Signals in the world of automation

During the more than 50 successful years of company history, it has always been possible to blaze new trails with innovative products.

Our central challenge is to intensify the necessary growth through future innovations as well and, whenever it makes sense, to support them through acquisitions.
Factory Automation Division

Product areas
- Binary and analogue sensors in various technologies
  - Inductive and capacitive sensors
  - Magnetic sensors
  - Ultrasonic sensors
  - Photoelectric sensors
- Incremental and absolute value rotary encoders
- Counters and secondary switching devices
- Identification systems
- AS-Interface

Branches and partners
- Mechanical engineering
- Printing and paper
- Conveyor and transport systems
- Packaging and beverage machines
- Automobile industry
Process Automation Division

Product areas

- Signal conditioners
- Intrinsically safe interface components
- Remote process interface
- Intrinsically safe field bus solutions
- Level control sensors
- Process measuring and control systems engineering at the interface level
- Ex-protection training

Branches and partners

- Chemistry
- Industrial and community wastewater systems
- Oil, gas and petro-chemicals
- PLC and process control systems
- Engineering companies for process systems
A worldwide presence

A worldwide sales and service organisation that provides consultation through competent and reliable employees, making it possible for you to reach us whenever and wherever you need us. There are more than 30 Pepperl+Fuchs companies throughout the world. You can find the current worldwide address information on our Web pages or in the Pepperl+Fuchs brochure, which you can request by e-mail.


**In harmony – the Pepperl+Fuchs triangle**

**Central office for America**
- Founding year 1983
- More than 220 employees
- R&D, production, sales

**Main headquarters of the company group**
- Founding year 1945
- More than 1000 employees
- R&D, production, sales

**Central office for Asia and Australia**
- Founding year 1979
- More than 600 employees
- R&D, production, sales

**Concentration and distribution – distributed unity**

Know-how, professional expertise and highly motivated employees can be found everywhere in the world. It would be inefficient not to use this potential. As an integral part of making economical use of all available resources, we have concentrated precisely defined assignment areas in Centers of Expertise. These are responsible not only for worldwide control and ongoing development, but also for ensuring that all relevant information is equally available at all locations.
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## Overview of all level measuring methods

### Limit value detection

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</tr>
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<td></td>
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<td>standard</td>
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<td></td>
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<td>96</td>
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</tr>
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<td></td>
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<td>88</td>
</tr>
<tr>
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<td>Ex-area zone 1 + 2</td>
<td>LKL-P</td>
<td>88</td>
</tr>
<tr>
<td>Hydrostatic</td>
<td>standard</td>
<td>plastic/stainless steel</td>
<td>104</td>
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<td>Capacitive</td>
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</tr>
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<td>immersion probe</td>
<td></td>
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</tr>
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<td></td>
<td>Ex-area zone 0</td>
<td>stainless steel</td>
<td>120</td>
</tr>
</tbody>
</table>
## Overview of all level measuring methods

### Continuous level measurement

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<thead>
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<th>Application</th>
<th>Design</th>
<th>Page</th>
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</thead>
<tbody>
<tr>
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<td>standard plastic</td>
<td>plastic, stainless steel</td>
<td>126</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>Ex-area zone 0</td>
<td>stainless steel</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>Ex-area zone 0 + VbF</td>
<td>stainless steel</td>
<td>130</td>
</tr>
<tr>
<td>Hydrostatic</td>
<td>standard rod, rope and suspension</td>
<td>LHC/PPC, suspension LHC-/PPC-M20, diaphragm seal LHC-M40</td>
<td>134</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>Ex-area</td>
<td></td>
<td>138</td>
</tr>
<tr>
<td>Ultrasonic</td>
<td>standard compact version – LUC4</td>
<td>LUC-T20</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>Ex-area zone 1</td>
<td>compact version – LUC-T10</td>
<td>172</td>
</tr>
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<td></td>
<td>Ex-area zone 20</td>
<td>compact version – LUC-T30</td>
<td>172</td>
</tr>
<tr>
<td>Guided microwave</td>
<td>standard rod, rope and coax version</td>
<td></td>
<td>182</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>182</td>
</tr>
<tr>
<td></td>
<td>Ex-area zone 0</td>
<td>rod, rope and coax version</td>
<td>182</td>
</tr>
<tr>
<td></td>
<td>Ex-area zone 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

![Limit value detection diagram]

**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).

![Continuous level measurement diagram]
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 microswitches 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.

