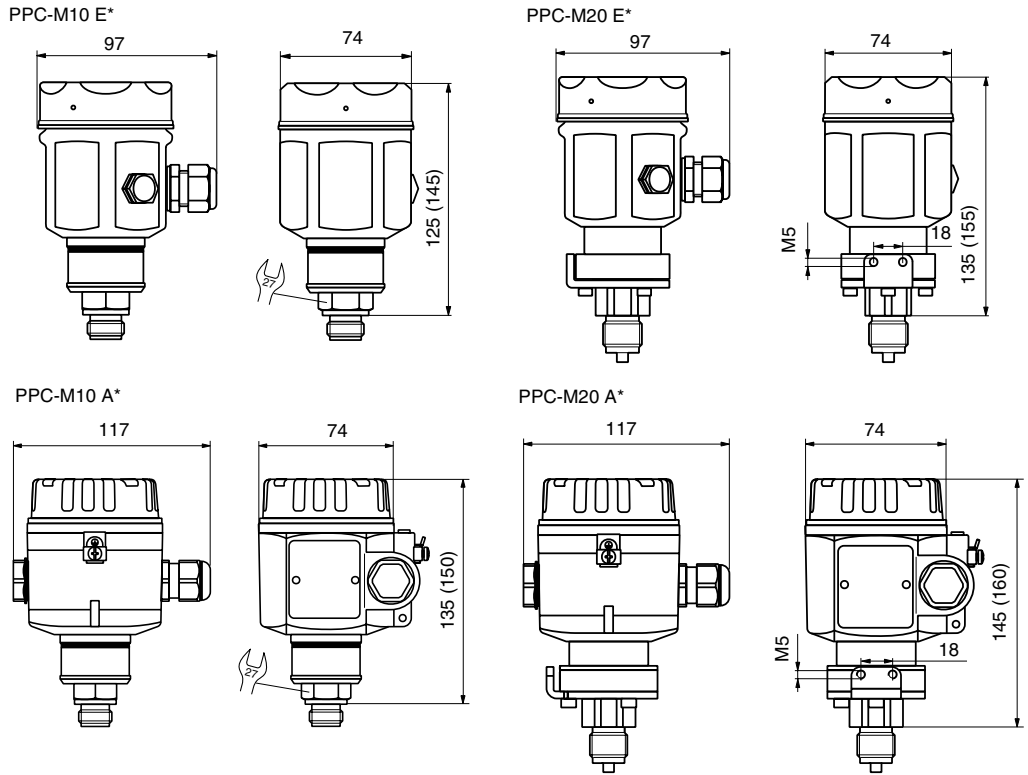
Hydrostatic pressure sensors



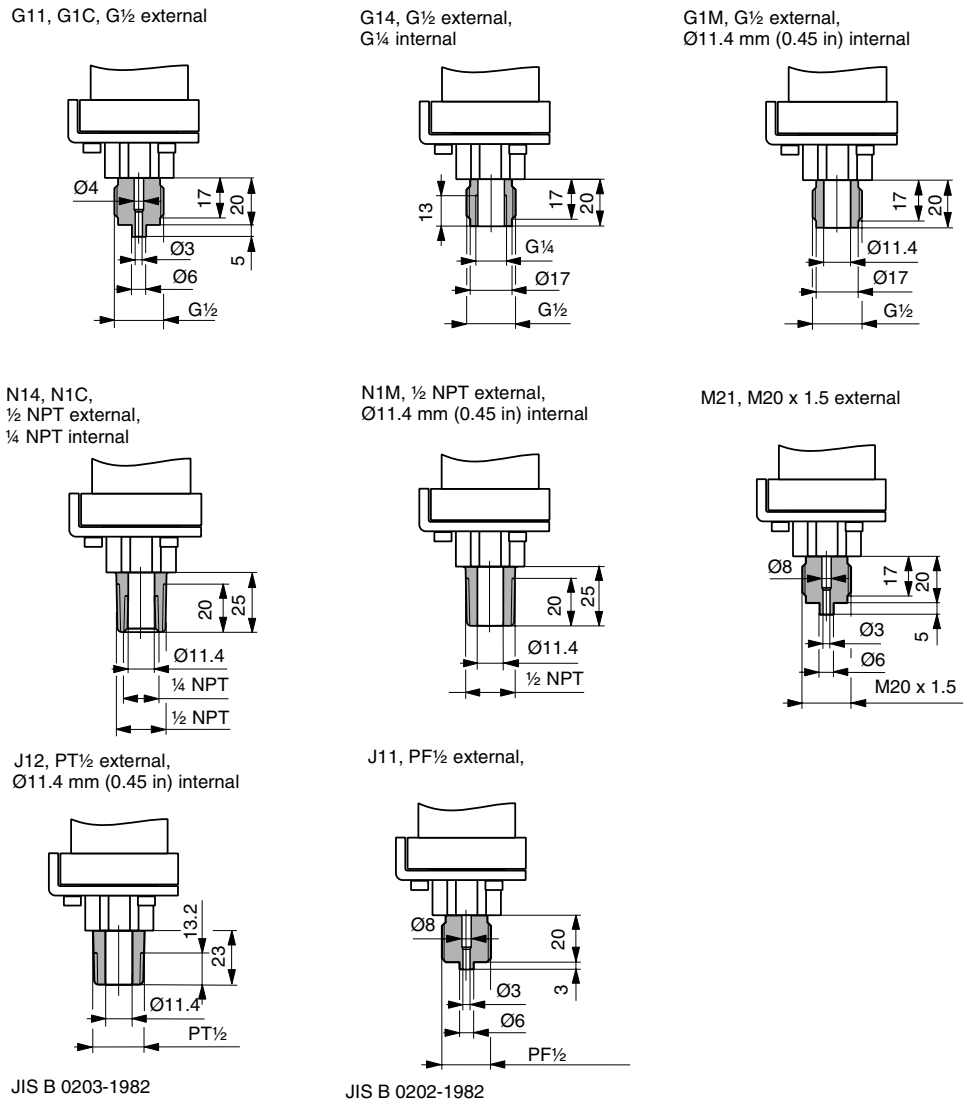
Dimensions

Housings

The values in brackets apply for housings with raised cover.



Process connections for PPC-M20



JIS B 0203-1982

JIS B 0202-1982

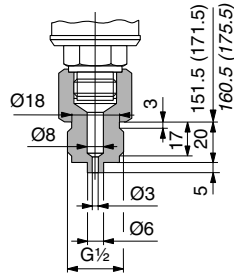


**Process connections for PPC-M10**

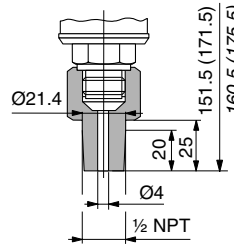
Values in brackets apply for housings with raised cover.

*Values in italics apply to devices with an aluminium housing.*

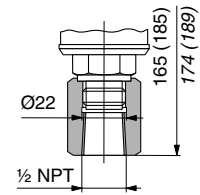
G1G, G½ external



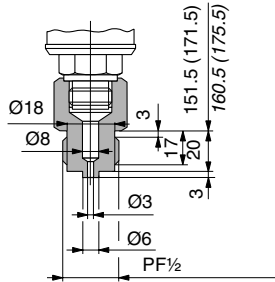
N1A, ½ NPT external



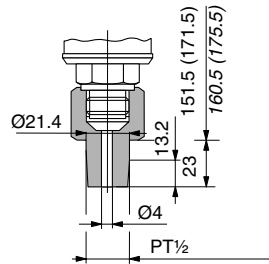
N11, ½ NPT internal



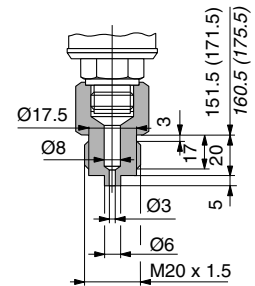
J11, PF½ external



J12, PT½ external



M21, M20 x 1.5, external



JIS B 0202-1982

JIS B 0203-1982

**Process connections**

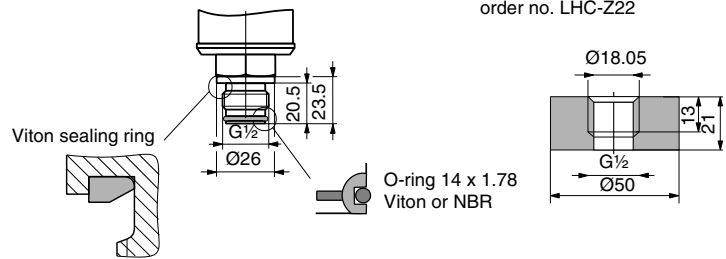
Pressure sensor dummy:

Pepperl+Fuchs offers a pressure sensor dummy for the welding nozzle order no. LHC-Z22.

This aids heat removal during welding and prevents nozzles warping during welding.

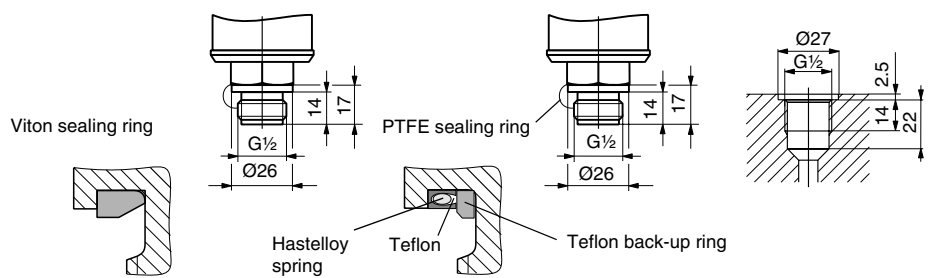
Order no. LHC-Z20

G1O, G½ external with O-ring for welding nozzles



Welding nozzles order no. LHC-Z22

G1F, G½ external screw-in bolt DIN 3852-E-G½



Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

**Measuring range**

PPC-M20				PPC-M10			
pressure type	meas. limits in bar	min. span in bar	overload in bar	pressure type	meas. limits in bar	min. span in bar	overload in bar
gauge pressure	0 ... 0.1	0.01	4	rel. pressure	0 ... 1	0.1	4
gauge pressure	0 ... 0.4	0.04	8	rel. pressure	0 ... 4	0.4	16
gauge pressure	0 ... 1	0.1	10	rel. pressure	0 ... 10	1	40
gauge pressure	0 ... 4	0.4	25	rel. pressure	0 ... 40*	4	160
gauge pressure	0 ... 10	1	40	rel. pressure	0 ... 100*	10	400
gauge pressure	0 ... 40	4	60	rel. pressure	0 ... 400*	40	600
gauge pressure	-0.1 ... 0.1	0.02	4	rel. pressure	-1 ... 1	0.2	4
gauge pressure	-0.4 ... 0.4	0.08	8	rel. pressure	-1 ... 4	0.5	16
gauge pressure	-1 ... 1	0.2	10	rel. pressure	-1 ... 10	1.1	40
gauge pressure	-1 ... 4	0.5	25				
gauge pressure	-1 ... 10	1.1	40				
abs. pressure	0 ... 0.4	0.04	8	abs. pressure	0 ... 1	0.1	4
abs. pressure	0 ... 1	0.1	10	abs. pressure	0 ... 4	0.4	16
abs. pressure	0 ... 4	0.4	25	abs. pressure	0 ... 10	1	40
abs. pressure	0 ... 10	1	40	abs. pressure	0 ... 40	4	160
abs. pressure	0 ... 40	4	60	abs. pressure	0 ... 100	10	400
				abs. pressure	0 ... 400	40	600

\*absolute pressure sensors

The given overload will apply for the sensor. Please note the permissible maximum gauge pressure of the diaphragm seals.

Vacuum resistance:

- PPC-M20
  - for sensors with nominal values 0.1 bar: up to 0.7 bar<sub>abs</sub>
  - for all other sensors: up to 0 bar<sub>abs</sub>
- PPC-M10
  - up to 10 mbar<sub>abs</sub>

**Accessories**

- LHC-Z10, cover with glass window for intrinsically safe units
- LHC-Z11, cover with glass window of polycarbonate for standard units
- LHC-Z12, cover with glass window for intrinsically safe units
- LHC-Z20, dummy for pressure sensors G½A
- LHC-Z21, dummy for pressure sensors G1A
- LHC-Z22, welded nozzle G½A
- LHC-Z23, welded nozzle G1A
- LHC-Z30, set for wall and pipe mounting PPC-M20
- LHC-Z30, set for wall and pipe mounting PPC-M10
- LHC-Z40, digital display for electrical outputs IA and PB
- LHC-Z41, analogue display for electrical output IB





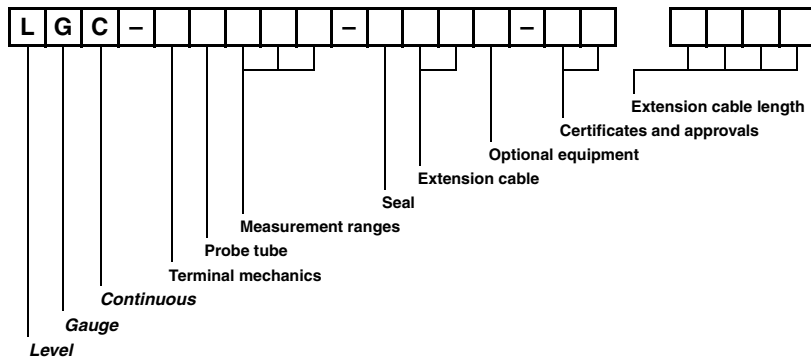


# Type code of level probes

The figure below shows the used characters and numbers of the level probes type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the level probes.

## Product group LGC



- Float switches
- Vibration limit switches
- Conductive limit switches
- Capacitive limit switches
- Limit value immersion probes
- Continuous immersion probes
- Hydrostatic pressure sensors

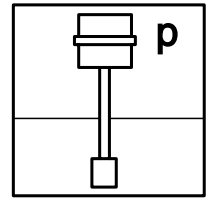


Level probe LGC

The level probe is used for hydrostatic level control, for level measuring and for temperature control (optional) of fresh, drinking and waste water.

The pressure acts directly on the rugged ceramic measuring cell (dry measuring cell) of the level probe LGC and causes it to move by about max. 0.005 mm.

The effects of air pressure on the liquid surface are transferred via a pressure compensating tube through the extension cable to the rear of the ceramic membrane and compensated. Pressure-dependent changes in capacitance caused by membrane movement are measured at the electrodes of the ceramic carrier. The electronics convert the movement into a pressure-proportional signal which is linear to the medium level.



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Type code of level probes . . . . .	176
Level probe LGC . . . . .	178

**Page**

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

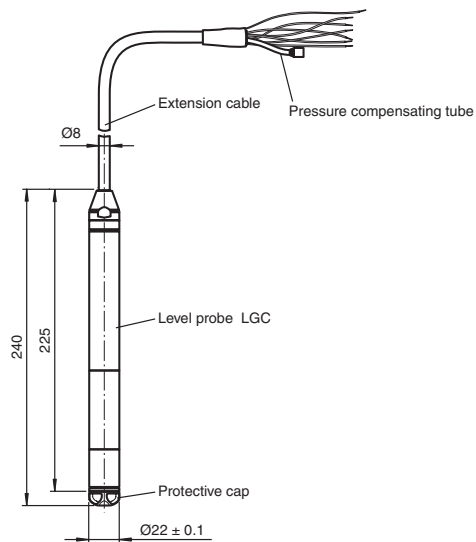
Continuous immersion probes

Hydrostatic pressure sensors

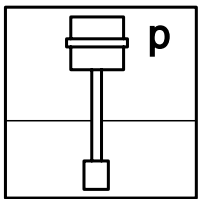
## Level probe



## Dimensions



## LGC



## Function

The level probe LGC is a hydrostatic pressure sensor for measuring the level. One outstanding feature of these level probe is their mechanical and electrical durability. The embedded electronics, a heavy-duty conical cable seal and a 2-filter system guarantee a perfect seal resistant to any climatic conditions.

Highly accurate ceramic pressure sensors with longterm stability guarantee reliable and secure filling level measurement. With an external diameter of 22 mm (0.9 in), integrated temperature sensor and extensive drinking water certificates, the level probe is ideally suited for fresh water and drinking water applications. The front-flush ceramic measuring cell also allows reliable applications of the level probe in wastewater.

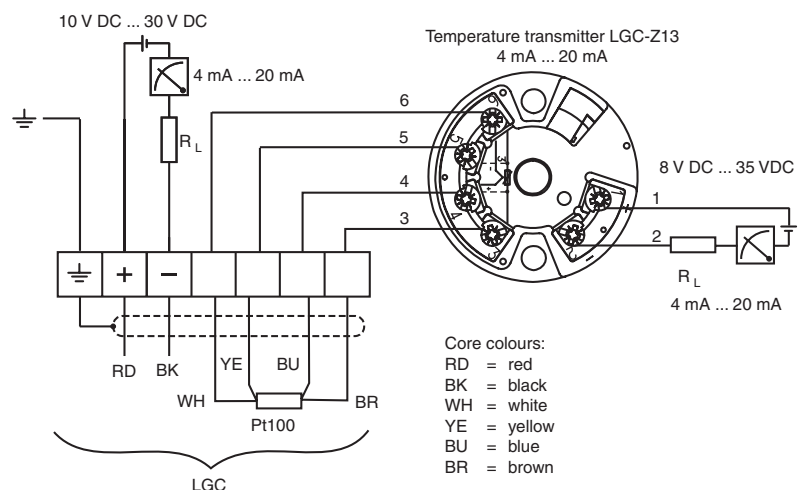
With extensive measurement accessories, like display, power supply and evaluation device, solutions for all typical applications in fresh water and wastewater are guaranteed.

## Features

- Hydrostatic pressure sensor for level measuring of water
- Measuring ranges: 0 bar ... 0.1 bar to 0 bar ... 20 bar
- High-precision and long-term stability ceramic measuring cell
- High mechanical resistance to overload and aggressive media
- Permanent hermetically sealed level probe
- Electronics comprising 4 mA ... 20 mA output signal and integrated overvoltage protection
- Simultaneous level and temperature measuring by optional integrated temperature probe Pt100
- KTW and NSF drinking water approval

## Electrical connection

Example: level probe LGC with Pt100 and temperature transmitter LGC-Z13 (4 mA ... 20 mA)



Other connection types see section electrical connections.






Technical data		Level probe LGC
<b>Application</b>		
Function principle	hydrostatic level control level measuring and temperature control (optional) of freshwater drinking water and wastewater	Float switches
<b>Function and system design</b>		
Measuring principle	Level control with ceramic measuring cell (dry measuring cell). The pressure acts directly on the rugged ceramic membrane of the LGC level probe and causes it to move by about max. 0.005 mm. The effects of air pressure on the liquid surface are transferred via a pressure compensating tube through the extension cable to the rear of the ceramic membrane and compensated. Pressure-dependent changes in capacitance caused by membrane movement are measured at the electrodes of the ceramic carrier. The electronics convert the movement into a pressure-proportional signal which is linear to the medium level.	Vibration limit switches
Equipment architecture	The measuring system consists of a LGC level probe and a SMART transmitter power supply (e. g. KFD2-STC4-Ex1) with a supply voltage between 10 ... 30 V DC.	
<b>Input characteristics</b>		
Measured variable	LGC: hydrostatic pressure of a liquid Pt100 (optional): temperature of a liquid temperature transmitter (optional): temperature	Conductive limit switches
Measurement range	LGC: - nine fixed pressure measuring ranges in bar, see ordering information - customer-specific measuring ranges, factory-calibrated Pt100 (optional): temperature measurement from -10 ... 70 °C (263 ... 343 K)	
Input signal	LGC: change in capacitance Pt100 (optional): change in resistance temperature transmitter (optional): Pt100 resistance signal, 4-wire	
<b>Output characteristics</b>		Capacitive limit switches
Output signal	LGC: 4 ... 20 mA for hydrostatic pressure measured value, two-wire Pt100 (optional): temperature-dependent resistance of Pt100 temperature transmitter (optional): 4 ... 20 mA for temperature measured value, two-wire	
Load	LGC, Pt100 (optional): $R_{total} \leq (U_b - 10 \text{ V})/0.0225 \text{ A} - 2 \times 0.09 \Omega/\text{m} \times l - R_{add}$ temperature transmitter (optional): $R_{total} \leq (U_b - 8 \text{ V})/0.025 \text{ A} - R_{add}$  - $R_{total}$ = max. load resistance [ $\Omega$ ] - $R_{add}$ = additional resistances such as resistance of evaluating device and/or display instrument, line resistance [ $\Omega$ ] - $U_b$ = supply voltage [V] - $l$ = simple length of extension cable [m] (cable resistance per wire $\leq 0.09 \Omega/\text{m}$ )	
<b>Auxiliary energy</b>		Limit value immersion probes
Electrical connection	Reverse voltage protection is integrated in LGC level probe and in the temperature transmitter LGC-Z13 changing the polarities has no impact on operation. The cable must end in a dry room. For installation outside, use the terminal housing (IP66/IP67) with GORE-TEX® filter from Pepperl+Fuchs.	
Supply voltage	LGC: 10 ... 30 V DC, EEx nA and EEx ia: 10 ... 30 V DC Pt100 (optional): 10 ... 30 V DC, EEx nA: 10 ... 30 V DC temperature transmitter (optional): 8 ... 35 V DC	
Connecting cable	LGC: - commercially available instrument cable - terminals, terminal housing LGC: 0.08 ... 2.5 mm <sup>2</sup> Pt100 (optional): - If the Pt100 signal is directly connected to a display and/or evaluation unit, we recommend the use of a shielded cable. temperature transmitter (optional): - connection transmitter: max. 1.75 mm <sup>2</sup> extension cable: - total outer diameter: 8.0 mm $\pm$ 0.25 mm (0.315 in $\pm$ 0.0098 in) - LGC: 3 x 0.227 mm <sup>2</sup> and pressure compensation tube with Teflon filter - Pt100 (optional): 7 x 0.227 mm <sup>2</sup> and pressure compensation tube with Teflon filter - pressure compensation tube with Teflon filter: outer diameter $\varnothing$ 2.5 mm (0.098 in), internal diameter $\varnothing$ 1.5 mm (0.059 in)	Continuous immersion probes
Power consumption	LGC, Pt100 (optional): $\leq 0.675 \text{ W}$ at 30 V DC temperature transmitter (optional): $\leq 0.875 \text{ W}$ at 35 V DC	
Current consumption	LGC: max. $\leq 22.5 \text{ mA}$ , min. $\geq 3.5 \text{ mA}$ Pt100 (optional): $\leq 0.6 \text{ mA}$ temperature transmitter (optional): Pt100 via temperature transmitter $\leq 0.6 \text{ mA}$	
Residual ripple	LGC, Pt100 (optional): without influence for 4 ... 20 mA signal up to $\pm 5 \%$ residual ripple within the permitted voltage range temperature transmitter (optional): $U_{pp} \geq 5 \text{ V}$ at $U_b \geq 13 \text{ V}$ , $f_{max} = 1 \text{ kHz}$	Hydrostatic pressure sensors
<b>Performance characteristics</b>		
Reference operating conditions	LGC, Pt100 (optional): acc. to DIN EN 60770, $T_{amb} = 25 \text{ °C}$ (296 K) temperature transmitter (optional): calibration temperature $23 \text{ °C} \pm 5 \text{ K}$ (296 K $\pm 5 \text{ K}$ )	
Accuracy	LGC: non-linearity including hysteresis and non-repeatability as per DIN EN 60770: $\pm 0.2 \%$ of upper range value (URV) Pt100 (optional): max. $\pm 0.7 \text{ K}$ (class B to DIN EN 60751) temperature transmitter (optional): $\pm 0.2 \text{ K}$ , with Pt100: max. $\pm 0.9 \text{ K}$	
Long-term drift	LGC, Pt100 (optional): $\pm 0.1 \%$ of upper range value (URL) per year temperature transmitter (optional): $\pm 0.1 \text{ K}$ per year	

## Level probe LGC

## Technical data

Float switches	Influence of medium temperature	<ul style="list-style-type: none"> <li>- thermal change in zero signal and output span for typical temperature range 0 ... 30 °C (273 ... 303 K): ± 0.4 % (± 0.5 %)* of the measuring span</li> <li>- thermal change in zero signal and output span for the total medium temperature range -10 ... 70 °C (263 ... 343 K): ± 1.0 % (± 1.5 %)* of the measuring span (Pt100)</li> <li>- temperature coefficient (TK) in zero signal and output span: 0.15 %/10 K (0.3 %/10 K)* of the measuring span (Pt100 and temperature transmitter)</li> </ul> <p>*specifications for sensors 0.1 bar and 0.6 bar</p>
	Rise time	LGC: 80 ms, Pt100 (optional): 160 s
	Warming-up time	LGC, Pt100 (optional): 20 ms, temperature transmitter (optional): 4 s
	Adjustment time	LGC: 150 ms, Pt100 (optional): 300 s
Vibration limit switches	<b>Operating conditions</b>	
	Mounting conditions	
	Installation position	vertical from above
	Ambient conditions	
	Ambient temperature	LGC, Pt100 (optional): -10 ... 70 °C (263 ... 343 K) = medium temperature temperature transmitter (optional): -40 ... 85 °C (233 ... 358 K)
Conductive limit switches	Storage temperature	LGC, Pt100 (optional): -40 ... 80 °C (233 ... 353 K) temperature transmitter (optional): -40 ... 100 °C (233 ... 373 K)
	Electromagnetic compatibility	LGC, Pt100 (optional): maximum deviation < 0.5 % of span
	Overvoltage protection	LGC, Pt100 (optional): integrated overvoltage protection to EN 61000-4-5 ≤ 1.2 kV, install overvoltage protection ≥ 1.2 kV, external if necessary temperature transmitter (optional): install overvoltage protection, external if necessary
	Process conditions	
	Medium temperature	LGC, Pt100 (optional): -10 ... 70 °C (263 ... 343 K), for Ex devices see safety information temperature transmitter (optional): -40 ... 85 °C (233 ... 358 K) = ambient temperature, install temperature transmitter outside medium
Capacitive limit switches	Medium temperature limits	LGC, Pt100 (optional): -20 ... 70 °C (253 ... 343 K) You may operate the LGC in this temperature range. The specification can then be exceeded, e. g. measuring accuracy, see also DIN 16086.
	<b>Mechanical specifications</b>	
	Protection degree	LGC, Pt100 (optional): IP68, permanently hermetically sealed, optional terminal box IP66/IP67 temperature transmitter (optional): IP00, moisture condensation permissible, when mounted in the optional terminal boxes IP66/IP67
	<b>Mechanical construction</b>	
	Construction type	rod probe
Limit value immersion probes	Dimensions	level probe LGC: Ø22 x 240 mm (Ø0.9 x 9.5 in) terminal housing LGC-Z11: 120 x 80 x 55 mm (4.7 x 3.15 x 2.2 in) temperature transmitter LGC-Z13: Ø44 x 21 mm (1.7 x 0.8 in) extension cable: 10 m (33 ft), 20 m (66 ft) or any length, can be cropped - max. free suspended length (mechanical stability under load): 1000 m (3294 ft) - max. length for non-Ex and EEx nA IIC T6, see section load - max. length for EEx ia IIC T6: see related safety information (SI)
	Mass	level probe LGC: 290 g terminal box LGC-Z11: 235 g temperature transmitter LGC-Z13: 40 g extension cable PE: 52 g/m extension cable FEP: 108 g/m suspension clamp LGC-Z10: 170 g extension cable mounting screw LGC-Z14: 770 g extension cable mounting screw LGC-Z16: 724 g
	Material	level probe LGC: 1.4435/316L process ceramic: Al <sub>2</sub> O <sub>3</sub> aluminium oxide ceramic seal (internal): EPDM or Viton protective cap: PE-HD (high-density polyethylene) terminal box LGC-Z11: PC (polycarbonate) temperature transmitter LGC-Z13: housing PC (polycarbonate) extension cable PE: insulation PE (polyethylene), copper wires, twisted extension cable FEP: insulation FEP (fluorinated ethylene propylene), copper wires, twisted suspension clamp LGC-Z10: 1.4404/316L and glass fibre reinforced PA (polyamide) extension cable mounting screw LGC-Z14: 1.4301/304 extension cable mounting screw LGC-Z16: 1.4301/304 additional weight LGC-Z12: 1.4404/316L
Hydrostatic pressure sensors	Mechanical loading	extension cable: - minimum bending radius: 120 mm (4.7 in) - tensile strength: min. 950 N - cable extraction force: ≥ 450 N - PE: approved for use with drinking water - resistance to UV light - cable resistance per wire: ≤ 0.09 Ω/m
	Electrical connection	3 terminals in terminal housing as standard 4 terminals in block, accessories LGC-Z15 for conductor cross section 0.08 ... 2.5 mm <sup>2</sup>
<b>Certificates and approvals</b>		

Ex approval	TÜV 01 ATEX 1749, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	Float switches
Type of protection	 II 2G EEx ia IIC T6 (TÜV 01 ATEX 1749)  II 3G EEx nA II T6	
Drinking water approval	KTW certificate and NSF approval	Vibration limit switches
<b>General information</b>		
<b>Directive conformity</b>		
Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1	
Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector)	
Directive 94/9 EC (ATEX)	EN 50014, EN 50020, EN 50021	
<b>Conformity</b>		Conductive limit switches
Electromagnetic compatibility	NE 21	
Protection degree	EN 60529	
Supplementary documentation	technical information TI-LGC operating instructions BA231O operating instructions SD126O (use in the drinking water sector) safety information SI131O (TÜV 01 ATEX 1749) safety information SI132O (  II 3G EEx nA II T6) FM control drawing ZD063O CSA control drawing ZD064O	Capacitive limit switches
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

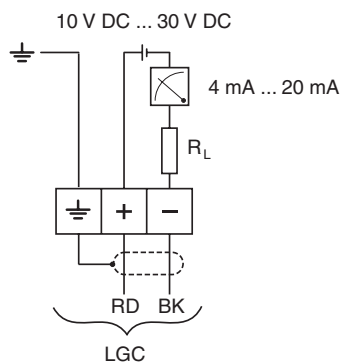
Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

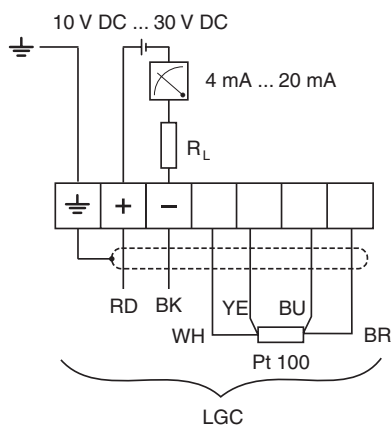
Electrical connection

Level probe LGC, standard,  
optional equipment N/2



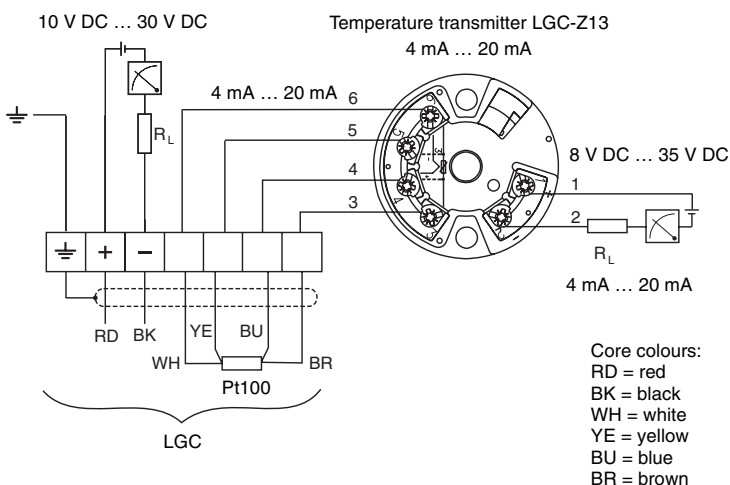
Core colours:  
RD = red  
BK = black

Level probe LGC with Pt100,  
optional equipment 1/3



Core colours:  
RD = red  
BK = black  
WH = white  
YE = yellow  
BU = blue  
BR = brown

Level probe LGC with Pt100 and temperature  
transmitter LGC-Z13 (4 mA ... 20 mA),  
optional equipment 4

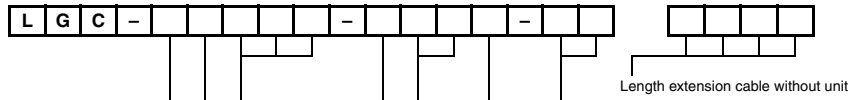


Core colours:  
RD = red  
BK = black  
WH = white  
YE = yellow  
BU = blue  
BR = brown

Accessories

- LGC-Z10, mounting clamp A for simple mounting of the level probe LGC
- LGC-Z11, terminal housing (IP65/IP67) with GORE-TEX® filter with 3 built-in terminals, the terminal housing is suitable for the installation of a temperature transmitter (LGC-Z13) or for 4 other terminals (LGC-Z15)
- LGC-Z12, additional weight  
these additional weights are used to prevent the lateral buoyancy (measuring error) or to simplify a lower in a guide tube
- LGC-Z13, temperature transmitter 2-wire for level probe LGC, -20 °C ... 80 °C (253 K ... 353 K)
- LGC-Z14, cable mounting screw G with cylindrical threading G1½A for simple mounting of the level probe LGC and for locking the extension cable
- LGC-Z15, terminal block with 4 terminals for LGC with optional equipment 3 with terminal housing LGC-Z11, suitable for conductor cross section 0.08 ... 2.5 mm²
- LGC-Z16, cable mounting screw N with tapered thread 1½ NPT for simple mounting of the level probe LGC and for locking the extension cable

Type code/model number



**Certificates**

- NA no approval
- EX II 2G, EEx ia IIC T6
- E3 II 3G, EEx nA IIC T6
- F1 FM, Cl. I, Div. 1, Group A - D, IS
- C1 CSA, Cl. I, Div. 1, Group A - D, IS
- CG CSA General Purpose

**Optional equipment**

- N without optional equipment
- 1 with integrated Pt100 temperature probe (4-wire)
- 2 terminal box with filter
- 3 pressure sensor with Pt100, 4-wire and terminal housing with filter (IP65/IP67)
- 4 pressure sensor with Pt100, -20 °C ... +80 °C, temperature transmitter 4 mA ... 20 mA (2-wire), in terminal housing with filter (IP65/IP67)

**Extension cable**

- XM in m, PE extension cable, can be cropped
- 2A 10 m (33 ft), PE extension cable, can be cropped
- 2C 20 m (66 ft), PE extension cable, can be cropped
- CM in m, FEP extension cable, can be cropped
- 3A 10 m (33 ft), FEP extension cable, can be cropped
- 3C 20 m (66 ft), FEP extension cable, can be cropped

**Seal**

- 1 Viton measurement cell sealing
- 2 EPDM measurement cell sealing

**Measurement ranges**

- R1A 0 bar ... 0.1 bar
- R1C 0 bar ... 0.2 bar
- R1D 0 bar ... 0.4 bar
- R1E 0 bar ... 0.6 bar
- R2A 0 bar ... 1.0 bar
- R2C 0 bar ... 2.0 bar
- R2D 0 bar ... 4.0 bar
- R3A 0 bar ... 10.0 bar
- R3C 0 bar ... 20.0 bar
- XXX set in accordance with customer specification

**Probe tube**

- S Ø22 mm (0.9 in), stainless steel 1.4435/316L
- T Ø22 mm (0.9 in) stainless steel 1.4435/316L with drinking water approval

**Terminal mechanics**

- K without mechanical connection
- A tension clamp, 1.4435/316L
- G extension cable mounting screw G1½, 1.4301/304
- N extension cable mounting screw 1½ NPT, 1.4301/304

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

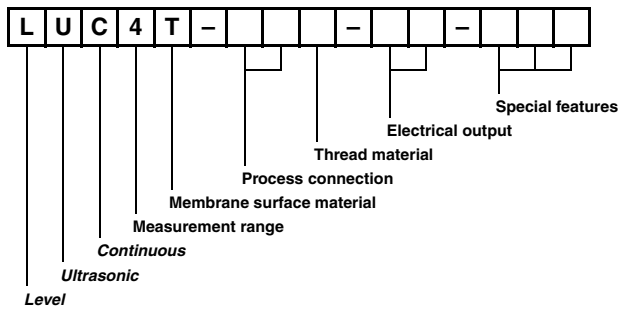
Hydrostatic pressure sensors

# Type code of ultrasonic level sensors

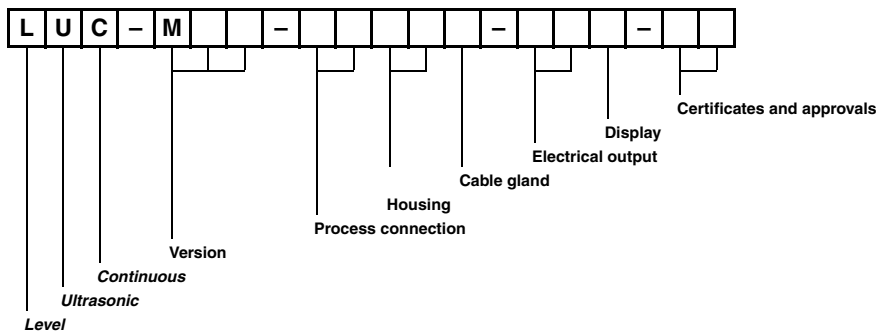
The figure below shows the used characters and numbers of the ultrasonic level sensors type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the ultrasonic level sensors.

## Product group LUC4



## Product group LUC-M\*\*



Ultrasonic level sensors  
 Guided microwave  
 Corrosion monitoring  
 Level signal conditioning electronics  
 Level control accessories  
 Pressurised enclosure system

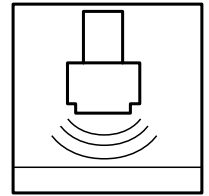


Ultrasonic level sensor LUC-M20

This continuous level measurement is based on the travel time of ultrasonic pulses to the surface of the medium and back.

When installing the sensor, the typical block distance has to be considered.

Rough liquid surfaces and the changed angle during filling and emptying granulated solids influence the reflection of the ultrasonic pulses and may impact the measurement.



Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Contents**

	<b>Page</b>
Type code of ultrasonic level sensors . . . . .	184
Ultrasonic level sensor LUC4, range 4 m (13.2 ft), fixed target suppression. . . . .	186
Ultrasonic level sensor LUC-M** . . . . .	190

## Ultrasonic level sensor

## Dimensions

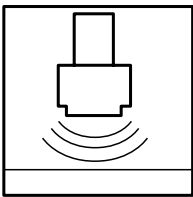
Ultrasonic level sensors



Guided microwave

## LUC4

Corrosion monitoring



Level signal conditioning electronics

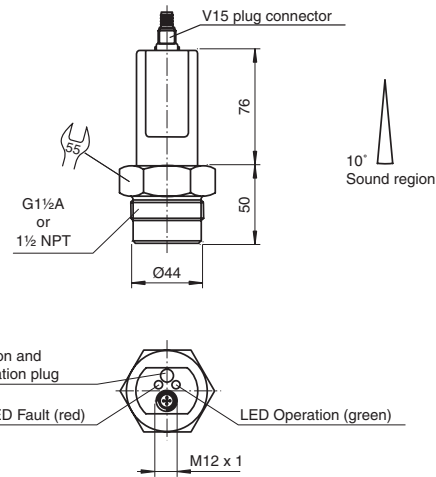


## Features

- Active fixed target suppression
- Temperature compensation
- 12 Bit D/A transducer
- Compact design
- Plug connection
- Function monitoring
- Fail-safe behaviour in the event of no echo
- Output signal 4 mA ... 20 mA/  
0 V ... 10 V
- Simple calibration

Level control accessories

Pressurised enclosure system



## Function

The LUC4 ultrasonic sensor is especially designed to measure the fill level of liquids. With its Teflon-coated surface, the sensor is outstandingly suited for use with corrosive liquids. The masking of fixed objects permits the sensor to be deployed in locations in which struts or other internal structures extend into the measuring field.

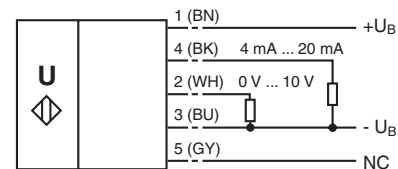
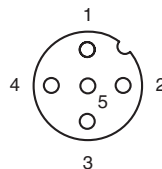
Sensors of the LUC4 series feature a 4 mA ... 20 mA current and 0 V ... 10 V voltage output as standard. The outputs have fail-safe behaviour in the event of a fault.

The ultrasonic converter sends out an acoustic pulse. This pulse is reflected by the contents of the container and registered by the converter after traveling the measuring distance. A microprocessor evaluates the echo signals and determines the fill level.

Sources of interference such as weld seams, fixed installations, etc. are suppressed reliably via the masking of fixed objects. Changes of the ultrasonic speed caused by changing temperatures are compensated.

## Electrical connection

### Connector V15



Core colours in accordance with EN 60947-5-2.

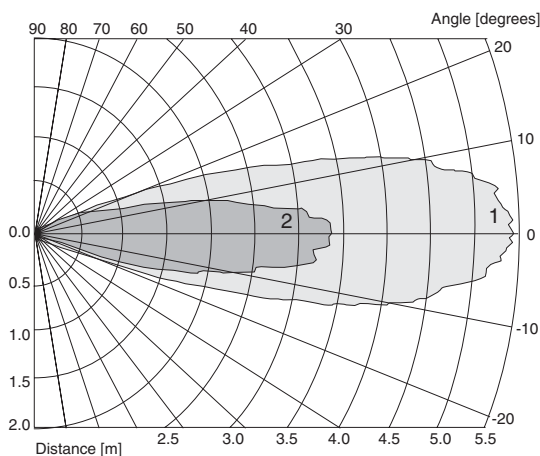


<b>Application</b>			Ultrasonic level sensors
Description	device for sending and evaluation of ultrasonic pulse reflection		
<b>Function and system design</b>			
Equipment architecture	A measuring system consists of an ultrasonic level sensor LUC4 and a display unit DA5 or a power supply, but can also be connected directly to a PLC.		Guided microwave
<b>Input characteristics</b>			
Measurement range	0.3 ... 4 m (1 ... 13 ft), for liquids		
<b>Output characteristics</b>			
Output signal	analog output: 4 ... 20 mA, $R_L \leq 500 \Omega$ , error $\geq 21$ mA voltage output: 0 ... 10 V, $R_L \geq 1 \text{ k}\Omega$ , error $\geq 10.5$ V		
<b>Auxiliary energy</b>			
Supply voltage	20 ... 30 V DC (3-wire)		
Power consumption	$\leq 1200$ mW		
Residual ripple	$\pm 10$ % <sub>pp</sub>		
<b>Performance characteristics</b>			
Resolution	2 mm		Corrosion monitoring
Accuracy	0.5 % of upper limit of measuring range		
<b>Operating conditions</b>			
Mounting conditions			
Installation instructions	Choose the installation direction in such a way that the sound direction is at right angles to the liquid surface.		
Ambient conditions			
Ambient temperature	-25 ... 70 °C (248 ... 343 K)		
Storage temperature	-40 ... 85 °C (233 ... 358 K)		
Process conditions			
Process temperature	-25 ... 70 °C (248 ... 343 K)		
Process pressure (static pressure)	atmospheric		
<b>Mechanical specifications</b>			Level signal conditioning electronics
Protection degree	IP65		
<b>Mechanical construction</b>			
Dimensions	Ø44 x 126 mm (1.7 x 5 in)		
Mass	220 g		
Material	housing: PBT membrane surface: PTFE process connection: version S: stainless steel 1.4571/316Ti version P: polypropylene		
Process connection	- cylindrical thread G1½A to DIN ISO 228/1 - conical thread 1½ NPT to ANSI B 1.20.1		
Electrical connection	V15 - connector (M12 x 1), 5 pin		
<b>Indication and operation</b>			
Display elements	operating mode: LED, green fault: LED, red, 2 Hz flashing		
Operating elements	calibration and configuration plug position: A1: empty calibration, E2/E3: TEACH-IN/fix target suppression, A2: full calibration, T: operation		Level control accessories
<b>General information</b>			
Directive conformity			
Directive 73/23/EEC (Low Voltage Directive)	EN 50178		Pressurised enclosure system
Directive 89/336/EC (EMC)	EN 60947-5-2		
Conformity			
Protection degree	EN 60529		
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .		

**Compensation**

Compensation (not installed)	Compensation (installed)	Plug position
1. Empty TEACH-IN simulation of 0 % level (wait 15 s)	1. Empty TEACH-IN approach 0 % level in container (wait 15 s)	T
Accept empty value Empty value accepted (red LED flashing) Empty TEACH-IN complete	Accept empty value Empty value accepted (red LED flashing) Empty TEACH-IN complete	A1 A1 T
2. Full TEACH-IN simulation of 100 % level (wait 15 s)	2. Full TEACH-IN approach 100 % level in container (wait 15 s)	T
Accept full value Full value accepted (red LED flashing) Full TEACH-IN complete	Accept full value Full value accepted (red LED flashing) Full TEACH-IN complete	A2 A2 T
TEACH-IN complete	TEACH-IN complete	T

**Characteristic response curve**

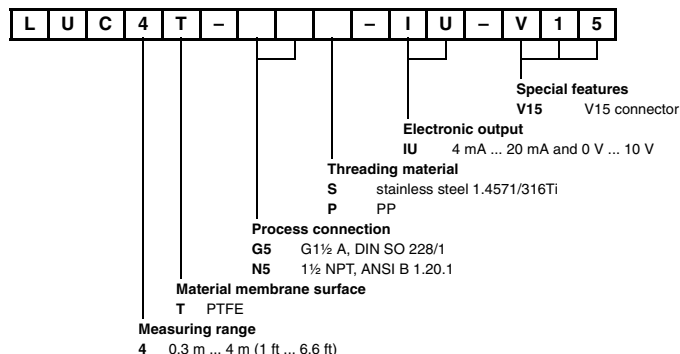


Curve 1: flat plate 100 mm x 100 mm  
Curve 2: round bar, Ø 25 mm

**Accessories**

- LUC4-Z30-G2V, external temperature probe, G½A
- LUC4-Z30-N2V, external temperature probe, ½ NPT
- V15-G-2M-PVC, cable box, straight, 2 m (6.6 ft) cable, PVC
- V15-W-2M-PVC, cable box, 90° angle, 2 m (6.6 ft) cable, PVC
- UC-30GM-PROG, extension cable for TEACH-IN

**Type code/model number**





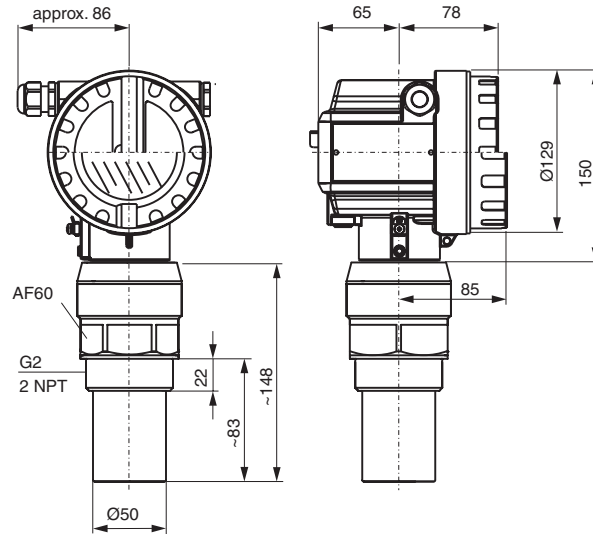
## Ultrasonic level sensor

## Dimensions

Ultrasonic level sensors



LUC-M20 with F12 housing and process connection 2"



Additional dimensions see section dimensions.

## Function

The LUC-M\*\* is a compact measuring device for continuous, non-contact level measurement. Depending on the sensor, the measuring range is up to 15 m in fluids and up to 7 m in bulk solids. By using the linearisation function, the LUC-M\*\* can also be used for flow measurements in open channels and measuring weirs.

The system integration is ensured via

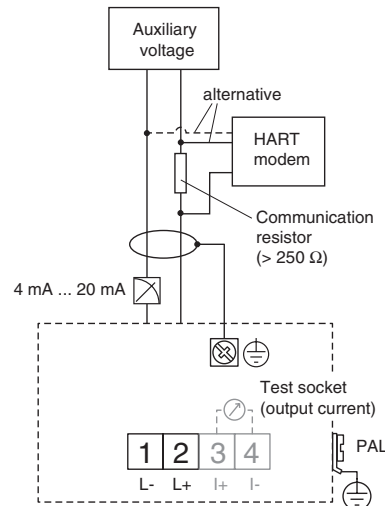
- HART (standard), 4 mA ... 20 mA,
- PROFIBUS PA and
- FOUNDATION Fieldbus.

The maximum measuring range with

- LUC-M10: 5 m (16.4 ft) in fluids and 2 m (6.6 ft) in bulk materials,
- LUC-M20: 8 m (26.2 ft) in fluids and 3,5 m (11.5 ft) in bulk materials,
- LUC-M30: 15 m (49.2 ft) in fluids and 7 m (23 ft) in bulk materials,
- LUC-M40: 10 m (32.8 ft) in fluids and 5 m (16.4 ft) in bulk materials.

## Electrical connection

Connection IH, 4 mA ... 20 mA with HART, 2-wire (example)

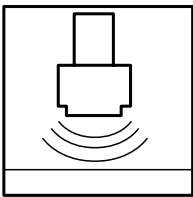


Other connection types see section electrical connection.

Guided microwave

## LUC-M\*\*

Corrosion monitoring



Level signal conditioning electronics



## Features

- Quick and simple commissioning via menu-guided onsite operation with four-line display
- Envelope curves on the on-site display for simple diagnosis
- Linearisation function (up to 32 points) for conversion of the measured value into any unit of length, volume or flow rate
- Non-contact measurement method minimises service requirements
- Optional remote display and operation (up to 20 m from transmitter)
- Integrated temperature sensor for automatic correction of the temperature dependent sound velocity

Level control accessories

Pressurised enclosure system

<b>Function and system design</b>		<p>Ultrasonic level sensors</p> <p>Guided microwave</p> <p>Corrosion monitoring</p> <p>Level signal conditioning electronics</p> <p>Level control accessories</p> <p>Pressurised enclosure system</p>
Measuring principle	The sensor of the LUC-M** transmits ultrasonic pulses in the direction of the product surface. There, they are reflected back and received by the sensor. The LUC-M** measures the time between pulse transmission and reception. The instrument uses the time (and the velocity of sound) to calculate the distance between the sensor membrane and the product surface. As the device knows the empty distance from a user entry, it can calculate the level.	
Equipment architecture	4 ... 20 mA output with HART protocol, system integration via PROFIBUS PA or FOUNDATION Fieldbus	
<b>Input characteristics</b>		
Measured variable	distance between the sensor membrane and the product surface using the linearisation function, the device calculate - level in any units - volume in any units - flow across measuring weirs or open channels in any units	
Measurement range	LUC-M10: 5 m (16.4 ft) in fluids and 2 m (6.6 ft) in bulk materials LUC-M20: 8 m (26.2 ft) in fluids and 3,5 m (11.5 ft) in bulk materials LUC-M30: 15 m (49.2 ft) in fluids and 7 m (23 ft) in bulk materials LUC-M40: 10 m (32.8 ft) in fluids and 5 m (16.4 ft) in bulk materials	
Blocking distance	LUC-M10: 0.25 m (0.8 ft) LUC-M20: 0.35 m (1 ft) LUC-M30: 0.6 m (2 ft) LUC-M40: 0.4 m (1.3 ft)	
Operating frequency	LUC-M10: approx. 70 kHz LUC-M20: approx. 50 kHz LUC-M30: approx. 35 kHz LUC-M40: approx. 42 kHz	
<b>Output characteristics</b>		
Output signal	according to the instrument version: - 4 ... 20 mA with HART protocol - PROFIBUS PA - FOUNDATION Fieldbus (FF)	
Signal on alarm	error information can be accessed via the following interfaces: - on-site display (error symbol, error code and plain text description) - current output (configurable) - digital interface	
Output damping	0 ... 255 s, freely selectable	
Load	minimum load for HART communication: 250 Ω	
Linearisation	The linearisation function of the LUC-M** allows conversion of the measured value into any unit of length or volume. In open channels or measuring weirs, also a flow linearisation is possible (calculation of the flow from the measured level).	
<b>Auxiliary energy</b>		
Electrical connection	terminal compartment: In the F12 housing, the terminals are located underneath the housing cover, in the T12 housing, they are under the cover of the separate terminal compartment. cable gland: M20 x 1.5 (recommended cable diameter 6 ... 10 mm (0.24 ... 0.4 in)) cable entry G1/2 or 1/2 NPT fieldbus plug connector: M12 plug connector (PROFIBUS PA plug), 7/8" plug connector (FOUNDATION Fieldbus plug)	
Supply voltage	2-wire HART (standard): - current consumption 4 ... 20 mA - min. terminal voltage 14 V (at 4 mA), 8 V (at 20 mA) - max. terminal voltage 36 V 4-wire HART: - DC version: voltage 10.5 ... 32 V, max. load 600 Ω - AC version: 90 ... 253 V, max. load 600 Ω PROFIBUS PA and FOUNDATION Fieldbus: 9 ... 32 V DC for additional information see technical information	
Power consumption	2-wire: 51 ... 800 mW 4-wire AC: max. 4 VA 4-wire DC, LUC-M10/LUC-M20: 330 ... 830 mW 4-wire DC, LUC-M30/LUC-M40: 0.6 ... 1 W	
Current consumption	2-wire devices: - HART: 3.6 ... 22 mA - PROFIBUS PA: max. 13 mA - FOUNDATION Fieldbus: max. 15 mA	
Ripple	HART: 47 ... 125 Hz, $U_{pp} = 200$ mV (measured at 500 Ω)	
Noise	HART: 0.5 ... 10 kHz, $U_{rms} = 2.2$ mV (measured at 500 Ω)	
Electrical isolation	With 4-wire devices, the evaluation electronics and mains voltage are galvanically isolated from each other.	
Terminal assignment	see section electrical connection	
<b>Performance characteristics</b>		
Response time	depends on the parameter settings (min. 0.5 s for 4-wire devices, min. 2 s for 2-wire devices)	

Date of issue 09/22/06 – Catalog Field Devices

## Ultrasonic level sensor LUC-M\*\*

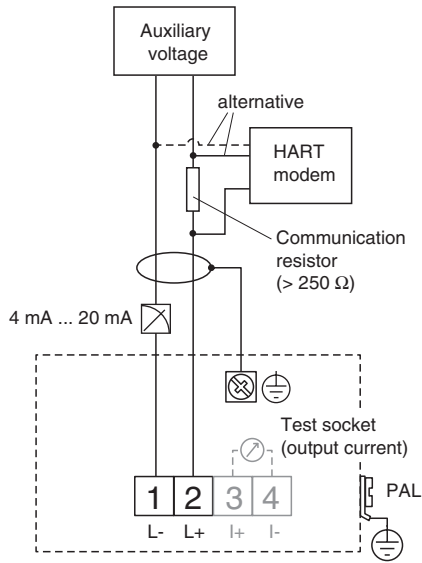
## Technical data

Ultrasonic level sensors	Reference operating conditions	temperature = 20 °C (293 K) pressure = 1013 mbar <sub>abs</sub> humidity = 50 % ideal reflective surface (e. g. calm, smooth fluid surface) no interference reflections within signal beam set application parameters: - tank shape = flat ceiling - medium property = liquid - process conditions = calm surface
	Measured value resolution	LUC-M10, LUC-M20: 1 mm (0.04 in) LUC-M30, LUC-M40: 2 mm (0.08 mm)
Guided microwave	Measuring frequency	2-wire devices: max. 0.5 Hz 4-wire devices: max. 2 Hz dependent on the type of device and the parameter settings
	Maximum measured error	typical specifications for reference operating conditions (include linearity, repeatability, and hysteresis): LUC-M10, LUC-M20: ± 2 mm (0.08 in) or 0.2% of set measuring range (empty calibration) <sup>1)</sup> LUC-M30, LUC-M40: ± 4 mm (0.16 in) or 0.2% of set measuring range (empty calibration) <sup>1)</sup> <sup>1)</sup> whichever is greater
	<b>Operating conditions</b>	
Corrosion monitoring	Mounting conditions	see technical information
	Ambient conditions	
	Ambient temperature	-40 ... 80 °C (233 ... 353 K), for additional information see technical information
	Storage temperature	-40 ... 80 °C (233 ... 353 K)
	Resistance to alternating temperature cycles	Nb test: +80 °C/- 40 °C (353 K/233 K), 1 K/min, 100 cycles
	Vibration resistance	20 ... 2000 Hz, 1 (m/s <sup>2</sup> )/Hz; 3 x 100 min
	Process conditions	
	Process temperature	-40 ... 80 °C (233 ... 353 K) (233 ... 353 K), a temperature sensor is integrated in the sensor for correction of the temperature-dependent time-of-flight
Level signal conditioning electronics	Process pressure (static pressure)	LUC-M10, LUC-M20: 0.7 ... 3 bar <sub>abs</sub> LUC-M30, LUC-M40: 0.7 ... 2.5 bar <sub>abs</sub>
	<b>Mechanical specifications</b>	
	Protection degree	with closed housing, tested according to - IP68, Nema 6p (24 h at 1.83 m under water surface) - IP66, Nema 4x with open housing: IP20, Nema 1 (also ingress protection of the display)
Level control accessories	<b>Mechanical construction</b>	
	Construction type	housing design: - F12 housing with sealed terminal compartment for standard or EEx ia applications - T12 housing with separate terminal compartment and explosion proof encapsulation cover: - version without on-site display - version with on-site display (transparent cover), this version cannot be supplied together with the ATEX II 1/2D certificate
	Dimensions	see section dimensions
Pressurised enclosure system	Mass	LUC-M10: approx. 2.5 kg LUC-M20: approx. 2.6 kg LUC-M30: approx. 3.5 kg LUC-M40: approx. 3 kg
	Material	material in contact with process: - LUC-M10, LUC-M20: sensor PVDF, seal EPDM - LUC-M30: sensor UP and stainless steel 1.4571/316Ti, seal EPDM, flange PP or stainless steel 1.4571/316Ti - LUC-M40: sensor PVDF, seal Viton or EPDM, flange PP, PVDF or stainless steel 1.4535/316L housing: - aluminium, seawater resistant, chromed, powder-coated cover: - aluminium, for version without on-site display - inspection glass for version with on-site display
Pressurised enclosure system	Process connection	- cylindrical thread G1½B, G2B to DIN ISO 228/1 - conical thread 1½ NPT, 2 NPT to ANSI B 1.20.1 - flanges to EN 1092-1 from DN80, to ANSI B 16.5 from 3", to JIS B 2238 (RF) from DN80 - mounting bracket LUC-Z17
	Electrical connection	cable gland M20 x 1.5 cable gland ½ NPT cable gland G½ PROFIBUS PA plug M12 x 1 FOUNDATION Fieldbus plug 7/8"
Pressurised enclosure system	<b>Indication and operation</b>	
	Display elements	LCD module VU331 at the device

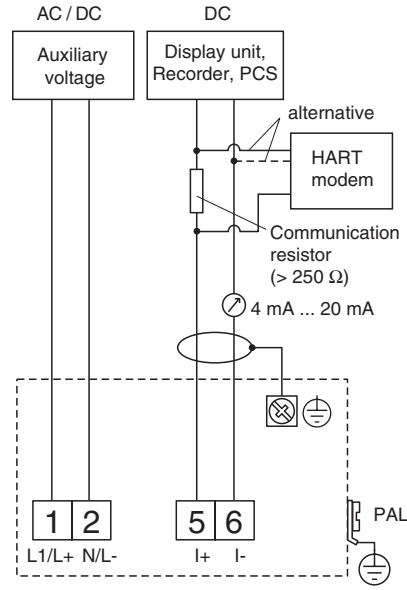
Operating elements	on-site operation: - via 3 keys of the LCD module VU331 - via handheld terminal remote control: - operation with operating program (for communication variants HART or PROFIBUS-PA) - operation with NI-FBUS configurator (only FOUNDATION Fieldbus)	Ultrasonic level sensors	
<b>Certificates and approvals</b>			
Ex approval	KEMA 05 ATEX 1111, KEMA 05 ATEX 1112, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	Guided microwave	
Type of protection	<p>⊕ II 1/2G or II 2G EEx ia IIC T6 (KEMA 05 ATEX 1111)</p> <p>⊕ II 1/2G or II 2G EEx d [ia] IIC T6 (KEMA 05 ATEX 1111)</p> <p>⊕ II 1/2G or II 2G EEx em [ia] IIC T6 (KEMA 05 ATEX 1111)</p> <p>⊕ II 1/2D or II 2D or II 1/3D or II 3D T115°C or T100°C or T95°C (KEMA 05 ATEX 1111)</p> <p>⊕ II 1/2D or II 2D or II 1/3D or II 3D T115°C or T83°C or T84°C or T86°C (KEMA 05 ATEX 1112)</p> <p>⊕ II 3G EEX nA II T6</p>		
<b>General information</b>			
Directive conformity			
Directive 73/23/EEC (Low Voltage Directive) Directive 89/336/EC (EMC)	EN 61010-1  emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector) A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communication signal (HART).		
Directive 94/9 EC (ATEX) Conformity	EN 50014, EN 50018, EN 50019, EN 50020, EN 50028, EN 50281-1-1, EN 50284	Corrosion monitoring	
Electromagnetic compatibility	NE 21		
Protection degree	EN 60529		
Climate class	EN 60068-2-38 (test Z/AD) DIN/IEC 68 T2-30Db		
Vibration resistance	EN 60068-2-64		
Resistance to alternating temperature cycles	EN 60068-2-14	Level signal conditioning electronics	
Supplementary documentation	technical information TI365O short instructions KA183O (can be found under the device housing cover) operating instructions KA191O (connection LUC-M**) operating instructions BA237O (4 ... 20 mA, HART devices) operating instructions BA238O (PROFIBUS PA devices) operating instructions BA239O (FOUNDATION Fieldbus devices) operating instructions BA240O (description of device functions) safety information SI174O (KEMA 05 ATEX 1111), HART version safety information SI175O (KEMA 05 ATEX 1111), PROFIBUS PA and FOUNDATION Fieldbus safety information SI176O (KEMA 05 ATEX 1111) safety information SI177O (KEMA 05 ATEX 1112), HART version safety information SI178O (KEMA 05 ATEX 1112), PROFIBUS PA and FOUNDATION Fieldbus safety information SI179O (⊕ II 3G EEX nA II T6) safety information SI180O (KEMA 05 ATEX 1111) safety information SI224O (KEMA 05 ATEX 1111), HART version safety information SI225O (KEMA 05 ATEX 1111), PROFIBUS PA and FOUNDATION Fieldbus safety information SI259O (KEMA 05 ATEX 1111), HART version FM control drawing ZD096O (HART devices, F12 housing) FM control drawing ZD097O (PROFIBUS PA and FOUNDATION Fieldbus devices) FM control drawing ZD098O (T12 housing) FM control drawing ZD139O (HART devices, T12-OVP housing) FM control drawing ZD140O (PROFIBUS PA and FOUNDATION Fieldbus devices, T12-OVP housing) CSA control drawing ZD088O (HART devices, F12 housing) CSA control drawing ZD099O (PROFIBUS PA and FOUNDATION Fieldbus devices) CSA control drawing ZD100O (T12 housing) CSA control drawing ZD101O (HART devices, T12 housing) CSA control drawing ZD102O (PROFIBUS PA and FOUNDATION Fieldbus devices)		
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .		Level control accessories
			Pressurised enclosure system

Electrical connection

Connection IH  
4 mA ... 20 mA with HART, 2-wire

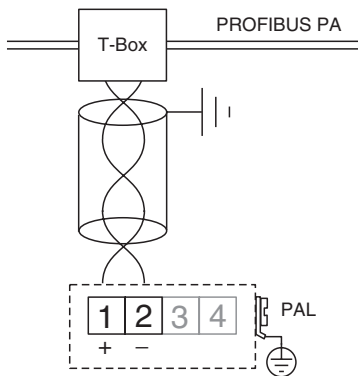


Connection AH, DH  
4 mA ... 20 mA with HART, active, 4-wire

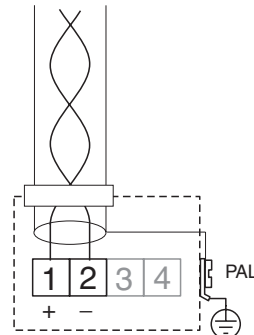


- Connect the connecting line to the screw terminals (line cross-sections of 0.5 mm... 2.5mm) in the terminal compartment.
- Use 2-wire twisted pair cable with screen for the connection.
- Protective circuitry against reverse polarity, RFI and over-voltage peaks is built into the device.

Connection PA  
PROFIBUS PA



Connection FF  
FOUNDATION Fieldbus



The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. Please use 2-wire twisted pair cable with screen.

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

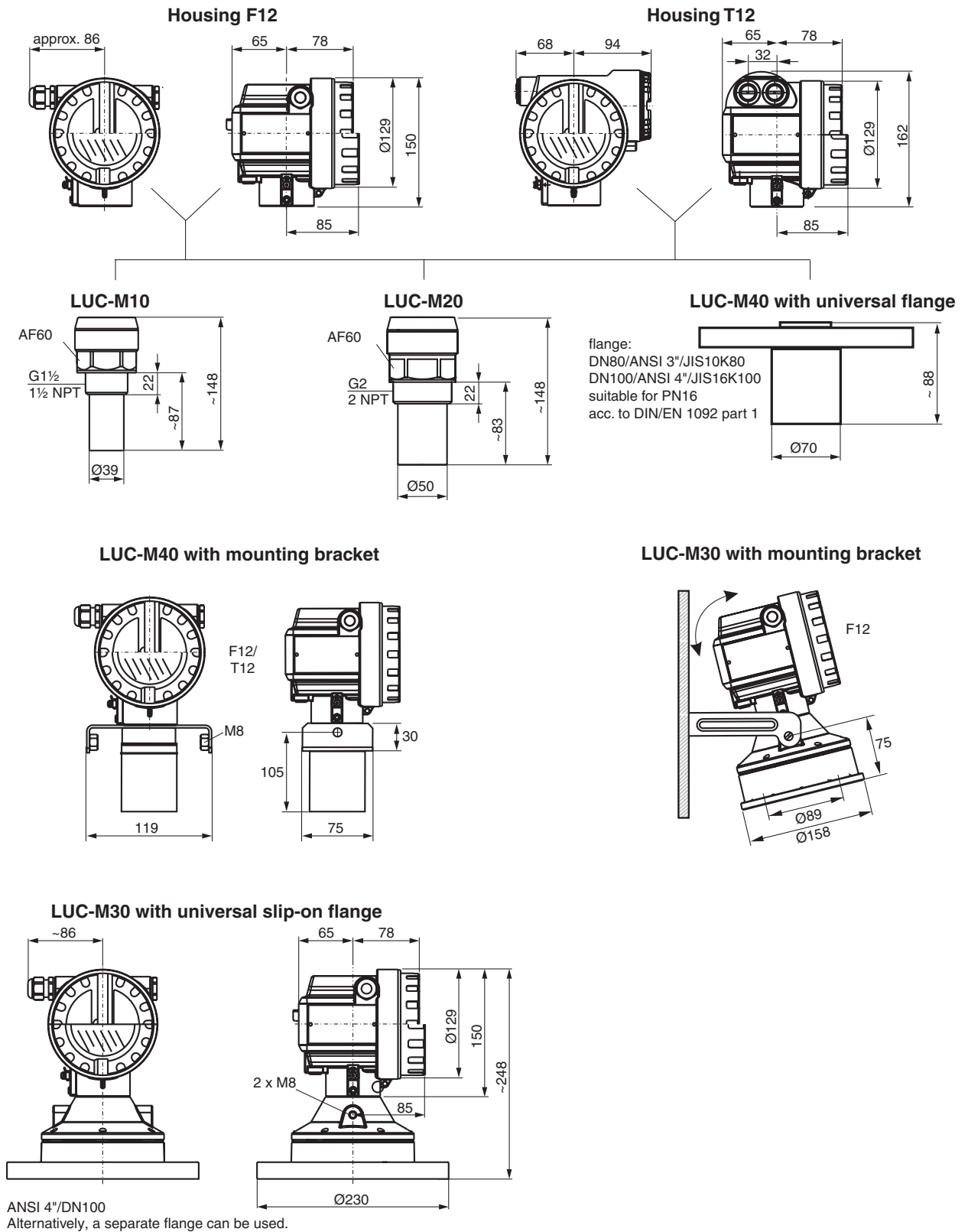
Level signal conditioning electronics

Level control accessories

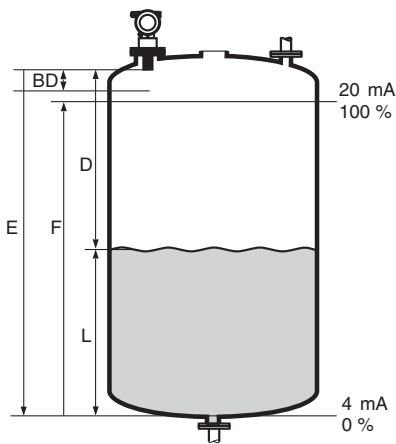
Pressurised enclosure system



Dimensions



### Blocking distance

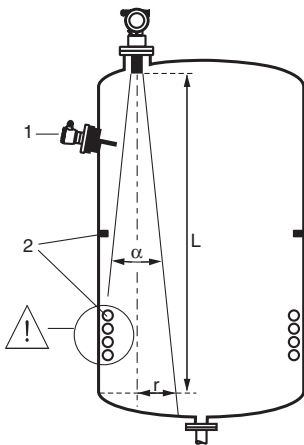


Sensor	BD	Max. range fluids	Max. range bulk materials
LUC-M10	0.25 m (9.8 in)	5 m (16.4 ft)	2 m (6.6 ft)
LUC-M20	0.35 m (13.8 in)	8 m (26.2 ft)	3.5 m (11.5 ft)
LUC-M30	0.6 m (23.6 in)	15 m (49.2 ft)	7 m (23 ft)
LUC-M40	0.4 m (15.7 in)	10 m (32.8 ft)	5 m (16.4 ft)

E: empty distance  
F: span (full distance)  
D: distance from sensor membrane - product surface  
L: level  
BD: blocking distance

### Emitting angle

To estimate the detection range, use the 3 dB emitting angle  $\alpha$ . Make sure that equipment (1) such as limit switches, temperature sensors, etc. are not located within the emitting angle  $\alpha$ . In particular, symmetrical equipment (2) such as heating coils, baffles etc. can influence measurement.



Sensor	$\alpha$	L	r
LUC-M10	11°	5 m (16.4 ft)	0.48 m (18.9 in)
LUC-M20	11°	8 m (26.2 ft)	0.77 m (30.3 in)
LUC-M30	6°	15 m (49.2 ft)	0.79 m (31.1 in)
LUC-M40	11°	10 m (32.8 ft)	0.96 m (37.8 in)

### Accessories

#### Mounting accessories

- LUC-Z17, mounting bracket for LUC-M30, LUC-M40
- LUC-Z18, mounting bracket for LUC-M10
- LUC-Z19, mounting bracket for LUC-M20
- LUC-Z2\*, cantilever for LUC-M10, LUC-M20
- LUC-Z3\*, mounting frame
- LUC-Z5\*, wall bracket

#### Flanges

- LUC-Z-\*\*\*, universal slip-on flange for LUC-M30
- LUC-Z-A\*\*N\*\*, adapter flange with conical thread for LUC-M10, LUC-M20
- LUC-Z-F\*\*G\*\*, adapter flange with metrical thread for LUC-M10, LUC-M20

#### Further accessories

- LUC-Z15, display and operating module VU331 for on-site operation
- LUC-Z16, weather protection cover
- LUC-Z40-\*\*1\*, remote display

for additional information see technical information





Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronics

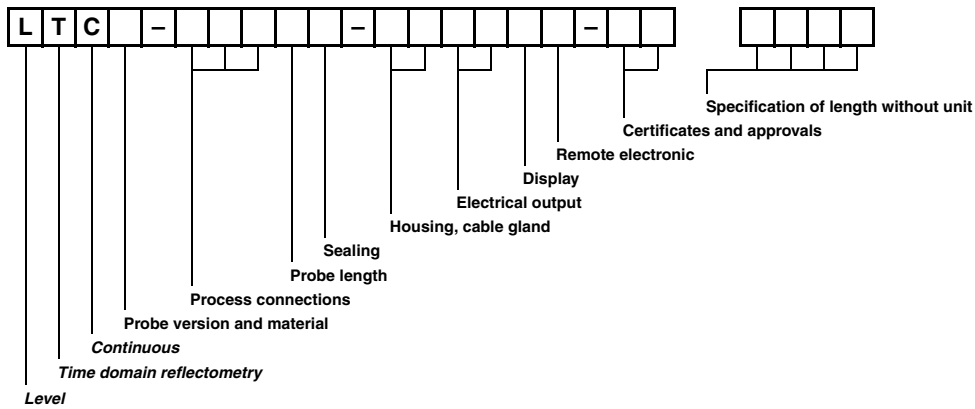
Level control  
accessories

Pressurised  
enclosure system

# Type code of guided microwave

The figure below shows the used characters and numbers of the guided microwaves type code. Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the guided microwaves.

## Product group Pulscon LTC\*



Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

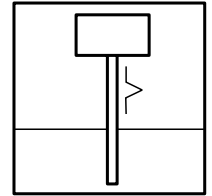
Pressurised enclosure system



This continuous level measurement for liquids and bulk solids is based on the propagation time measurement of microwave pulses according to the principle of time domain reflectometry (TDR), which are guided along a rod or a rope.

A high-frequency pulse is guided along a single conductor, the sensor rod, and reflected by the medium surface. The interface electronics determines the level of the bulk material from the propagation time of the pulse.

To a great extent the measuring principle is independent of process influences such as pressure, temperature or moving surfaces.



Guided microwave Pulscon LTC\* with coax probe

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

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Type code of guided microwaves .....	200
Guided microwave Pulscon LTC* .....	202





<b>Application</b>		The Pulscon LTC is a transmitter for continuous level measurement in powdery to granular bulk solids and liquids. The distance from the reference point (process connection of the measuring device) to the product surface is measured. High-frequency pulses are injected to a probe and led along the probe. The pulses are reflected by the product surface, received by the electronic evaluation unit and converted into level information.	Ultrasonic level sensors
Function principle			
<b>Function and system design</b>		The Pulscon LTC is a measuring system that functions according to the time-of-flight method. The distance from the reference point (process connection of the measuring device) to the product surface is measured.	Guided microwave
Measuring principle			
Equipment architecture		The Pulscon LTC is usable as single measuring cell or integrated in PROFIBUS PA or FOUNDATION Fieldbus systems.	Corrosion monitoring
<b>Input characteristics</b>			
Measured variable		distance between a reference point and a reflective surface (e. g. medium surface)	Guided microwave
Measurement range		max. 35 m (115 ft), dependent on the medium, the probe type and the probe length - rod probe 6 mm: 0.3 ... 2 m (1 ... 6.6 ft) - rod probe 16 mm/coax probe: 0.3 ... 4 m (1 ... 13.2 ft) - rope probe: 1 ... 35 m (3 ... 115 ft) for details see technical information	
Blocking distance		The upper blocking distance (= UB) is the minimum distance from the reference point of the measurement (mounting flange) to the maximum level.  The lower blocking distance (= LB) is the range of the probe from the lower edge calculated upwards, in which exact measurement is not possible.  The utilisable measuring range amounts between lower blocking distance and upper blocking distance the empty distance value and the measuring range value can be tuned independent from it. - rod probe 6 mm: 0.2 m (8 in) - rod probe 16 mm: 0.2 m (8 in) - coax probe: 0 m - rope probe: 0.2 m (8 in) for details see technical information	Corrosion monitoring
Measuring conditions		used frequency spectrum: 0.1 ... 1.5 GHz	
<b>Output characteristics</b>		4 ... 20 mA with HART protocol PROFIBUS PA FOUNDATION Fieldbus (FF)	Level signal conditioning electronics
Output signal			
Signal on alarm		error information can be accessed via the following interfaces: - local display with error symbol, plain text display - current output - digital interface	Level signal conditioning electronics
Linearisation		The Pulscon LTC linearisation function enables conversion of the measured value into any desired length or volume unit, mass or %. Linearisation tables for volume calculation in cylindrical tanks are pre-programmed. Any other table from up to 32 value pairs can be input manually or semi-automatically.	
<b>Auxiliary energy</b>		connection IH: 4 ... 20 mA with HART, 2-wire connection AH: 4 ... 20 mA with HART, 4-wire active, AC version connection DH: 4 ... 20 mA with HART, 4-wire active, DC version connection PA: PROFIBUS PA connection FF: FOUNDATION Fieldbus	Level control accessories
Electrical connection			
Supply voltage		connection IH: 7.5 ... 36 V DC; Ex version: 7.5 ... 30 V DC connection AH: 90 ... 253 V AC connection DH: 10.5 ... 32 V DC	Level control accessories
Power consumption		60 ... 900 mW	
Current consumption		connection AH: approx. 3 ... 6 mA connection DH: approx. 100 mA connection PA: max. 11 mA connection FF: max. 15 mA	Pressurised enclosure system
Overvoltage protection		If there is the risk of differences in potential forming when installing the Pulscon LTC to measure the level of flammable liquids, the device can be fitted with a T12 housing and integrated overvoltage protection (600 V gas tube surge arrester), see ordering information. This overvoltage protection meets the requirements of DIN EN 60079-14, test standard 60060-1, and also protects the device (10 kA, impulse 8/20 µs).	
Residual ripple		connection IH: HART residual ripple $U_{pp} \leq 200$ mV connection DH: HART residual ripple $U_{pp} \leq 2$ V, voltage incl. ripple within the permitted voltage (10.5 ... 32 V)	Pressurised enclosure system
Terminal assignment		see section electrical connection	
Load		connections IH, AH, DH: > 250 Ω	Pressurised enclosure system
<b>Performance characteristics</b>			
Resolution		digital: 1mm (0.04 in) analogue: 0.03 % of measuring range	Pressurised enclosure system
Response time		The reaction time depends on the configuration, shortest time: - 2-wire electronics: 1 s - 4-wire electronics: 0.7 s	

Ultrasonic level sensors	Reference operating conditions	<p>temperature = 20 °C (293 K) ± 5 K                      pressure = 1013 mbar<sub>abs</sub> (14.7 psi) ± 20 mbar (0.3 psi)                      relative humidity (air) = 65 % ± 20 %                      reflection factor ≥ 0.8 (surface of water for coax probe, metal plate for rod and rope probe with min. 1 m (39.4 in) Ø)                      flange for rod or rope probe ≥ 30 cm (11.8 in) Ø                      distance to obstructions ≥ 1 m (39.4 in)</p>
	Maximum measured error	<p>typical statements for reference conditions: DIN EN 61298-2, percentage of the span.                      output: sum of non-linearity, non-repeatability and hysteresis                      digital                      - measuring range: up to 10 m (30 ft): ± 3 mm (0.12 in), &gt; 10 m (30 ft): ± 0.03 %                      - for PA coated rope measuring range: up to 5 m (15 ft): ± 5 mm (0.2 in), &gt; 5 m (15 ft): ± 0.1 %                      analogue ± 0.06 %                      output: offset/zero                      digital ± 4 mm (0.16 in)                      analogue ± 0.03 %                      If the reference conditions are not met, the offset/zero arising from the mounting situation may be up to ± 12 mm (0.47 in). This additional offset/zero can be compensated for by entering a correction ("offset" function) during commissioning.</p>
Guided microwave	Influence of ambient temperature	<p>The measurements are carried out in accordance with EN 61298-3.                      digital output (HART, PROFIBUSPA, FOUNDATION Fieldbus):                      LTC, average TK: 0.6 mm/10 K, max. ± 3.5 mm (0.14 in) over the entire temperature range -40 ... 80 °C (233 ... 353 K)                      2-wire, current output (additional error, in reference to the span of 16 mA):                      - zero point (4 mA), average TK: 0.032 %/10 K, max. 0.35 % over the entire temperature range -40 ... 80 °C (233 ... 353 K)                      - span (20 mA), average TK: 0.05%/10 K, max. 0.5 % over the entire temperature range -40 ... 80 °C (233 ... 353 K)                      4-wire, current output (additional error, in reference to the span of 16 mA):                      - zero point (4 mA), average TK: 0.02 %/10 K, max. 0.29 % over the entire temperature range -40 ... 80 °C (233 ... 353 K)                      - span (20 mA), average TK: 0.06 %/10 K, max. 0.89 % over the entire temperature range -40 ... 80 °C (233 ... 353 K)</p>
Corrosion monitoring	<b>Operating conditions</b>	
	Mounting conditions	for details see technical information
Level signal conditioning electronics	Ambient conditions	
	Ambient temperature	-40 ... 80 °C (233 ... 353 K), for details see technical information
	Ambient temperature limits	For process connection temperatures above 80 °C (353 K), the allowed ambient temperature at the housing is reduced. for details see technical information
	Storage temperature	-40 ... 80 °C (233 ... 353 K)
Level control accessories	Process conditions	
	Process temperature	The maximum permitted temperature at the process connection is determined by the O-ring version ordered: O-ring material - FKM (Viton): -30 ... 150 °C (243 ... 423 K) - EPDM: -40 ... 120 °C (233 ... 393 K) - FFKM (Kalrez): -5 ... 150 °C (268 ... 423 K)
	Process pressure limits (overpressure)	-1 ... 40 bar
	Dielectric constant	with coax probe: DC ≥ 1.4, rod and rope probe: DC ≥ 1.6
Pressurised enclosure system	<b>Mechanical specifications</b>	
	Protection degree	with closed housing tested according to - IP68, NEMA 6p (24 h at 1.83 m (72 in) under water) - IP66, NEMA 4x with open housing: IP20, NEMA 1 (also degree of protection of display) Caution! Degree of protection IP68 NEMA 6p applies for M12 PROFIBUS PA plugs only when the PROFIBUS cable is plugged in.
	<b>Mechanical construction</b>	
	Construction type	housing F12 with sealed terminal compartment for standard or EEx ia applications housing T12 with separate terminal compartment and explosion proof encapsulation
	Versions	LTC1 with 4 mm (0.16 in) rope probe LTC2 with 16 mm (0.6 in) rod probe LTC3 with 6 mm (0.24 in) rod probe LTC4 with coax probe LTC5 with 6 mm (0.24 in) rope probe LTC8 with 6 mm (0.24 in) rope probe, PA coated

Dimensions	<p>housing:</p> <ul style="list-style-type: none"> <li>- housing F12: 174 x 150 x 143 mm (6.8 x 6 x 5.6 in)</li> <li>- housing T12: 194 x 162 x 143 mm (7.6 x 6.4 x 5.6 in)</li> </ul> <p>distance sleeve: diameter 60 mm (2.36 in), height 400 mm (15.7 in)</p> <p>remote electronic: length 3000 mm (9.9 ft)</p> <p>process connections: length 61 ... 281.6 mm (2.4 ... 11.1 in)</p> <p>probes:</p> <ul style="list-style-type: none"> <li>- 4 mm (0.16 in) and 6 mm (0.24 in) rope probe: length 1000 ... 35000 mm (3 ... 115 ft)</li> <li>- 6 mm (0.24 in) rod probe: length 300 ... 2000 mm (1 ... 6.6 ft)</li> <li>- 16 mm (0.6 in) rod probe: length 300 ... 4000 mm (1 ... 13.2 ft)</li> <li>- coax probe: diameter 42.4 mm (1.67 in), length 300 ... 4000 mm (1 ... 13.2 ft)</li> </ul> <p>see section dimensions</p>	Ultrasonic level sensors	
Mass	<p>housing F12 or T12: approx. 4000 g</p> <p>4 mm (0.16 in) rope probe: approx. 100 g/m</p> <p>6 mm (0.24 in) rod or rope probe: approx. 200 g/m</p> <p>16 mm (0.63 in) rod probe: approx. 1600 g/m</p> <p>coax probe: approx. 3500 g/m</p> <p>process connections: depending on the design</p>	Guided microwave	
Material	<p>housing: aluminium (AlSi10Mg), seawater resistant, chromed, powder-coated</p> <p>transparent window: glass</p> <p>process connection: 1.4435/316L, 1.4462</p> <p>rope: 1.4401/316</p> <p>rod and coax pipe: 1.4435/316L</p> <p>weight: 1.4435/316L</p>	Guided microwave	
Process connection	<ul style="list-style-type: none"> <li>- flanges to ANSI B 16.5 1½" ... 8", 150 lbs/300 lbs, RF</li> <li>- flanges to EN 1092-1 DN40 PN25/40 ... DN200 PN10/16, Form C, sealing strip</li> <li>- cylindrical threads G¾, G1½, BSP, to DIN ISO 228/1</li> <li>- conical threads ¾ NPT, 1½ NPT to ANSI B 1.20.1</li> </ul>	Corrosion monitoring	
Electrical connection	<p>connection AH, DH, IH: cable gland: M20 x 1.5 (Ex d version only with cable entry), cable entry: G½ or ½ NPT</p> <p>connection PA: M12 plug</p> <p>connection FF: 7/8" plug</p>	Corrosion monitoring	
<b>Indication and operation</b>			
Display elements	LCD module VU331 at the device	Level signal conditioning electronics	
Operating elements	<p>on-site operation:</p> <ul style="list-style-type: none"> <li>- via 3 keys of the LCD module VU331</li> <li>- via handheld terminal</li> </ul> <p>remote control:</p> <ul style="list-style-type: none"> <li>- operation with operating program (for communication variants HART or PROFIBUS-PA)</li> <li>- operation with NI-FBUS configurator (only FOUNDATION Fieldbus)</li> </ul>		
<b>Certificates and approvals</b>			
Ex approval	KEMA 02 ATEX 1254, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	Level control accessories	
Type of protection	<ul style="list-style-type: none"> <li>⊗ II 2G EEx em [ia] IIC T6</li> <li>⊗ II 1/2G II EEx ia IIC T6 with WHG</li> <li>⊗ II 1/2G EEx d [ia] IIC T6</li> <li>⊗ II 1/2G, II 1/3D EEx ia IIC T6</li> <li>⊗ II 1/2G, II 1/3D EEx ia IIC T6 with WHG</li> <li>⊗ II 1/2G EEx ia IIC T6</li> <li>⊗ II 1/3D transparent cover, dust-Ex</li> <li>⊗ II 1/2D aluminium cover, dust-Ex</li> </ul>		
SIL classification	up to SIL2 acc. to IEC 61508, for 4 ... 20 mA output		
Overspill protection	Z-65.16-368 (overspill protection in acc. with WHG)		
Telecommunications	Complies with part 15 of the FCC rules for an unintentional radiator. All probes meet the requirements for a class A digital device (commercial, industrial or business environment). Coax probes and probes mounted in closed metallic vessels also meet the requirement for a class B digital device (residential environment).		
<b>General information</b>			
Directive conformity			Pressurised enclosure system
Directive 73/23/EEC (Low Voltage Directive)	EN 61010		
Directive 89/336/EC (EMC)	<p>When installing the probes in metal and concrete tanks and when using a coax probe:</p> <ul style="list-style-type: none"> <li>- interference emission to EN 61326, Electrical Equipment Class B</li> <li>- interference immunity to EN 61326, Annex A (Industrial area)</li> </ul> <p>The measured value can be affected by strong electromagnetic fields when installing rod and rope probes without a shielding/metallic wall, e. g. plastic, and in wooden silos.</p> <ul style="list-style-type: none"> <li>- interference emission to EN 61326, Electrical Equipment Class A</li> <li>- interference immunity: the measured value can be affected by strong electromagnetic fields</li> </ul>		
Conformity			
Electromagnetic compatibility	NE 21		
Protection degree	EN 60529		
Climate class	EN 60068, part 2-38 (test Z/AD)		
Vibration resistance	EN 60068-2-64/IEC 68-2-64: 20 ... 2000 Hz, 1 (m/s <sup>2</sup> )/Hz		

Date of issue 09/22/06 – Catalog Field Devices

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Ultrasonic level sensors</p>	<p>Supplementary documentation</p>	<p>technical information TI3580  short instructions KA1890 (can be found under the device housing cover)  operating instructions BA2420 (4 ... 20 mA, HART devices)  operating instructions BA2430 (PROFIBUS PA devices)  operating instructions BA2440 (FOUNDATION Fieldbus devices)  operating instructions BA2450 (description of device functions)  operating instructions KA1370 (protective hood LTC-Z01)  operating instructions KA1950 (centering disc LTC-Z30)  operating instructions KA1960 (flange with horn adapter LTC-Z20)  operating instructions KA1970 (insulating sleeve LTC-Z50-*0)  operating instructions KA5490 (exchange of display VU311)  operating instructions KA5750 (exchange of a rope or rod probe)  safety information SI1640 (HART devices)  safety information SI1650 (PROFIBUS PA and FOUNDATION Fieldbus devices)  safety information SI1660 (PROFIBUS PA and FOUNDATION Fieldbus devices)  safety information SI1670  safety information SI1680 (HART devices)  safety information SI1720  safety information SI1730  safety information SI2110 (HART devices)  safety information SI2120 (PROFIBUS PA- and FOUNDATION Fieldbus devices)  safety information SI2130  safety information SI2140 (HART devices)  safety information SI2150 (HART devices)  safety information SI2160 (PROFIBUS PA- and FOUNDATION Fieldbus devices)  safety information SI2170  approval ZE256O overspill protection acc. to WHG (Z-65.16-368)  FM control drawing ZD0750 (HART devices, F12 housing)  FM control drawing ZD0760 (PROFIBUS PA- and FOUNDATION Fieldbus devices, F12 housing)  FM control drawing ZD0770 (T12 housing)  FM control drawing ZD0770 (F12 housing)  CSA control drawing ZD0800 (HART devices, F12 housing)  CSA control drawing ZD0810 (PROFIBUS PA- and FOUNDATION Fieldbus devices, F12 housing)  CSA control drawing ZD0820 (T12 housing)  CSA control drawing ZD0830 (F12 housing)</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Guided microwave</p>		
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Corrosion monitoring</p>		
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Level signal conditioning electronics</p>	<p>Supplementary information</p>	<p>EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Level control accessories</p>		
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Pressurised enclosure system</p>		

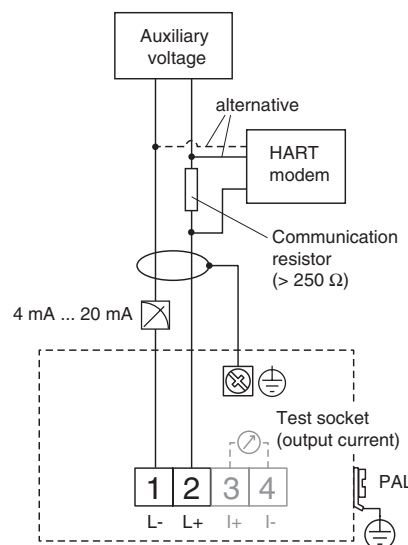
Electrical connections

Connection IH, 2-wire connection with HART (DC)

4 mA ... 20 mA with HART, 2-wire

Cable specification:

A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).