Hydrostatic pressure

The rising level of the liquid compresses the air in the probe tube which contains a membrane switch.

The changeover contacts are switched when the pressure reaches a preset value.

Once the liquid level falls, and thus the pressure on the membrane switch lowers, the changeover contacts switch back.

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, vapor, 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 and VbF.

**Ex-area:**

**Zone 0:** In this most dangerous zone, only devices are allowed that have been certified and posses 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.

**VbF:** In systems that are subject to the scope of validity of the ordinance on flammable liquids (VbF), devices that have been in use there require from December 1996 on (since § 12 VbF was abolished) the construction type approval as defined by the German Water Resources Law (WHG) and a certificate of conformity for use in zone 0 (for example from the Federal Physical Technical Institute or the DMT Organisation for Research and Testing mbH). Devices that are still certified according to § 12 VbF may still be used.

**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”.

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**

<table>
<thead>
<tr>
<th>Company:</th>
<th>Responsible person:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plant, operation, key words:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of control</th>
<th>limit value detection</th>
<th>continuous level measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O maximum</td>
<td>O continuous measurement</td>
</tr>
<tr>
<td></td>
<td>O minimum</td>
<td>O continuous measurement</td>
</tr>
<tr>
<td></td>
<td>O linked switching</td>
<td>O continuous measurement</td>
</tr>
<tr>
<td></td>
<td>points as min-max-control</td>
<td>with limit value detection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you need devices in explosion proof version?</th>
<th>O yes, Ex-area zone:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O no</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you need certified overspill preventions?</th>
<th>O in acc. with VbF for flammable liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O in acc. with WHG for non flammable liquids</td>
</tr>
<tr>
<td></td>
<td>O no</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Which measuring principle would you prefer?</th>
<th>limit value detection</th>
<th>continuous level measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O float switches</td>
<td>O hydrostatic</td>
</tr>
<tr>
<td></td>
<td>O vibration</td>
<td>O magnet-operated immersion probe</td>
</tr>
<tr>
<td></td>
<td>O conductive</td>
<td>O ultrasonic</td>
</tr>
<tr>
<td></td>
<td>O capacitive</td>
<td>O guided microwave</td>
</tr>
<tr>
<td></td>
<td>O magnet-operated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>immersion probe</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vessel</th>
<th>shape:</th>
<th>material:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>connection piece for the probe:</td>
<td>level:</td>
</tr>
<tr>
<td></td>
<td>coating of the inside walls:</td>
<td>height of level limit:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explanations for the vessel type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating pressure in the vessel: max.:</td>
</tr>
<tr>
<td>Operating temperature in the vessel: max.:</td>
</tr>
<tr>
<td>min.:</td>
</tr>
<tr>
<td>min.:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medium name:</th>
<th>liquid</th>
<th>solid (bulk material)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>flammable</td>
<td>density:</td>
</tr>
<tr>
<td></td>
<td>non-flammable</td>
<td>bulk material:</td>
</tr>
<tr>
<td></td>
<td>adhesive</td>
<td>concentration:</td>
</tr>
<tr>
<td></td>
<td>coating</td>
<td>viscosity:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conductive medium?</th>
<th>O yes</th>
<th>O no</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>If known, dielectric constant:</th>
<th>conductance:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Which of the following materials are resistant against the medium?</th>
<th>O stainless steel 1.4571</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O Hastelloy B/C</td>
</tr>
<tr>
<td></td>
<td>O titanium</td>
</tr>
<tr>
<td></td>
<td>O tantalum</td>
</tr>
<tr>
<td></td>
<td>O PP</td>
</tr>
<tr>
<td></td>
<td>O PTFE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Which supply voltage is available:</th>
<th>O V AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O V DC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of signal conditioning</th>
<th>O standard casing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O eurocard</td>
</tr>
</tbody>
</table>

Please insert a sketch of the vessel including the switching points and the connection piece of the probe.
## Level control sensors

### Contents

#### Limit value detection

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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

```
| L | F | L | - | - | - |
```

- **L**: Limit
- **F**: Float
- **L**: Level
- **-**: Electrical output
- **-**: Float material
- **-**: Switching element
- **-**: Cable material
- **-**: Cable length

Product group LFL

<table>
<thead>
<tr>
<th>Cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical output</td>
</tr>
<tr>
<td>Float material</td>
</tr>
<tr>
<td>Switching element</td>
</tr>
<tr>
<td>Float</td>
</tr>
<tr>
<td>Limit</td>
</tr>
<tr>
<td>Level</td>
</tr>
</tbody>
</table>

The possible combinations are shown on the according data sheets of the float switches.
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, microswitches with operation ball.