Connection AH, 4-wire connection with HART (AC),  
Connection DH, 4-wire connection with HART (DC)

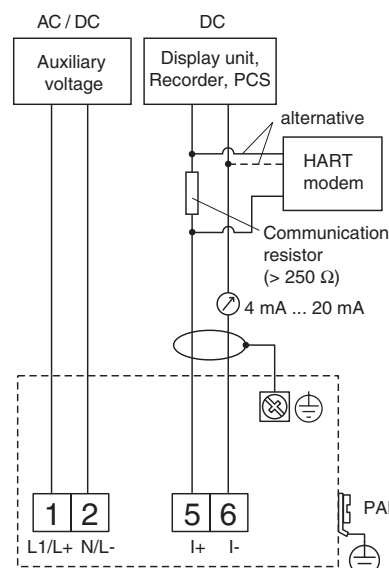
4 mA ... 20 mA with HART, 4-wire active

Cable specification:

A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).

Note!

If 4-wire for dust-Ex-applications is used, the current output is intrinsically safe.

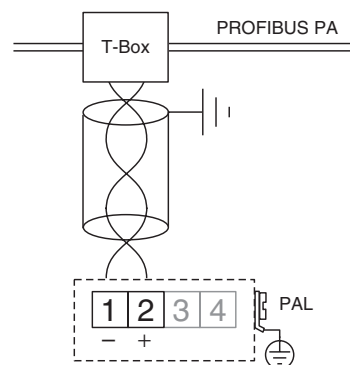


Connection PA, PROFIBUS PA

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. For further information on the network structure and earthing and for further bus system components such as bus cables, see the relevant documentation, e. g. the PNO guideline.

Cable specification:

Use a twisted, screened two-wire cable, preferably cable type A.

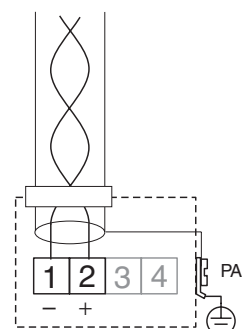


Connection FF, FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. For further information on the network structure and earthing and for further bus system components such as bus cables, see the relevant documentation, e. g. the FOUNDATION Fieldbus guideline.

Cable specification:

Use a twisted, screened two-wire cable, preferably cable type A.



Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronics

Level control  
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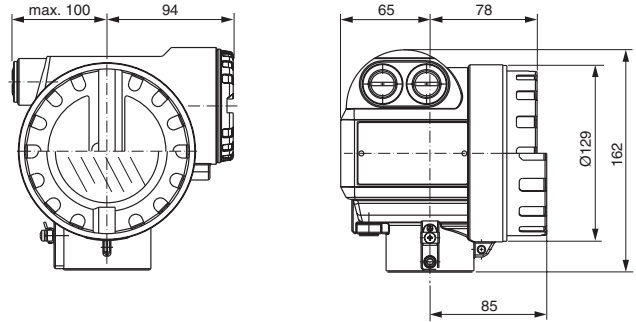
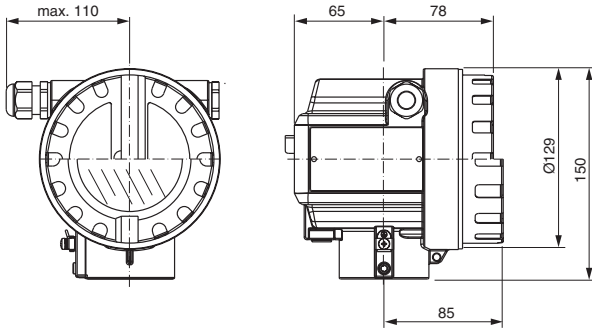
Pressurised  
enclosure system

**Dimensions**

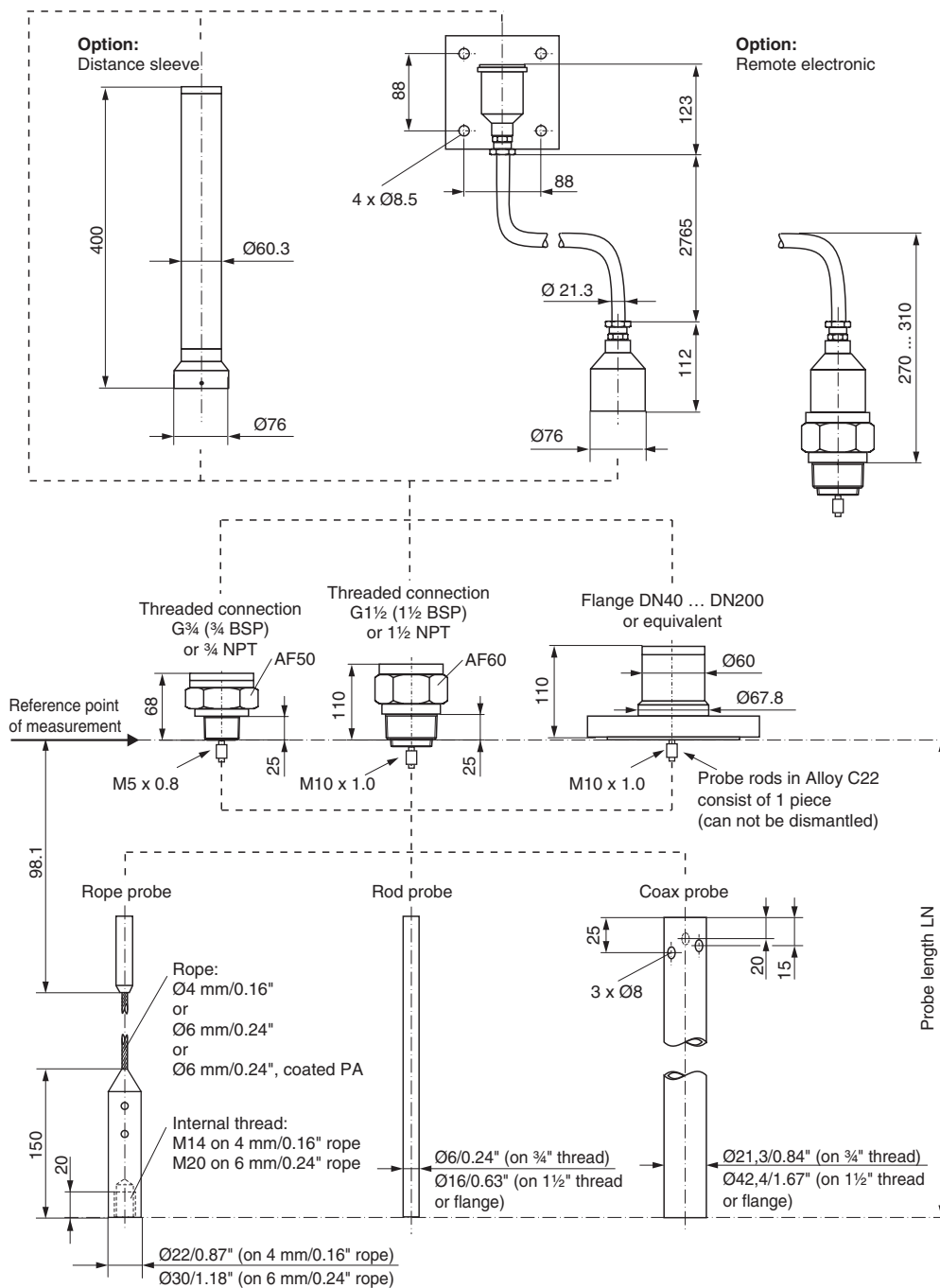
**Housing dimensions**

Housing A\*, type F12, aluminium

Housing T\*, type T12, aluminium



**Dimensions process connections, probes**



**Accessories**

- LTC-Z-D\*\*G5S, adapter flange with metrical thread
- LTC-Z-A\*\*N5S, adapter flange with conical thread
- LTC-Z01, weather protection cover
- LTC-Z02, operating and display module VU331
- LTC-Z20-\*0, flange with horn adapter
- LTC-Z30-\*\*\*, extension rod/centering
- LTC-Z40-\*\*1\*, remote display
- LTC-Z50-\*0, mounting kit isolated

Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

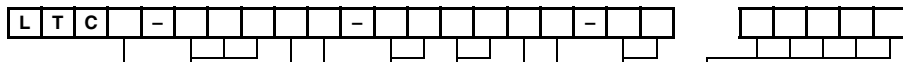
Level signal  
conditioning electronics

Level control  
accessories

Pressurised  
enclosure system



Type code/model number



Specification of length without unit

Certificates

- NA** version for non-hazardous area
- WH** overspill protection WHG
- C1** CSA IS, Cl. I, II, III, Div. 1, group A-D, G and coal dust, N.I.
- C2** CSA XP, Cl. I, II, III, Div. 1, group A-D, G and coal dust, N.I.
- CG** CSA General Purpose
- CS** CSA DIP, Cl. II, Div. 1, group G and coal dust, N.I.
- E1** II 2G EEx em[ia] IIC T6
- EA** II 1/2G II EEx ia IIC T6 with WHG
- ED** II 1/2G EEx d[ia] IIC T6
- ES** II 1/2G, II 1/3D EEx ia IIC T6
- EW** II 1/2G, II 1/3D EEx ia IIC T6 with WHG
- EX** II 1/2G EEx ia IIC T6
- F1** FM IS, Cl. I, II, III, Div. 1, group A-G, N.I.
- F2** FM XP, Cl. I, II, III, Div. 1, group A-G
- FM** FM DIP, Cl. II, Div. 1, group E-G, N.I.
- S2** II 1/3D transparent cover, dust
- SX** II 1/2D aluminium cover, dust-Ex

Remote electronic

- 1** standard, compact version
- 2** distance sleeve for electronics, 400 mm (15.7 in)
- 3** remote electronic, cable 3 m (10 ft)

Display

- A** \* prepared for remote display, order display as accessory LTC-Z40-\*\*\*
- B** without display
- D** with display VU331 including on-site operation

Electrical output

- IH** 2-wire, HART 4 mA ... 20 mA
- PA** 2-wire, PROFIBUS PA
- FF** 2-wire, FOUNDATION Fieldbus
- AH** 4-wire, 90 V AC ... 250 V AC, HART 4 mA ... 20 mA
- DH** 4-wire, 10.5 V DC ... 32 V DC, HART 4 mA ... 20 mA

Housing, cable entry

- A1** Aluminium housing F12, IP68, M20 gland
- A2** Aluminium housing F12, IP68, ½ NPT entry
- A3** Aluminium housing F12, IP68, G½ entry
- A4** Aluminium housing F12, IP68, PROFIBUS PA M12 x 1 plug
- A5** Aluminium housing F12, IP68, connector 7/8"
- T1** Aluminium housing T12, IP68, M20 gland
- T2** Aluminium housing T12, IP68, ½ NPT entry
- T3** Aluminium housing T12, IP68, G½ entry
- T4** Aluminium housing T12, IP68, PROFIBUS PA M12 x 1 plug
- T5** Aluminium housing T12, IP68, connector 7/8"

Sealing

- 2** VITON O-ring
- 3** EPDM O-ring
- 4** KALREZ O-ring

Probe length

- A** rope Ø4 mm, length in mm, 1000 mm ... 35000 mm, 1.4401/316
- B** rope Ø6 mm, length in mm, 1000 mm ... 35000 mm, 1.4401/316
- C** rope Ø1/6", length in in, 40 in ... 1378 in, 1.4401/316
- D** rope Ø1/4", length in in, 40 in ... 1378 in, 1.4401/316
- E** rope Ø6 mm, length in mm, 1000 mm ... 35000 mm, 1.4301/304, coated PA
- F** rope Ø1/4", length in in, 40 in ... 1378 in, 1.4301/304, coated PA
- K** rod probe Ø16 mm (0.6 in), length in mm, 300 mm ... 4000 mm, 1.4435/316L
- L** coax probe, length in mm, 300 mm ... 4000 mm, 1.4435/316L
- M** rod probe Ø16 mm (0.6 in), length in in, 8 in ... 157 in, 1.4435/316L
- N** coax probe, length in in, 8 in ... 157 in, 1.4435/316L
- P** rod probe Ø6 mm (0.24 in), length in mm, 300 mm ... 2000 mm, 1.4435/316L
- R** rod probe Ø6 mm (0.24 in), length in in, 8 in ... 80 in, 1.4435/316L

Process connections

- A51** 1½", ANSI B 16.5, 150 lbs RF, 1.4435/316L
- A52** 1½", ANSI B 16.5, 300 lbs RF, 1.4435/316L
- A61** 2", ANSI B 16.5, 150 lbs RF, 1.4435/316L
- A62** 2", ANSI B 16.5, 300 lbs RF, 1.4435/316L
- A81** 3", ANSI B 16.5, 150 lbs RF, 1.4435/316L
- A82** 3", ANSI B 16.5, 300 lbs RF, 1.4435/316L
- A91** 4", ANSI B 16.5, 150 lbs RF, 1.4435/316L
- A92** 4", ANSI B 16.5, 300 lbs RF, 1.4435/316L
- AA1** 6", ANSI B 16.5, 150 lbs RF, 1.4435/316L
- AB1** 8", ANSI B 16.5, 150 lbs RF, 1.4435/316L
- D65** DN40 PN25/40, EN 1092-1 Form B1, 1.4435/316L, sealing strip
- D75** DN50 PN25/40, EN 1092-1 Form B1, 1.4435/316L, sealing strip
- D93** DN80 PN10/16, EN 1092-1 Form B1, 1.4435/316L, sealing strip
- D95** DN80 PN25/40, EN 1092-1 Form B1, 1.4435/316L, sealing strip
- DA3** DN100 PN10/16, EN 1092-1 Form B1, 1.4435/316L, sealing strip
- DA5** DN100 PN25/40, EN 1092-1 Form B1, 1.4435/316L, sealing strip
- DC3** DN150 PN10/16, EN 1092-1 Form B1, 1.4435/316L, sealing strip
- DE3** DN200 PN10/16, EN 1092-1 Form B1, 1.4435/316L, sealing strip
- G21** G¾, DIN ISO 228/1, BSP, 1.4435/316L
- G51** G1½, DIN ISO 228/1, BSP, 1.4435/316L
- N21** ¾ NPT, ANSI B 1.20.1, 1.4435/316L
- N51** 1½ NPT, ANSI B 1.20.1, 1.4435/316L
- XXX** special version

Probe version

- 1** rope probe Ø4 mm/1/6", 1.4401/304, predominantly liquids
- 2** rod probe Ø16 mm (0.6 in), 1.4435/316L, predominantly liquids
- 3** rod probe Ø6 mm (0.24 in), 1.4435/316L with short block distance, liquids
- 4** coax probe, 1.4435/316L, liquids
- 5** rope probe Ø6 mm/¼", 1.4401/304, predominantly solids
- 8** rope probe Ø6 mm/¼", 1.4401/304, coated PA, solids, T<sub>max</sub> = 100 °C (373 K)

\* in preparation



Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronics

Level control  
accessories

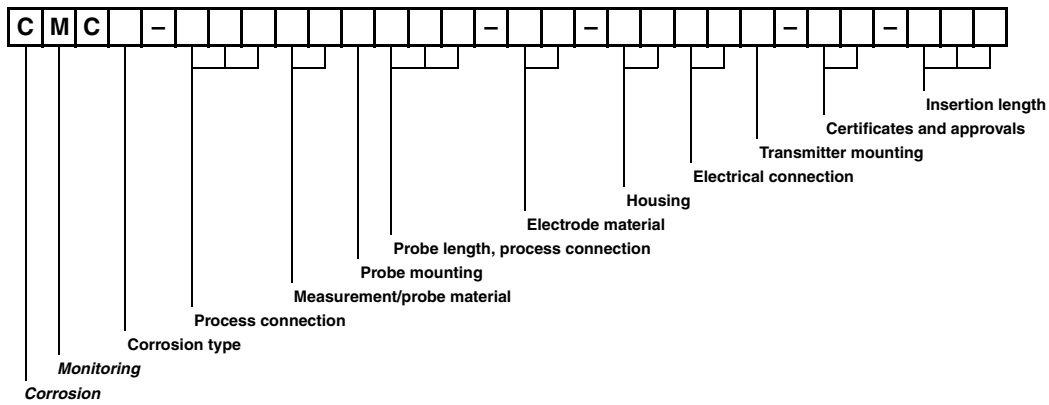
Pressurised  
enclosure system

# Type code of corrosion monitoring

The figure below shows the used characters and numbers of the corrosion monitoring type code.

Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the corrosion monitoring.

## Product group CorrTran CMC\*



Ultrasonic level sensors  
 Guided microwave  
 Corrosion monitoring  
 Level signal conditioning electronics  
 Level control accessories  
 Pressurised enclosure system



Corrosion monitoring CorrTran CMC\*

The CorrTran instrument utilises state-of-the-art algorithms and data analysis techniques to accurately measure corrosion rate or pitting.

Harmonic distortion analysis (HDA) is applied to improve the performance of the industry accepted linear polarisation resistance (LPR) technique used to measure corrosion rate. To further enhance the performance, an application specific Stern Geary variable (B value) can be stored in the transmitter. During the 7-minute measurement cycle, CorrTran also performs an automated electrochemical noise (ECN) measurement, which in combination with the corrosion rate data can provide a measurement of localised corrosion (pitting).

At the completion of each measurement cycle, the respective corrosion rate or pitting value in the form of a 4 mA ... 20 mA/HART signal is produced and made available to the plant personnel.

Ultrasonic level sensors

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**Contents**

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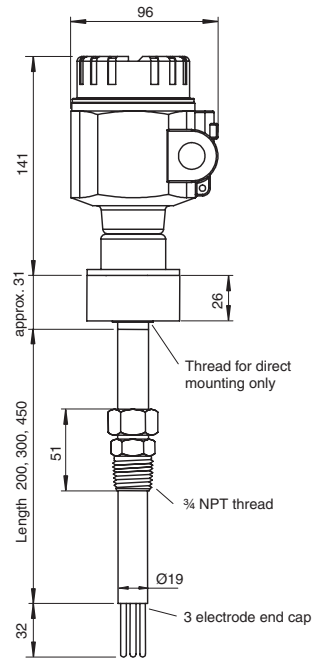
Type code of corrosion monitoring .....	212
Corrosion monitoring CorrTran CMC* .....	214

## Corrosion monitoring

## Dimensions



CorrTran CMC with adjustable stainless steel probe



Additional dimensions see section dimensions.

CMC\*

## Function

The CorTran CMC\* is a compact, 4 mA ... 20 mA corrosion transmitter used to detect general or localized corrosion in a wide range of industries.

The transmitter measures the corrosion rate in mil/year or mm/year and outputs a pitting factor in the range of 0 ... 1. The readings are taken in real time and are updated every 7 minutes.

The CorTran CMC\* utilizes state-of-the-art algorithms and data analysis techniques to accurately measure corrosion rate or pitting. Harmonic distortion analysis (HDA) is applied to improve the performance of the industry accepted linear polarization resistance (LPR) technique used to measure corrosion rate.

## Features

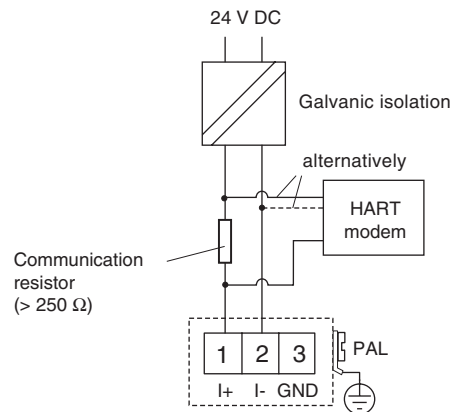
- On-line corrosion monitoring
- 2-wire, 4 mA ... 20 mA transmitter, HART interface
- General or localised corrosion (pitting) monitoring
- Maximum process pressure up to 102 bar (1500 psi)
- Custom configuration



## Electrical connection

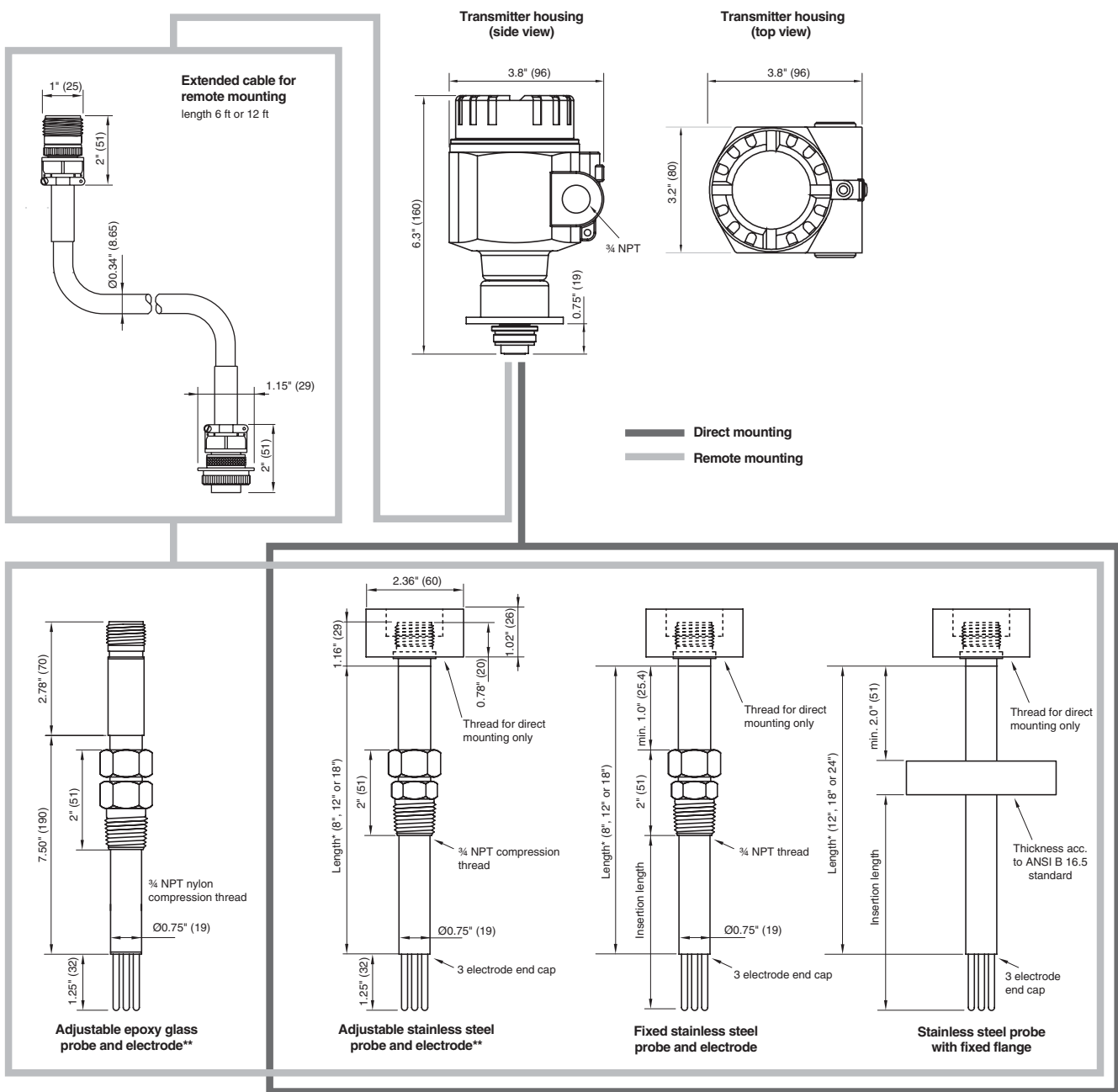
2-wire connection with HART (DC)

4 mA ... 20 mA with HART



<b>Supply</b>		<b>Ultrasonic level sensors</b>
Rated voltage	9 ... 30 V DC	
<b>Electrical specifications</b>		<b>Guided microwave Corrosion monitoring</b>
Nominal voltage $U_0$	min. 9 V DC at max. loop current 2-wire (4 ... 20 mA)	
Linearity	0.0015 % non linear	
<b>Output</b>		
Output rated operating current	high alarm: 22.5 mA, low alarm current: 3.7 mA	
<b>Transfer characteristics</b>		
Resolution	17 Bit	
<b>Input characteristics</b>		
Measured variable	Corrosion, update time 7.2 min (fixed)	
<b>Auxiliary energy</b>		
Electrical connection	4 ... 20 mA with HART, 2-wire	<b>Level signal conditioning electronics</b>
Connectable load	max. load at 24 V DC: 680 $\Omega$ with high alarm/750 $\Omega$ without high alarm	
<b>Operating conditions</b>		
Ambient conditions		
Ambient temperature	-40 ... 70 °C (253 ... 343 K)	
Process conditions		
Process temperature	stainless steel probe: - direct mounting: max. 121 °C (394 K) - remote mounting: max. 260 °C (533 K) epoxy glass probe: max. 65 °C (338 K)	
Process pressure (static pressure)	stainless steel probe: max. 102 bar (1500 psi) epoxy glass probe: max. 7 bar (100 psi)	
Flow	max. 6.1 m/s (20 fps)	
<b>Mechanical specifications</b>		
Protection degree	IP66, NEMA 4x	
<b>Mechanical construction</b>		
Mass	approx. 500 g	
Material	housing: aluminium process connections: stainless steel 1.4401/316 or nylon probes: stainless steel 1.4401/316 or epoxy glass, fill material epoxy end cap seal: glass or epoxy electrode material see section references to type code, table 1	
Process connection	stainless steel probe: - conical thread $\frac{3}{4}$ NPT acc. to ANSI B 1.20.1 - flanges 1", 2" acc. to ANSI B 16.5 epoxy glass probe: conical nylon thread $\frac{3}{4}$ NPT acc. to ANSI B 1.20.1	
Electrical connection	conical thread $\frac{3}{4}$ NPT to ANSI B 1.20.1	
<b>Indication and operation</b>		
Operating elements	HART electronics with HART protocol: operation via a PC with operating program	
Configuration	The adjustments and scaling can be done using a handheld terminal or the operating software. general corrosion rate: - range: min. 20 mils/year, max. 400 mils/year, default 40 mils/year - Zero/span adjustments available with HART. localised corrosion (pitting) factor: - default: 0.001 ... 1.0 - low pitting: 0.001 ... 0.01 - average pitting: 0.01 ... 0.1 - high pitting: 0.1 ... 1.0	
Factory setting	B value (Stern Geary value): 25.6 mV K value (corrosion constant): 11800 (2e- in reaction)	<b>Pressurised enclosure system</b>
<b>Certificates and approvals</b>		
Ex approval	LCIE 05 ATEX 6097X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	
Type of protection	II 1G EEx ia IIC T4	
<b>General information</b>		
Directive conformity		
Directive 94/9 EC (ATEX)	EN 50014, EN 50020, EN 50284	
Conformity		
Protection degree	EN 60529	
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	

Dimensions



\* Standard lengths are 8", 12", 18" and 24". Other lengths are available in increments of 0.5" or 10 mm. Minimum length is 7" or 170 mm and the maximum length is 30" or 770 mm. Insertion lengths for fixed probes are specified in 0.2" or 5 mm increments.

\*\* All adjustable probes include a safety retaining bracket which must be used in all pressurized applications.

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

References to type code

Key number electrode material	UNS number	Electrode material	K value
0A	G10180	1018 carbon steel	11597.63
0B	K03005	A53 carbon steel, class B	11583.07
0C	S30400	1.4301/304	11334.57
0D	S30403	1.4307/304L	11342.80
0E	S31600	1.4401/316	11513.39
0F	S31603	1.4404/316L	11519.53
0G	N08020	Carpenter 20Cb3	11595.52
0H	N04400	Monel 400	11077.87
0I	C71500	CDA 715 Cu/Ni70/30	11337.86
0J	C11000	CDA 110 ETP 99.9Cu	11686.71
0K	C70600	CDA 706 Cu/Ni90/10	11513.44
0L	C68700	CDA 867 Aluminium brass	12411.53
0M	C44300	CDA 443 ARS AD brass	12324.74
0N	A91100	Aluminium 1100	10940.96
0O	A92024	Aluminium 2024	11400.51
0P	R50400	Titan GR2	8644.02
0Q	N10276	Hastelloy C-276	11666.48

Other materials are available upon request.

Table 1: Electrode material vs. K value

Key number probe mounting	Probe type	Mounting	Process connection	Probe material
A	Standard	direct mounting	fixed	stainless steel
B	Standard	remote mounting	fixed	stainless steel
C	Standard	direct mounting	adjustable	stainless steel
D	Standard	remote mounting	adjustable	stainless steel
E	retractable*	remote mounting	adjustable	stainless steel
F	special*	-	-	-

\*Please contact Pepperl+Fuchs.

Table 2: Probe selection

Accessories

- HART accessories
  - KFD2-HMM-16, 16-channel MUX master
  - KFD0-HMS-16, 16-channel slave
  - HIS2700, 32-channel MUX
  - US-HI-311, HART/RS 232 interface
  - US-HI-321, HART/USB interface

Please contact Pepperl+Fuchs for termination board selection.

- Control devices
  - KFD2-STC4-1, 1-channel SMART transmitter power supply
  - KFD2-STC4-1.20, 1-channel SMART transmitter power supply, 1 input, 2 outputs
  - KFD2-STC4-Ex1, 1-channel SMART transmitter power supply
  - KFD2-STC4-Ex2, 2-channel SMART transmitter power supply
  - KFD2-STC4-Ex1.20, 1-channel SMART transmitter power supply, 1 input, 2 outputs
  - KFU8-CRG-1.D, 1-channel transmitter supply isolator 4 mA ... 20 mA
  - KFU8-CRG-Ex1.D, 1-channel transmitter supply isolator 4 mA ... 20 mA
- Overvoltage protection
  - K-LB-1.30, 1-channel overvoltage protection for DIN rail mounting
  - K-LB-2.30, 2-channel overvoltage protection for DIN rail mounting
  - FN-LB-I, 1-channel overvoltage protection for screw mounting for field mounting
  - P-LB-1, 1-channel overvoltage protection, plug-in terminal module
  - P-LB-2, 2-channel overvoltage protection, plug-in terminal module
- CMC-PMB-01, wall or pipe mounting bracket for remote mounted transmitters
- PW2-BASIC, CorrTran interface demo software on CD-ROM

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Level signal  
conditioning electronics

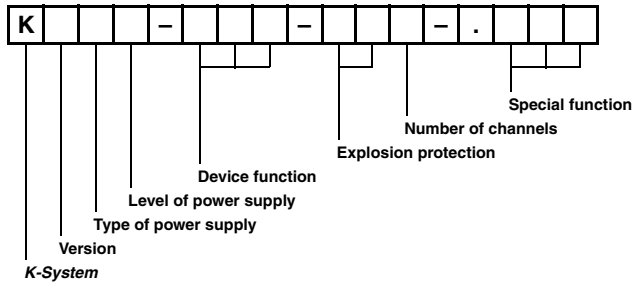
Level control  
accessories

Pressurised  
enclosure system

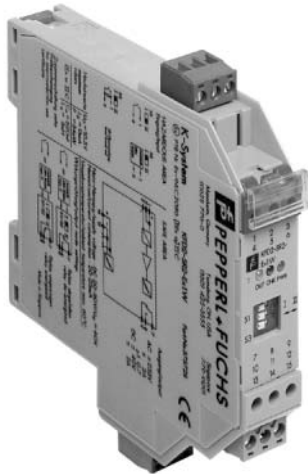
# Type code of level signal conditioning electronics

The figure below shows the used characters and numbers of the level signal conditioning electronics type code. Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets.

## Product group interface units



Ultrasonic level sensors  
Guided microwave  
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Level signal conditioning electronics  
Level control accessories  
Pressurised enclosure system



In order to prepare a standardised measurement signal for the various level sensors, the proper interface electronics are required.

In general, a distinction is made between limit value and continuous level control. Depending on the specific application, these interface electronics are approved for use in Ex areas as well as for overspill protection acc. to WHG.

The complete product selection for interface electronics you will find in the catalogue "DIN-Rail housing".

All information for the approvals and certifications please find at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

Transformer isolated barrier KFD2-SR2-Ex1.W

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## Contents

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Electrode relay, KFA*-ER-1.* . . . . .	224
Electrode relay, KF**-ER-1.W.LB. . . . .	226
Electrode relay, KF**-ER-Ex1.W.LB. . . . .	230
Electrode relay, KF**-ER-2.W.LB . . . . .	234
Current/voltage trip amplifier, KFD2-GS-1.2W . . . . .	238
SMART transmitter power supply, KFD2-STC4-1 . . . . .	242
SMART transmitter power supply, KFD2-STC4-Ex1 . . . . .	244
Transformer isolated barrier for potentiometer, KFD2-PT2-Ex1** . . . . .	248
Transformer isolated barrier for 3-wire sensors, KFA6-SR-2.3L . . . . .	252
Transformer isolated barrier for NAMUR sensors, KFD2-SR2-Ex1.W. . . . .	258
Transformer isolated barrier for NAMUR sensors, KFA6-SR2-Ex2.W.IR. . . . .	262



Ultrasonic level sensors

- 1-channel
- Relay for conductive limit value detection
- Adjustable sensitivity
- Measuring circuit in acc. with VDE 0100 part 410 "Funktionskleinspannung"
- Minimum/maximum control
- Open/closed circuit current principle switchable
- EMC acc. to NAMUR NE 21
- This model replaces KHA6-ER-1.\* and HR-122620

Guided microwave

Corrosion monitoring

24 V DC  
**KFD2-ER-1.5**  
24 V DC  
**KFD2-ER-1.6**

Level signal conditioning electronics

**Function**

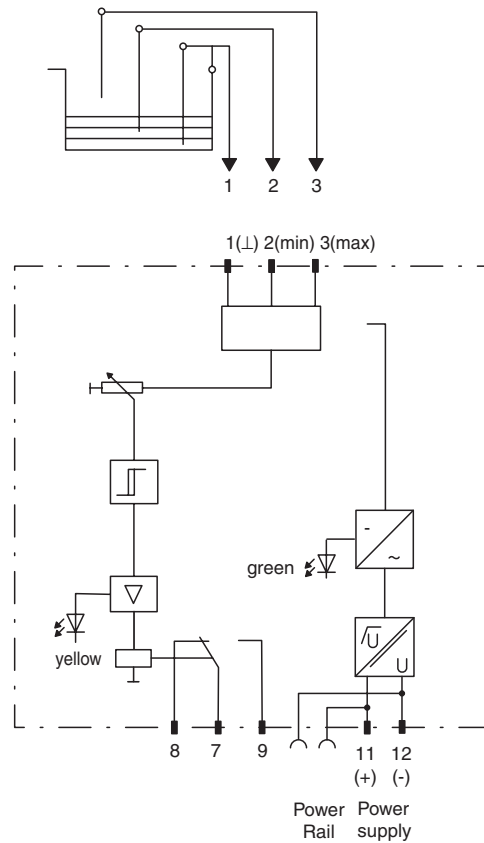
The relays provide the AC measuring voltage for the electrodes and react with a small alternating current after the electrodes get in contact with the medium.

The switching amplifiers are voltage and temperature stabilised and guarantee a defined switching characteristics. An electronic holding contact allows a minimum maximum control. Since the conductance of the media may vary, the relay response sensitivity is adjustable.

Level control accessories

Pressurised enclosure system

**Connection**



**Composition**

**Front view**

Housing type B2

LED yellow: Relais output

Potentiometer Response sensitivity

Removable terminals green

LED green: Power supply

Switch S1 Open circuit current/ closed circuit current

Removable terminals green



	KFD2-ER-1.5	KFD2-ER-1.6
<b>Supply</b>		
Connection	Power Rail or terminals 11+, 12-	
Rated voltage	20 ... 30 V DC	
<b>Input</b>		
Connection	terminals 1 (mass), 2 (min), 3 (max)	terminals 1 (mass), 2 (min), 3 (max)
Open-circuit voltage/short-circuit current	approx. 10 V AC (approx. 1 Hz)/approx. 5 mA	approx. 10 V AC (approx. 1 Hz)/approx. 5 mA
Control input	min./max. control system: terminals 1, 2, 3 on/off control system: terminals 1, 3	min./max. control system: terminals 1, 2, 3 on/off control system: terminals 1, 3
Response sensitivity	1 ... 30 kΩ, adjustable via potentiometer (20 turns)	5 ... 150 kΩ, adjustable via potentiometer (20 turns)
<b>Output</b>		
Connection	terminals 7, 8, 9	
Output	1 changeover contact	
Contact loading	253 V AC/2 A/cos $\Phi$ > 0.7; 40 V DC/2 A resistive load	
Energised/de-energised delay	approx. 1 s/approx. 1 s	
<b>Electrical isolation</b>		
Input/output	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>	
Input/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>	
Output/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>	
<b>Directive conformity</b>		
Electromagnetic compatibility Directive 89/336/EC	EN 61326, EN 50081-2	
<b>Conformity</b>		
Insulation coordination	EN 50178	
Electrical isolation	EN 50178	
Electromagnetic compatibility	NE 21	
Protection degree	IEC 60529	
<b>Ambient conditions</b>		
Ambient temperature	-20 ... 60 °C (253 ... 333 K)	
<b>Mechanical specifications</b>		
Protection degree	IP20	
Connection	screw connection, max. 2.5 mm <sup>2</sup>	
Mass	approx. 110 g	
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)	
Mounting	Power Rail or pull-out latches using for screw mounting	
<b>Indication and operation</b>		
Operating elements	switch S1 position I open circuit current: In the open circuit current principle, the relay becomes active when the limit is reached. position II closed circuit current: In closed circuit current principle, the relay is activated when power is applied. The relay is deactivated when the limit is reached.	
<b>General information</b>		
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	

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Pressurised enclosure system

**Accessories**

**Power Rail PR-03**

**Power Rail UPR-03**

**Power feed module KFD2-EB2...**

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**



Ultrasonic level sensors

- 1-channel
- Relay for conductive limit value detection
- Adjustable sensitivity
- Measuring circuit in acc. with VDE 0100 part 410 "Funktionskleinspannung"
- Minimum/maximum control
- Open/closed circuit current principle switchable
- EMC acc. to NAMUR NE 21
- This model replaces KHA6-ER-1.\* and HR-122620

Guided microwave

Corrosion monitoring

- 115 V AC  
**KFA5-ER-1.5**
- 115 V AC  
**KFA5-ER-1.6**
- 230 V AC  
**KFA6-ER-1.5**
- 230 V AC  
**KFA6-ER-1.6**

Level signal conditioning electronics

**Function**

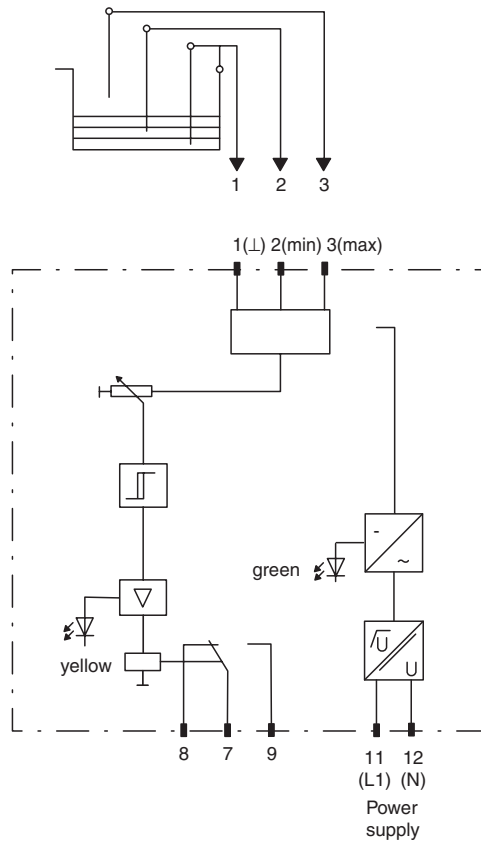
The relays provide the AC measuring voltage for the electrodes and react with a small alternating current after the electrodes get in contact with the medium.

The switching amplifiers are voltage and temperature stabilised and guarantee a defined switching characteristics. An electronic holding contact allows a minimum maximum control. Since the conductance of the media may vary, the relay response sensitivity is adjustable.

Level control accessories

Pressurised enclosure system

**Connection**



**Composition**

**Front view**

Housing type B2

Removable terminals green

LED yellow: Relais output

LED green: Power supply

Potentiometer Response sensitivity

Switch S1 Open circuit current/ closed circuit current

Removable terminals green



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	KFA5-ER-1.5	KFA5-ER-1.6	KFA6-ER-1.5	KFA6-ER-1.6
<b>Supply</b>				
Connection	terminals 11 (L1), 12 (N)			
Rated voltage	103.5 ... 126 V AC, 45 ... 65 Hz		207 ... 253 V AC, 45 ... 65 Hz	
Power consumption	approx. 0.8 W			
<b>Input</b>				
Connection	terminals 1 (mass), 2 (min), 3 (max)			
Open-circuit voltage/short-circuit current	approx. 10 V AC (approx. 1 Hz)/approx. 5 mA			
Control input	min./max. control system: terminals 1, 2, 3 on/off control system: terminals 1, 3			
Response sensitivity	1 ... 30 kΩ, adjustable via potentiometer (20 turns)	5 ... 150 kΩ, adjustable via potentiometer (20 turns)	1 ... 30 kΩ, adjustable via potentiometer (20 turns)	5 ... 150 kΩ, adjustable via potentiometer (20 turns)
<b>Output</b>				
Connection	terminals 7, 8, 9			
Output	1 changeover contact			
Contact loading	253 V AC/2 A/cos $\Phi > 0.7$ ; 40 V DC/2 A resistive load			
Energised/de-energised delay	approx. 1 s/approx. 1 s			
<b>Electrical isolation</b>				
Input/output	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>			
Input/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>			
Output/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>			
<b>Directive conformity</b>				
Electromagnetic compatibility				
Directive 89/336/EC	EN 61326, EN 50081-2			
<b>Conformity</b>				
Insulation coordination	EN 50178			
Electrical isolation	EN 50178			
Electromagnetic compatibility	NE 21			
Protection degree	IEC 60529			
<b>Ambient conditions</b>				
Ambient temperature	-20 ... 60 °C (253 ... 333 K)			
<b>Mechanical specifications</b>				
Protection degree	IP20			
Connection	screw connection, max. 2.5 mm <sup>2</sup>			
Mass	approx. 110 g			
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)			
Mounting	pull-out latches using for screw mounting			
<b>Indication and operation</b>				
Operating elements	switch S1 position I open circuit current: In the open circuit current principle, the relay becomes active when the limit is reached. position II closed circuit current: In closed circuit current principle, the relay is activated when power is applied. The relay is deactivated when the limit is reached.			
<b>General information</b>				
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .			

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 1-channel
- Relay for conductive limit value detection
- Minimum/maximum control
- On/off control system
- Open/closed circuit current principle switchable
- LB monitoring
- EMC acc. to NAMUR NE 21
- LB collective error message via Power Rail

Guided microwave

- 24 V DC
- KFD2-ER-1.W.LB**
- 115 V AC
- KFA5-ER-1.W.LB**
- 230 V AC
- KFA6-ER-1.W.LB**

Corrosion monitoring

**Function**

The relays provide the AC measuring voltage for the electrodes and react with a small alternating current after the electrodes get in contact with the medium.

The switching amplifiers are voltage and temperature stabilised and guarantee a defined switching characteristics. The electrode relay can be used as on/off control and as minimum/maximum control. The input signal is damped to compensate oscillations and prevent the relays from uncontrolled switching. The time constant for damping can be adjusted between 0.5 s and 10 s via DIP switches.

The device is equipped with lead breakage monitoring (current free relay in event of failure). For this purpose, the enclosed 430 kΩ resistance must be switched between the maximum and reference electrode. This function can be deactivated with DIP switches.

When using LB monitoring, the second relay output serves as fault signal output. When deactivating the LB monitoring, the second relay output is following the first relay output.

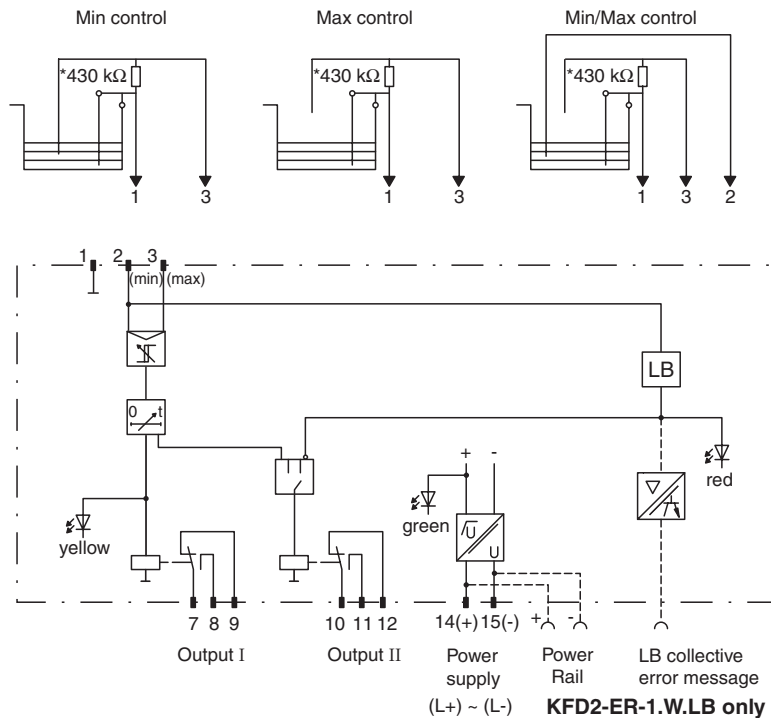
DC-powered units offer a collective error message via Power Rail.

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Connection**



\*Resistor inevitably by activated lead breakage monitoring.

**Composition**

**Front view**

Housing type B2

DIP switch S1  
Functions see operating elements

LED yellow:  
Relais output I

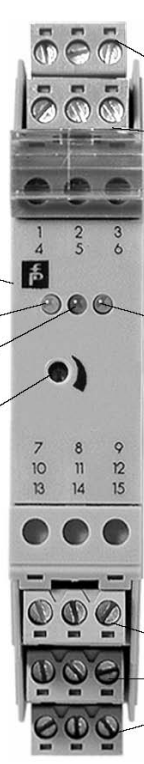
LED red:  
LB/SC output II

Potentiometer  
Response sensitivity

Removable terminals green

LED green:  
Power supply

Removable terminals green



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	KFD2-ER-1.W.LB	KFA5-ER-1.W.LB	KFA6-ER-1.W.LB
<b>Supply</b>			
Connection	Power Rail or terminals 14+, 15-	terminals 14, 15	terminals 14, 15
Rated voltage	20 ... 30 V DC	103.5 ... 126 V AC, 45 ... 65 Hz	207 ... 253 V AC, 45 ... 65 Hz
Rated current	30 ... 40 mA	12 mA	≤ 7 mA
Power consumption	-	< 1.2 W	< 1.2 W
<b>Input</b>			
Connection	terminals 1 (mass), 2 (min), 3 (max)		
Control input	min./max. control system: terminals 1, 2, 3 on/off control system: terminals 1, 3		
Response sensitivity	1 ... 150 kΩ, adjustable via potentiometer		
<b>Output</b>			
Connection	terminals 7, 8, 9; 10, 11, 12		
Switch power	max. 192 W, 2000 VA		
Output	relay		
Contact loading	253 V AC/2 A/cos Φ > 0.7; 40 V DC/2 A resistive load		
Time constant for signal damping	0.5 s, 2 s, 5 s, 10 s		
<b>Electrical isolation</b>			
Input/output	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
Input/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
Output/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
<b>Directive conformity</b>			
Electromagnetic compatibility			
Directive 89/336/EC	EN 61326, EN 50081-2		
<b>Conformity</b>			
Insulation coordination	EN 50178		
Electrical isolation	EN 50178		
Electromagnetic compatibility	NE 21		
Protection degree	IEC 60529		
<b>Ambient conditions</b>			
Ambient temperature	-20 ... 60 °C (253 ... 333 K)		
<b>Mechanical specifications</b>			
Protection degree	IP20		
Connection	screw connection, max. 2.5 mm <sup>2</sup>		
Mass	approx. 150 g		
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)		
Mounting	Power Rail or pull-out latches using for screw mounting	pull-out latches using for screw mounting	pull-out latches using for screw mounting
<b>General information</b>			
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .		

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

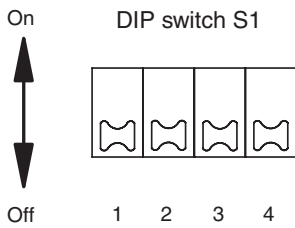
Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Operating elements**

DIP switch function on side of device



DIP switch S1	Position	Function
1	Off	open circuit current
	On	closed circuit current
2	Off	LB deactivated
	On	LB activated

DIP switch 3	DIP switch 4	Time constant for signal damping
Off	Off	0.5 s
Off	On	2 s
On	Off	5 s
On	On	10 s

- Open circuit current principle: In open circuit current principle the relay becomes active when the limit is reached.
- Closed circuit current principle: In closed circuit current principle, the relay is activated when power is applied. The relay is deactivated when the limit is reached.

**Accessories**

- Power Rail PR-03**
- Power Rail UPR-03**
- Power feed module KFD2-EB2...**

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**

Ultrasonic level sensors

Guided microwave

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Ultrasonic level sensors

- 1-channel
- Relay for conductive limit value detection
- Minimum/maximum control
- On/off control system
- Open/closed circuit current principle switchable
- LB monitoring
- EMC acc. to NAMUR NE 21
- LB collective error message via Power Rail

Guided microwave

Corrosion monitoring

24 V DC  
**KFD2-ER-Ex1.W.LB**  
 115 V AC  
**KFA5-ER-Ex1.W.LB**  
 230 V AC  
**KFA6-ER-Ex1.W.LB**

Level signal conditioning electronics

**Function**

The relays provide the AC measuring voltage for the electrodes and react with a small alternating current after the electrodes get in contact with the medium.

The switching amplifiers are voltage and temperature stabilised and guarantee a defined switching characteristics. The electrode relay can be used as on/off control and as minimum/maximum control. The input signal is damped to compensate oscillations and prevent the relays from uncontrolled switching. The time constant for damping can be adjusted between 0.5 s and 10 s via DIP switches.

The device is equipped with lead breakage monitoring (current free relay in event of failure). For this purpose, the enclosed 430 kΩ resistance must be switched between the maximum and reference electrode. This function can be deactivated with DIP switches.

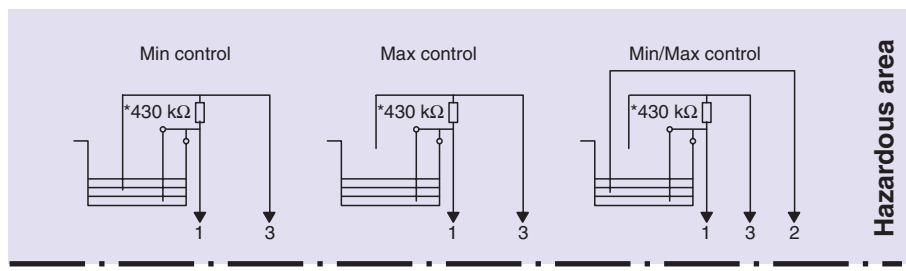
When using LB monitoring, the second relay output serves as fault signal output. When deactivating the LB monitoring, the second relay output is following the first relay output.

DC-powered units offer a collective error message via Power Rail.

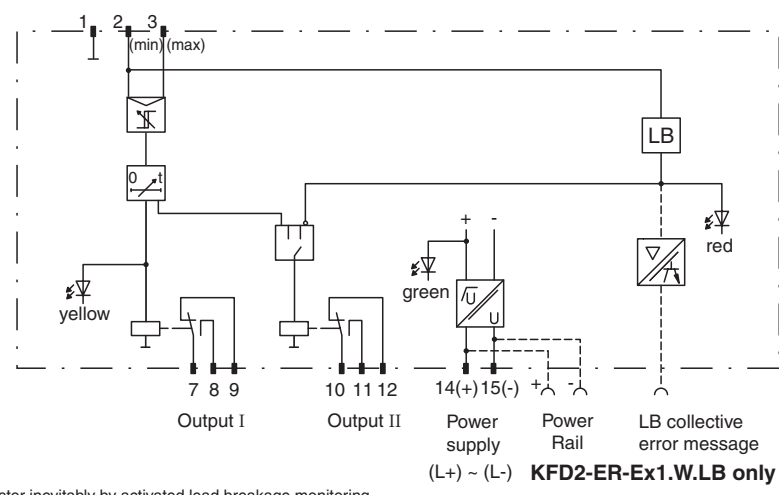
Level control accessories

Pressurised enclosure system

**Connection**



Hazardous area



Safe area

**Composition**

**Front view**

Housing type B2

DIP switch S1  
 Functions see operating elements

LED yellow:  
 Relais output I

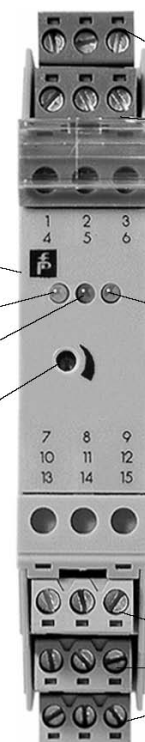
LED red:  
 LB/SC output II

Potentiometer  
 Response sensitivity

Removable terminals blue

LED green:  
 Power supply

Removable terminals green



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	KFD2-ER-Ex1.W.LB	KFA5-ER-Ex1.W.LB	KFA6-ER-Ex1.W.LB
<b>Supply</b>			
Connection	Power Rail or terminals 14+, 15-	terminals 14, 15	terminals 14, 15
Rated voltage	20 ... 30 V DC	103.5 ... 126 V AC, 45 ... 65 Hz	207 ... 253 V AC, 45 ... 65 Hz
Rated current	30 ... 40 mA	12 mA	≤ 7 mA
Power consumption	-	< 1.2 W	< 1.2 W
<b>Input</b>			
Connection	terminals 1 (mass), 2 (min), 3 (max)		
Control input	min./max. control system: terminals 1, 2, 3 on/off control system: terminals 1, 3		
Response sensitivity	1 ... 150 kΩ, adjustable via potentiometer		
<b>Output</b>			
Connection	terminals 7, 8, 9; 10, 11, 12		
Switch power	max. 192 W, 2000 VA		
Output	signal; relay		
Time constant for signal damping	0.5 s, 2 s, 5 s, 10 s		
<b>Electrical isolation</b>			
Output/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
<b>Directive conformity</b>			
Electromagnetic compatibility			
Directive 89/336/EC	EN 61326, EN 50081-2		
<b>Conformity</b>			
Insulation coordination	EN 50178		
Electrical isolation	EN 50178		
Electromagnetic compatibility	NE 21		
Protection degree	IEC 60529		
<b>Ambient conditions</b>			
Ambient temperature	-20 ... 60 °C (253 ... 333 K)		
<b>Mechanical specifications</b>			
Protection degree	IP20		
Connection	screw connection, max. 2.5 mm <sup>2</sup>		
Mass	approx. 150 g		
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)		
Mounting	Power Rail or pull-out latches using for screw mounting	pull-out latches using for screw mounting	pull-out latches using for screw mounting
<b>Data for application in conjunction with hazardous areas</b>			
EC-Type Examination Certificate	DMT 00 ATEX E 033, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	DMT 00 ATEX E 032, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	DMT 00 ATEX E 032, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
Group, category, type of protection	⊕ II (1)G [EEx ia] IIC [circuit(s) in zone 0/1/2]	⊕ II (1)G [EEx ia] IIC [circuit(s) in zone 0/1/2]	⊕ II (1)G [EEx ia] IIC [circuit(s) in zone 0/1/2]
Input	[EEx ia] IIC	[EEx ia] IIC	[EEx ia] IIC
Voltage U <sub>o</sub>	10 V	10 V	10 V
Current I <sub>o</sub>	2.5 mA	2.5 mA	2.5 mA
Power P <sub>o</sub>	6 mW	6 mW	6 mW
<b>Supply</b>			
Safety maximum voltage U <sub>m</sub>	40 V DC (Attention! U <sub>m</sub> is no rated voltage.)	265 V AC/150 V AC (Attention! U <sub>m</sub> is no rated voltage.)	265 V AC/150 V AC (Attention! U <sub>m</sub> is no rated voltage.)
<b>Output</b>			
Contact loading	253 V AC/2 A/cos Φ > 0.7; 40 V DC/2 A resistive load		
<b>Electrical isolation</b>			
Input/output	safe electrical isolation acc. to EN 50020, voltage peak value 375 V		
Input/power supply	safe electrical isolation acc. to EN 50020, voltage peak value 375 V		
<b>Directive conformity</b>			
Directive 94/9 EC	EN 50014, EN 50020, EN 50284		
<b>General information</b>			
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .		

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

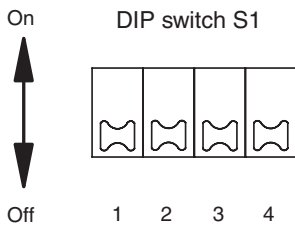
Level control accessories

Pressurised enclosure system

Date of issue 09/22/06 – Catalog Field Devices

**Operating elements**

DIP switch function on side of device



DIP switch S1	Position	Function
1	Off	open circuit current
	On	closed circuit current
2	Off	LB deactivated
	On	LB activated

DIP switch 3	DIP switch 4	Time constant for signal damping
Off	Off	0.5 s
Off	On	2 s
On	Off	5 s
On	On	10 s

- Open circuit current principle: In open circuit current principle the relay becomes active when the limit is reached.
- Closed circuit current principle: In closed circuit current principle, the relay is activated when power is applied. The relay is deactivated when the limit is reached.

**Accessories**

**Power Rail PR-03**

**Power Rail UPR-03**

**Power feed module KFD2-EB2...**

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 2-channel
- Relay for conductive limit value detection
- Minimum/maximum control
- On/off control system
- Open/closed circuit current principle switchable
- LB monitoring
- EMC acc. to NAMUR NE 21
- LB collective error message via Power Rail

Guided microwave

- 24 V DC  
**KFD2-ER-2.W.LB**
- 115 V AC  
**KFA5-ER-2.W.LB**
- 230 V AC  
**KFA6-ER-2.W.LB**

Corrosion monitoring

**Function**

The relays provide the AC measuring voltage for the electrodes and react with a small alternating current after the electrodes get in contact with the medium.

The switching amplifiers are voltage and temperature stabilised and guarantee a defined switching characteristics. The electrode relay can be used as on/off control and as minimum/maximum control. The input signal is damped to compensate oscillations and prevent the relays from uncontrolled switching. The time constant for damping can be adjusted between 0.5 s and 10 s via DIP switches.

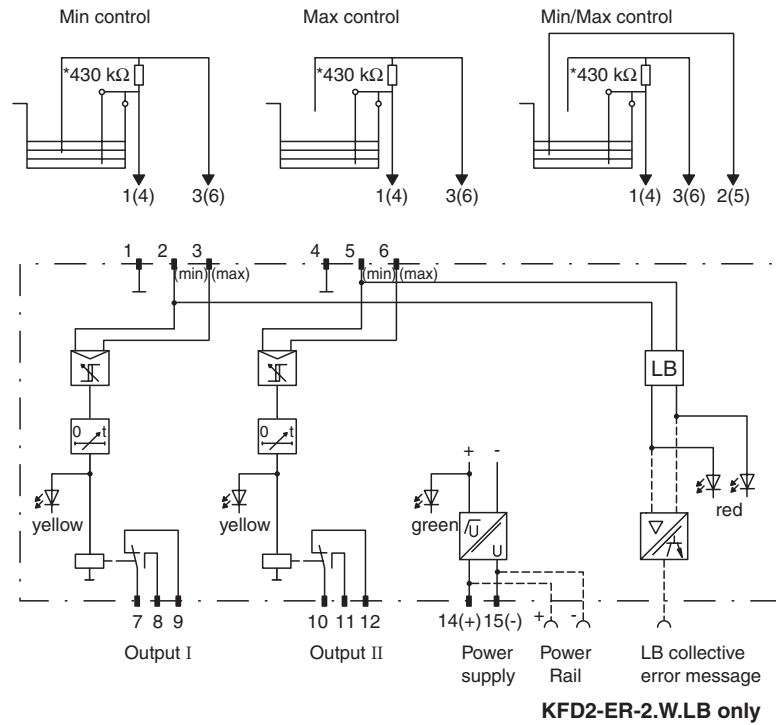
The device is equipped with lead breakage monitoring (current free relay in event of failure). For this purpose, the enclosed 430 kΩ resistance must be switched between the maximum and reference electrode. This function can be deactivated with DIP switches. DC-powered units offer a combined error signal via Power Rail.

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Connection**



(2. channel in clips)  
\*Resistor inevitably by activated lead breakage monitoring.

**KFD2-ER-2.W.LB only**

**Composition**

**Front view**

Housing type B2

DIP switches S1/S2  
Functions see operating elements

LED yellow:  
Relais output I

LED yellow:  
Relais output II

Potentiometer  
Response sensitivity calibration I

Potentiometer  
Response sensitivity calibration II

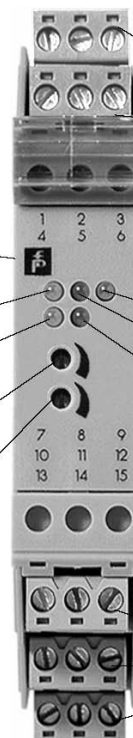
Removable terminals green

LED green:  
Power supply

LED red:  
LB/SC channel I

LED red:  
LB/SC channel II

Removable terminals green



Date of issue 09/22/06 – Catalog Field Devices



	KFD2-ER-2.W.LB	KFA5-ER-2.W.LB	KFA6-ER-2.W.LB
<b>Supply</b>			
Connection	Power Rail or terminals 14+, 15-	terminals 14, 15	terminals 14, 15
Rated voltage	20 ... 30 V DC	103.5 ... 126 V AC, 45 ... 65 Hz	207 ... 253 V AC, 45 ... 65 Hz
Rated current	30 ... 40 mA	12 mA	≤ 7 mA
Power consumption	-	< 1.2 W	< 1.2 W
<b>Input</b>			
Connection	terminals 1 (mass), 2 (min), 3 (max)		
Control input	min./max. control system: terminals 1, 2, 3 on/off control system: terminals 1, 3		
Response sensitivity	1 ... 150 kΩ, adjustable via potentiometer		
<b>Output</b>			
Connection	terminals 7, 8, 9; 10, 11, 12		
Switch power	max. 192 W, 2000 VA		
Output	relay		
Contact loading	253 V AC/2 A/cos Φ > 0.7; 40 V DC/2 A resistive load		
Time constant for signal damping	0.5 s, 2 s, 5 s, 10 s		
<b>Electrical isolation</b>			
Input/output	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
Input/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
Output/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
<b>Directive conformity</b>			
Electromagnetic compatibility			
Directive 89/336/EC	EN 61326, EN 50081-2		
<b>Conformity</b>			
Insulation coordination	EN 50178		
Electrical isolation	EN 50178		
Electromagnetic compatibility	NE 21		
Protection degree	IEC 60529		
<b>Ambient conditions</b>			
Ambient temperature	-20 ... 60 °C (253 ... 333 K)		
<b>Mechanical specifications</b>			
Protection degree	IP20		
Connection	screw connection, max. 2.5 mm <sup>2</sup>		
Mass	approx. 150 g		
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)		
Mounting	Power Rail or pull-out latches using for screw mounting	pull-out latches using for screw mounting	pull-out latches using for screw mounting
<b>General information</b>			
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .		

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

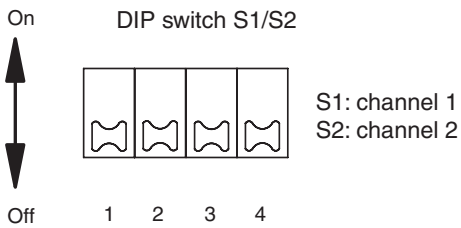
Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Operating elements**

DIP switches function on side of device



DIP switch S1/S2	Position	Function
1	Off	open circuit current
	On	closed circuit current
2	Off	LB deactivated
	On	LB activated

DIP switch 3	DIP switch 4	Time constant for signal damping
Off	Off	0.5 s
Off	On	2 s
On	Off	5 s
On	On	10 s

- Open circuit current principle: In open circuit current principle the relay becomes active when the limit is reached.
- Closed circuit current principle: In closed circuit current principle, the relay is activated when power is applied. The relay is deactivated when the limit is reached.

**Accessories**

- Power Rail PR-03**
- Power Rail UPR-03**
- Power feed module KFD2-EB2...**

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 1-channel
- 24 V DC supply voltage
- 2 switching points operate on 2 output relays (changeover contacts) or limit value 1 actuates both output relays (DIP switch S1.6 in ON position)
- Measuring sockets for switching point (limit value) and actual value
- High/low alarm settable
- Mode of operation adjustable
- Hysteresis 0 % ... 60 % of measuring range, adjustable
- EMC acc. to NAMUR NE 21

Guided microwave

Corrosion monitoring

**KFD2-GS-1.2W**

**Function**

The KFD2-GS-1.2W is a trip amplifier for 2 independently adjustable limit values. Input, output and power supply are galvanically isolated from each other.

The trip amplifier converts the electrical unit signals 0/4 mA ... 20 mA, 0/1 V ... 5 V, 0/2 V ... 10 V into a proportional internal voltage. A comparator compares this internal voltage with the two preset reference values. The hysteresis, the operating mode of the relay outputs and the type of alarm (high or low) is selectable for each switch point.

High alarm indicates that the status of the relay has changed when the calibrated limit is exceeded. This status changes when a lower value is not met. The difference of both values represents the hysteresis which can be adjusted on the front panel. In a low alarm condition, the alarm signal occurs when the limit value is not met.

The trip amplifier is adjustable by means of a selector switch and potentiometers.

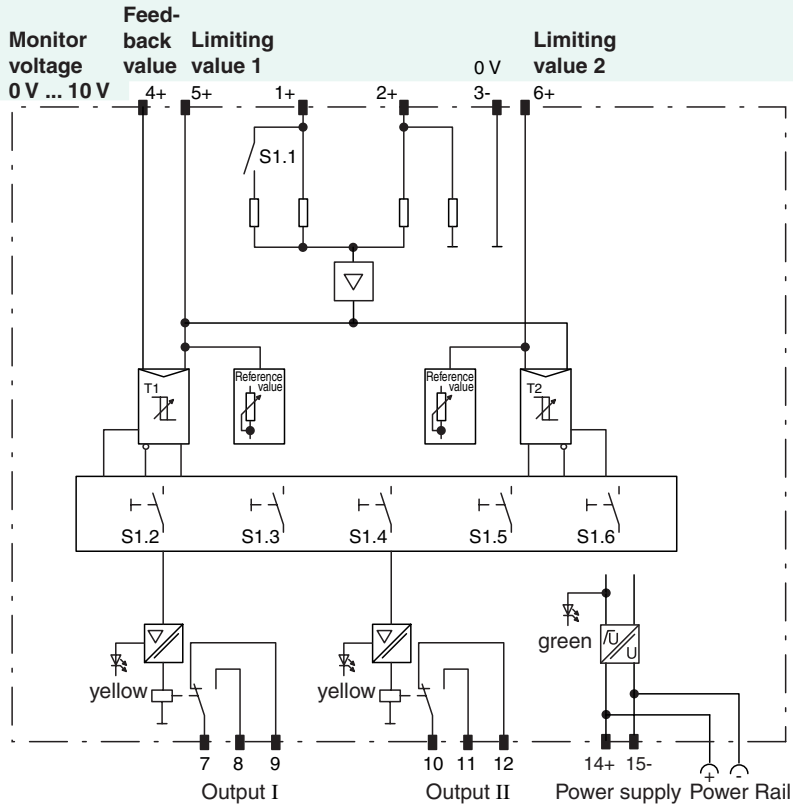
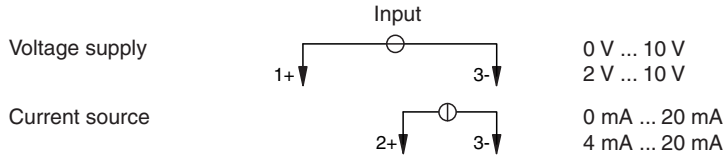
A monitoring voltage of 0 V ... 10 V can be used via the 2 mm test sockets for the adjustment of the device (limit value, hysteresis). It is possible in this way to adjust the device during operation or without a measurement signal at the input.

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Connection**



**Composition**

**Front View**

Housing type C (see system description)

LED yellow: Relay output 1

LED yellow: Relay output 2

Hysteresis adjustment for trip value 1

Hysteresis adjustment for trip value 2

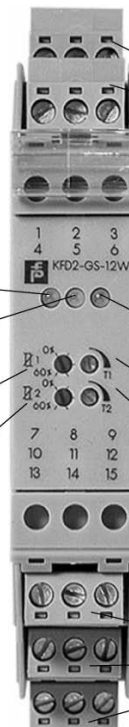
Removable terminals green KF-STP-GN Device connectors with test sockets.

LED green: Power supply

Trip value 1

Trip value 2

Removable terminals green



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<b>Supply</b>	
Connection	Power Rail or terminals 14+, 15-
Rated voltage	20 ... 30 V DC
Rated current	75 mA
Power loss	1 W
Power consumption	2.25 W (typ. 1.68 W)
<b>Input</b>	
Measurement range	terminals 1+, 3-; voltage: 0/1 ... 5 V; 50 kΩ or 0/2 ... 10 V; 100 kΩ terminals 2+, 3-; current: 0/4 ... 20 mA; 50 Ω
<b>Output</b>	
Output I	limit value: terminals 7, 8, 9
Output II	limit value: terminals 10, 11, 12
Contact loading	250 V AC/5 A/1250 VA; 125 V DC/5 A/150 W
<b>Transfer characteristics</b>	
Deviation	≤ 0.5 %
Influence of ambient temperature	0.01 %/K of adjusted limit value
Input delay	100 ms
<b>Electrical isolation</b>	
Input/output	safe isolation acc. to DIN VDE 0106, rated insulation voltage 253 V <sub>eff</sub>
Input/power supply	function insulation acc. to DIN EN 50178, rated insulation voltage 50 V <sub>eff</sub>
Output/power supply	safe isolation acc. to DIN VDE 0106, rated insulation voltage 253 V <sub>eff</sub>
<b>Directive conformity</b>	
Electromagnetic compatibility	
Directive 89/336/EC	EN 50081-2, EN 50082-2
<b>Conformity</b>	
Insulation coordination	EN 50178
Electrical isolation	EN 50178
Electromagnetic compatibility	NE 21
Protection degree	IEC 60529
<b>Ambient conditions</b>	
Ambient temperature	-20 ... 60 °C (253 ... 333 K)
<b>Mechanical specifications</b>	
Protection degree	IP20
Mass	approx. 120 g
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

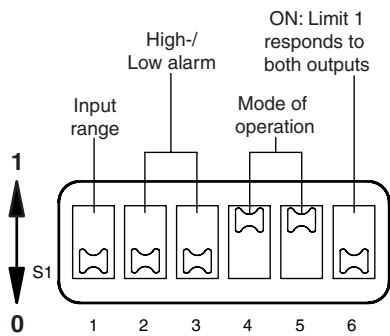
**Supplementary information**

Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

## Notes

DIP switch function on the side of device

Delivery status of S1 DIP switch



Switch	Position	Function
S1.1	0	0/2 V ... 10 V input range
	1	0/1 V ... 5 V input range
S1.2	0	Low alarm output I
	1	High alarm output I
S1.3	0	Low alarm output II
	1	High alarm output II
S1.4	0	Relays open in alarm state output I
	1	Relays closed on alarm state output I
S1.5	0	Relays open in alarm state output II
	1	Relays closed on alarm state output II
S1.6	0	Output I independent of output II
	1	Limit 1 responds to both outputs

### Adjustment instructions

The following applies to the 0 mA ... 20 mA, 0 V ... 5 V, 0 V ... 10 V unit input signals:

1. Connect a voltmeter to terminals 5+, 3- for limit 1 or to terminals 6+, 3- for limit 2. 10 V represent 100 %, 0 V represent 0 % of the input measurement range.
2. The switch point for limit 1 or limit 2 are set with potentiometers T1 or T2.

#### Example:

Input signal 0 V ... 5 V

Switch point 2.5 V

2.5 V represent 50 % of the input measurement range. The voltage between terminals 5+, 3- or 6+, 3- should then be adjusted to 5 V (represent 50 %).

The following applies to the 4 mA ... 20 mA, 1 V ... 5 V, 2 V ... 10 V unit input signals:

1. Connect a voltmeter to terminals 5+, 3- for limit 1 or to terminals 6+, 3- for limit 2. 10 V represent 100 %, 2 V represent 0 % of the input measurement range.
2. The switch point for limit 1 or limit 2 are set with potentiometers T1 or T2.  
The selected switch point (SP) represents y % of the input measurement range.  
 $y = (\text{SP} - \text{lower input value}) / (\text{upper input value} - \text{lower input value})$   
The limit value (LV) is calculated using the following formula:  $\text{LV} = (y \times 8 \text{ V}) + 2 \text{ V}$

#### Example:

Input signal 4 mA ... 20 mA

Switch point (SP) 12 mA

$y = (12 \text{ mA} - 4 \text{ mA}) / (20 \text{ mA} - 4 \text{ mA})$ ,  $y = 50 \%$

$\text{LV} = (50 \% \times 8 \text{ V}) + 2 \text{ V}$ ,  $\text{LV} = 6 \text{ V}$

12 mA represent 50 % of the input measurement range. The voltage (LV) between terminals 5+, 3- or 6+, 3- should be adjusted to 6 V (represent 50 %).

**Accessories**

**Power Rail PR-03**

**Power Rail UPR-03**

**Power feed module KFD2-EB2...**

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



- 1-channel
- Galvanically isolated output
- 24 V DC supply voltage
- SMART capable up to 7.5 kHz (-3 dB)
- EMC acc. to NAMUR NE 21
- Up to SIL2 acc. to IEC 61508

**Input 0/4 mA ... 20 mA**  
**Output 0/4 mA ... 20 mA**  
**KFD2-STC4-1**

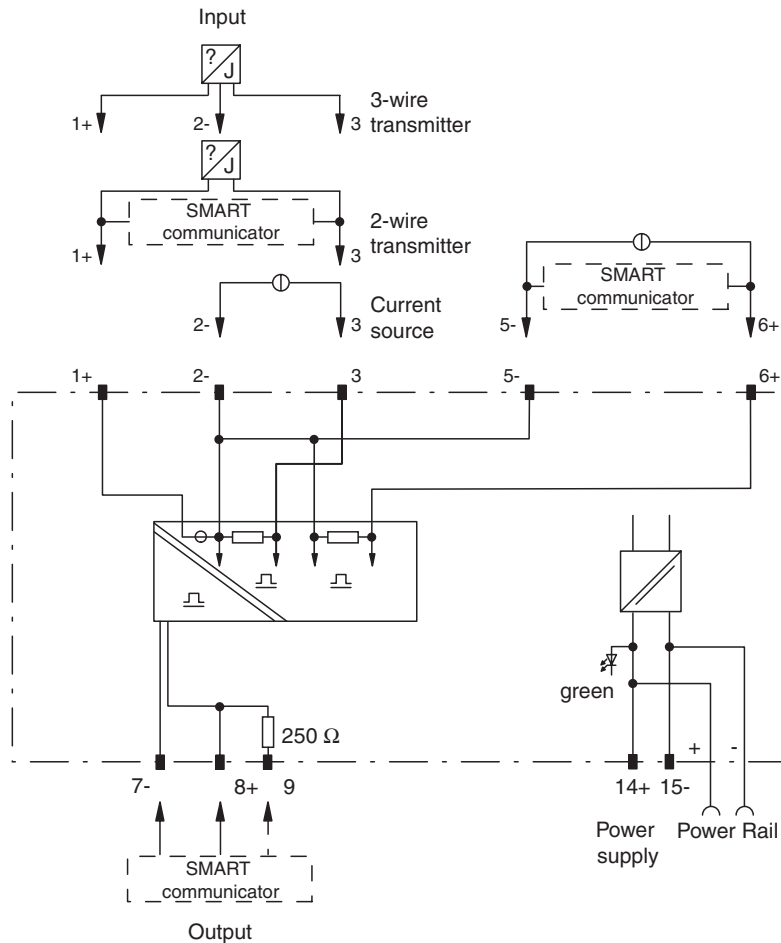
**Function**

SMART transmitter power supplies provide a 2- or 3-wire SMART transmitter and transfer the analogue values. Digital signals may be superimposed on the analogue values, which will be transferred bidirectionally. Handheld terminals should be connected as shown in the block diagram. An internal resistor at terminal 9 is available, which may be used to increase the AC impedance for the HART signal. SMART transmitter power supplies are delivered with terminal type KF-STP-\*\*. Jacks are integrated in these terminals for the connection of the handheld units.

**Application**

- Power supply for SMART transmitters and transfer of the measurement current to the output
- for the transfer of a current source
- suited for the following SMART systems:  
 ABB, Endress+Hauser, Emerson, Fuji, Smar, VEGA, Yokogawa

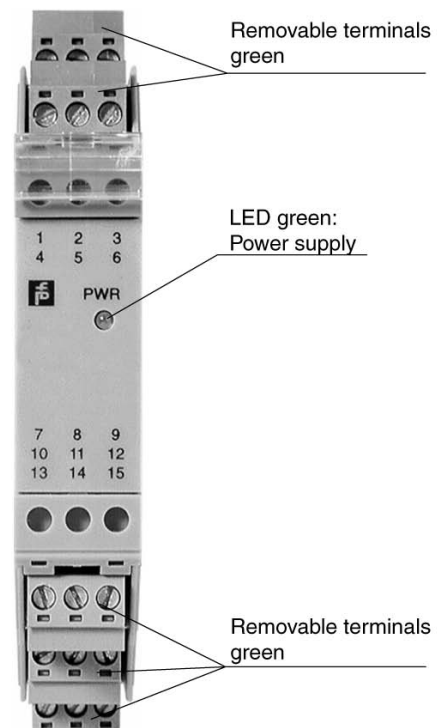
**Connection**



**Composition**

**Front view**

Housing type B2  
 (see system description)





<b>Supply</b>			<b>Ultrasonic level sensors</b>  <b>Guided microwave</b>  <b>Corrosion monitoring</b>  <b>Level signal conditioning electronics</b>  <b>Level control accessories</b>  <b>Pressurised enclosure system</b>
Connection	Power Rail or terminals 14+, 15-		
Rated voltage	20 ... 35 V DC		
Ripple	within the supply tolerance		
Power consumption	1.9 W		
<b>Input</b>			
Connection	terminals 1+, 2-, 3 or 5-, 6+		
Input signal	0/4 ... 20 mA		
Input resistance	≤ 64 Ω terminals 2-, 3		
Available voltage	≥ 16 V at 20 mA, terminals 1+, 3		
<b>Output</b>			
Connection	terminals 7-, 8+, 9		
Load	0 ... 800 Ω		
Output signal	0/4 ... 20 mA (overload > 25mA)		
Ripple	≤ 50 μA <sub>eff</sub>		
<b>Transfer characteristics</b>			
Deviation	at 20 °C (293 K), 4 ... 20 mA ≤ 20 μA incl. calibration, linearity, hysteresis, loads and fluctuations of supply voltage		
Influence of ambient temperature	≤ 20 ppm/K		
Frequency range	bandwidth at 0.5 V <sub>pp</sub> -signal 0 ... 7.5 kHz (-3 dB) bandwidth at 0.5 V <sub>pp</sub> -signal 0.3 ... 7.5 kHz (-3 dB)		
<b>Electrical isolation</b>			
Input/output	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
Input/power supply	basic insulation according to EN 50178, rated insulation voltage 253 V <sub>eff</sub>		
Output/power supply	basic insulation acc. to EN 50178, rated insulation voltage of 50 V AC		
<b>Directive conformity</b>			
Electromagnetic compatibility			
Directive 89/336/EC	EN 61326, EN 50081-2		
<b>Conformity</b>			
Electrical isolation	EN 50178		
Electromagnetic compatibility	NE 21		
Protection degree	IEC 60529		
Input	EN 60947-5-6		
<b>Ambient conditions</b>			
Ambient temperature	-20 ... 60 °C (253 ... 333 K)		
<b>Mechanical specifications</b>			
Protection degree	IP20		
Mass	approx. 200 g		
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)		
<b>General information</b>			
Supplementary information	Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .		

**Accessories**

**Power Rail PR-03**

**Power Rail UPR-03**

**Power feed module KFD2-EB2...**

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**



Ultrasonic level sensors

- 1-channel
- Device installation permissible in zone 2
- Input EEx ia IIC;  $U_o = 25.4\text{ V}$
- Galvanically isolated output
- 24 V DC supply voltage
- SMART capable up to 7.5 kHz (-3 dB)
- EMC acc. to NAMUR NE 21
- Up to SIL2 acc. to IEC 61508

Input 0/4 mA ... 20 mA  
Output 0/4 mA ... 20 mA  
**KFD2-STC4-Ex1**

**Function**

SMART transmitter power supplies provide a 2- or 3-wire SMART transmitter and transfer the analogue values.

Digital signals may be superimposed on the analogue values, which will be transferred bidirectionally. Handheld terminals should be connected as shown in the block diagram.

An internal resistor at terminal 9 is available, which may be used to increase the AC impedance for the HART signal.

SMART transmitter power supplies are delivered with terminal type KF-STP-\*\*. Jacks are integrated in these terminals for the connection of the handheld units.

**Application**

- Power supply for SMART transmitters and transfer of the measurement signal to the output
- for the transfer of a current source to the safe area
- suitable for the following SMART systems:  
ABB, Endress+Hauser, Emerson, Fuji, Smar, VEGA, Yokogawa

Guided microwave

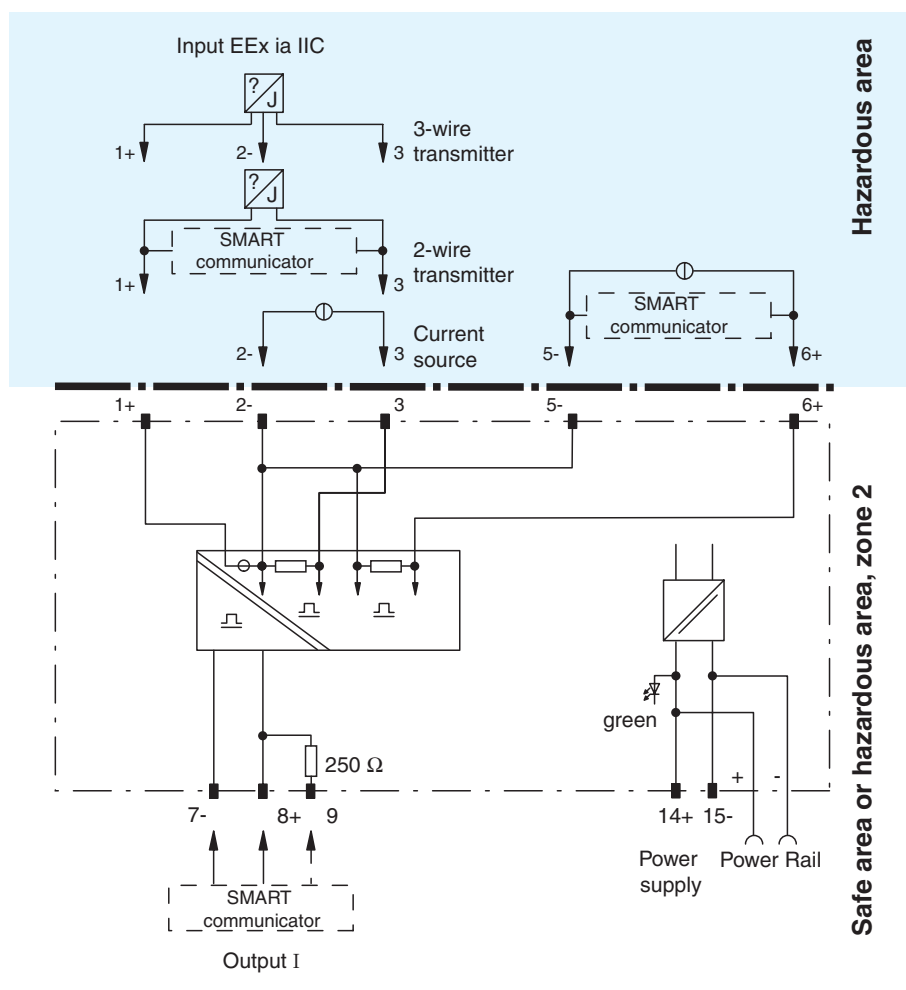
Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

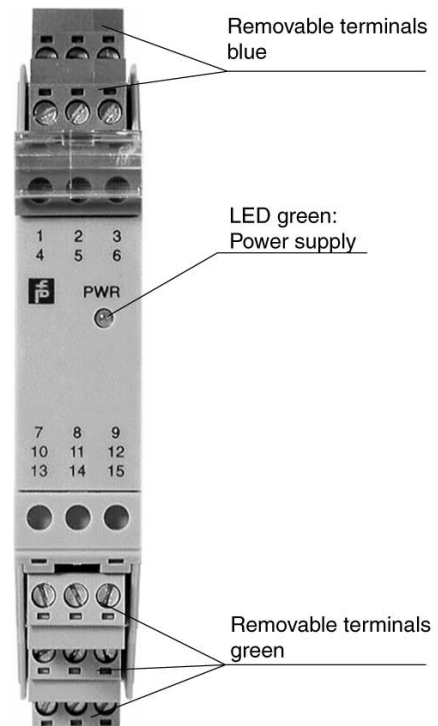
**Connection**



**Composition**

**Front view**

Housing type B2  
(see system description)



<b>Supply</b>			Ultrasonic level sensors
Connection	Power Rail or terminals 14+, 15-		
Rated voltage	20 ... 35 V DC		
Ripple	within the supply tolerance		
Power consumption	1.9 W		Guided microwave
<b>Input</b>			
Connection	terminals 1+, 2-, 3 or 5-, 6+		
Input signal	0/4 ... 20 mA		
Input resistance	≤ 64 Ω terminals 2-, 3; ≤ 500 Ω terminals 1+, 3 (250 Ω load)		Corrosion monitoring
Available voltage	≥ 16 V at 20 mA terminals 1+, 3		
<b>Output</b>			
Connection	terminals 7-, 8+, 9		
Load	0 ... 800 Ω		Level signal conditioning electronics
Output signal	0/4 ... 20 mA (overload > 25mA)		
Ripple	≤ 50 μA <sub>rms</sub>		
<b>Transfer characteristics</b>			
Deviation	at 20 °C (293 K), 4 ... 20 mA ≤ 10 μA incl. calibration, linearity, hysteresis, loads and fluctuations of supply voltage		Level control accessories
Influence of ambient temperature	0.25 μA/°C		
Frequency range	hazardous area into the safe area: bandwidth with 0.5 V <sub>pp</sub> -signal 0 ... 7.5 kHz (-3 dB) safe area into the hazardous area: bandwidth with 0.5 V <sub>pp</sub> -signal 0.3 ... 7.5 kHz (-3 dB)		
Rise time	20 μs		
<b>Electrical isolation</b>			Pressurised enclosure system
Output/power supply	basic insulation acc. to EN 50178, rated insulation voltage of 50 V AC		
<b>Directive conformity</b>			
Electromagnetic compatibility			
Directive 89/336/EC	EN 61326, EN 50081-2		Level control accessories
<b>Conformity</b>			
Electromagnetic compatibility	NE 21		
Protection degree	IEC 60529		
<b>Ambient conditions</b>			Level control accessories
Ambient temperature	-20 ... 60 °C (253 ... 333 K)		
<b>Mechanical specifications</b>			
Protection degree	IP20		
Mass	approx. 200 g		Level control accessories
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)		
<b>Data for application in conjunction with hazardous areas</b>			
EC-Type Examination Certificate	BAS 99 ATEX 7060, for additional certificates see www.pepperl-fuchs.com		
Group, category, type of protection	⊕ II (1)GD [EEx ia] IIC (-20 °C ≤ T <sub>amb</sub> ≤ 60 °C) [circuit(s) in zone 0/1/2]		Level control accessories
Input	EEx ia IIC		
<b>Supply</b>			
Safety maximum voltage U <sub>m</sub>	250 V (Attention! The rated voltage can be lower.)		
<b>Equipment</b>			Level control accessories
Equipment	terminals 1+, 3-		
Voltage U <sub>i</sub>	30 V		
Current I <sub>i</sub>	115 mA		
Voltage U <sub>o</sub>	25.4 V		Level control accessories
Current I <sub>o</sub>	86.8 mA		
Power P <sub>o</sub>	551 mW		
Internal capacitance C <sub>i</sub>	12 nF		
Internal inductance L <sub>i</sub>	0 mH		Level control accessories
<b>Equipment</b>			
Equipment	terminals 2-, 3		
Current I <sub>o</sub> /Current I <sub>i</sub>	74 mA/115 mA		
Current I <sub>i</sub>	115 mA		Level control accessories
Voltage U <sub>o</sub>	3.5 V		
Current I <sub>o</sub>	74 mA		
Power P <sub>o</sub>	64 mW		
<b>Equipment</b>			Level control accessories
Equipment	terminals 1+, 2/3-		
Voltage U <sub>o</sub>	25.4 V		
Current I <sub>o</sub>	115 mA		
Power P <sub>o</sub>	584 mW		Level control accessories
<b>Equipment</b>			
Equipment	terminals 5-, 6+		
Voltage U <sub>i</sub>	30 V		
Current I <sub>i</sub>	115 mA		Level control accessories

Ultrasonic level sensors	Voltage	$U_o$	8.7 V
	Current	$I_o$	0 mA
	Output		
	Safety maximum voltage $U_m$		250 V (Attention! The rated voltage can be lower.)
	Statement of conformity		TÜV 99 ATEX 1499 X, observe statement of conformity
	Group, category, type of protection, temperature classification		⊕ II 3G EEx nA II T4 [device in zone 2]
	Electrical isolation		
	Input/output		safe electrical isolation acc. to EN 50020, voltage peak value 375 V
	Input/power supply		safe electrical isolation acc. to EN 50020, voltage peak value 375 V
	Directive conformity		
Directive 94/9 EC		EN 50014, EN 50020, EN 50021	
<b>General information</b>			
Supplementary information		EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .	