Mercury-change-over contacts are still available.
**Float switch**

**Dimensions**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>The initiator (normally open contact) is integrated in a PP float and is activated in the event of deviations from the horizontal position. The operation 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).</td>
</tr>
</tbody>
</table>

**Features**

- Switching element: float switch with initiator
- Electrical connections in acc. with NAMUR for hazardous area
- Determination of limiting values for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

**Electrical connection**

<table>
<thead>
<tr>
<th>Cable colours</th>
<th>= L+</th>
<th>= L-</th>
</tr>
</thead>
<tbody>
<tr>
<td>brown or black</td>
<td>1/BN/BL</td>
<td>1</td>
</tr>
<tr>
<td>blue</td>
<td>2/BU</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sleeve design:** LFL1-CK-N

**Ball design:** LFL1-BK-N

---

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## Technical data

### Application
**LFL1-N**

**Description**
Inductive sensor with operation ball

### Function and system design
**Equipment architecture**
A measuring system consists of a float switch LFL1-N and a transformer isolated barrier, e.g. KFD2-SR2-Ex1.W

### Auxiliary energy
**Supply voltage**
8.2 V ± 2 V
**Current consumption**
- Unswitched (de-energised at the bottom): < 1.0 mA
- Switched (floated up at the top): > 2.2 mA

### Reverse polarity protection
Yes

### Operating conditions
**Installation instructions**
- Range of application and minimum length between mounting and float:
  - PVC version: ≥ 50 mm (2 inches), preferred for water, waste water, slightly aggressive liquids
  - PUR version: ≥ 100 mm (4 inches), preferred for fuels, heating oils, oily fluids
  - CSM/CM version: ≥ 100 mm (4 inches), preferred for many acids and lyes

  - Mounting:
    - The float switch is mounted either from sidewards 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

### Ambient conditions
**Protection class**
DIN EN 60529, IP68

### Process conditions
**Process temperature**
-20 ... +70 °C (253 ... 343 K)
**Process 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/cm³
- Ball design: ≥ 0.6 g/cm³

### Mechanical construction
**Versions**
- LFL1-CK-N-PVC3
- LFL1-CK-N-PUR3
- LFL1-CK-N-CSM3
- 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 mm²)
  - PUR version: PUR cable, highly flexible (2 x 0.50 mm²)
  - CSM/CM version: CSM/CM cable (chlorinated polyethylene, (2 x 0.75 mm²)

**Switch point**
- Switch angle: upper switching point +12°, lower switching point -12°, measured against the horizontal

### Certificates and approvals
**Ex approval**
- TÜV 99 ATEX 1407
- T5 (Ta = 70 °C (343 K)): Uₐ = 16 V, Iₐ = 52 mA, Pₐ = 180 mW, Lₐ = 1 mH, Cₐ = 153 nF
- T4 (Ta = 70 °C (343 K)): Uₐ = 16 V, Iₐ = 72 mA, Pₐ = 242 mW, Lₐ = 1 mH, Cₐ = 153 nF

**Type of protection**
- ATEX II 2 G EEex ia II B T5

### General information
**Directive conformity**
- Directive 94/9/EC (ATEX) approval standards
  - TÜV 99 ATEX 1470, II 2 G EEex ia II B T5
  - EN 50014: 1997,
  - EN 50020: 1994

**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 switch
LFL1-N

Technical data

Accessories

Designation

- 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-Z431, cable gland 1 NPT, PVC
- LFL-Z432, cable gland 1 NPT, brass

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

Type code/model number

- LFL1-K-N
- Cable length
  - 3 3 m (10 ft)
  - 5 5 m (16.5 ft)
  - 10 10 m (33 ft)
- Cable material
  - PVC
  - PVC cable
  - PUR
  - PUR cable
  - CSM
  - CSM/CM cable
- Electrical output
  - N according to DIN EN 60947-5-6 (NAMUR)
- Float material
  - K plastic PP
- Float form
  - C sleeve
  - B ball
- Switching element
  - 1 initiator with operation ball
<table>
<thead>
<tr>
<th>Technical data</th>
<th>Float switch LFL1-N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float switches</td>
<td>Vibration limit switches</td>
</tr>
<tr>
<td>Conductive limit switches</td>
<td></td>
</tr>
<tr>
<td>Capacitive limit switches</td>
<td></td>
</tr>
<tr>
<td>Limit value immersion probes</td>
<td></td>
</tr>
<tr>
<td>Continuous immersion probes</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic pressure sensors</td>
<td></td>
</tr>
</tbody>
</table>
Float switch

LFL1-Z0/Z1

Function

The initiator is integrated in a PP float and is activated in the event of deviations from the horizontal position. The operation 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).