## Accessories

### Power Rail PR-03

### Power Rail UPR-03

### Power feed module KFD2-EB2...

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 1-channel
- Input EEx ia IIC
- 24 V DC supply voltage
- Current or voltage output
- Accuracy 0.05 %
- EMC acc. to NAMUR NE 21

**KFD2-PT2-Ex1\*\***

Replacement device for KFD2-PT-Ex1  
Attention: output polarity now 7-, 8+

**Function**

The KFD2-PT2-Ex1 supplies power to the potentiometers in the hazardous area. The loop voltages are transmitted. The KFD2-PT2-Ex1 is available with current and voltage outputs (terminals 7 and 8). It can be operated in the 3-, 4- or 5-wire mode with the potentiometer.

In the 5-wire mode of operation, the potentiometer voltage is measured at terminals 2 and 5 and automatically readjusted. For a 4-wire connection on the KFD2-PT2-Ex1, terminals 4- and 5- are bridged. With the resistance adjustment on the front housing panel, it is possible to adjust the final value. For potentiometer resistances greater than 1 kΩ, the potentiometer can be used to compensate for lead resistances up to 5 % of the potentiometer value. For potentiometer values in a range of 800 Ω up to 1 kΩ the adjustment value is 50 Ω. During adjustment, the potentiometer is set to 100 % of its value and the output signal is adjusted to 100 % of the required value. This adjustment can be repeated setting the potentiometer to 0 %.

Terminals 4 and 5 as well as 1 and 2 must be bridged for a 3-wire connection to the potentiometer.

**Application**

Because of the high transfer accuracy, the unit is well suited for precise path or positioning requirements per potentiometer, reference element, etc.

Guided microwave

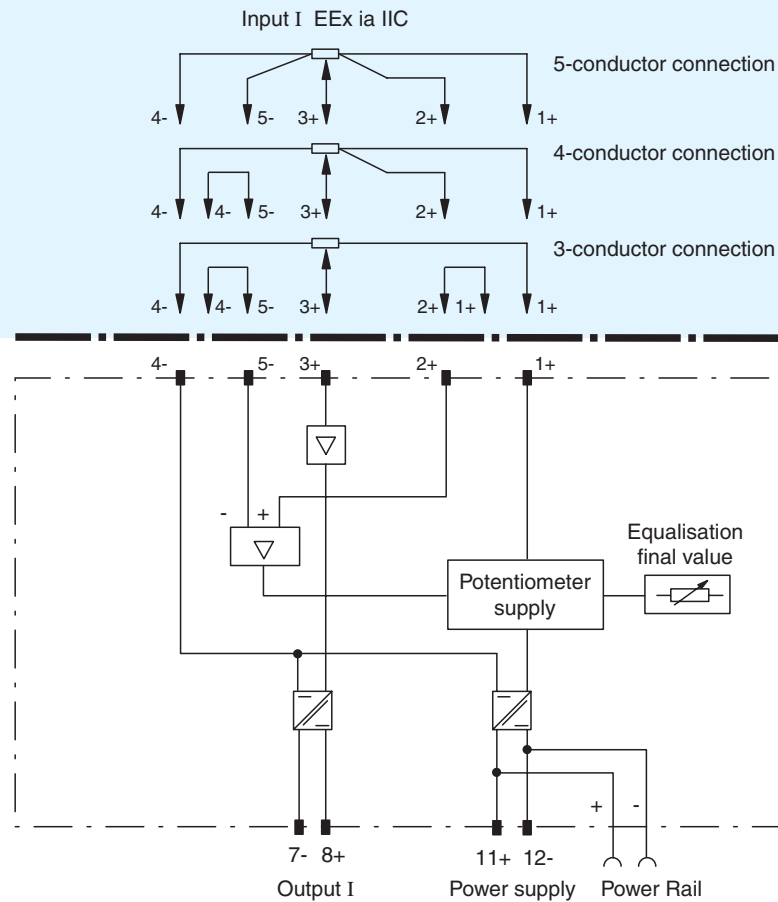
Corrosion monitoring

Level control conditioning electronics

Level control accessories

Pressurised enclosure system

**Connection**



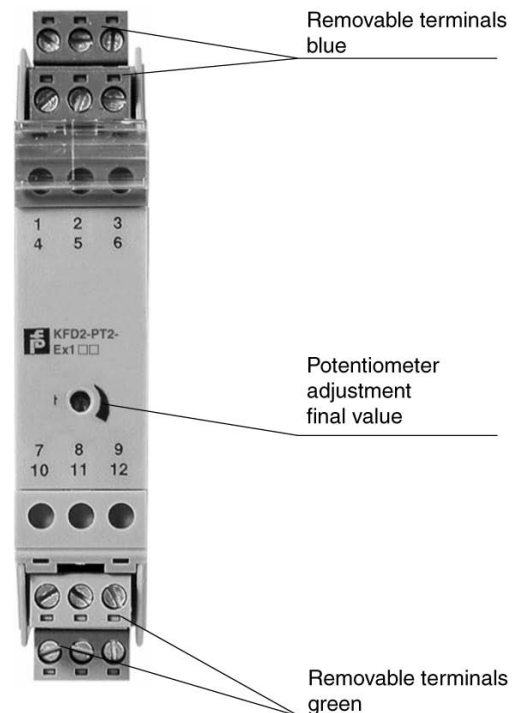
Hazardous area

Safe area

**Composition**

**Front View**

Housing type A4 (see system description)



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<b>Supply</b>	
Connection	Power Rail or terminals 11+, 12-
Rated voltage	20 ... 35 V DC
Ripple	within the supply tolerance
Power loss	0.5 W
Power consumption	0.6 W for voltage output; 1.3 W
<b>Input</b>	
Connection	terminals 4-, 5-, 3+, 2+, 1+
Lead resistance	≤ 50 Ω at potentiometer resistance ≤ 1 kΩ 5 % of the potentiometer resistance at ≥ 1 kΩ (can be equalised by user)
Potentiometer resistance	≥ 800 Ω
Potentiometer voltage	approx. 4.7 V
<b>Output</b>	
Voltage output	0/1 ... 5 V or 0/2 ... 10 V
Connection	terminals 7-, 8+
Current output	0/4 ... 20 mA; load ≤ 1 kΩ
Output resistance	≤ 30 Ω
<b>Transfer characteristics</b>	
Deviation	
Linearity	≤ ± 5 mV in case of voltage output/≤ ± 10 µA in case of current output
Influence of ambient temperature	≤ 5 mV/K in case of voltage output/≤ 1 µA in case of current output
Rise time	10 to 90 % ≤ 8 ms; 10 to 90 % within 1 % of span ≤ 25 ms
<b>Electrical isolation</b>	
Output/power supply	basic insulation acc. to EN 50178, rated insulation voltage of 50 V AC
<b>Directive conformity</b>	
Electromagnetic compatibility	
Directive 89/336/EC	EN 50081-2, EN 50082-2, IEC 801-6 intensity level 2
<b>Conformity</b>	
Insulation coordination	EN 50178
Electrical isolation	EN 50178
Electromagnetic compatibility	NE 21
Protection degree	IEC 60529
<b>Ambient conditions</b>	
Ambient temperature	-20 ... 60 °C (253 ... 333 K)
<b>Mechanical specifications</b>	
Protection degree	IP20
Mass	approx. 120 g
Dimensions	20 x 107 x 115 mm (0.8 x 4.2 x 4.5 in)
<b>Data for application in conjunction with hazardous areas</b>	
EC-Type Examination Certificate	BAS 00 ATEX 7171, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
Group, category, type of protection	⊕ II (1)GD [Ex ia] IIC (-20 °C ≤ T <sub>amb</sub> ≤ 60 °C)
Voltage U <sub>o</sub>	10.4 V
Current I <sub>o</sub>	31.4 mA
Power P <sub>o</sub>	82 mW
<b>Supply</b>	
Safety maximum voltage U <sub>m</sub>	250 V (Attention! The rated voltage can be lower.)
<b>Output</b>	
Safety maximum voltage U <sub>m</sub>	250 V (Attention! The rated voltage can be lower.)
<b>Electrical isolation</b>	
Input/output	safe electrical isolation acc. to EN 50020, voltage peak value 375 V
Input/power supply	safe electrical isolation acc. to EN 50020, voltage peak value 375 V
<b>Directive conformity</b>	
Directive 94/9 EC	EN 50014, EN 50020

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Supplementary information**

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

## Notes

The KFD2-PT2-Ex1 is available with various output options.

Model number	Output	Model number	Output	Model number	Output
KFD2-PT2-Ex1	0 V ... 10 V	KFD2-PT2-Ex1-2	2 V ... 10 V	KFD2-PT2-Ex1-4	0 mA ... 20 mA
KFD2-PT2-Ex1-1	0 V ... 5 V	KFD2-PT2-Ex1-3	1 V ... 5 V	KFD2-PT2-Ex1-5	4 mA ... 20 mA

## Accessories

**Power Rail PR-03****Power Rail UPR-03****Power feed module KFD2-EB2...**

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**



Ultrasonic level sensors

Guided microwave

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Ultrasonic level sensors

- 2-channel
- 90 V AC to 253 V AC wide range power pack
- Input for contacts, PNP/NPN sensors or push-pull output stages
- 2-channel switching amplifier with 1 changeover contact each
- Selectable min/max control (bistable control)
- Signal doubling: one input is switching both relay outputs (not for min/max control)
- Reversible mode of operation
- Both channels separate adjustable

Guided microwave

Corrosion monitoring

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Level control accessories

Pressurised enclosure system

**KFA6-SR-2.3L**

**Function**

The sensor amplifier transmits digital signals, optionally from 3-wire sensors or from sensors with push-pull outputs.

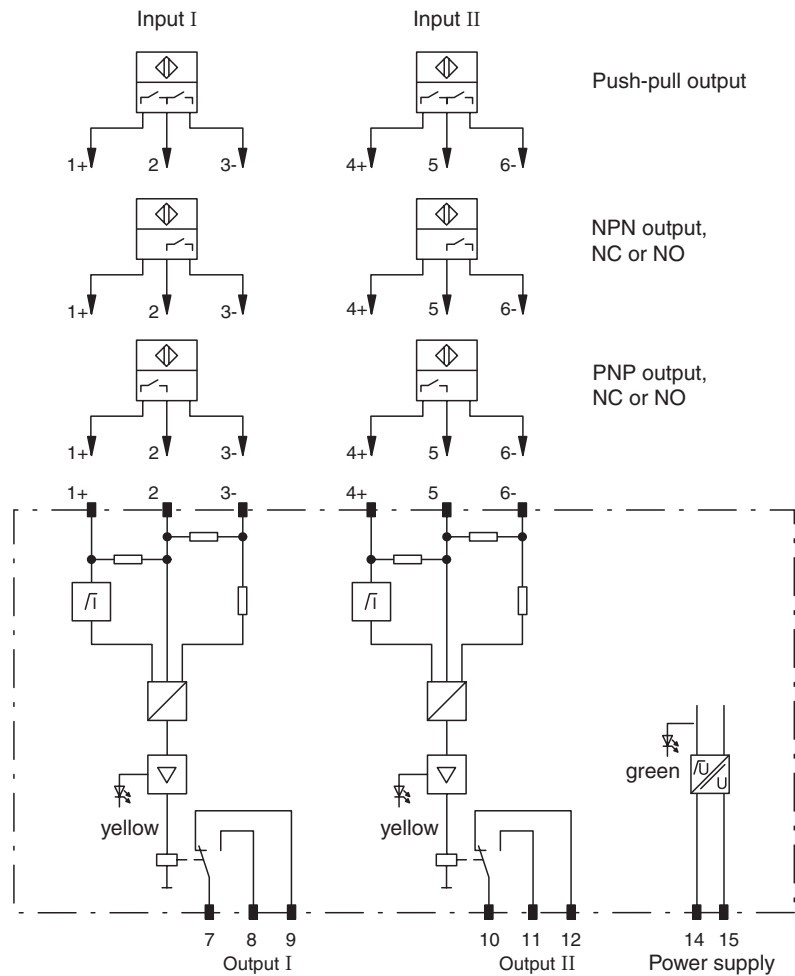
The selectable bistable operating behaviour (for min/max control) allows the use for a two point regulation, e. g. to control a level.

Signal doubling:  
Jumper terminals 2 and 5, one input is switching both relay outputs (not for min/max control).

**Application**

- Pump control for filling or emptying of vessels (control signal from the level sensors)
- Direction control for opening and closing of sluices and gates (control signal from the end position sensors)
- Two-point control (min/max control) with storage of status (control signal from the min/max sensors)
- Dual channel switching amplifier with 24 V/100 mA sensor supply and relay output as change-over contact

**Connection**



**Composition**

**Front View**

Housing type C (see system description)

LED yellow: Relay output I

LED yellow: Relay output II

Switch S1: (mode of operation input I)

Switch S3: (dual channel or min/max)

Removable terminals green

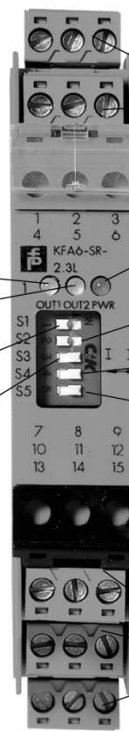
LED green: Power

Switch S2: (mode of operation input II)

Switch S4: (sensor type input I)

Switch S5: (sensor type input II)

Removable terminals green



<b>Supply</b>	
Connection	terminals 14, 15
Rated voltage	90 ... 253 V AC, 45 ... 65 Hz
Rated current	≤ 150 mA
Power loss	2.5 W
Power consumption	≤ 7 W
<b>Input</b>	
Connection	Input I: terminals 1+, 2, 3-; Input II: terminals 4+, 5, 6-
Rated values	22 ... 24 V DC/100 mA, see notes
Short-circuit current	110 mA
<b>Output</b>	
Connection	output I: terminals 7, 8, 9 output II: terminals 10, 11, 12
Output I and II	
Contact loading	250 V AC/4 A/cos $\Phi$ > 0.7; 40 V DC/2 A resistive load
Energised/de-energised delay	max. 6 ms
Mechanical life	10 <sup>7</sup> switching cycles
<b>Transfer characteristics</b>	
Switching frequency	≤ 10 Hz
<b>Electrical isolation</b>	
Input/output	safe electrical isolation per EN 50178, voltage peak value 253 V
Input/power supply	safe electrical isolation per EN 50178, voltage peak value 253 V
Output/power supply	safe electrical isolation per EN 50178, voltage peak value 253 V
Output/output	basic insulation acc. to EN 50178, rated insulation voltage 253 V <sub>eff</sub>
<b>Directive conformity</b>	
Electromagnetic compatibility	
Directive 89/336/EC	EN 50081-2, EN 50082-2
<b>Conformity</b>	
Electrical isolation	EN 50178
Electromagnetic compatibility	NE 21
Protection degree	IEC 60529
<b>Ambient conditions</b>	
Ambient temperature	-20 ... 60 °C (253 ... 333 K)
<b>Mechanical specifications</b>	
Protection degree	IP20
Mass	approx. 150 g
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Supplementary information**

Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

Notes

Function

The isolated amplifier has two inputs and two relay outputs (change-over contact) and is usable either as dual channel isolated amplifier or as two-point control (min/max control).

The inputs are designed in a way, that the signals of sensors which have PNP or NPN output transistors as well as push-pull outputs, can be processed. In the case of sensors with push-pull outputs the switches S4 or S5 have to be set to position I. For sensors with PNP or NPN output transistors, the switches S4 or S5 have to be set to position II. The operating behaviour of the sensor can be selected: NO S1/S2 in position I; NC S1/S2 in position II.

Dual channel switching amplifier for binary sensors or contacts

With this function (S3 in position I) contact or sensor signals from the input are transmitted to the relay output.

Parallel operation (1 input, 2 outputs)

A signal duplication can be realized by the following measures:

- Jumper terminal 2 to terminal 5.
- One sensor to input I or II.

Two-point control (min/max control) with storage of status

On this setting (S3 in position II) the information from the two inputs is combined.

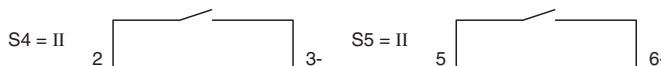
When the supply voltage is switched on, relay 1 is energised until input 2 is activated (reset input). Input 1 works as an set input.

Truth table (min/max control)

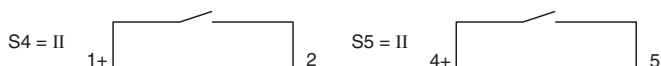
Conditions	Inputs		Outputs relay I and II
	E I	E II	
Activation of the supply voltage	not activated	not activated	relay energised
	activated	not activated	relay energised
	activated	activated	relay de-energised
Normal operation	activated	transition: not activated/activated	relay de-energising
	transition: activated/not activated	not activated	relay energising

Sensor connection

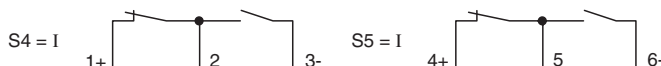
NPN output/contact



PNP output/contact



Push-pull output

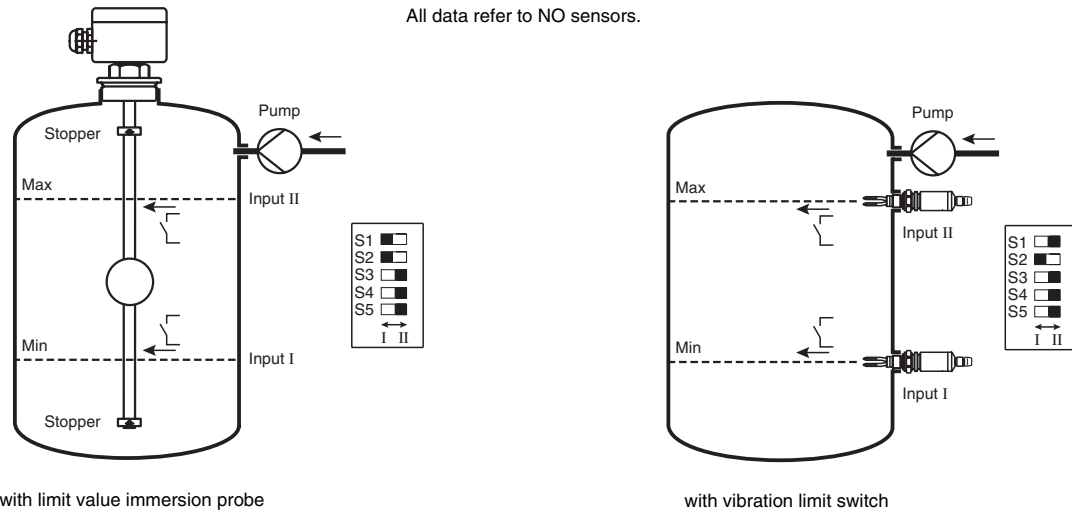


Function of the DIP switches

Function	Switch function	Switch/position
Operating behaviour of the sensor input	input 1 is activated if sensor 1 is closed	S1/I
	input 1 is activated if sensor 1 is open	S1/II
	input 2 is activated if sensor 2 is closed	S2/I
	input 2 is activated if sensor 2 is open	S2/II
Dual channel or min/max	dual channel independent	S3/I
	min/max function with storage of the status	S3/II
Sensor type	input 1: push-pull output stage, NO	S4/I
	input 1: PNP/NPN, NO	S4/II
	input 2: push-pull output stage, NO	S5/I
	input 2: PNP/NPN, NO	S5/II

**Example 1: filling of a vessel (two-point level control, S3 in position II)**

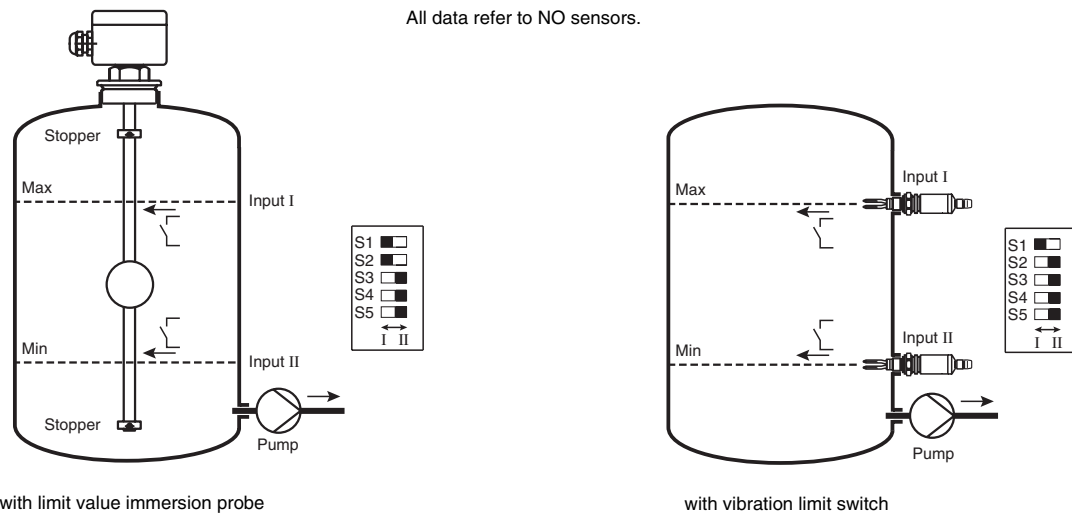
Min contact or min sensor is connected to input 1 (set), max contact or max sensor is connected to input 2 (reset). Dip switch S1 and S2 are on position I. A filling pump is connected to output 1 or 2 (terminals 7/8 or 10/11).



When the supply voltage of the KFA6-SR-2.3L is switched on, the pump will also switched on as long as the Max contact is not activated. During operation the pump is switched off as soon as the level has reached max position. If the level reach min position, the pump is switched on. If the KFA6-SR-2.3L has no power supply, the pump is switched off.

**Example 2: emptying of a vessel (two-point level control, S3 in position II)**

Max contact or max sensor is connected to input 1 (set), min contact or min sensor is connected to input 2 (reset). Dip switch S1 and S2 are set to position I. An emptying pump is connected to output 1 or 2 (terminals 7/9 or 10/12).



When the supply voltage of the KFA6-SR-2.3L is switched on, the pump will also switched on, if max contact is activated. During operation the pump is switched off as soon as the level has reached min position. If the level reach max position, the pump switched on. If the KFA6-SR-2.3L has no power supply, the pump is switched on.

**Comments:**

1. NO with push-pull output stage means that the closing contact or transistor is connected to terminal 2 and 3 (5 and 6).  
NC with push-pull output stage means that the opening contact or transistor is connected to terminal 2 and 3 (5 and 6).
2. In dip switch position S3/I (dual channel, independent) an output relay is activated if the corresponding input is activated.

**Derating of the sensor currents in dependence of the ambient temperature**

The maximum value of the sensor currents is controlled by a thermal overload protection of the device.

Ultrasonic level sensors



Attention

*The device determines its ambient temperature and limits the sensor currents accordingly (see figure). An inadmissibly high ambient temperature can limit the function of the sensors.*

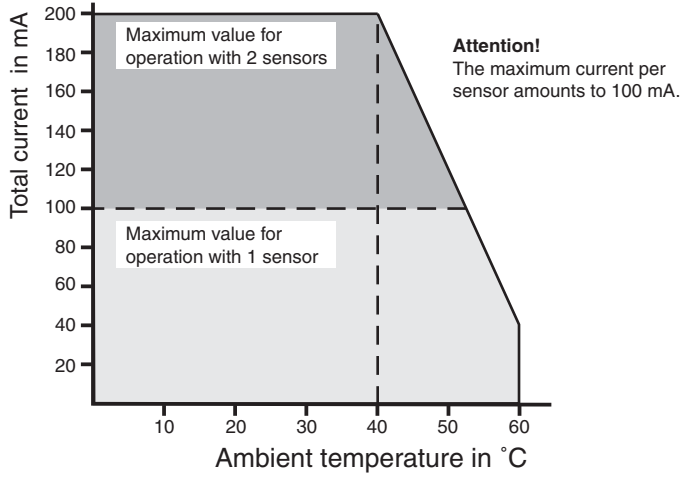
Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 1-channel
- Control circuit EEx ia IIC
- Reversible mode of operation
- 1 relay output with 1 changeover contact
- EMC acc. to NAMUR NE 21
- LB/SC monitoring
- LB/SC collective error message via Power Rail
- Up to SIL2 acc. to IEC 61508

Guided microwave

**KFD2-SR2-Ex1.W**

**Function**

The transformer isolated barrier transfers digital signals from the hazardous area. Sensors per EN 60947-5-6 (NAMUR) and mechanical contacts may be used as alarms. Control circuits are monitored for lead breakage (LB) and short circuit (SC). The external faults are indicated according to NAMUR NE44 by a red flashing LED.

For type KFD2-SR2-Ex1.W, an LB/SC collective error message is in addition transferred through the Power Rail to the power feed module.

The intrinsically safe input is per EN 50020 safely isolated from the output and the power supply. The relay output is in accordance with IEC 61140 safely isolated from the power supply.

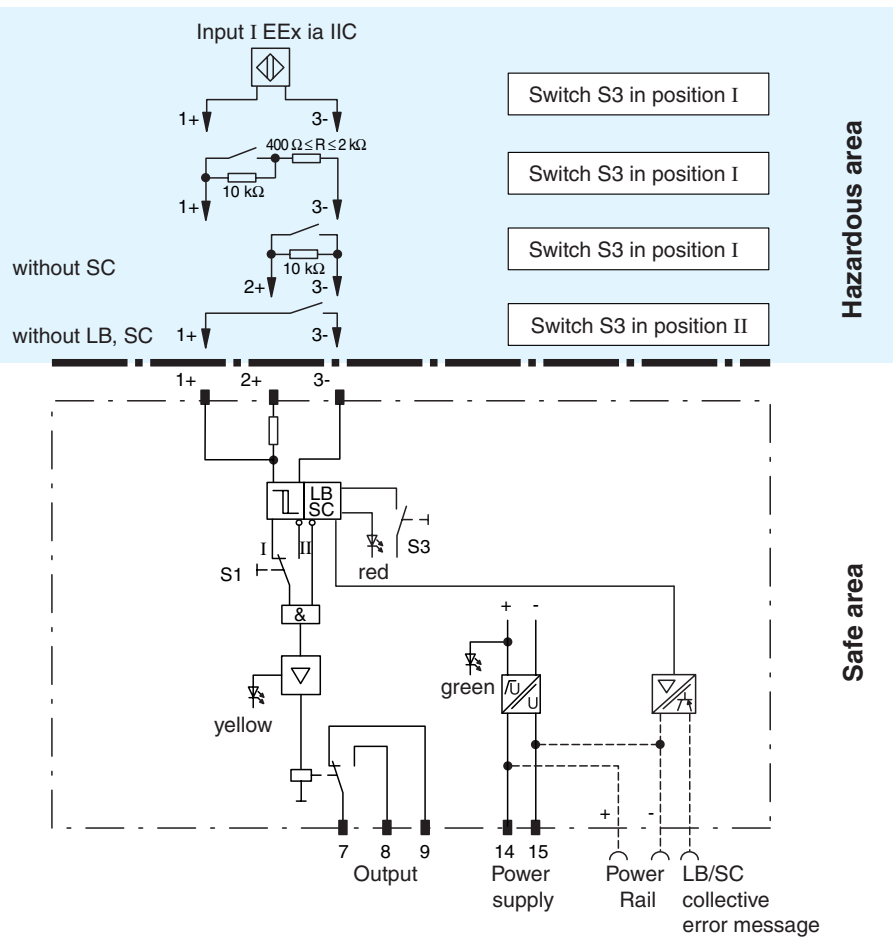
Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Connection**



Hazardous area

Safe area

**Composition**

**Front View**

Housing type B2 (see system description)

LED yellow: Relay output

LED red: LB/SC

Switch S2 (no functions)

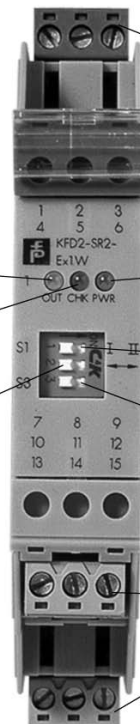
Removable terminal blue

LED green: Power supply

Switch S1 (Mode of operation)

Switch S3 (LB/SC-monitoring)

Removable terminals green



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<b>Supply</b>			Ultrasonic level sensors
Connection	Power Rail or terminals 14+, 15-		
Rated voltage	20 ... 30 V DC		
Ripple	≤ 10 %		
Rated current	≤ 30 mA		
Power loss	0.7 W		
Power consumption	< 0.9 W		
<b>Input</b>			
Connection	terminals 1+, 2+, 3-		
Rated values	acc. to EN 60947-5-6 (NAMUR), see system description for electrical data		
Open-circuit voltage/short-circuit current	approx. 8 V DC/approx. 8 mA		Guided microwave
Switching point/Switching hysteresis	1.2 ... 2.1 mA/approx. 0.2 mA		
Pulse/Pause ratio	≥ 20 ms/≥ 20 ms		
Lead monitoring	breakage I ≤ 0.1 mA, short-circuit I > 6 mA		
<b>Output</b>			
Connection	terminals 7, 8, 9		
Output	signal; relay		Corrosion monitoring
Contact loading	253 V AC/2 A/cos ϕ > 0.7; 126.5 V AC/4 A/cos ϕ > 0.7; 40 V DC/2 A resistive load		
Minimum switch current	2 mA/24 V DC		
Energised/de-energised delay	approx. 20 ms/approx. 20 ms		
Mechanical life	10 <sup>7</sup> switching cycles		
<b>Transfer characteristics</b>			
Switching frequency	< 10 Hz		
<b>Electrical isolation</b>			
Output/power supply	reinforced insulation acc. to IEC 61140, rated insulation voltage 300 V <sub>eff</sub>		
<b>Directive conformity</b>			
Electromagnetic compatibility			
Directive 89/336/EC	EN 61326		
Low voltage			
Directive 73/23/EEC	IEC 62103		
<b>Conformity</b>			
Electromagnetic compatibility	NE 21		
Protection degree	IEC 60529		
Protection against electric shock	IEC 61140		
<b>Ambient conditions</b>			Level control accessories
Ambient temperature	-20 ... 60 °C (253 ... 333 K)		
<b>Mechanical specifications</b>			
Protection degree	IP20		
Mass	approx. 150 g		
Dimensions	20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)		
<b>Data for application in conjunction with hazardous areas</b>			
EC-Type Examination Certificate	PTB 00 ATEX 2080, for additional certificates see www.pepperl-fuchs.com		
Group, category, type of protection	⊕ II (1)GD [EEx ia] IIC [circuit(s) in zone 0/1/2]		
Input	EEx ia IIC		
Voltage U <sub>o</sub>	10.5 V		
Current I <sub>o</sub>	13 mA		
Power P <sub>o</sub>	34 mW (linear characteristic)		
<b>Supply</b>			Pressurised enclosure system
Safety maximum voltage U <sub>m</sub>	253 V AC/125 V DC (Attention! U <sub>m</sub> is no rated voltage.)		
<b>Output</b>			
Contact loading	253 V AC/2 A/cos ϕ > 0.7; 126.5 V AC/4 A/cos ϕ > 0.7; 40 V DC/2 A resistive load		
Safety maximum voltage U <sub>m</sub>	253 V AC (Attention! The rated voltage can be lower.)		
Statement of conformity	Pepperl+Fuchs		
Group, category, type of protection	⊕ II (3)G (EEx nL) IIC X [circuit(s) in zone 2]		
Input	[EEx nL] IIC		
Voltage U <sub>o</sub>	10.5 V		
Current I <sub>o</sub>	13 mA		
Power P <sub>o</sub>	34 mW (linear characteristic)		
<b>Output</b>			
Contact loading	253 V AC/2 A/cos ϕ > 0.7; 126.5 V AC/4 A/cos ϕ > 0.7; 40 V DC/2 A resistive load		
Statement of conformity	TÜV 99 ATEX 1493 X, observe statement of conformity		

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Group, category, type of protection, temperature classification

 II 3G EEx nAC IIC T4 [device in zone 2]

## Output

Contact loading 50 V AC/4 A/cos  $\Phi > 0.7$ ; 40 V DC/2 A resistive load

## Electrical isolation

Input/output safe electrical isolation acc. to EN 50020, voltage peak value 375 V

Input/power supply

safe electrical isolation acc. to EN 50020, voltage peak value 375 V

## Directive conformity

Directive 94/9 EC EN 50014, EN 50020, EN 50021

## Supplementary information

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

## Accessories

## Power Rail PR-03

## Power Rail UPR-03

## Power feed module KFD2-EB2...

Using Power Rail PR-03 or UPR-03 the devices are supplied with 24 V DC by means of the power feed modules. If no Power Rails are used, power supply of the individual devices is possible directly via their device terminals.

Each power feed module is used for fusing and monitoring groups with up to 100 individual devices. The Power Rail PR-03 is an inset component for the DIN rail. The Power Rail UPR-03 is a complete unit consisting of the electrical inset and an aluminium profile rail 35 mm x 15 mm x 2000 mm. To make electrical contact, the devices are simply engaged.

**The Power Rail must not be fed via the device terminals of the individual devices!**

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 2-channel
- Control circuit EEx ia IIC
- Reversible mode of operation
- Bistable
- 1 signal output with 2 changeover contacts
- EMC acc. to NAMUR NE 21
- LB/SC monitoring

Guided microwave

230 V AC  
KFA6-SR2-Ex2.W.IR

Corrosion monitoring

Function

The separation switching amplifier behaves in a bistable manner. It is set by an active signal on input I and is reset by an active signal on input II. The mode of operation of inputs I and II can be programmed. An active signal can be generated if the corresponding sensor is damped or if it is not damped. Both inputs are intrinsically safe, and there are two relays available on the output with one changeover contact each (the relays switch simultaneously).

During commissioning, the output relays are switched until an active signal on input II resets them. The mode of operation for input I can be selected with switch S1, while the mode of operation for input II can be selected with switch S2.

Monitoring for a line break opens the output relay if a lead break or short circuit is detected in the control circuit. Switch S3 (de-)activates monitoring for lead break or short circuit.

Level signal conditioning electronics

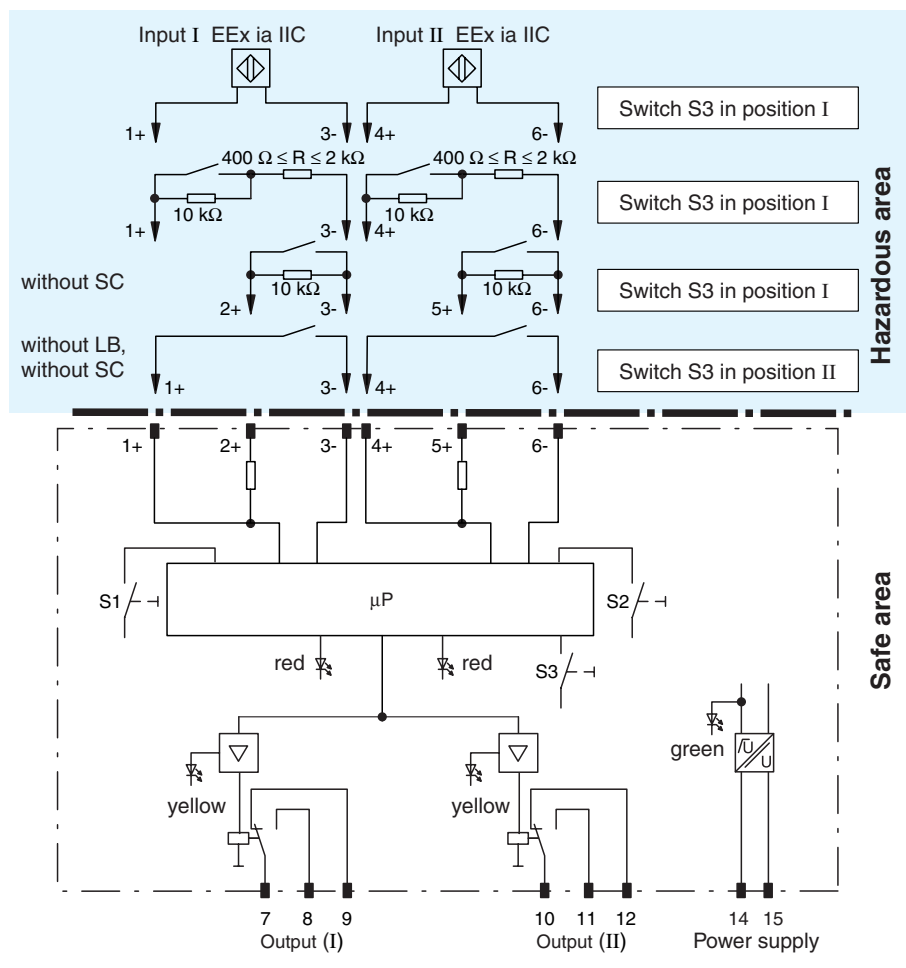
Level control accessories

Application

Two-point controller or filling level controller for minimum/maximum control

Pressurised enclosure system

Connection



Composition

Front View

Housing type C (see system description)

LED yellow: Relay output (I)

LED red: LB/SC input I

LED yellow: Relay output (II)

LED red: LB/SC input II

Removable terminals blue

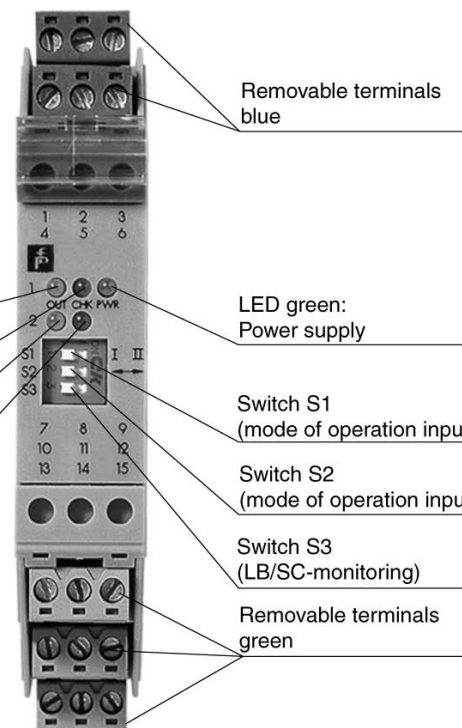
LED green: Power supply

Switch S1 (mode of operation input I)

Switch S2 (mode of operation input II)

Switch S3 (LB/SC-monitoring)

Removable terminals green



Date of issue 09/22/06 – Catalog Field Devices

<b>Supply</b>			
Connection		terminals 14, 15	
Rated voltage		207 ... 253 V AC, 45 ... 65 Hz	
Power consumption		≤ 1.5 W	
<b>Input</b>			
Connection		terminals 1+, 2+, 3-; 4+, 5+, 6-	
Rated values		acc. to EN 60947-5-6 (NAMUR)	
Open-circuit voltage/short-circuit current		approx. 8 V DC/approx. 8 mA	
Pulse/Pause ratio		≥ 10 ms/≥ 10 ms	
Lead monitoring		breakage I ≤ 0.1 mA, short-circuit I > 6 mA	
<b>Output</b>			
Connection		output I: terminals 7, 8, 9; output II: terminals 10, 11, 12	
Output I and II		signal; relay	
Contact loading		253 V AC/2 A/cos Φ > 0.7; 126.5 V AC/4 A/cos Φ > 0.7; 40 V DC/2 A resistive load	
Energised/de-energised delay		approx. 20 ms/approx. 20 ms	
Mechanical life		10 <sup>7</sup> switching cycles	
<b>Transfer characteristics</b>			
Switching frequency		≤ 10 Hz	
<b>Electrical isolation</b>			
Output/power supply		safe isolation acc. to DIN VDE 0106, rated insulation voltage 253 V <sub>eff</sub>	
Output/output		basic insulation acc. to EN 50178, rated insulation voltage 253 V <sub>eff</sub>	
<b>Directive conformity</b>			
Electromagnetic compatibility			
Directive 89/336/EC		EN 61326, EN 50081-2	
<b>Conformity</b>			
Electrical isolation		EN 50178	
Electromagnetic compatibility		NE 21	
Protection degree		IEC 60529	
<b>Ambient conditions</b>			
Ambient temperature		-20 ... 60 °C (253 ... 333 K)	
<b>Mechanical specifications</b>			
Protection degree		IP20	
Mass		approx. 150 g	
Dimensions		20 x 119 x 115 mm (0.8 x 4.6 x 4.5 in)	
<b>Data for application in conjunction with hazardous areas</b>			
EC-Type Examination Certificate		PTB 00 ATEX 2081, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	
Group, category, type of protection		Ⓔ II (1)GD [EEx ia] IIC [circuit(s) in zone 0/1/2]	
Input		EEx ia IIC	
Voltage	U <sub>o</sub>	10.6 V	
Current	I <sub>o</sub>	19.1 mA	
Power	P <sub>o</sub>	51 mW (linear characteristic)	
<b>Supply</b>			
Safety maximum voltage U <sub>m</sub>		253 V AC/126.5 V AC (Attention! U <sub>m</sub> is no rated voltage.)	
<b>Output</b>			
Contact loading		253 V AC/2 A/cos Φ > 0.7; 126.5 V AC/4 A/cos Φ > 0.7; 40 V DC/2 A resistive load	
Safety maximum voltage U <sub>m</sub>		253 V AC (Attention! The rated voltage can be lower.)	
<b>Electrical isolation</b>			
Input/input		not available	
Input/output		safe electrical isolation acc. to EN 50020, voltage peak value 375 V	
Input/power supply		safe electrical isolation acc. to EN 50020, voltage peak value 375 V	
<b>Directive conformity</b>			
Directive 94/9 EC		EN 50014, EN 50020	

**Supplementary information**

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

## Notes

## Function of the DIP switches

Switch	Position	Function
S1: Mode of operation Input I	I	Input I active, whenever connected sensor damped
	II	Input I active, whenever connected sensor undamped
S2: Mode of operation Input II	I	Input II active, whenever connected sensor damped
	II	Input II active, whenever connected sensor undamped
S3: LB/SC control	I	LB/SC monitoring active
	II	No LB/SC monitoring

Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronicsLevel control  
accessoriesPressurised  
enclosure system

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

# Level control accessories

Pressurised enclosure system
Level control accessories
Level signal conditioning electronics
Corrosion monitoring
Guided microwave
Ultrasonic level sensors





Lightning protection barrier P-LB

Overvoltage diverters are used as modules positioned upstream in the circuit from the corresponding electrical equipment. They make it possible to protect against overvoltages originating from various causes (lightening strikes, switching processes, etc.). This is achieved by diverting the transient current and limiting the voltage throughout the duration of the overvoltage surge.

The complete product selection for lightning protection barriers you will find in the catalogue "DIN-Rail housing".

All information for the approvals and certifications please find at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

Ultrasonic level sensors

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Ultrasonic level sensors

- 2- or 4-wire protection
- For non-insulated measurement and control circuits
- Also for intrinsically safe control circuits EEx ia IIC
- Fulfills requirements to 500 V insulation to earth, housing components and other intrinsically safe circuits
- Installation directly in the hazardous area for protecting the field devices
- Discharge current 10 kA
- Grounding as simple as snapping onto the DIN mounting rail
- Uninterruptable operation (auto reset)

Guided microwave

Corrosion monitoring

**2-wire protection**  
**K-LB-1.30**  
**4-wire protection**  
**K-LB-2.30**

Level signal conditioning electronics

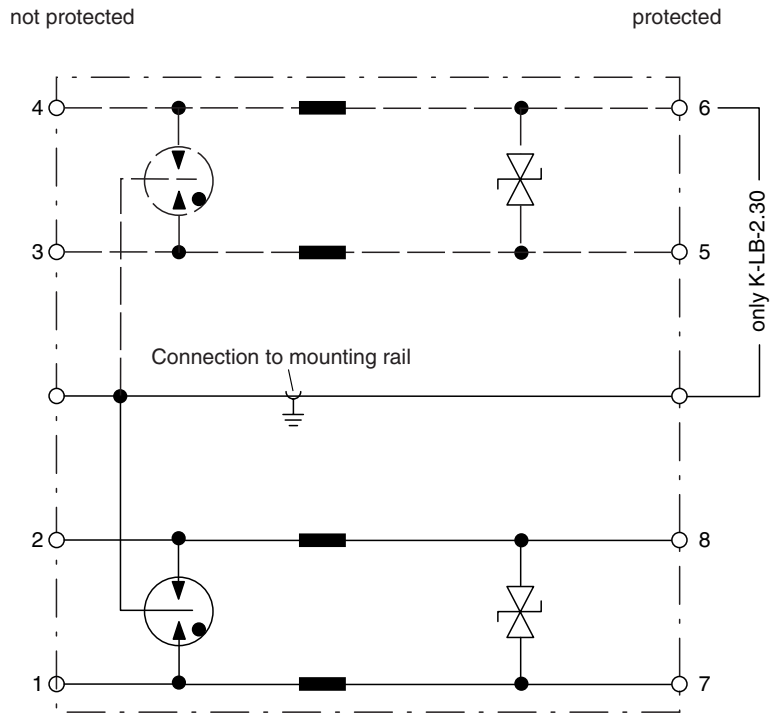
**Application**

With the application of a K-LB-..., field devices and processing units are effectively protected against overvoltages of various origins (i. e. lightning stroke, switching impulse, etc.). Two galvanically isolated circuits can be protected, thus 2 x 2 wires.

Level control accessories

Pressurised enclosure system

**Connection**



**Composition**

**Front View**

Housing type Z1  
 (see system description)



	K-LB-1.30	K-LB-2.30
<b>Supply</b>		
Connection	terminals 7, 8; 1, 2	terminals 1, 2; 7, 8/3, 4; 5, 6
Rated voltage	≤ 30 V	≤ 30 V
Rated current	≤ 250 mA	≤ 250 mA
Leakage current	≤ 5 µA	≤ 5 µA
On-state voltage	≤ 45 V	≤ 45 V
Ground insulation	500 V breakdown voltage	500 V breakdown voltage
<b>Input</b>		
Number of channels	1	2
<b>Conformity</b>		
Protection degree	IEC 60529	
<b>Ambient conditions</b>		
Ambient temperature	-30 ... 80 °C (243 ... 353 K) for applications in safe areas, -30 ... 60 °C (243 ... 333 K) for applications in hazardous areas	
<b>Mechanical specifications</b>		
Protection degree	IP20	
Mass	approx. 100 g	
Dimensions	12.5 x 114 x 110 mm (0.5 x 4.5 x 4.3 in)	
<b>Data for application in conjunction with hazardous areas</b>		
EC-Type Examination Certificate	PTB 00 ATEX 2176X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	
Group, category, type of protection, temperature classification	⊕ II 2(1)G EEx ia IIC T6	
Voltage $U_i$	30 V	
Current $I_i$	250 mA	
Maximum leakage current	10 kA (8/20 µs) per core according to IEC 60-2	
<b>Nominal response time</b>		
Symmetrical	1 ns	
Asymmetric	100 ns	
Series resistance	≤ 0.3 Ω per conductor	
Bandwidth	≥ 40 kHz	
<b>Directive conformity</b>		
Directive 94/9 EC	EN 50014, EN 50020	

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

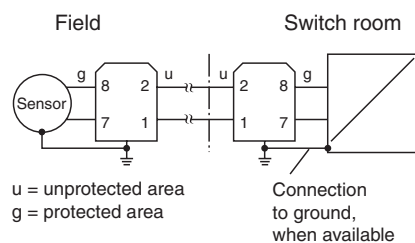
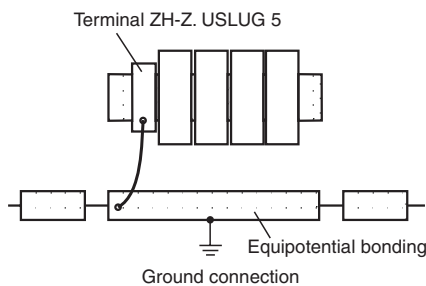
Supplementary information

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

Notes

Surge protectors must always be connected to a solid effective ground (large cross sections, short wiring). This is the basic requirement for an effective protection.

Example installations





Ultrasonic level sensors

- 2- or 4-wire protection
- For insulated C&I circuits up to 6 V
- Also for intrinsically safe control circuits EEx ia IIC

Guided microwave

- Fulfills requirements to 500 V insulation to earth, housing components and other intrinsically safe circuits
- Installation directly in the hazardous area for protecting the field devices
- Discharge current 10 kA
- Grounding as simple as snapping onto the DIN mounting rail
- Uninterruptable operation (auto reset)

Corrosion monitoring

**2-wire protection**  
**K-LB-1.6**  
**4-wire protection**  
**K-LB-2.6**

Level signal conditioning electronics

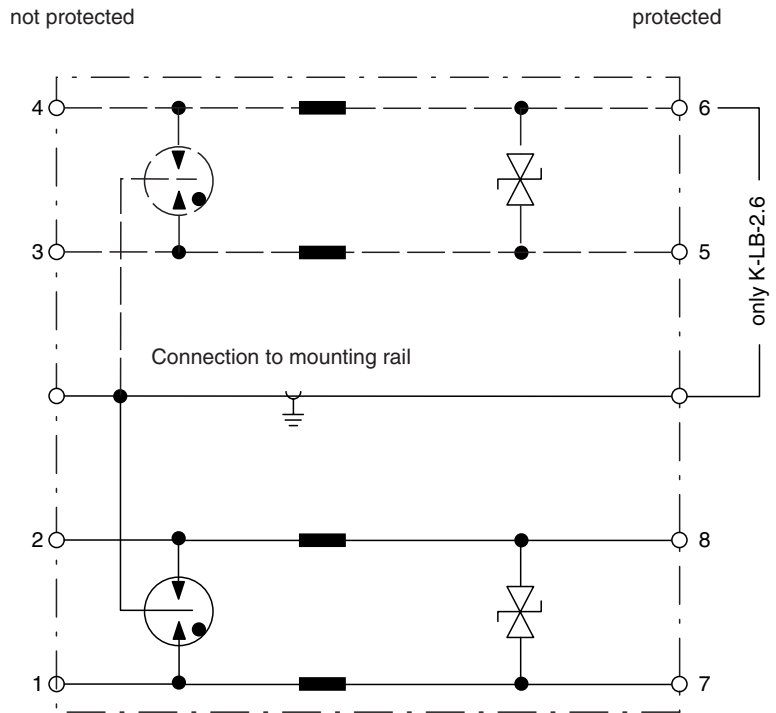
**Application**

With the application of a K-LB-..., field devices and processing units are effectively protected against overvoltages of various origins (i. e. lightning stroke, switching impulse, etc.). Two galvanically isolated circuits can be protected, thus 2 x 2 wires.

Level control accessories

Pressurised enclosure system

**Connection**



**Composition**

**Front View**

Housing type Z1  
 (see system description)



	K-LB-1.6	K-LB-2.6
<b>Supply</b>		
Connection	terminals 7, 8; 1, 2	terminals 1, 2; 7, 8/3, 4; 5, 6
Rated voltage	≤ 6 V	≤ 6 V
Rated current	≤ 250 mA	≤ 250 mA
Leakage current	≤ 10 µA	≤ 10 µA
On-state voltage	≤ 12 V	≤ 12 V
Ground insulation	500 V breakdown voltage	500 V breakdown voltage
<b>Input</b>		
Number of channels	1	2
<b>Conformity</b>		
Protection degree	IEC 60529	
<b>Ambient conditions</b>		
Ambient temperature	-30 ... 80 °C (243 ... 353 K) for applications in safe areas, -30 ... 60 °C (243 ... 333 K) for applications in hazardous areas	
<b>Mechanical specifications</b>		
Protection degree	IP20	
Mass	approx. 100 g	
Dimensions	12.5 x 114 x 110 mm (0.5 x 4.5 x 4.3 in)	
<b>Data for application in conjunction with hazardous areas</b>		
EC-Type Examination Certificate	PTB 00 ATEX 2176X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	
Group, category, type of protection, temperature classification	⊕ II 2(1)G EEx ia IIC T6	
Voltage $U_i$	6 V	
Current $I_i$	250 mA	
Maximum leakage current	10 kA (8/20 µs) per core according to IEC 60-2	
<b>Nominal response time</b>		
Symmetrical	1 ns	
Asymmetric	100 ns	
Series resistance	≤ 0.3 Ω per conductor	
Bandwidth	≥ 40 kHz	
<b>Directive conformity</b>		
Directive 94/9 EC	EN 50014, EN 50020	

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

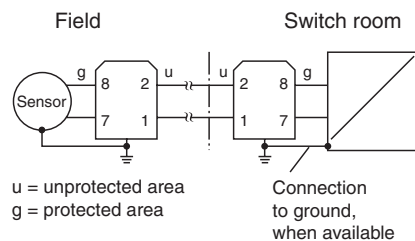
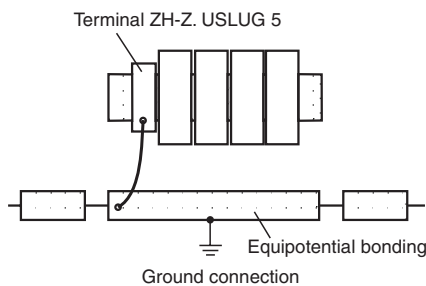
**Supplementary information**

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**Notes**

Surge protectors must always be connected to a solid effective ground (large cross sections, short wiring). This is the basic requirement for an effective protection.

**Example installations**





Ultrasonic level sensors

- 2- or 4-wire protection
- For non-insulated C&I circuits up to 30 V
- Also for intrinsically safe control circuits EEx ia IIC
- Installation directly in the hazardous area for protecting the field devices
- Discharge current 10 kA
- Grounding as simple as snapping onto the DIN mounting rail
- Uninterruptable operation (auto reset)

Guided microwave

Corrosion monitoring

**2-wire protection**  
**K-LB-1.30G**  
**4-wire protection**  
**K-LB-2.30G**

**Application**

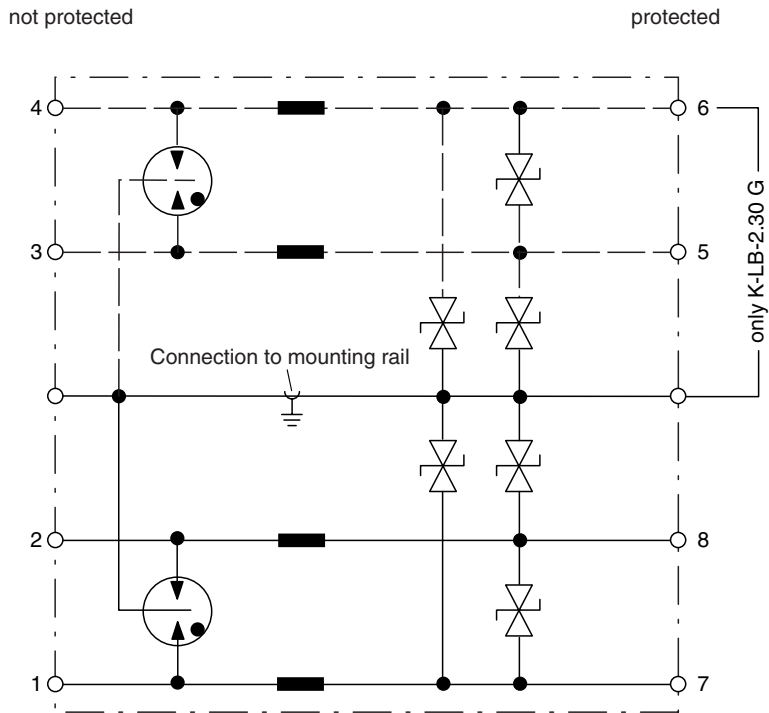
With the application of a K-LB-..., field devices and processing units are effectively protected against overvoltages of various origins (i. e. lightning stroke, switching impulse, etc.). Two galvanically isolated circuits can be protected, thus 2 x 2 wires.

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Connection**



**Composition**

**Front View**

Housing type Z1  
 (see system description)



	K-LB-1.30G	K-LB-2.30G
<b>Supply</b>		
Connection	terminals 7, 8; 1, 2	terminals 1, 2; 7, 8/3, 4; 5, 6
Rated voltage	≤ 30 V	≤ 30 V
Rated current	≤ 250 mA	≤ 250 mA
Leakage current	≤ 5 µA	≤ 5 µA
On-state voltage	≤ 45 V	≤ 45 V
<b>Input</b>		
Number of channels	1	2
<b>Conformity</b>		
Protection degree	IEC 60529	
<b>Ambient conditions</b>		
Ambient temperature	-30 ... 80 °C (243 ... 353 K) for applications in safe areas, -30 ... 60 °C (243 ... 333 K) for applications in hazardous areas	
<b>Mechanical specifications</b>		
Protection degree	IP20	
Mass	approx. 100 g	
Dimensions	12.5 x 114 x 110 mm (0.5 x 4.5 x 4.3 in)	
<b>Data for application in conjunction with hazardous areas</b>		
EC-Type Examination Certificate	PTB 00 ATEX 2176X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	
Group, category, type of protection, temperature classification	⊕ II 2(1)G EEx ia IIC T6	
Voltage $U_i$	30 V	
Current $I_i$	250 mA	
Maximum leakage current	10 kA (8/20 µs) per core according to IEC 60-2	
<b>Nominal response time</b>		
Symmetrical	1 ns	
Asymmetric	100 ns	
Series resistance	≤ 0.3 Ω per conductor	
Bandwidth	≥ 40 kHz	
<b>Directive conformity</b>		
Directive 94/9 EC	EN 50014, EN 50020	

Ultrasonic level sensors  
Guided microwave  
Corrosion monitoring  
Level signal conditioning electronics

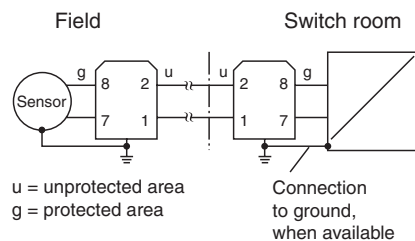
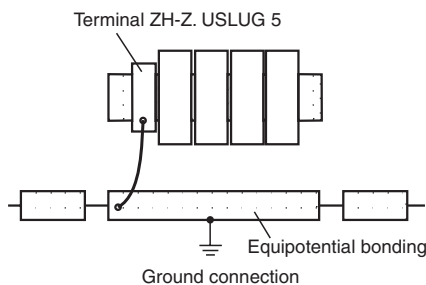
Supplementary information

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Notes

Surge protectors must always be connected to a solid and effective ground (large cross sections, short wiring). This is the basic requirement for an effective protection.

Example installations



Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 2- or 4-wire protection
- For non-insulated C&I circuits up to 6 V
- Also for intrinsically safe control circuits EEx ia IIC
- Installation directly in the hazardous area for protecting the field devices
- Discharge current 10 kA
- Grounding as simple as snapping onto the DIN mounting rail
- Uninterruptable operation (auto reset)

Guided microwave

**2-wire protection**  
**K-LB-1.6G**  
**4-wire protection**  
**K-LB-2.6G**

Corrosion monitoring

**Application**

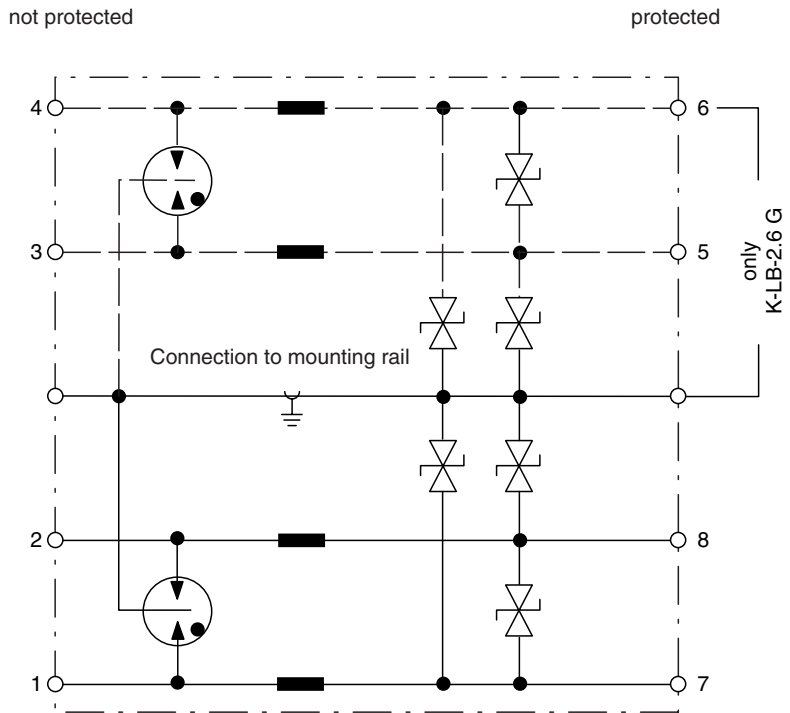
With the application of a K-LB-..., field devices and processing units are effectively protected against overvoltages of various origins (i. e. lightning stroke, switching impulse, etc.). Two galvanically isolated circuits can be protected, thus 2 x 2 wires.

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Connection**



**Composition**

**Front View**

Housing type Z1  
 (see system description)





	K-LB-1.6G	K-LB-2.6G
<b>Supply</b>		
Connection	terminals 7, 8; 1, 2	terminals 1, 2; 7, 8/3, 4; 5, 6
Rated voltage	≤ 6 V	≤ 6 V
Rated current	≤ 250 mA	≤ 250 mA
Leakage current	≤ 5 µA	≤ 5 µA
On-state voltage	≤ 12 V	≤ 12 V
<b>Input</b>		
Number of channels	1	2
<b>Conformity</b>		
Protection degree	IEC 60529	
<b>Ambient conditions</b>		
Ambient temperature	-30 ... 80 °C (243 ... 353 K) for applications in safe areas, -30 ... 60 °C (243 ... 333 K) for applications in hazardous areas	
<b>Mechanical specifications</b>		
Protection degree	IP20	
Mass	approx. 100 g	
Dimensions	12.5 x 114 x 110 mm (0.5 x 4.5 x 4.3 in)	
<b>Data for application in conjunction with hazardous areas</b>		
EC-Type Examination Certificate	PTB 00 ATEX 2176X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	
Group, category, type of protection, temperature classification	⊕ II 2(1)G EEx ia IIC T6	
Voltage $U_i$	6 V	
Current $I_i$	250 mA	
Maximum leakage current	10 kA (8/20 µs) per core according to IEC 60-2	
<b>Nominal response time</b>		
Symmetrical	1 ns	
Asymmetrical	100 ns	
Series resistance	≤ 0.3 Ω per conductor	
Bandwidth	≥ 40 kHz	
<b>Directive conformity</b>		
Directive 94/9 EC	EN 50014, EN 50020	

Ultrasonic level sensors

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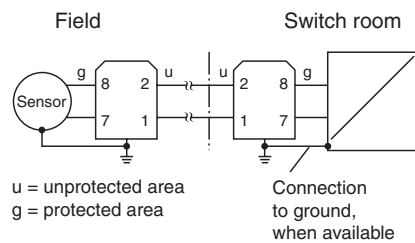
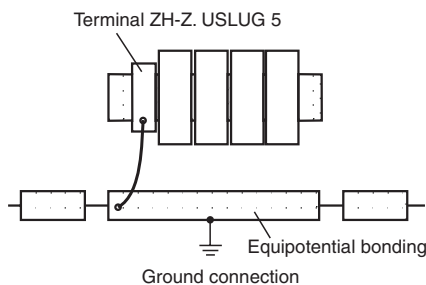
**Supplementary information**

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

**Notes**

Surge protectors must always be connected to a solid and effective ground (large cross sections, short wiring). This is the basic requirement for an effective protection.

**Example installations**





Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

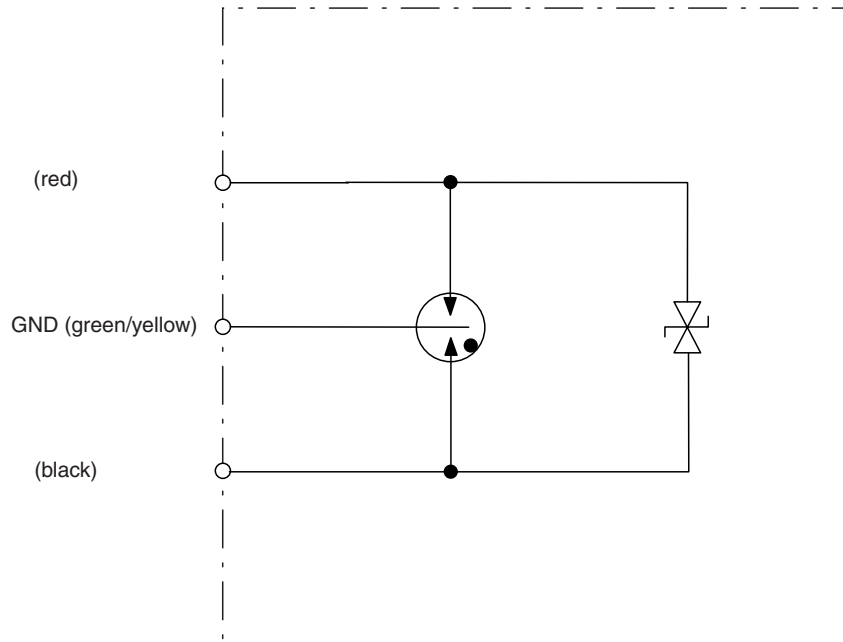
- 2-wire protection
- For insulated C&I circuits
- Fulfils requirements to 500 V insulation to earth, housing components and other intrinsically safe circuits
- Installation directly in the hazardous area for protecting the field devices
- Discharge current 10 kA
- Simple installation in the free cable gland on the field device
- Uninterruptable operation (auto reset)

**M20 x 1.5 thread**  
**FS-LB-I**  
**PG13.5 thread**  
**FP-LB-I**  
**½ NPT thread**  
**FN-LB-I**

**Function**

By using an F\*-LB-I, field devices and control interface units are safely protected from voltage surges due to e. g. flash of lightning, switching processes etc.). This is accomplished by the derivation of the higher current to ground and a voltage limit during the high level pulse. The continuous current capacity of the circuit that is to be protected must not exceed the rated operational current.

**Connection**



**Composition**



<b>Supply</b>	
Rated voltage	≤ 48 V
Rated current	≤ 250 mA
Leakage current	≤ 5 µA
On-state voltage	≤ 85 V
Ground insulation	≥ 500 V breakdown voltage
<b>Conformity</b>	
Protection degree	IEC 60529
<b>Ambient conditions</b>	
Ambient temperature	-30 ... 60 °C (243 ... 333 K) for Ex application, please observe EC-Type Examination Certificate
<b>Mechanical specifications</b>	
Protection degree	IP20
Mass	approx. 200 g
Dimensions	AF22 x 77 mm (0.9 x 3 in)
<b>Data for application in conjunction with hazardous areas</b>	
EC-Type Examination Certificate	PTB 00 ATEX 2175, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
Group, category, type of protection, temperature classification	⊕ II 2G EEx ia IIC T6
Voltage U <sub>i</sub>	50 V
Maximum leakage current	10 kA (8/20 µs) per core according to IEC 60-2
Nominal response time	
Symmetrical	1 ns
Asymmetric	100 ns
Bandwidth	≥ 40 kHz
Directive conformity	
Directive 94/9 EC	EN 50014, EN 50020

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

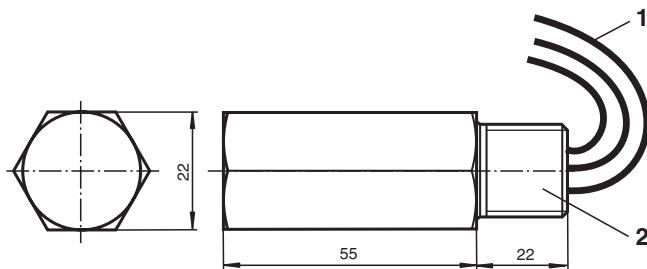
Pressurised enclosure system

**Supplementary information**

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

**Notes**

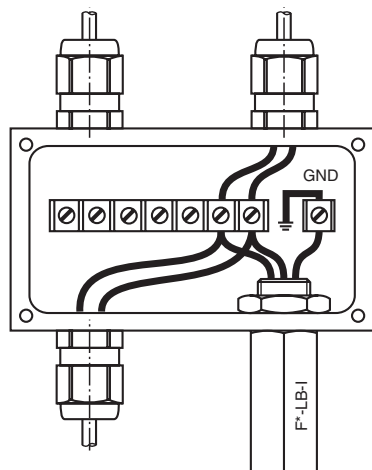
Surge protectors must always be connected to a solid ground (large cross sections, short wiring). This is the basic requirement for an effective protection.



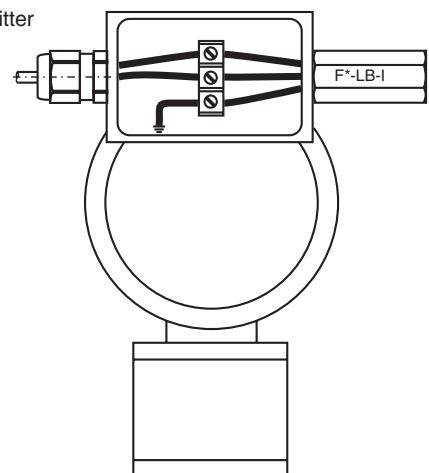
- 1 Cable cross sectional area 1.0 mm  
Cable length 400 mm
- 2 FP-LB-I: PG13.5 thread  
FS-LB-I: M20 x 1.5 thread  
FN-LB-I: ½ NPT thread

**Examples:**

Terminal box



Transmitter





Ultrasonic level sensors

- 2- or 4-wire protection
- For analogue and binary MSR-circuits
- Suitable for intrinsically safe control current circuits EEx ia IIC
- Discharge current 10 kA
- Simple grounding via busbar
- Uninterruptable operation (auto reset)

Guided microwave

**P-LB-1.A.13**  
**P-LB-2.A.1346**

Corrosion monitoring

**Function**

The P-LB is optimised for the devices of the K-series.

By simple snapping onto the standard K-modules, these are safely protected against voltage surges of different origin (e. g. lightning stroke, switching impulse, etc.).

Level signal conditioning electronics

This is accomplished by diverting the destructive surge current to ground and limiting the voltage during the high level pulses.

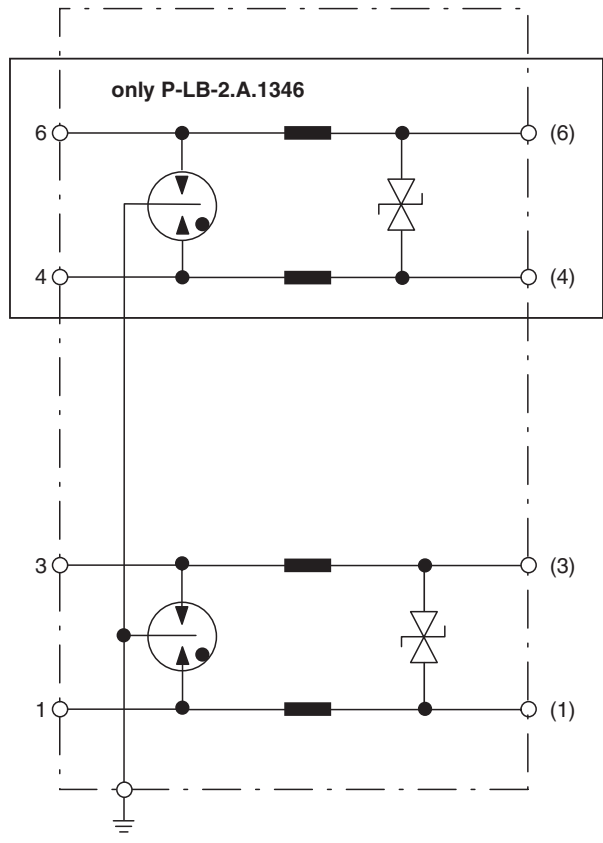
The P-LB-\*. \* allows the protection of 1 up to 2 galvanically isolated circuits.

The end digits of the P-LB designation correspond to the protected terminals of the respective K-device.

Level control accessories

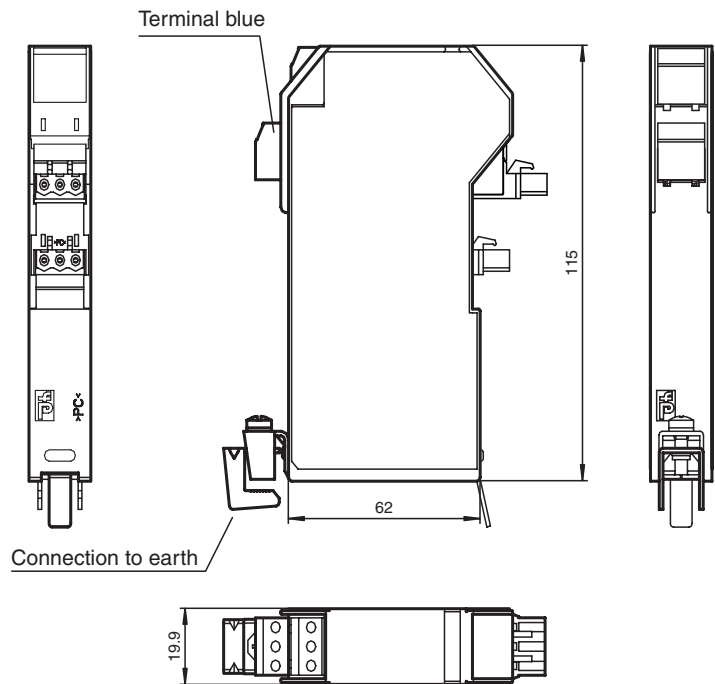
Pressurised enclosure system

**Connection**



Connection to busbar

**Composition**



	P-LB-1.A.13	P-LB-2.A.1346
<b>Signal lines</b>		
Connection	terminals 1, 3	terminals 1, 3; 4, 6
Rated voltage	≤ 30 V	≤ 30 V
Rated current	≤ 250 mA	≤ 250 mA
Leakage current	≤ 5 µA	≤ 5 µA
On-state voltage	≤ 45 V	≤ 45 V
Ground insulation	≤ 500 V breakdown voltage	≤ 500 V breakdown voltage
<b>Input</b>		
Number of channels	1	2
<b>Conformity</b>		
Protection degree	IEC 60529	
<b>Ambient conditions</b>		
Ambient temperature	-20 ... 60 °C (253 ... 333 K)	
<b>Mechanical specifications</b>		
Protection degree	IP20	
Mass	approx. 70 g	
Dimensions	20 x 62 x 115 mm (0.8 x 2.4 x 4.5 in)	
<b>Data for application in conjunction with hazardous areas</b>		
EC-Type Examination Certificate	PTB 02 ATEX 2044, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>	
Group, category, type of protection	⊕ II (1)G [EEx ia] IIC	
Voltage U <sub>o</sub>	≤ 30 V	
Current I <sub>i</sub>	≤ 250 mA	
Power P <sub>o</sub>	≤ 1.3 W	
Maximum leakage current	10 kA (8/20 µs) per conductor	
Nominal response time		
Symmetrical	1 ns	
Asymmetric	100 ns	
Series resistor	≤ 0.5 Ω per wire	
Bandwidth	≥ 40 kHz	
Declaration of conformity	Pepperl+Fuchs	
Group, category, type of protection, temperature classification	⊕ II 3G EEx nA II T6	
Directive conformity		
Directive 94/9 EC	EN 50014, EN 50020, EN 50021	

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Supplementary information**

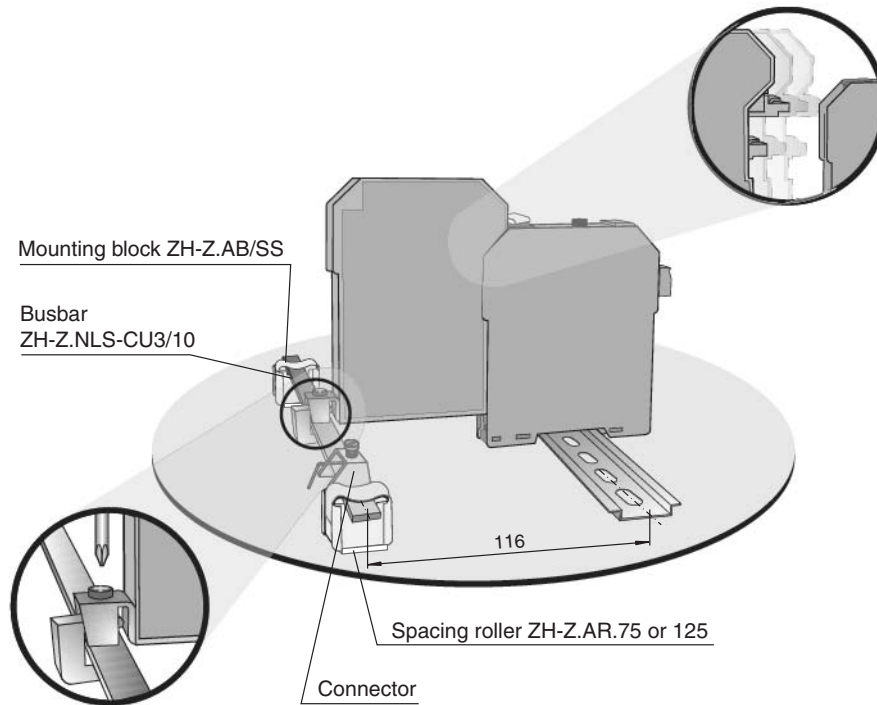
EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

**Note**

Surge protectors must always be connected to a solid and effective ground (large cross sections, short wiring). This is a basic requirement for an effective protection.

## Accessories

- Busbar ZH-Z.NLS-Cu3/10
- Spacing roller ZH-Z.AR.75 for PR 03 or ZH-Z.AR.125 for UPR 03
- Connector ZH-Z.AK16
- Mounting block ZH-Z.AB/SS



Keep the drilling distance of 116 mm between center mounting rail and center grounding bar.

Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronicsLevel control  
accessoriesPressurised  
enclosure system

Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronics

Level control  
accessories

Pressurised  
enclosure system



Ultrasonic level sensors

- 2- or 4-wire protection
- For analogue and binary MSR-circuits
- Suitable for intrinsically safe control current circuits EEx ia IIC
- Discharge current 10 kA
- Simple grounding via busbar
- Uninterruptable operation (auto reset)

Guided microwave

**P-LB-1.B.12**  
**P-LB-2.B.1245**

Corrosion monitoring

**Function**

The P-LB is optimised for the devices of the K-series.

By simple snapping onto the standard K-modules, these are safely protected against voltage surges of different origin (e. g. lightning stroke, switching impulse, etc.).

Level signal conditioning electronics

This is accomplished by diverting the destructive surge current to ground and limiting the voltage during the high level pulses.

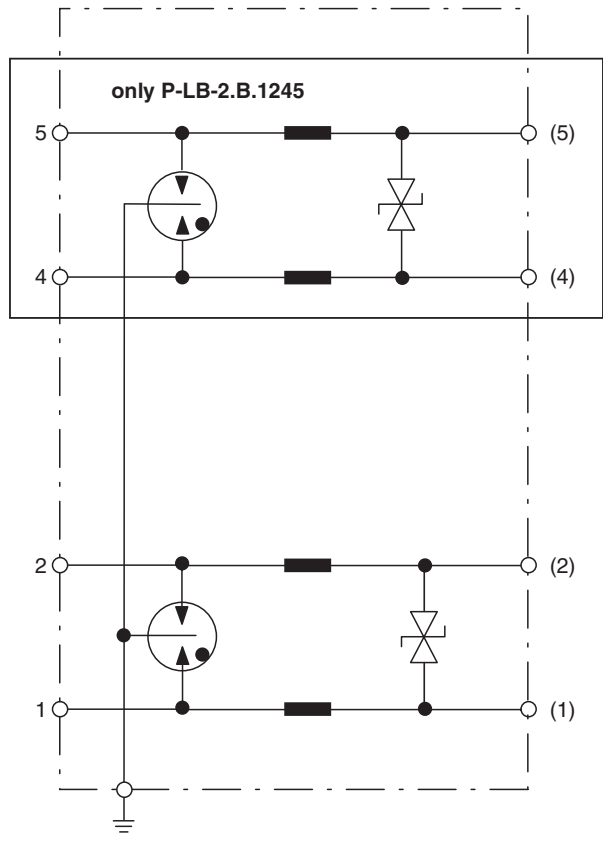
The P-LB-\*. \* allows the protection of 1 up to 2 galvanically isolated circuits.

The end digits of the P-LB designation correspond to the protected terminals of the respective K-device.

Level control accessories

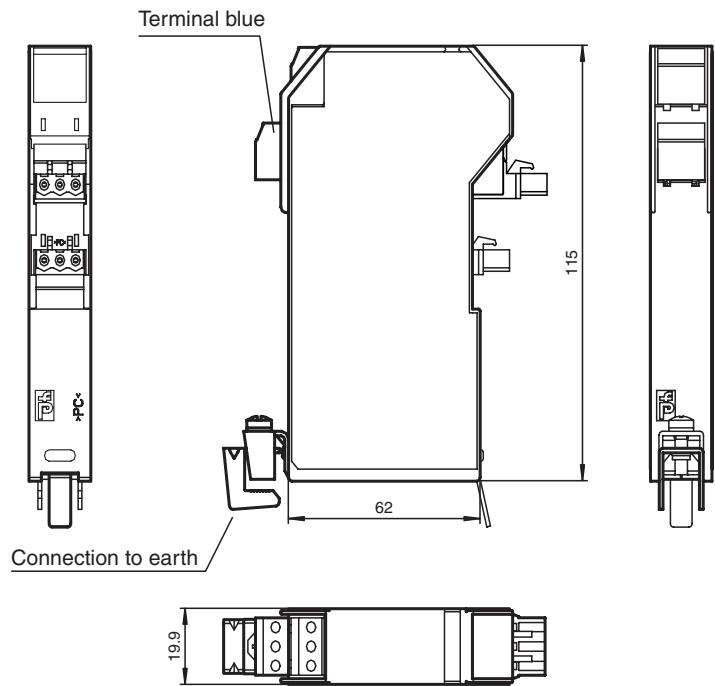
Pressurised enclosure system

**Connection**



Connection to busbar

**Composition**





	P-LB-1.B.12	P-LB-2.B.1245	
<b>Signal lines</b>			
Connection	terminals 1, 2	terminals 1, 2; 4, 5	Ultrasonic level sensors
Rated voltage	≤ 30 V	≤ 30 V	
Rated current	≤ 250 mA	≤ 250 mA	
Leakage current	≤ 5 µA	≤ 5 µA	
On-state voltage	≤ 45 V	≤ 45 V	
Ground insulation	≤ 500 V breakdown voltage	≤ 500 V breakdown voltage	
<b>Input</b>			
Number of channels	1	2	Guided microwave
<b>Conformity</b>			
Protection degree	IEC 60529		
<b>Ambient conditions</b>			
Ambient temperature	-30 ... 60 °C (243 ... 333 K)		
<b>Mechanical specifications</b>			
Protection degree	IP20		
Mass	approx. 70 g		
Dimensions	20 x 62 x 115 mm (0.8 x 2.4 x 4.5 in)		
<b>Data for application in conjunction with hazardous areas</b>			
EC-Type Examination Certificate	PTB 02 ATEX 2044, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>		Corrosion monitoring
Group, category, type of protection	⊕ II (1)G [EEx ia] IIC		
Voltage U <sub>o</sub>	≤ 30 V		
Current I <sub>i</sub>	≤ 250 mA		
Power P <sub>o</sub>	≤ 1.3 W		
Maximum leakage current	10 kA (8/20 µs) per conductor		
Nominal response time			Level signal conditioning electronics
Symmetrical	1 ns		
Asymmetric	100 ns		
Series resistor	≤ 0.5 Ω per wire		
Bandwidth	≥ 40 kHz		
Declaration of conformity	Pepperl+Fuchs		
Group, category, type of protection, temperature classification	⊕ II 3G EEx nA II T6		
Directive conformity			Level control accessories
Directive 94/9 EC	EN 50014, EN 50020, EN 50021		

**Supplementary information**

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

**Note**

Surge protectors must always be connected to a solid and effective ground (large cross sections, short wiring). This is a basic requirement for an effective protection.

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

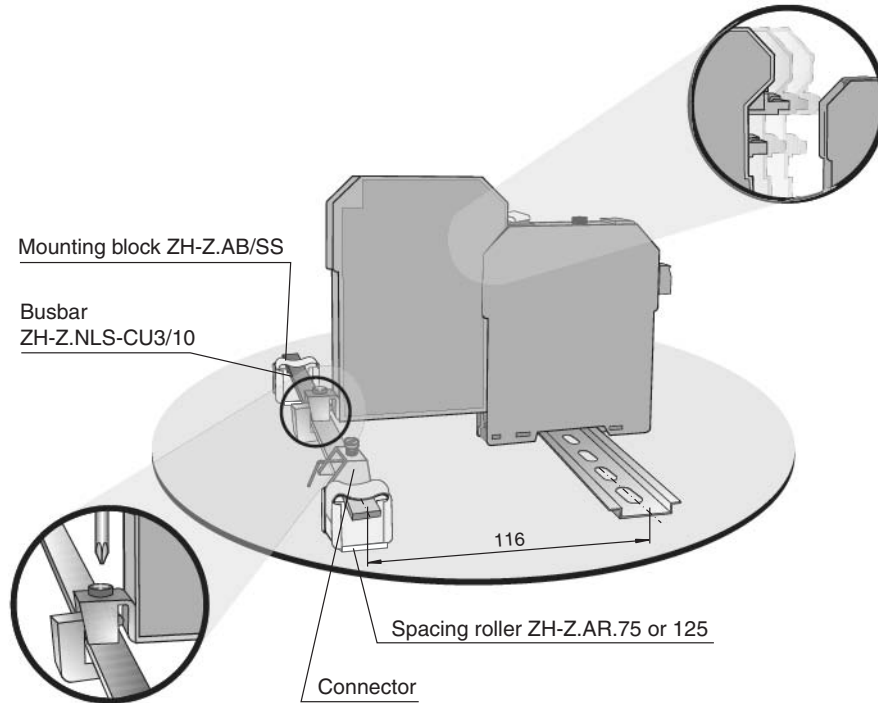
Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Accessories**

- Busbar ZH-Z.NLS-Cu3/10
- Spacing roller ZH-Z.AR.75 for PR 03 or ZH-Z.AR.125 for UPR 03
- Connector ZH-Z.AK16
- Mounting block ZH-Z.AB/SS



Keep the drilling distance of 116 mm between center mounting rail and center grounding bar.

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 3- or 6-wire protection
- For analogue and binary MSR-circuits
- Suitable for intrinsically safe control current circuits EEx ia IIC
- Discharge current 10 kA
- Simple grounding via busbar
- Uninterruptable operation (auto reset)

**P-LB-1.C.123**  
**P-LB-2.D.123456**

Guided microwave

**Function**

The P-LB is optimised for the devices of the K-series.

By simple snapping onto the standard K-modules, these are safely protected against voltage surges of different origin (e. g. lightning stroke, switching impulse, etc.).

This is accomplished by diverting the destructive surge current to ground and limiting the voltage during the high level pulses.

The P-LB-\*. \* allows the protection of 1 up to 2 galvanically isolated circuits.

The end digits of the P-LB designation correspond to the protected terminals of the respective K-device.

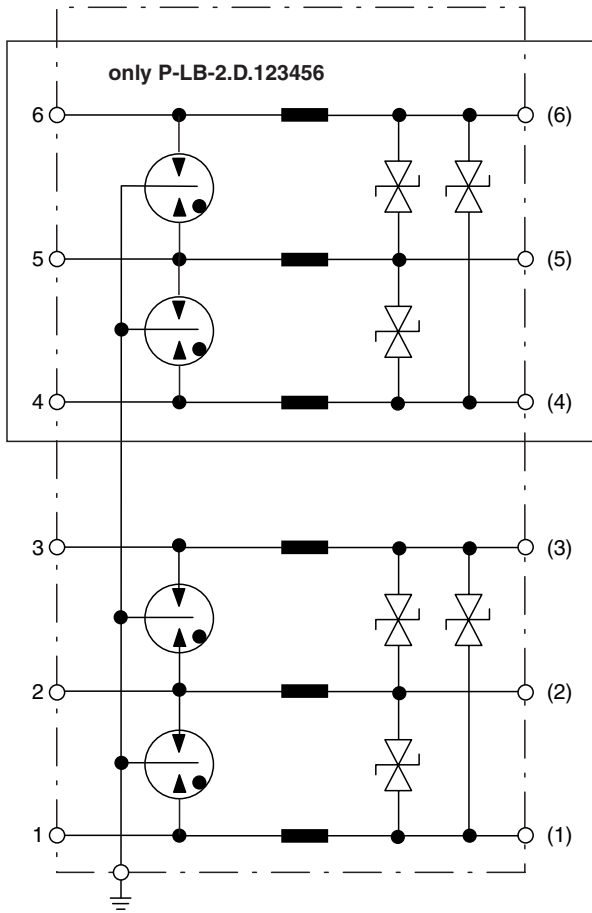
Corrosion monitoring

Level signal conditioning electronics

Level control accessories

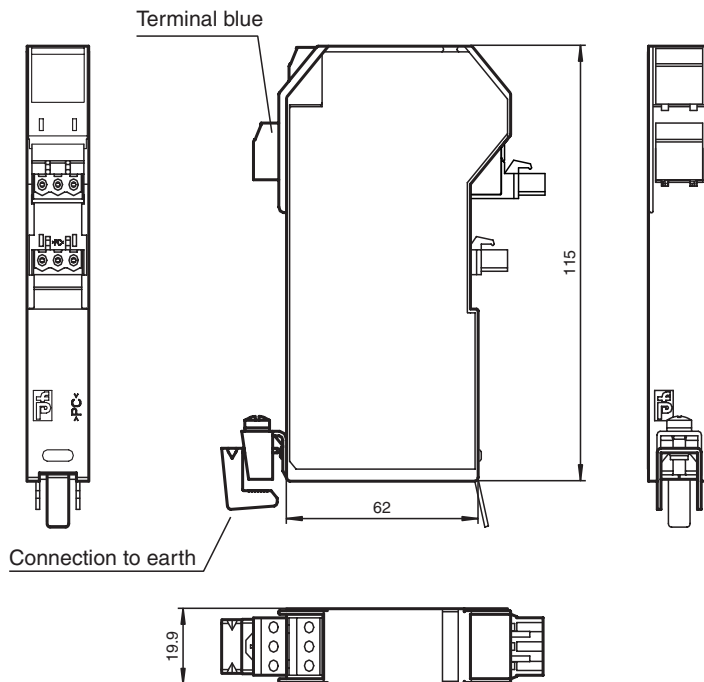
Pressurised enclosure system

**Connection**



Connection to busbar

**Composition**



	P-LB-1.C.123	P-LB-2.D.123456	
<b>Signal lines</b>			
Connection	terminals 1, 2, 3	terminals 1, 2, 3; 4, 5, 6	Ultrasonic level sensors
Rated voltage	≤ 30 V	≤ 30 V	
Rated current	≤ 250 mA	≤ 250 mA	
Leakage current	≤ 5 µA	≤ 5 µA	
On-state voltage	≤ 45 V	≤ 45 V	
Ground insulation	≤ 500 V breakdown voltage	≤ 500 V breakdown voltage	
<b>Input</b>			
Number of channels	1	2	Guided microwave
<b>Conformity</b>			
Protection degree	IEC 60529		
<b>Ambient conditions</b>			
Ambient temperature	-30 ... 60 °C (243 ... 333 K)		
<b>Mechanical specifications</b>			
Protection degree	IP20		
Mass	approx. 70 g		
Dimensions	20 x 62 x 115 mm (0.8 x 2.4 x 4.5 in)		
<b>Data for application in conjunction with hazardous areas</b>			
EC-Type Examination Certificate	PTB 02 ATEX 2044, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>		Corrosion monitoring
Group, category, type of protection	⊕ II (1)G [EEx ia] IIC		
Voltage U <sub>o</sub>	≤ 30 V		
Current I <sub>i</sub>	≤ 250 mA		
Power P <sub>o</sub>	≤ 1.3 W		
Maximum leakage current	10 kA (8/20 µs) per conductor		
Nominal response time			Level signal conditioning electronics
Symmetrical	1 ns		
Asymmetric	100 ns		
Series resistor	≤ 0.5 Ω per wire		
Bandwidth	≥ 40 kHz		
Declaration of conformity	Pepperl+Fuchs		
Group, category, type of protection, temperature classification	⊕ II 3G EEx nA II T6		
Directive conformity			Level control accessories
Directive 94/9 EC	EN 50014, EN 50020, EN 50021		

**Supplementary information**

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

**Note**

Surge protectors must always be connected to a solid and effective ground (large cross sections, short wiring). This is a basic requirement for an effective protection.

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

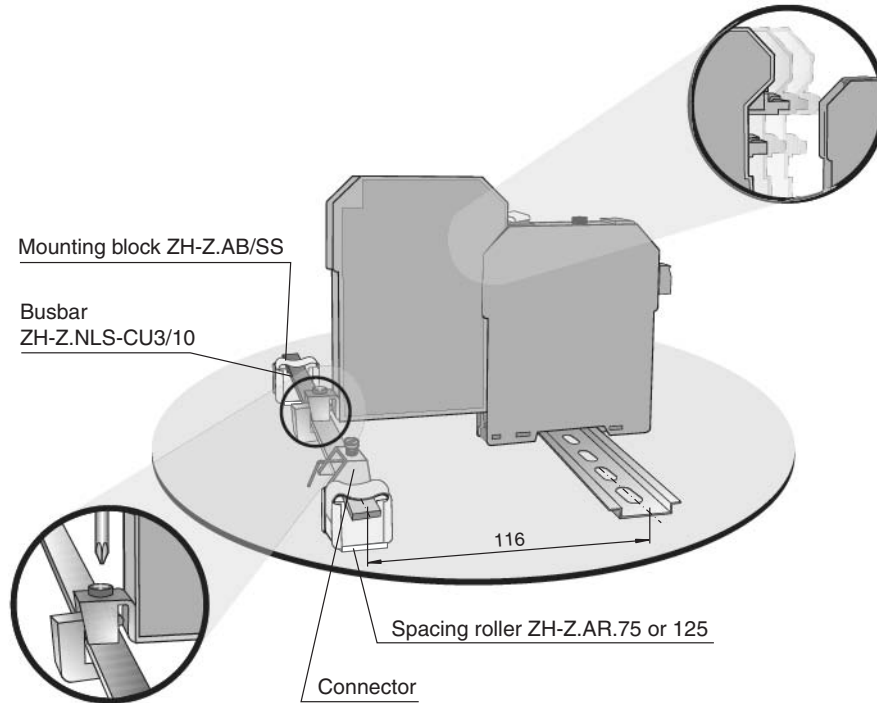
Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

## Accessories

- Busbar ZH-Z.NLS-Cu3/10
- Spacing roller ZH-Z.AR.75 for PR 03 or ZH-Z.AR.125 for UPR 03
- Connector ZH-Z.AK16
- Mounting block ZH-Z.AB/SS



Keep the drilling distance of 116 mm between center mounting rail and center grounding bar.

Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronicsLevel control  
accessoriesPressurised  
enclosure system

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 2- or 4-wire protection
- For analogue and binary MSR-circuits
- Suitable for intrinsically safe control current circuits EEx ia IIC
- Discharge current 10 kA
- Simple grounding via busbar
- Uninterruptable operation (auto reset)

**P-LB-1.E.23**  
**P-LB-2.C.2356**

Guided microwave

**Function**

The P-LB is optimised for the devices of the K-series.

By simple snapping onto the standard K-modules, these are safely protected against voltage surges of different origin (e. g. lightning stroke, switching impulse, etc.).

This is accomplished by diverting the destructive surge current to ground and limiting the voltage during the high level pulses.

The P-LB-\*. \* allows the protection of 1 up to 2 galvanically isolated circuits.

The end digits of the P-LB designation correspond to the protected terminals of the respective K-device.

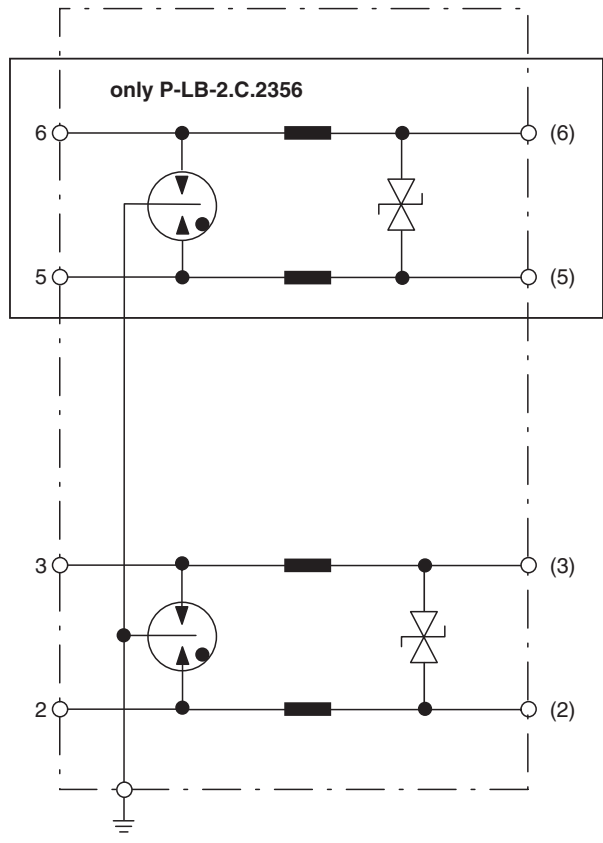
Corrosion monitoring

Level signal conditioning electronics

Level control accessories

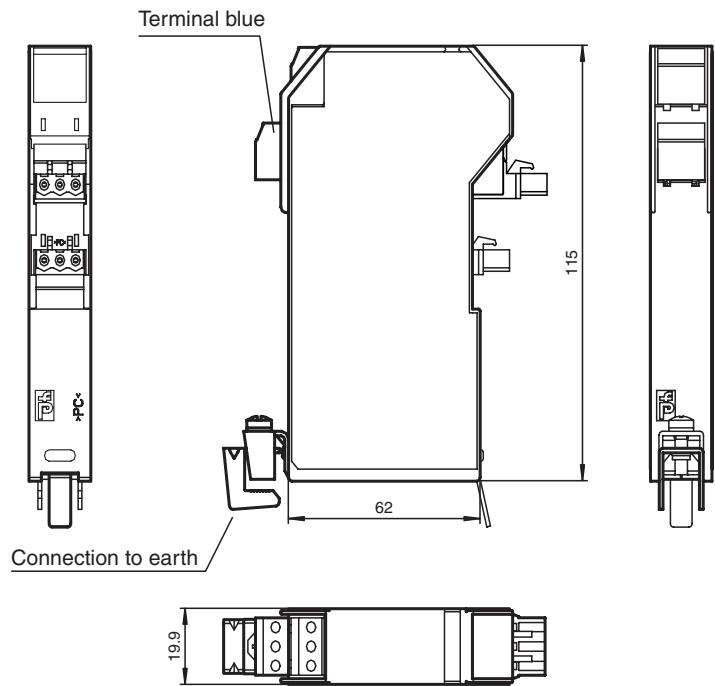
Pressurised enclosure system

**Connection**



Connection to busbar

**Composition**





	P-LB-1.E.23	P-LB-2.C.2356		
<b>Signal lines</b>				
Connection	terminals 2, 3	terminals 2, 3; 5, 6	Ultrasonic level sensors	
Rated voltage	≤ 30 V	≤ 30 V		
Rated current	≤ 250 mA	≤ 250 mA		
Leakage current	≤ 5 µA	≤ 5 µA		
On-state voltage	≤ 45 V	≤ 45 V		
Ground insulation	≤ 500 V breakdown voltage	≤ 500 V breakdown voltage		
<b>Input</b>				
Number of channels	1	2	Guided microwave	
<b>Conformity</b>				
Protection degree	IEC 60529		Corrosion monitoring	
<b>Ambient conditions</b>				
Ambient temperature	-30 ... 60 °C (243 ... 333 K)			
<b>Mechanical specifications</b>				
Protection degree	IP20		Level signal conditioning electronics	
Mass	approx. 70 g			
Dimensions	20 x 62 x 115 mm (0.8 x 2.4 x 4.5 in)			
<b>Data for application in conjunction with hazardous areas</b>				
EC-Type Examination Certificate	PTB 02 ATEX 2044, for additional certificates see www.pepperl-fuchs.com		Level control accessories	
Group, category, type of protection	⊕ II (1)G [EEx ia] IIC			
Voltage U <sub>o</sub>	≤ 30 V			
Current I <sub>i</sub>	≤ 250 mA			
Power P <sub>o</sub>	≤ 1.3 W		Pressurised enclosure system	
Maximum leakage current	10 kA (8/20 µs) per conductor			
Nominal response time				
Symmetrical	1 ns			
Asymmetric	100 ns			
Series resistor	≤ 0.5 Ω per wire			
Bandwidth	≥ 40 kHz			
Declaration of conformity	Pepperl+Fuchs			
Group, category, type of protection, temperature classification	⊕ II 3G EEx nA II T6			
Directive conformity				
Directive 94/9 EC	EN 50014, EN 50020, EN 50021			

**Supplementary information**

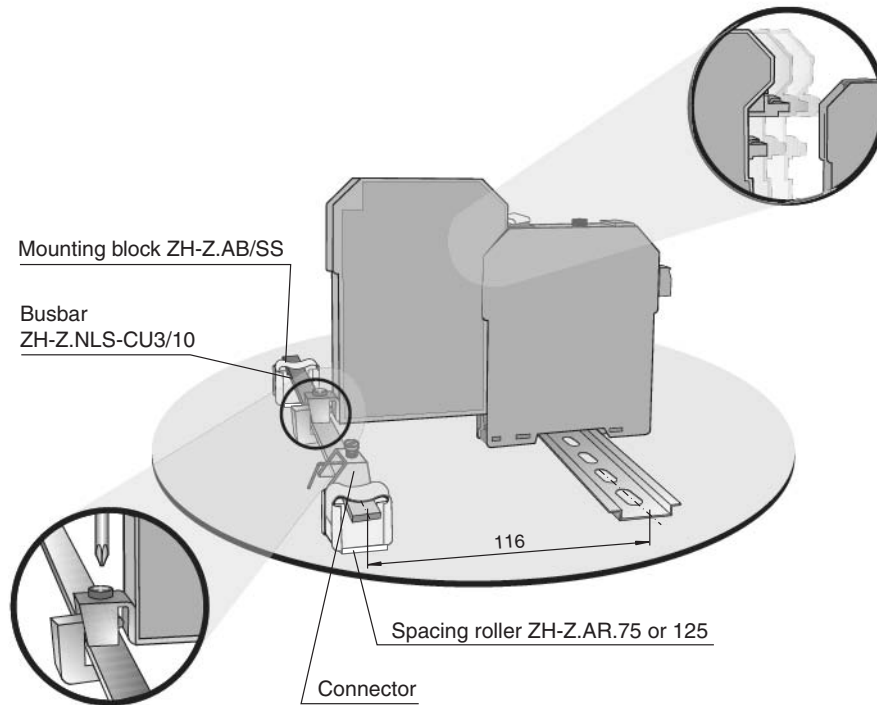
EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see www.pepperl-fuchs.com.

**Note**

Surge protectors must always be connected to a solid and effective ground (large cross sections, short wiring). This is a basic requirement for an effective protection.

## Accessories

- Busbar ZH-Z.NLS-Cu3/10
- Spacing roller ZH-Z.AR.75 for PR 03 or ZH-Z.AR.125 for UPR 03
- Connector ZH-Z.AK16
- Mounting block ZH-Z.AB/SS



Keep the drilling distance of 116 mm between center mounting rail and center grounding bar.

Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronicsLevel control  
accessoriesPressurised  
enclosure system

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors

- 4-wire protection
- For analogue and binary MSR-circuits
- Suitable for intrinsically safe control current circuits EEx ia IIC
- Discharge current 10 kA
- Simple grounding via busbar
- Uninterruptable operation (auto reset)

Guided microwave

**P-LB-1.D.1234**  
**P-LB-1.F.1236**

Corrosion monitoring

**Function**

The P-LB is optimised for the devices of the K-series.

By simple snapping onto the standard K-modules, these are safely protected against voltage surges of different origin (e. g. lightning stroke, switching impulse, etc.).

This is accomplished by diverting the destructive surge current to ground and limiting the voltage during the high level pulses.

The P-LB-\*. \* allows the protection of 1 galvanically isolated circuit.

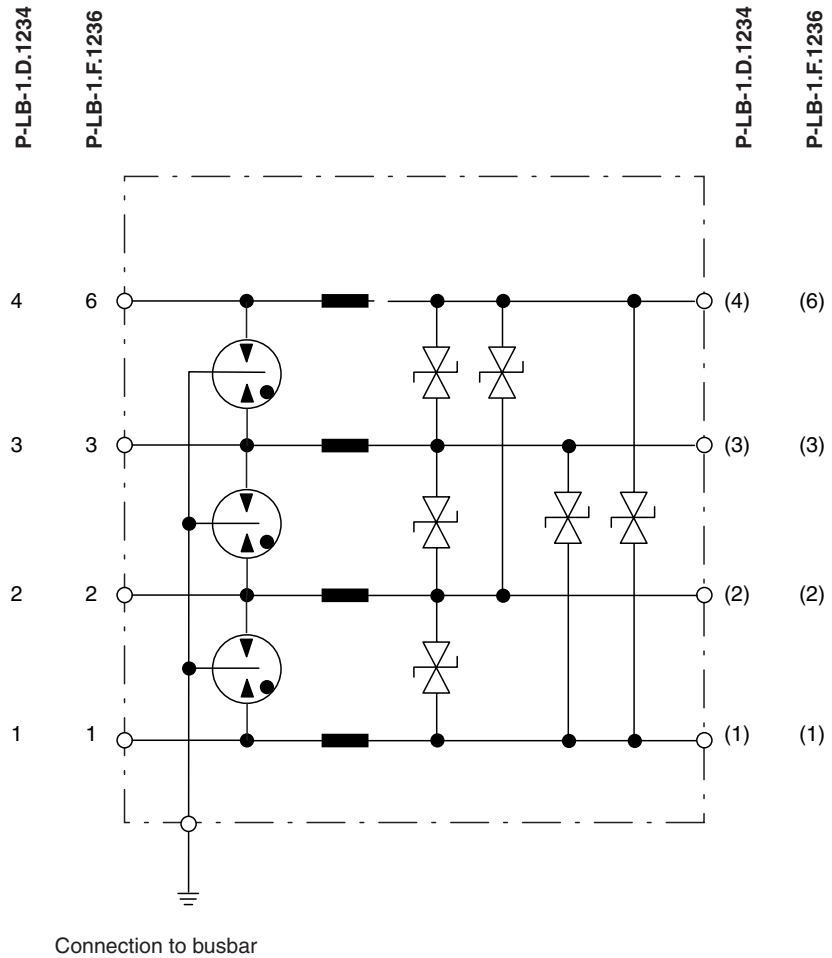
The end digits of the P-LB designation correspond to the protected terminals of the respective K-device.

Level signal conditioning electronics

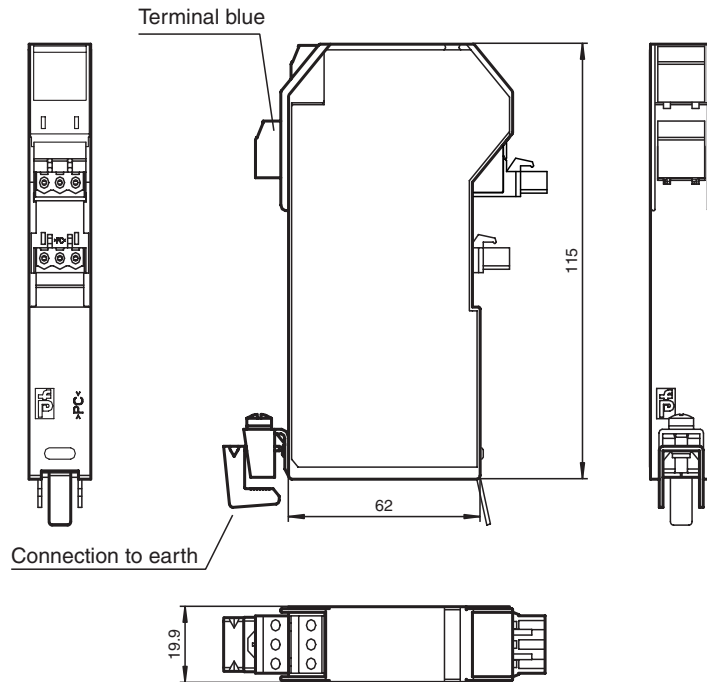
Level control accessories

Pressurised enclosure system

**Connection**



**Composition**



	P-LB-1.D.1234	P-LB-1.F.1236		
<b>Signal lines</b>				
Connection	terminals 1, 2, 3, 4	terminals 1, 2, 3, 6	Ultrasonic level sensors	
Rated voltage	≤ 30 V	≤ 30 V		
Rated current	≤ 250 mA	≤ 250 mA		
Leakage current	≤ 5 µA	≤ 5 µA		
On-state voltage	≤ 45 V	≤ 45 V		
Ground insulation	≤ 500 V breakdown voltage	≤ 500 V breakdown voltage		
<b>Input</b>				
Number of channels	1		Guided microwave	
<b>Conformity</b>				
Protection degree	IEC 60529			
<b>Ambient conditions</b>				
Ambient temperature	-30 ... 60 °C (243 ... 333 K)		Corrosion monitoring	
<b>Mechanical specifications</b>				
Protection degree	IP20			
Mass	approx. 70 g		Level signal conditioning electronics	
Dimensions	20 x 62 x 115 mm (0.8 x 2.4 x 4.5 in)			
<b>Data for application in conjunction with hazardous areas</b>				
EC-Type Examination Certificate	PTB 02 ATEX 2044, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>			
Group, category, type of protection	⊕ II (1)G [EEx ia] IIC			
Voltage U <sub>o</sub>	≤ 30 V			
Current I <sub>i</sub>	≤ 250 mA			
Power P <sub>o</sub>	≤ 1.3 W			
Maximum leakage current	10 kA (8/20 µs) per conductor			
Nominal response time				
Symmetrical	1 ns			
Asymmetric	100 ns			
Series resistor	≤ 0.5 Ω per wire			
Bandwidth	≥ 40 kHz			
Declaration of conformity	Pepperl+Fuchs			
Group, category, type of protection, temperature classification	⊕ II 3G EEx nA II T6			
Directive conformity				
Directive 94/9 EC	EN 50014, EN 50020, EN 50021			

**Supplementary information**

EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

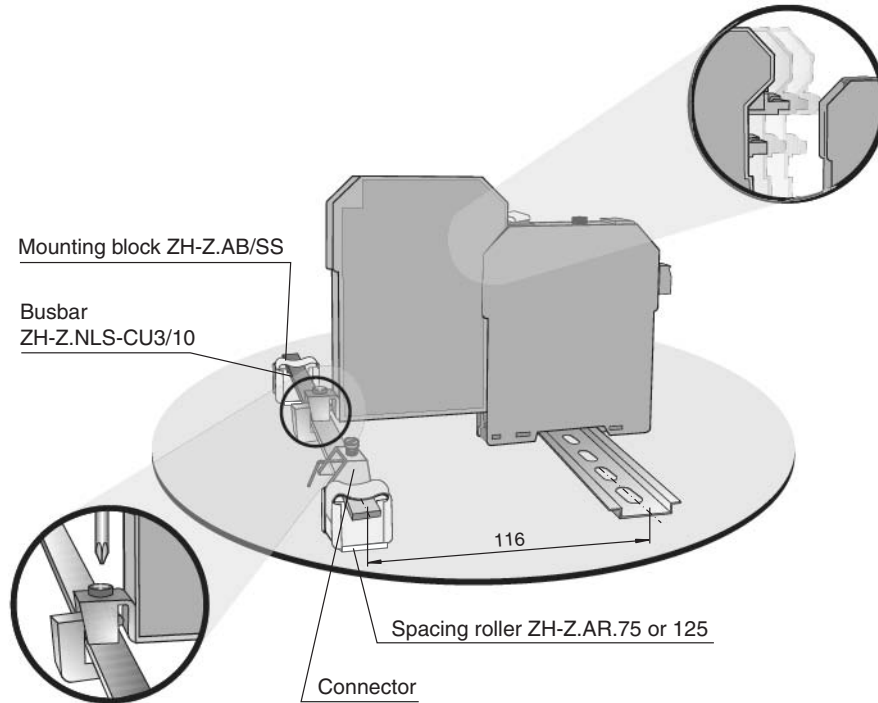
**Note**

Surge protectors must always be connected to a solid and effective ground (large cross sections, short wiring). This is a basic requirement for an effective protection.

Ultrasonic level sensors  
Guided microwave  
Corrosion monitoring  
Level signal conditioning electronics  
Level control accessories  
Pressurised enclosure system

**Accessories**

- Busbar ZH-Z.NLS-Cu3/10
- Spacing roller ZH-Z.AR.75 for PR 03 or ZH-Z.AR.125 for UPR 03
- Connector ZH-Z.AK16
- Mounting block ZH-Z.AB/SS



Keep the drilling distance of 116 mm between center mounting rail and center grounding bar.

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

Ultrasonic  
level sensors

Guided microwave

Corrosion monitoring

Level signal  
conditioning electronics

Level control  
accessories

Pressurised  
enclosure system

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



**Model number**  
DA5-IU-2K-C  
DA5-IU-2K-V

**Features**

- 2 adjustable limit values
- 2 relay outputs
- Operation via keypad
- Programmable characteristics
- Resetting the outputs, automatic, manual or with external signal
- Connection via plug-in screw terminals
- Auxiliary power output for sensors (Only DA5-IU-2K-V)
- Protection degree IP65 in accordance with DIN EN 60529 (front only)
- Shock resistance in accordance with DIN EN 60068-2-27
- Vibration resistance in accordance with DIN EN 60068-2-6
- System hum suppression

**Technical data**

	DA5-IU-2K-C	DA5-IU-2K-V
<b>General specifications</b>		
Pre-selection	2-fold	
Data storage	10 <sup>6</sup> storage cycles or 10 years, EEPROM	
Programming	keypad-driven menu	
UL File Number	E225084	
<b>Indicators/operating means</b>		
Type	7-segment LED display, red	
Number of decades	5	
Display value	digit height 14.2 mm	
Pre-selection	digit height 14.2 mm	
Key interlock	with "high"-level at terminal "KEY"	
Display interval	-19999 ... 99999	
Decimal point	freely adjustable	
Resolution	14 Bit	
Scale factor	via characteristic curve with up to 24 value pairs	
Reset	manually or external	
<b>Electrical specifications</b>		
Operating voltage	10 ... 30 V DC	90 ... 260 V AC
Power consumption P <sub>o</sub>	2 W	7 VA
<b>Input</b>		
Impedance	> 1 MΩ for voltage measurement < 50 Ω for current measurement	
Analogue voltage input	0 ... 10 V/2 ... 10 V DC, -10 ... 10 V DC	
Analogue current input	0 ... 20 mA/4 ... 20 mA	
<b>Output</b>		
Relay	2 x 250 V AC/300 V DC, 3 A, changeover contact	2 x 250 V AC/300 V DC, 3 A, changeover contact
Sensor supply	-	24 V DC, 100 mA
<b>Ambient conditions</b>		
Ambient temperature	-10 ... 50 °C (263 ... 323 K)	
Storage temperature	-25 ... 70 °C (248 ... 343 K)	
Relative humidity	≤ 80 % (non-condensing)	
<b>Mechanical specifications</b>		
Connection	8-pin and 11 pin connectors with plug-in screw terminals	
Mass	220 g	
Dimensions	96 mm x 48 mm x 90 mm	
Mounting	mounting frame with latch fastener	

**Notes**

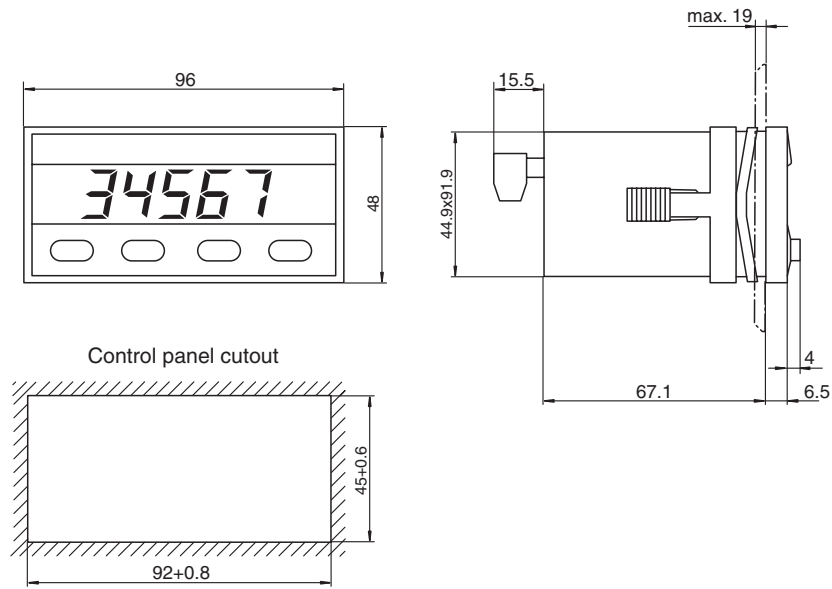
The DA5-IU-2K-... permits a simple visual inspection by operating and maintenance personnel. It converts the analogue sensor output signal into a readable form for this purpose. Depending on the task or setting, 4 mA ... 20 mA or 0 % ... 100 % values can be displayed.

**Scope of delivery:**

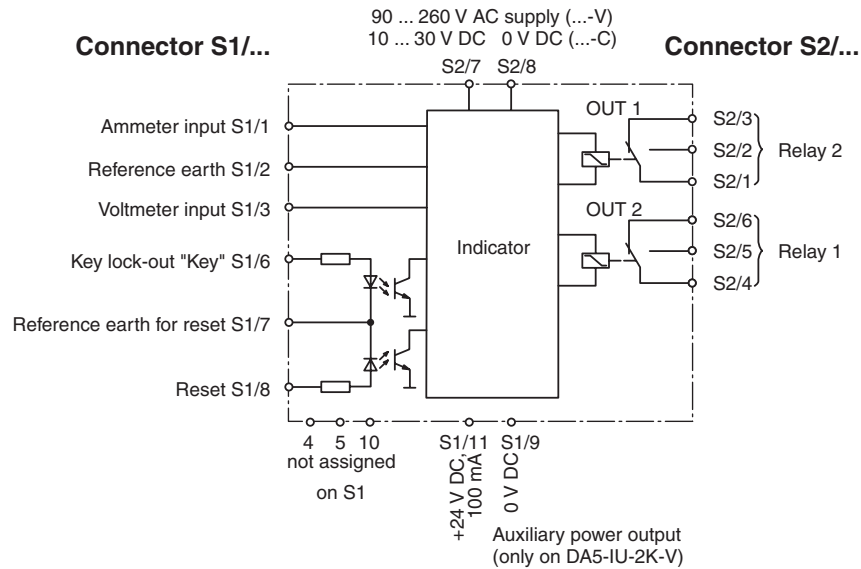
- Process control unit DA5-IU-2K-\*
- Screw terminals  
1 RM 5.08 8-pole terminal for power supply and outputs  
1 RM 3.81 11-pole terminal for measuring and control inputs
- Clamp clip
- Seal
- 1 sheet of adhesive symbols



Dimensions



Electrical connection



## LED cluster lamp

## Dimensions

Ultrasonic level sensors



Guided microwave

### LED-Ex1.\*

Corrosion monitoring

Level signal conditioning electronics



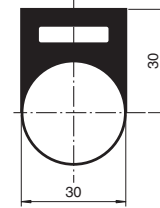
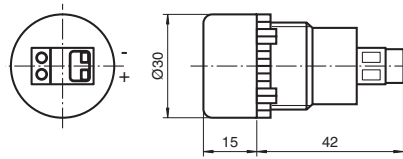
Level control accessories

### Features

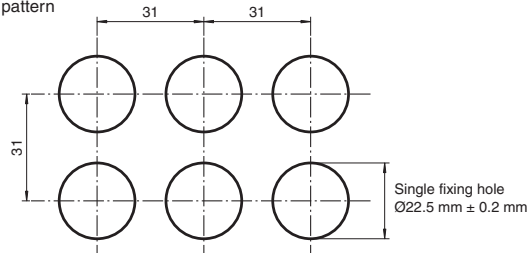
- Intrinsically safe EEx ia IIC T4
- Protection degree IP65 (front)
- Protection degree IP20 (rear)
- Low current, max. 22 mA

Pressurised enclosure system

Optional legend plate  
LED-Ex1.NAME PLATE



Drilling pattern



### Function

The LED cluster lamp provides reliable visual status indication. A group of high efficiency light emitting diodes are mounted behind a coloured diffuser to produce a bright, uniform output.

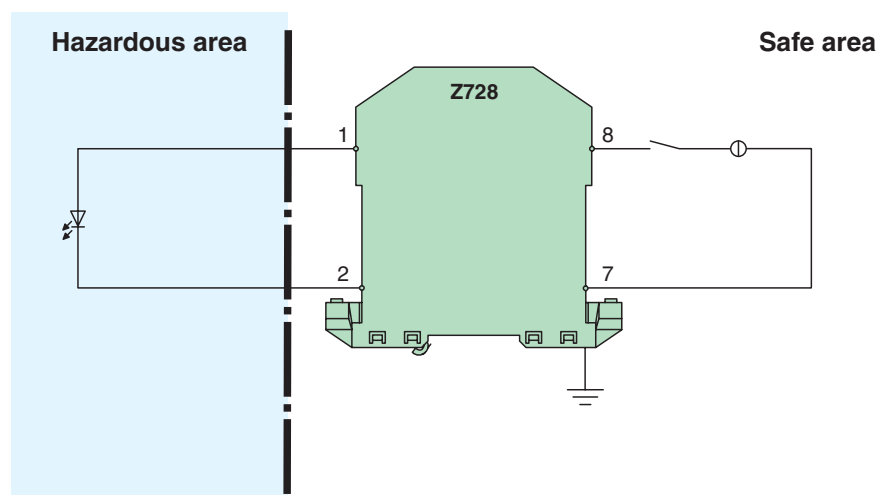
All models contain a 20 mA current regulator which maintains constant brilliance, provides protection against excess voltages and enables to comply with common system design rules.

Two lamps may be powered from a single IIC intrinsically safe source, and up to four lamps from a IIB source.

IP65 sealing of the lens and the joint between the lamp and the panel makes the LED-Ex1.\* ideal for installation in areas which will be hosed, washed or splashed.

Mounting is via a single standard 22.5 mm (0.9 inches) diameter hole. The lamp housing, fixing nut and terminals have a maximum diameter of 30 mm (1.2 inches) which permits a very high packing density on the panel. To aid identification from the rear of the panel, the model number and suffix which identifies the colour are marked on the lamp body close to the terminals.

### Electrical connection



<b>Supply</b>			Ultrasonic level sensors
Rated voltage	14 ... 30 V DC		
Rated current	18 ... 22 mA		Guided microwave
<b>Output</b>			
Mechanical life	10 <sup>5</sup> h		Corrosion monitoring
<b>Directive conformity</b>			
Electromagnetic compatibility			Level signal conditioning electronics
Directive 89/336/EC	EN 61326, EN 50081-2		
<b>Conformity</b>			Level control accessories
Electromagnetic compatibility	NE 21		
Protection degree	IEC 60529		Pressurised enclosure system
<b>Ambient conditions</b>			
Ambient temperature	-20 ... 60 °C (253 ... 333 K)		
Storage temperature	-40 ... 85 °C (233 ... 358 K)		
Relative humidity	5 ... 95 %, non-condensing		
<b>Mechanical specifications</b>			
Protection degree	IP65 (front), IP20 (rear)		
Connection	screw terminals for 1.5 mm <sup>2</sup>		
Material	housing: polyamid 6.6 lens: polycarbonat		
Mass	18 g		
Dimensions	Ø30 x 57 mm (1.2 x 2.2 in)		
<b>Mechanical construction</b>			
Versions	LED-Ex1.A: yellow LED LED-Ex1.B: blue LED LED-Ex1.G: green LED LED-Ex1.R: red LED LED-Ex1.W: white LED		
<b>Data for application in conjunction with hazardous areas</b>			
EC-Type Examination Certificate	BSA 01 ATEX 1062 X (firm BEKA)		
Group, category, type of protection	⊕ II 1G EEx ia IIC T4 [circuit(s) in zone 0/1/2]		
Voltage U <sub>o</sub>	30 V DC		
Power P <sub>o</sub>	max. 1.3 W, see also section installation		
<b>Supply</b>			
Safety maximum voltage U <sub>m</sub>	60 V (Attention! The rated voltage is lower.)		
<b>Directive conformity</b>			
Directive 94/9 EC	EN 50014, EN 50020, EN 50284		
<b>General information</b>			
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .		

**Installation**

One or two LED-Ex1.\* lamps may be powered by any certified Zener barrier or solenoid driver with output parameters within the following limits:

- voltage U<sub>o</sub>: 30 V DC
  - power P<sub>o</sub>: 1.3 W at 40 °C (313 K); 1.2 W at 60 °C (333 K)
  - gas groups IIA, IIB or IIC
- e. g. 28 V, 300 Ω with a Zener barrier (Typ Z 728) or a solenoid driver (KFD2-SD-Ex1.\*\*, KFD2-SL2-Ex\*.\*)

Up to three LED-Ex1.\* lamps may be powered in an ambient temperature up to 40 °C (313 K) by a solenoid driver with output parameters within the following limits:

- voltage U<sub>o</sub>: 30 V DC
- power P<sub>o</sub>: 1.3 W at 40 °C (313 K)
- gas groups IIA or IIB

**Accessories**

Legend plate LED-Ex1.NAME PLATE

Pressurised enclosure system
Level control accessories
Level signal conditioning electronics
Corrosion monitoring
Guided microwave
Ultrasonic level sensors



Control unit FA6-PCU300A-Ex.O14

The EEx p pressurising system is an Ex protection class which allows to use non-Ex-approved devices in Ex-areas up to zone 1 in a cost efficient way.

A pressurising system consists of a control unit with integrated pressure monitor, solenoid valve and a pressurising housing.

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

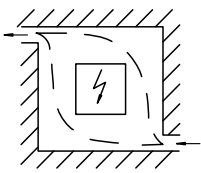
Pressurised enclosure system

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Solenoid valves FU*PV32*-Ex. ....	309
Operation panel FD0-T301A-Ex.* .....	310
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## Overview

### Function:



A pressurised enclosure system consists of the components **control unit with integrated pressure monitor**, **solenoid operated valve** as well as a **housing** which contains the actual apparatus. Air or an inert gas such as nitrogen is fed into the enclosure housing, thus producing a non-explosive atmosphere so that any ignition sources present cannot trigger an explosion. The control unit, in conjunction with the pressure switch, monitors the circulation process and the pressure; when purging is complete, it allows the electrical apparatus to be switched on. If the pressurised enclosure is opened, the pressure is released and the control unit isolates the apparatus mounted in it from the power supply.

Pressurised enclosures can be divided into two types, depending on the application:

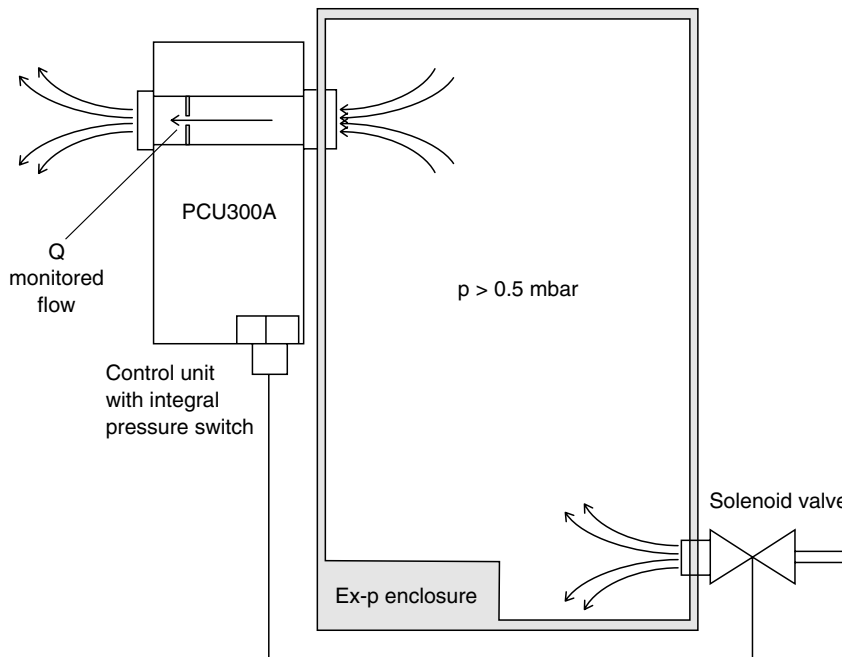
- Leakage compensation
- Constant purging circulation

**Leakage compensation:** After circulating a defined quantity of inert gas, as specified in EN 50016, the housing is hermetically sealed on the outlet side. Possible leaks are compensated by feeding in inert gas. This ensures minimum consumption of the inert gas.

**Constant purging (dilution):** After pre-circulation, purging continues with a reduced quantity of air. This method is used with internal gas sources (e. g. analytical devices) in order to achieve a dilution of the gas mixture below the lower explosion ignition limit to achieve a non-explosive concentration. A further effect is the reduction of a possible temperature rise within the housing due to the heat given off by the device.

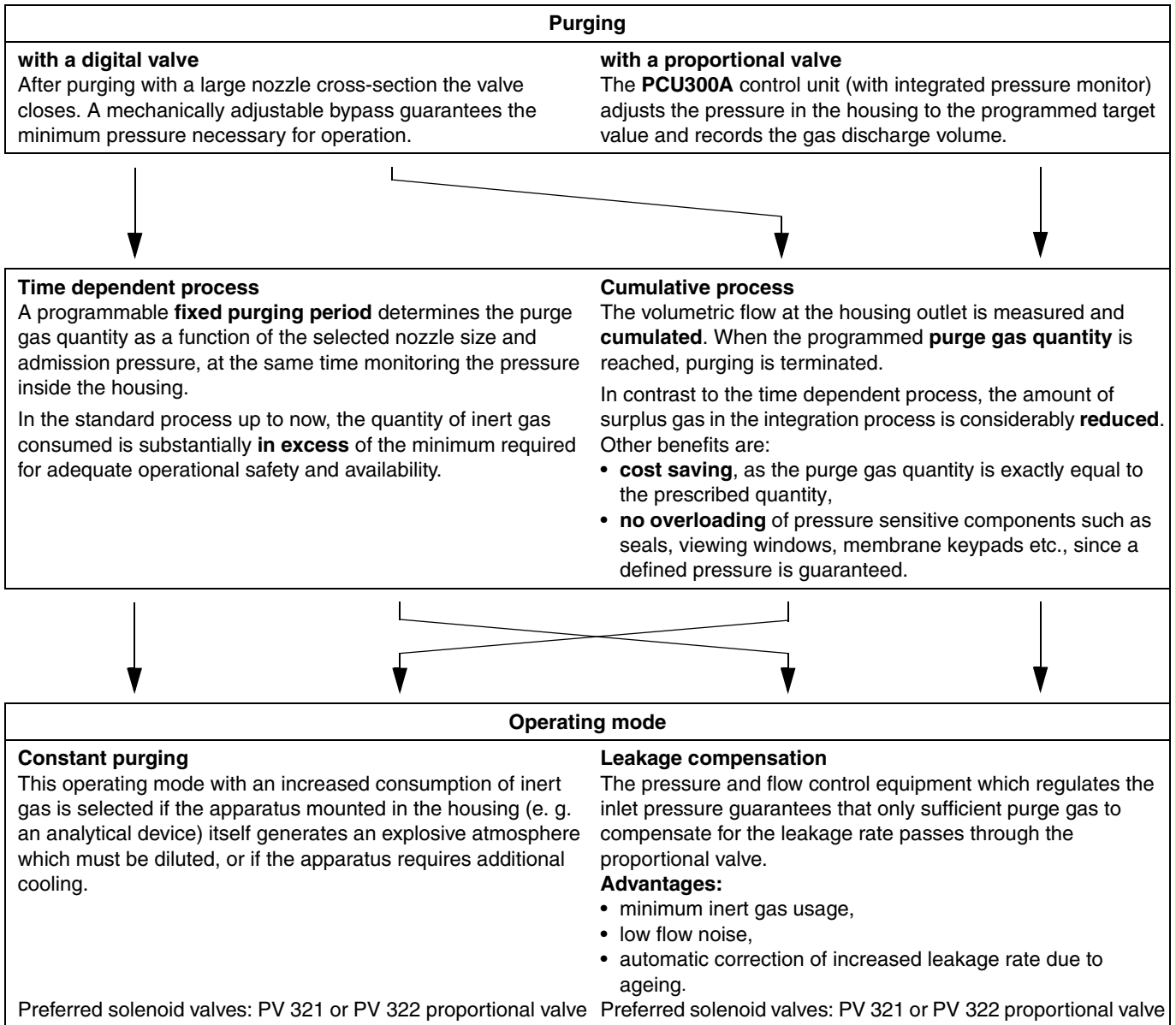
If internal gas sources are present ("Containment System") it is preferable to use nitrogen as the ignition-inhibiting gas.

### General design of a pressurised enclosure system:



**Selection table**

The following types of purging and operation can be achieved with the components supplied by Pepperl+Fuchs:



**Choice of control unit orifice meter and solenoid valve nozzle diameter**

**Digital valve:** The purging volume required by EN 50016 and the desired purging period determine the purge gas flow (in litres/hour) at the solenoid valve. In the middle section of the table, below, select a volumetric flow rate corresponding to the available admission pressure, which is greater than the pre-determined value, taking leakage losses from the housing into account. The diameter of the digital valve nozzle and the control unit orifice meter will be found on the same line, in the right and left-hand columns.

**Proportional valve:** Experience has shown that a control unit with a 14 mm orifice meter covers a broad range of applications (preferred type).

PCU 300A orifice meter Ø [mm]	Purge gas volumetric flow [litres/hour] at solenoid valve							Digital valve nozzles Ø [mm]
	1.5	2	2.5	3	3.5	4	4.5	
6	1100	1350	1560	1750	1908	2063	2203	1
10	2495	3017	3485	3827	4302	4608	4921	1.5
14	4349	5328	6149	6869	7513	8107	8654	2
18	9634	11772	13532	15070	16448	-	-	3
	1.5	2	2.5	3	3.5	4	4.5	
	Purge gas admission pressure [bar]							

Date of issue 09/22/06 – Catalog Field Devices

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

## Pressure control unit

## Dimensions

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

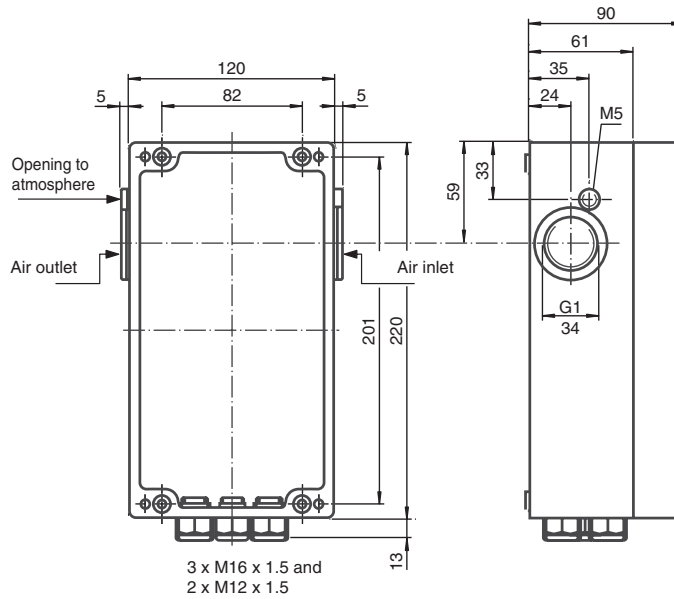
Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



**F\*\* -PCU300A-Ex.O\*\***



## Features

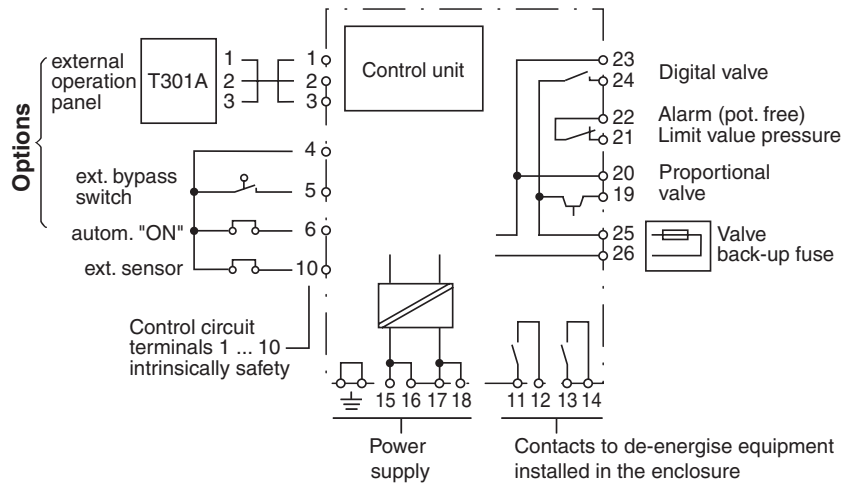
- Compact design
- Easy installation
- Economical purging method
- High safety standard
- LCD indication of operating status
- Menu driven programming

## Function

The pressure control unit with integrated pressure switch monitor the purge-gas pressure and throughput. Operating modes and parameters can be programmed and called-up with 4 keys. They are displayed in an 8-character LC display. Optimum adaptation to the application is provided by the choice of orifice meters.



## Electrical connection

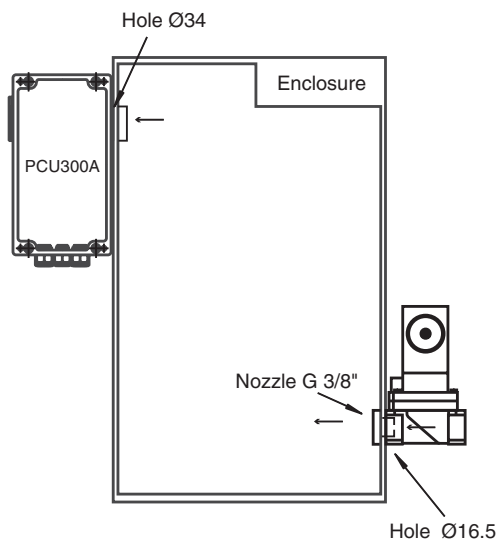




	FD2-PCU300A-Ex.O**	FA5-PCU300A-Ex.O**	FA6-PCU300A-Ex.O**	
<b>Supply</b>				Ultrasonic level sensors
Rated voltage	24 V DC	115 V AC, 48 ... 62 Hz	230 V AC, 48 ... 62 Hz	
Power consumption	approx. 2.5 VA			
<b>Conformity</b>	IEC 60529			Guided microwave
Protection degree	IEC 60529			
<b>Input characteristics</b>	pressure measurement range 0 ... 18 mbar volumetric flow measurement range depends on the orifice size			
<b>Operating conditions</b>	inside or outside the enclosure Back-up fuse for solenoid valve in the control unit must be ordered separately (see selection table in data sheet PCU-F-Ex.***MA).			Corrosion monitoring
Mounting conditions	inside or outside the enclosure Back-up fuse for solenoid valve in the control unit must be ordered separately (see selection table in data sheet PCU-F-Ex.***MA).			
<b>Ambient conditions</b>	-20 ... 45 °C (253 ... 318 K) at T6 -20 ... 60 °C (253 ... 333 K) at T4			
<b>Mechanical specifications</b>	IP65 (without consideration of the air outlet opening)			Level signal conditioning electronics
Protection degree	IP65 (without consideration of the air outlet opening)			
Material	aluminium, lacquer-coated			
Dimensions	220 x 120 x 90 mm (8.7 x 4.7 x 3.5 in)			Pressurised enclosure system
<b>Data for application in conjunction with hazardous areas</b>	EC-Type Examination Certificate Group, category, type of protection			
EC-Type Examination Certificate	DMT 00 ATEX E 004 X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>			
Supply	$\text{Ex}$ II 2G EEx em [ib] [p] IIC T6 (-20 °C ≤ T <sub>amb</sub> ≤ 45 °C) $\text{Ex}$ II 2G EEx em [ib] [p] IIC T4 (-20 °C ≤ T <sub>amb</sub> ≤ 60 °C) $\text{Ex}$ II 2D Ex tD [ibD] [pD] IP65 T70°C (-20 °C ≤ T <sub>amb</sub> ≤ 60 °C)			
Safety maximum voltage U <sub>m</sub>	253 V (Attention! U <sub>m</sub> is no rated voltage.)			
Output	250 V AC/5 A/cos Φ > 0.7/30 V DC/5 A/150 W			
Directive conformity	EN 50014, EN 50016, EN 50019, EN 50020, EN 50028, EN 954-1, IEC 61241-0, IEC 61241-1, IEC 61241-11			
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .			

Mounting example

External mounting



**Type code/model number**

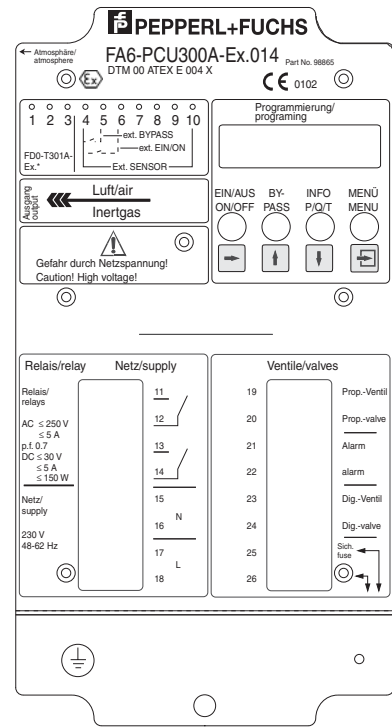
Control unit      F \* \* PCU300A-Ex.O \* \*

Operating voltage      230 V AC ..... A 6  
                                  115 V AC ..... A 5  
                                  24 V DC ..... D 2

Minimum flow (l/s)

Orifice\*                      6 mm ..... 6              0.15  
                                  10 mm ..... 10             0.35  
                                  14 mm (preferred type)..... 14            0.85  
                                  18 mm ..... 18             1.25

\*See the operating instruction for selection assistance.



Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system



Ultrasonic level sensors



**Type code**

**FD0-T301A-Ex.\***

**Features**

- Intelligent operation panel
- Operating and error messages

**Function**

The control panel is used primarily when the PCU300A control unit is installed in the pressurised housing. It permits the operation and call of all operating parameters.

Guided microwave

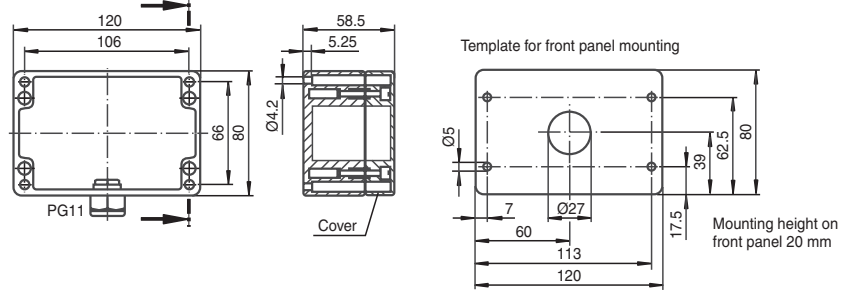
Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

**Dimensions**



**Technical data**

**Operating conditions**

Mounting conditions	
Installation position	type F: front panel mounting (mounting height 20 mm (0.8 in)) type H: housing

**Ambient conditions**

Ambient temperature	-20 ... 40 °C (253 ... 313 K)
---------------------	-------------------------------

**Mechanical specifications**

Protection degree	IP65 (with housing)
Dimensions	58.5 x 80 x 120 mm (2.3 x 3.15 x 4.7 in)

**Data for application in conjunction with hazardous areas**

EC-Type Examination Certificate	DMT 00 ATEX E 004 X, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
Group, category, type of protection	Ex II 2G EEx ib IIC T6 (T <sub>amb</sub> ≤ 40 °C) Ex II 2D Ex ibD T80°C (T <sub>amb</sub> ≤ 40 °C)

**Supply**

Safety maximum voltage U <sub>m</sub>	253 V (Attention! U <sub>m</sub> is no rated voltage.)
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**Output**

Contact loading	250 V AC/5 A/cos Φ > 0.7/30 V DC/5 A/150 W
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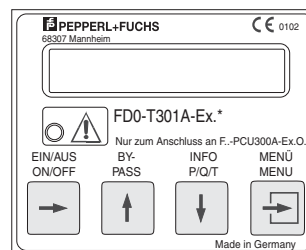
**Directive conformity**

Directive 94/9 EC	EN 50014, EN 50016, EN 50019, EN 50020, EN 50028, EN 954-1, IEC 61241-0, IEC 61241-1, IEC 61241-11
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**General information**

Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .
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**Notes**



When the bypass button is pressed, the operating safety instructions must be complied with (e. g. presentation of a fire permit).

**Operation panel FD0-T301A-Ex.\***

Front panel mounted ..... F  
Housing IP65 . . . . . H

**Type code**  
PCU-F-Ex.\*\*\*\*MA

**Features**

- Integrated in the control unit

**Function**

- The fuse is integrated in the control unit. It must be selected acc. to type (DV/PV) and operating voltage and ordered separately.
- Maximum fusing values when using other solenoid valves:
  - 230 V AC            200 mA
  - 115 V AC           315 mA
  - 24 V DC            2000 mA

**Technical data**

Electrical specifications	
Current	see type code

**Type code/model number**

Back-up fuse for solenoid valves			PCU-F-Ex. * * * * MA
	DV	PV	
80 mA	230 V		..... 8 0
100 mA			..... 1 0 0
160 mA	115 V		..... 1 6 0
200 mA		230 V	..... 2 0 0
315 mA			..... 3 1 5
400 mA		115 V	..... 4 0 0
630 mA	24 V		..... 6 3 0
1000 mA			..... 1 0 0 0
1600 mA		24 V	..... 1 6 0 0
2000 mA			..... 2 0 0 0

Ultrasonic level sensors

Guided microwave

Corrosion monitoring

Level signal conditioning electronics

Level control accessories

Pressurised enclosure system

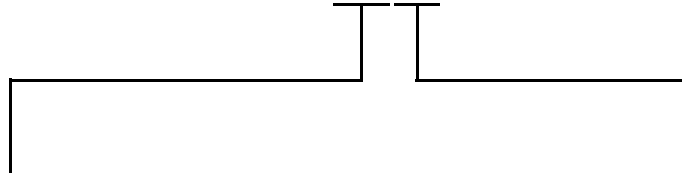


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## Housing protection class

### Protection provided by housings (DIN VDE 0470 part 1, IEC 60529)

# IP67



Protection against contact and foreign bodies		Degree of protection against water	
0	Not protected	0	Not protected
1	Protected against solid foreign bodies with a size and diameter of 50 mm (2 in) and above Protected against contact with hazardous components with the backs of the hand	1	Protected against dripping water
2	Protected against solid foreign bodies with a size and diameter of 12.5 mm (0.5 in) and above Protected against contact with hazardous components with fingers	2	Protected against dripping water, when housing is tilted up to 15°
3	Protected against solid foreign bodies with a size and diameter of 2.5 mm (0.1 in) and above Protected against contact with hazardous components with a tool	3	Protected against sprayed water
4	Protected against solid foreign bodies with a size and diameter of 1.0 mm (0.04 in) and above Protected against contact with hazardous components with a wire	4	Protected against splash water
		4K	Protected against splash water with increased pressure
5	Protection from dust Protected against contact with hazardous components with a wire	5	Protected against water jets
6	Dust tight Protected against contact with hazardous components with a wire	6	Protected against strong water jets with increased pressure
		6K	Protected against strong water jets
		7	Protected against temporary submersion in water
		8	Protected against continuous submersion in water
		9K	Protected against water on high pressure cleaning or vapour stream cleaning

#### Notes:

Wherever a code number is not required, the letter "X" must be used in its place.

Devices having a second digit of 7 or 8 do not need to fulfil the requirements of the second digits 5 or 6, thus, if the device fulfils both degree 6 and 7 against water, a double description must be used (e. g. IPX6/IPX7).

The conditions of Pepperl+Fuchs GmbH for IPX8 are:

- 1 m water column above the test subject
- 24 h operation under water with cyclical damping and amplification under rated load
- cycle time 2 h
- water temperature = room temperature  $\pm 5$  °C ( $\pm 5$  K)



## Introduction to explosion protection through intrinsic safety

When introducing electrical equipment in a hazardous area, extensive regulations must be observed that are subdivided into European (EU) and national requirements.

The European standards define the general specifications and the detailed guidelines for methods of protection against explosion. The national requirements primarily contain the installation criteria.

Electrical instruments for explosion groups I and II, as well as the T1 ... T6 temperature classifications, are grouped in DIN EN 50014 (see "Division of Hazards, Ignition Hazards due to Sparks and Hot Surfaces" in the following table).

DIN EN 50020 presents categories, design and test specifications and type identification of intrinsically safe apparatus. Approvals for electrical instruments that are used in explosive environments are regulated by EG-Ex-Framework guidelines 76/117/EEG and guideline 94/9/EG.

The intrinsic safety method of explosion protection always relates to intrinsically safe circuitry that comprises an intrinsically safe apparatus, an appropriate electrical power source and the connecting cables. In intrinsically safe circuits, an explosive environment cannot be ignited by sparking or a thermal effect when operating normally under prescribed fault conditions. In an intrinsically safe circuit for category ia, 2 calculable faults (see definition EN 50020) must not cause an ignition and in category ib only 1 such fault is permissible. Limiting the power supply, total inductance and total capacitance within the intrinsically safe circuitry is the basic principle of the intrinsically safe explosion protection method.

The project manager or user has to compare the permissible internal limit values for intrinsically safe electrical apparatus with the permissible connection values of the associated electrical apparatus, in accordance with the following table:

Intrinsically safe apparatus and cable	Demonstration of intrinsic safety	Associated apparatus
$U_i$	$\geq$	$U_o$
$I_i$	$\geq$	$I_o$
$P_i$	$\geq$	$P_o$
$L_i + L_c$	$\leq$	$L_o$
$C_i + C_c$	$\leq$	$C_o$

These limit values are obtained from the prototype test certificate. The comparison of the limit values satisfies the requirement of DIN EN 60079-14 with regard to the demonstration of intrinsic safety. When installing complex intrinsically safe circuitry with more than one item of associated electrical apparatus, a calculated demonstration of intrinsic safety has to be carried out and this must then be referenced back to the explosion limit curves for DIN EN 50020 or to the tables that these curves represent.

In this case all the active associated electrical apparatus are combined in one complex associated electrical apparatus. "Active" refers to any apparatus that can provide power to the intrinsically safe circuit under normal or malfunctioning operating conditions.

For the intrinsically safe connection terminals of this complex apparatus, the effective values for

- the maximum output voltage  $U_o$ ,
- the maximum output current  $I_o$ ,
- the maximum output power  $P_o$ ,

are calculated as follows, depending on the combined circuitry of the individual associated apparatus:

For parallel circuits:

- $I_o$  from the sum of the individual currents,
- $U_o$  from the maximum value of the individual voltages.

For series connection:

- $I_o$  from the maximum value of the individual currents,
- $U_o$  from the sum of the individual voltages.

The individual values are taken from the certificates of conformity. The maximum output power is calculated from the following formula for assigned apparatus with linear current-voltage output characteristics:

$$P_o = 1/4 \times U_o \times I_o$$

Based on the calculated maximum value, the intrinsic safety has to be checked using the ignition limit curves.

DIN EN 60079-14 references limitations (PTB report W39 is to be used for associated apparatus with non-linear current-voltage characteristics) and safety factors.

In addition to this demonstration of intrinsic safety, the integrity of the intrinsically safe circuitry must also be assured against the ingress of energy from other electrical power sources. If both requirements are fulfilled, a safe power limit within the circuitry will not be exceeded, even if there is an interruption, a short circuit or grounding of the circuitry (EN 60079-14). A detailed description of "Explosion protection through intrinsic safety" can be found in the manual of the same name.

The previously valid national specifications will be replaced in the future by the following European standards:

EN 1127-1	Machine safety/combustion and explosion protection (zone 0; 1; 2 for gas and steam/ zone 20; 21; 22 for dust)
EN 60079-10	Installation of electrical systems in potentially explosive areas (division into areas)
EN 60079-14	Installation of electrical systems in potentially explosive areas (installation specification)

## Explosion protection through intrinsic safety

The following table compares important general guidelines for explosion protection as applied in the European Union and North America.

	European Union	North America
Classification of hazards	Explosive mixture in Group I: mines susceptible to firedamp Group II: other areas outside of mines	Explosive mixtures of air and CLASS I: Gases and vapours CLASS II: Dusts CLASS III: Fibres
Ignition due to sparks	Grouping of the ignition protection methods of intrinsic safety/flame proof enclosure, as well as ignition protection method "u", in respect of the minimum ignition current/limit gap and in accordance with the minimum ignition energy of representative gases: Group I Methane Group IIA Propane IIB Ethylene IIC Hydrogen, Acetylene	Sub-division of the class according to ignition energy: CLASS I Group A Acetylene B Hydrogen C Ethylene D Methane CLASS II Group E Metal dusts F Coal dusts G Grain dusts CLASS III No grouping
Ignition hazards due to hot surfaces	Division into temperature classes in accordance with IEC 60079-8 for maximum surface temperatures with an ambient temperature of 40 °C, under fault conditions: T1 ≤ 450 °C T2 ≤ 300 °C T3 ≤ 200 °C T4 ≤ 135 °C T5 ≤ 100 °C T6 ≤ 85 °C	
Division of hazardous areas	The following are subdivided according to the probability of the occurrence of a dangerous explosive atmosphere:	
	For gases, vapours, mists: (EN 1127-1) Zone 0 constant or long term Zone 1 occasionally Zone 2 seldom and short term for dusts: (EN 1127-1) Zone 20 constant or long term or frequently 21 occasionally 22 short term or accumulation or layers of dust	for gases and dusts: Division 1 Division 1 Division 2
	Note (see IEC 60079-10): constant or long term corresponds to > 1000 h/year, occasionally corresponds to 10...1000 h/year, seldom or short term corresp. to < 10 h/year	
Safety characteristics	The characteristics of flammable gases and vapours as a basis for classification in respect of ignition energy and temperature/flashpoint are contained in:	
	DIN EN 50014: 1997 appendix A BS 5345, part 1	NFPA 497 M CSA No. C22-1
Approval authorities (named locations in accordance with Directive 94/9/EC)	PTB Physikalisch-Technische Bundesanstalt DMT (old) Deutsche Montan Technologie EXAM (new) BBG Prüf- und Zertifizier-GmbH BASEEFA British Approvals Service for Electrical Equipment in Flammable Atmospheres TÜV TÜV Nord Cert GmbH & Co. KG and others	UL Underwriters Laboratories, USA FM Factory Mutual Research, USA CSA Canadian Standards Association
Installation requirements	EN 60079-14 (VDE 0165, part 1) for explosive gas environments EN 50281-1-2 (VDE 0165, part 2) for environments with flammable dust and other EC-wide and national (for example ExVo) requirements	NFPA 70 National Electrical Code Art. 500 NFPA 70 National Electrical Code Art. 505 NFPA 493 Standard for Intrinsically safe operations ...



# SIL classification acc. to IEC/EN 61508

## Interface modules

Model	Function	Loop architecture	Remark
		simple (1oo1)	
ED2-STC4-**2	SMART transmitter power supply	SIL2	exida report
ED2-VM-Ex*.3**	Solenoid driver	SIL2	exida report
EG*-***	Isolated switch amplifier	SIL2	exida report
HiD2025/2026 (SK)	SMART transmitter power supply	SIL2	exida report
HiD2029/2030 (SK)	SMART transmitter power supply	SIL2	exida report
HiD2033/2034	Isolated repeater	SIL2	exida report, loop powered
HiD2037/2038	Isolated repeater	SIL2	exida report
HiD2821/2822/2824	Isolated switch amplifier	SIL2	exida report
HiD2842/2844	Isolated switch amplifier	SIL2	exida report
HiD2871/2872	Solenoid driver	SIL2	exida report, optional loop powered
HiD2875/2876	Solenoid driver	SIL2	exida report, optional loop powered
HiD2881	Solenoid driver	SIL2	exida report, optional loop powered
K**-SH-Ex1	Isolated switch amplifier	SIL3	exida report
KCD0-SD-Ex1.1245	Solenoid driver	SIL3	exida-report, loop powered
KCD2-SCD-Ex1	SMART repeater	SIL2	exida-report
KCD2-SR-***.**	Isolated switch amplifier	SIL2	exida-report
KCD2-STC-Ex1	SMART transmitter power supply	SIL2	exida-report
KF**-CRG-***.*	Transmitter supply isolator	SIL2	exida report, with trip value function
KF**-DWB-***.*	Rotational speed controller	SIL2	exida report
KF**-GUT-***.*	Temperature converter with limit value	SIL2	exida report
KF**-SOT2-***.**	Isolated switch amplifier	SIL2	exida report
KF**-SR2-***.**	Isolated switch amplifier	SIL2	exida report
KF**-UFC-***.*	Frequency current converter	SIL2	exida report
KFD0-CS-***.**	Isolated repeater	SIL2	exida report, loop powered
KFD0-HMS-16	Multiplexer slave	SIL3	exida report, loop powered
KFD0-RO-***	Relay module	SIL2	exida calculation
KFD0-RSH-1	Relay module	SIL3	exida report, loop powered
KFD0-SCS-***.**	SMART repeater	SIL2	exida report, loop powered
KFD2-CD*-*.*.*	Isolated repeater	SIL2	exida report
KFD2-HMM-16	Multiplexer master	SIL3	exida report
KFD2-SCD*-*.*.*	SMART repeater	SIL2	exida report
KFD2-SD-***.**	Solenoid driver	SIL3	exida report, loop powered
KFD2-SL-***.**	Solenoid driver	SIL3	exida report
KFD2-SL2-***.**	Solenoid driver	SIL2	exida report
KFD2-SL-4	Solenoid driver	SIL2	exida report
KFD2-SR2-**2.W.SM	Standstill controller	SIL2	exida report
KFD2-ST2-***.**	Isolated switch amplifier	SIL2	exida report
KFD2-STC4-***.**	SMART transmitter power supply	SIL2	exida report
KFD2-STV4-***.**	SMART transmitter power supply	SIL2	exida report
Mux2700	Multiplexer	SIL3	exida report
P-LB-***	Lightning-protection barrier	SIL3	exida calculation

## Field devices

Model	Function	Loop architecture	Remark
		simple (1oo1)	
LHC-M20/M40	Hydrostatic pressure sensor	SIL2	Declaration of conformity
LTC***	Guided microwave	SIL2	Declaration of conformity
LVL-M* with FEL51 ... FEL58	Vibration limit switch	SIL2	Declaration of conformity
NCB2-12GM35-N0	Inductive initiator	SIL2	exida report
NCB2-V3-N0	Inductive initiator	SIL2	exida report
NCB5-18GM40-N0	Inductive initiator	SIL2	exida report
NCN3-F25*-SN4***	Inductive safety initiator	SIL3	exida report
NCN3-F31K-N4-V1-V1	Inductive initiator	SIL2	exida report
NCN3-F31-N4-K-K	Inductive initiator	SIL2	exida report
NCN4-12GM35-N0	Inductive initiator	SIL2	exida report
NCN4-V3-N0	Inductive initiator	SIL2	exida report
NCN8-18GM40-N0	Inductive initiator	SIL2	exida report
NJ10-30GK-SN***	Inductive safety initiator	SIL3	exida report
NJ15-30GK-SN***	Inductive safety initiator	SIL3	exida report
NJ15S+U*+N***	Inductive safety initiator	SIL3	exida report
NJ20S+U*+N***	Inductive safety initiator	SIL3	exida report
NJ2-11-SN***	Inductive safety initiator	SIL3	exida report
NJ2-11-SN-G***	Inductive safety initiator	SIL3	exida report
NJ2-12GK-SN***	Inductive safety initiator	SIL3	exida report
NJ3-18GK-S1N***	Inductive safety initiator	SIL3	exida report
NJ40-FP-SN***	Inductive safety initiator	SIL3	exida report
NJ4-12GK-SN***	Inductive safety initiator	SIL3	exida report
NJ5-18GK-SN***	Inductive safety initiator	SIL3	exida report
NJ5-30GK-S1N***	Inductive safety initiator	SIL3	exida report
NJ6-22-SN***	Inductive safety initiator	SIL3	exida report
NJ6-22-SN-G***	Inductive safety initiator	SIL3	exida report
NJ6S1+U*+N1***	Inductive safety initiator	SIL3	exida report
NJ8-18GK-SN***	Inductive safety initiator	SIL3	exida report
PPC-M10/M20	Process pressure transmitter	SIL2	Declaration of conformity
SC3,5-N0	Inductive initiator	SIL2	exida report
SJ2-N	Inductive initiator	SIL2	exida report
SJ2-S1N***	Inductive safety initiator	SIL3	exida report
SJ2-SN***	Inductive safety initiator	SIL3	exida report
SJ3,5-N	Inductive initiator	SIL2	exida report
SJ3,5-S1N***	Inductive safety initiator	SIL3	exida report
SJ3,5-SN***	Inductive safety initiator	SIL3	exida report

# Application sheet corrosion monitoring CorrTran

Submitted by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Company: \_\_\_\_\_ Application number: \_\_\_\_\_  
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 Address: \_\_\_\_\_ Telephone: \_\_\_\_\_  
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## General application information

Pipe/vessel material: \_\_\_\_\_  
 Material to be monitored: \_\_\_\_\_  
 Medium: \_\_\_\_\_  
 Process temperature: \_\_\_\_\_ Ambient temperature: \_\_\_\_\_  
 Process pressure: \_\_\_\_\_  
 Area classification (explosive): \_\_\_\_\_  
 Type of protection:  Non-hazardous  Intrinsic safety  Division 2  Explosion proof

## Probe configuration

Type of monitoring:  General corrosion  Localised corrosion (pitting)  
 Scale of units:  mpy, mils per year (standard)\*\*  mm per year  
 Housing mounting:  Direct mounting Remote mounting  6 ft  12 ft  
 Total length in " : \_\_\_\_\_ Fixed insertion length in " : \_\_\_\_\_  
 Process connection:  3/4 NPT Flange  ANSI 1"  ANSI 2"  
 Probe material:  1.4401/316  Epoxy glass  Other: \_\_\_\_\_  
 Material end cap seal:  Glass (standard)  Kalrez  Epoxy  
 Alarm configuration\*: Low: = 3.7 mA High: = 22.5 mA  
 Low/auto reset  Low/manual reset  
 High/auto reset  High/manual reset  
 Alarm off (standard)  
 Lower range value LRV: \_\_\_\_\_ (standard 0 mpy) Upper range value URV: \_\_\_\_\_ (standard 40 mpy)

## Model number

C	M	C	-							-	0	-	A	2	I	H	-		-		
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**Configuration data** (internal use only)\*

General corrosion or pitting: _____	B value: _____
PV Units: _____	A Elec Area: _____
LRV: _____	K Comp Prop: _____
URV: _____	Meas Mode: _____
Damping: _____ 0.1 s	Firmware: _____
Alarm Config: _____	Method: _____
Filter Freq: _____	
CorrTran serial number: _____	Transmitter/HART ID: _____
Probe: _____	Element: _____

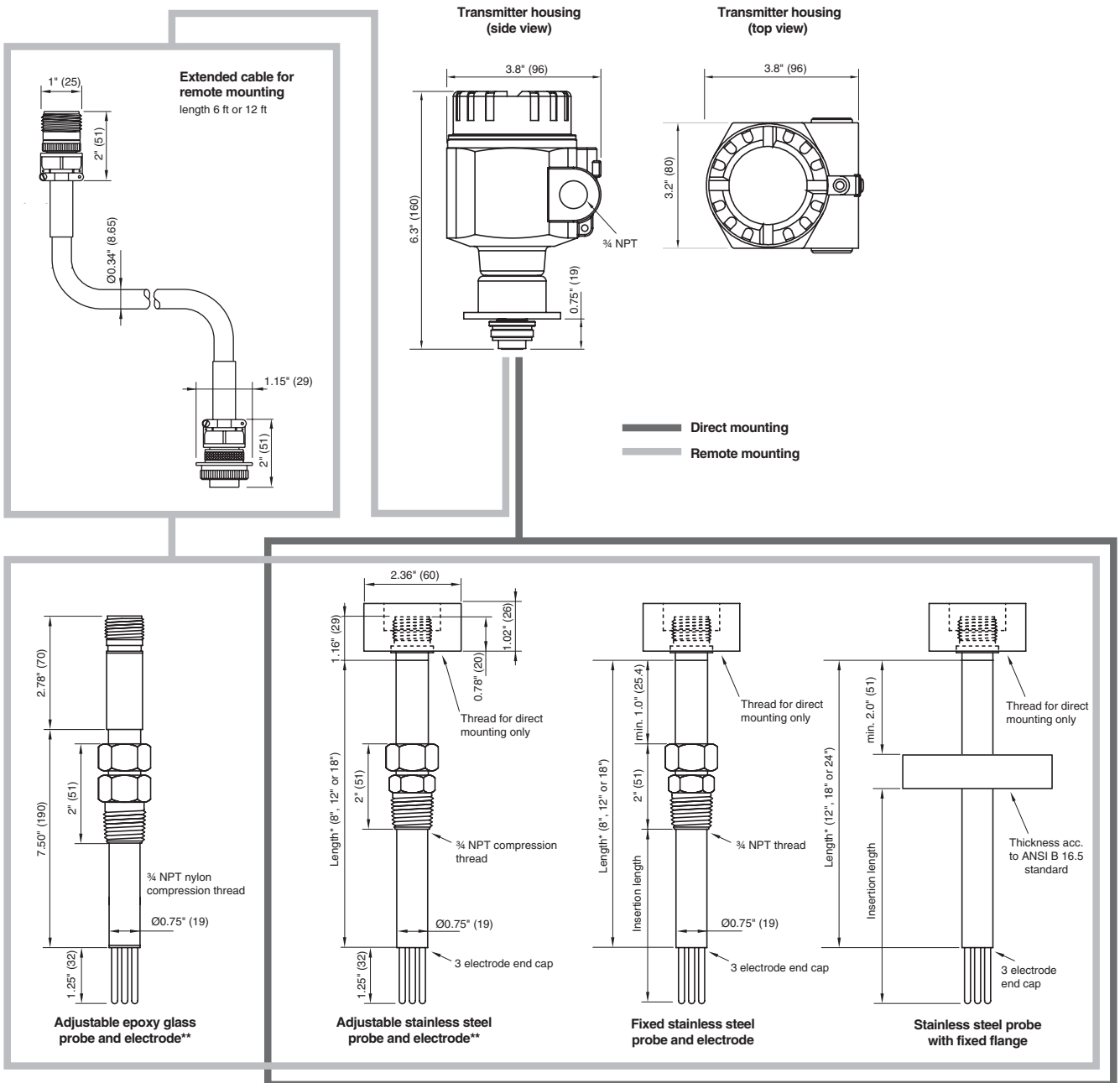
CO number: \_\_\_\_\_ MO number: \_\_\_\_\_  
 Part number: \_\_\_\_\_

\* only for general corrosion probe

\*\* 1 mil = 1/1000"

This application sheet is intended to be used with the data sheet and instruction manual as an aid in specifying the corrosion monitoring CorrTran CMC\*. This application sheet can be included with your order for custom configuration of your CorrTran. Only include the front page, this page is not required.

Below are the dimensions of the probe, the probe length, and the fixed and insertion length.



## A

**AS-i bus:** actuator sensor interface: 1 master and 62 slaves. 4 bit bidirectional transfer on a 2-wire conductor, 100 m.

## B

**BPG-ÜS:** construction and test principles for overspill protection systems.

**Brass:** CuZn alloy

## C

**CENELEC:** within the scope of the European Community, the CENELEC (European Committee for Electrotechnical Standardisation) develops harmonised regulations for the design and testing of electrical apparatus for hazardous areas.

**Conditions for conductive measurement:** minimum conductivity of approx. 10  $\mu\text{S}/\text{cm}$ .

**Conductive limit value detection:** analysis of the measuring current which flows between two electrodes via a conductive medium.

**Conductivity:** a measure of the ability of a material to conduct electrical current.

**Continuous level measurement:** determination of the current fill height in a measuring range.

**Converter:** a plug-in module in the terminal box of the measuring sensor

**CSM:** chlorosulfonated polyethylene, widely resistant to acids, lyes and many solvents.

## D

**DIBt:** German Institute for Structural Engineering in Berlin (earlier: IfBt)

**Dielectric constant  $\epsilon_r$ :** material constant. It represents how many times more than in vacuum the medium increases the capacity of a capacitor.

**DIN:** German Institute for Standards

**DMT:** German Mining and Exploration Institute (earlier BVS)

## E

**ECTFE:** thermoplastic fluoroplastics, resistant to most industrial acids, lyes and solvents.

**Electrodes:** mostly rod type electrodes with different coatings, diameters and lengths for conductive, capacitive measurement.

**Electrode relay:** a current flow between the electrodes when coming into contact with a conductive liquid activates the relay.

**Electronical converter:**  $\rightarrow$  converter

**Ellex V:** German ordinance on electrical apparatus used in potentially explosive atmospheres

**Ex area/Ex zone:** areas of an installation (container, pipe, surroundings of discharge valves, etc.) in which a combustible medium can produce an explosive mixture with atmospheric oxygen (see section Ex i).

**Explosion protection (Ex):** In areas where potentially explosive atmospheres are present, all components of the measuring system must have the corresponding approval.

## H

**Hastelloy B:** = 2.4617 = NiMo28

**Hastelloy C:** = 2.4610 = NiMo16Cr16Ti

**Hydrostatic level measurement:** determination of the fill height via the liquid pressure; conditions: constant density

**Hypalon:**  $\rightarrow$  CSM

## I

**Initiator:**  $\rightarrow$  proximity switch

## K

**Kalrez:** Perfluorelastomer (sealing material)

## L

**Level measurement:**  $\rightarrow$  continuous level measurement

**Limit value detection:** measurement of whether a medium has reached or exceeded a fixed filling height.

## M

**Measuring circuit:** Produced by applying a small measuring AC voltage to the electrodes, supplied from the electrode relay or transformer.

**Measuring sensor:** detector, proximity switch, sensor

**Min/Max control:** the output signal changes as the maximum is reached. This status is maintained until the level drops below the minimum level. At that moment the output signal is reset. Min/Max control is used frequently for pump automation.

## N

**NAMUR:** standard committee for measurement and control techniques. Among others the committee defined EN 60947-5-6<sup>1</sup> which rules the energy balance of the electrical equipment.

## O

**Open circuit:** via the potential free changeover contacts of a relay switched circuit (AC/DC).

**OSS/WHG:** water contaminating, non combustible liquids

**OSS/VbF:** water contaminating and combustible liquids

**Overspill prevention system (OSS):** A device which triggers an alarm when water contaminating liquids threaten to overflow from a container.

<sup>1</sup> EN 60947-5-6 (also IEC 60947-5-6) is identical to EN 50227 and corresponds to DIN 19234.



**P**

**PA:** polyamide, resistant to oils, greases and most solvents

**PE:** polyethylene, resistant to diluted acids and lyes, most solvents, alcohol, benzine, water, greases and oils.

**Permanence:** manufacturers offer permanence lists for various materials. The preconditions listed must be exactly observed.

Our experts will be happy to give you information concerning special problems. Pepperl+Fuchs has the experience necessary for solving most problems.

**PP:** polypropylene, resistant to acids, lyes, greases, oils and solvents

**Process connection:**

screw fitting G\*A, e. g. G1¼A, cylindrical threading in accordance with DIN ISO 228/1

Screw fitting \* NPT, e. g. 1 NPT, conical threading in accordance with ANSI B 1.20.1

**Proximity switch:** reacts to approaching objects with an electrical switching signal

**PrZV:** Testing mark ordinance

**PTB/PTBP:** polybutyleneterephthalate

**PTB:** German Federal Physical Technical Institute Braunschweig

**PTFE:** polytetrafluor ethylene, highly resistant to all chemicals

**PUR:** polyurethane, widely resistant to fuels, fuel oils and liquids containing oil

**PVC:** polyvinyl chloride, preferred for water, contaminated water, slightly aggressive liquids

**PVDF:** polyvinylidenfluoride, very resistant to oils and greases, acids and lyes resistant to solvents

**R**

**Responsive sensitivity:** selectable range in which the current flow (between electrodes in contact with the liquid) produces a switching signal.

**S**

**Screw fitting:** → process connection

**Sensitivity:** → response sensitivity

**T**

**Transformer isolated barrier:** The relay responds to defined current changes in accordance with EN 6094-5-6 (NAMUR), e. g. KFD2-SR2-Ex1.W

**TÜV:** A technical surveying association in Germany

**U**

**Ultrasonic:** acoustic waves within the non audible range, for US-Sensors frequencies between 50 kHz and 500 kHz are used.

**V**

**VAwS:** German ordinance for installations which store water-contaminating substances

**VDE:** Association of German Electrical Engineers

**Viton:** fluorocautchouc (fluorine-containing polymer)

**W**

**WHG (German water resources law):** the use of overspill prevention systems is prescribed in § 19 of the german water resources law and the applicable state ordinances concerning installations which store, drain and transport water contaminating substances (VAwS). Such an overspill prevention system must possess the respective approval.









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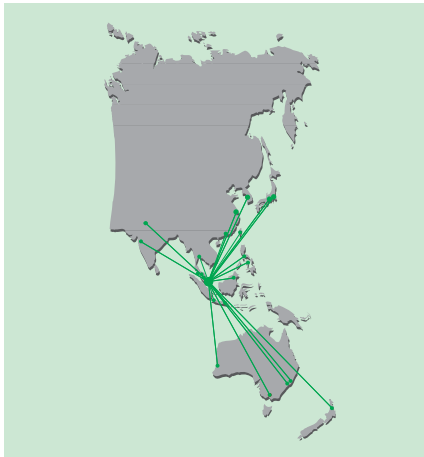
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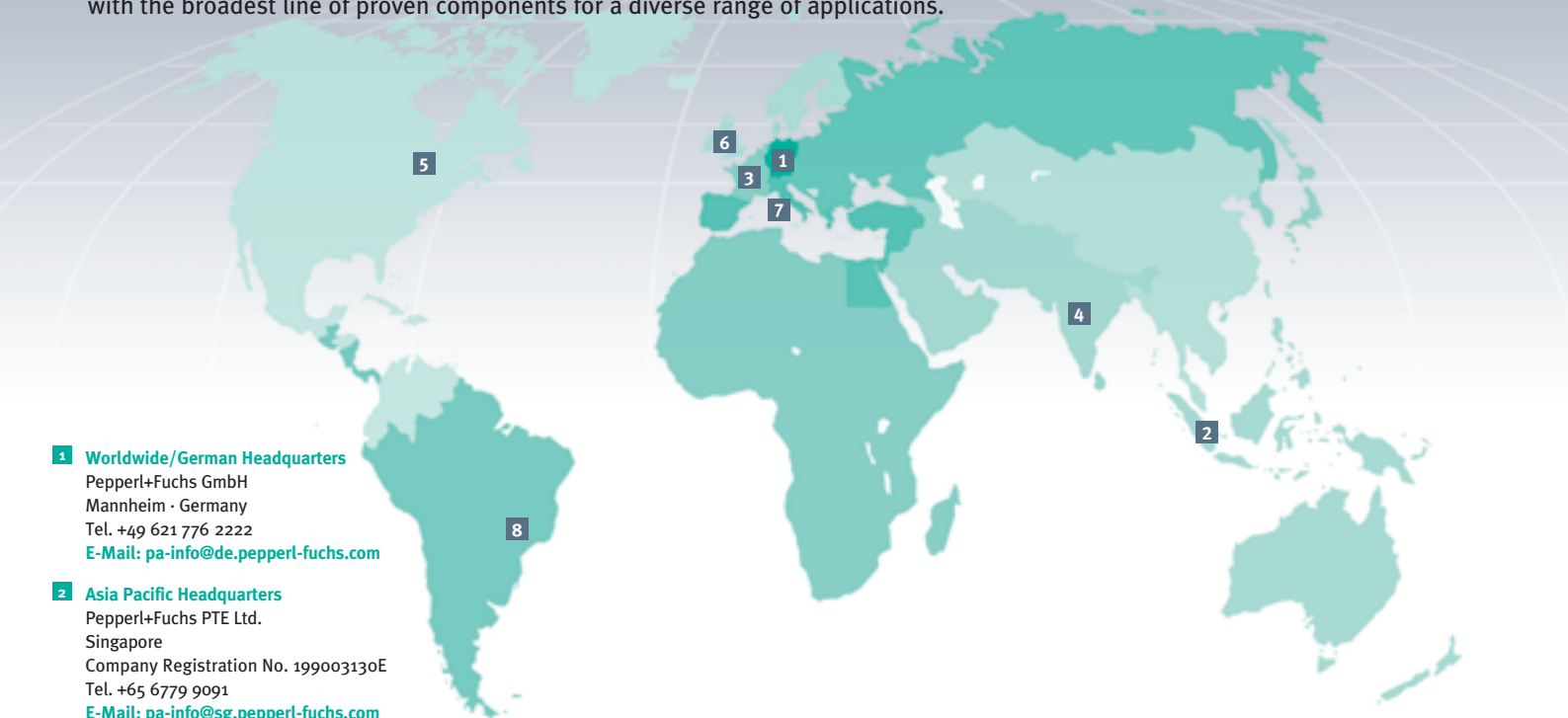
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