Features

- Switching element: float switch with initiator
- Electrical connections 2-wire 6 V DC ... 60 V DC
- Determination of limiting values for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

Electrical connection

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

Z0 floating up closing

Z0

3/BN/BL
4/BU

L+
L-

1/BN/BL
2/BU

Z1 floating up opening

Z1

1/BN/BL
2/BU

L+
L-
## Technical data

### LFL1-Z0/Z1

| Application | Description | inductive sensor with operation ball  
|            |            | Z0 = floating up closing (normally open)  
|            |            | Z1 = floating up opening (normally closed) |

### Function and system design

#### Equipment architecture

a measuring system consists of a float switch LFL1-Z0/Z1 and a load switched in series

### Auxiliary energy

#### Supply voltage

6 ... 60 V DC

#### Current consumption

4 ... 100 mA

#### Voltage drop

approx. 4.7 V at 100 mA

#### No load current

0.73 mA

#### Reverse polarity protection

yes

#### Short circuit protection

no

### Operating conditions

#### Installation instructions

range of application and minimum length between mounting and float:

- PVC version: ≥ 50 mm (2 inches), preferred for water, waste water, slightly aggressive liquids
- PUR version: ≥ 100 mm (4 inches), preferred for fuels, heating oils, oily fluids
- CSM/CM version: ≥ 100 mm (4 inches), preferred for many acids and yes

mounting:

- the float switch is mounted either from sidewards 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.

### Ambient conditions

#### Protection class

DIN EN 60529, IP68

#### Process conditions

##### 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

- sleeve design: ≤ 3 bar at 20 °C (293 K)
- ball design: ≤ 2 bar at 20 °C (293 K)

##### Density

- sleeve design: ≥ 0.8 g/cm³
- ball design: ≥ 0.6 g/cm³

#### Mechanical construction

##### Versions

- LFL1-CK-Z*-PVC3
- LFL1-CK-Z*-PVC5
- LFL1-CK-Z*-CSM10
- LFL1-BK-Z*-PVC5
- LFL1-BK-Z*-CSM5

##### Material

- float: PP (Polypropylene)
- cable:
  - PVC version: PVC cable, highly flexible (2 x 0.75 mm²)
  - PUR version: PUR cable, highly flexible (2 x 0.50 mm²)
  - CSM/CM version: CSM/CM cable (chlorinated polyethylene, (2 x 0.75 mm²)

##### Switch point

switch angle: upper switching point +12°, lower switching point -12°, measured against the horizontal

### General information

#### Directive conformity


#### 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 switch
#### LFL1-Z0/Z1

**Accessories**

**Designation**

- LFL-Z31, 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)

**Type code/model number**

- LFL1-Z0/Z1

<table>
<thead>
<tr>
<th>Cable length</th>
<th>Electrical output</th>
<th>Switching element</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 m (10 ft)</td>
<td>Z0 normally open 24 V DC</td>
<td>1 initiator with operation ball</td>
</tr>
<tr>
<td>5 m (16.5 ft)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 m (33 ft)</td>
<td>Z1 normally closed 24 V DC</td>
<td></td>
</tr>
</tbody>
</table>

**Cable material**

- PVC
- PUR
- CSM/CM

**Float material**

- plastic PP

**Float form**

- sleeve
- ball

**Electrical output**

- Z0 normally open 24 V DC
- Z1 normally closed 24 V DC

**Switching element**

- 1 initiator with operation ball
<table>
<thead>
<tr>
<th>Technical data</th>
<th>Float switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float switches</td>
<td>LFL1-Z0/Z1</td>
</tr>
<tr>
<td>Vibration</td>
<td></td>
</tr>
<tr>
<td>Conductive</td>
<td></td>
</tr>
<tr>
<td>Capacitive</td>
<td></td>
</tr>
<tr>
<td>Limit value</td>
<td></td>
</tr>
<tr>
<td>Immersion</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic</td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td></td>
</tr>
</tbody>
</table>
Float switch

LFL1-WS/WO

Function
The initiator is integrated in a PP float and is activated in the event of deviations from the horizontal position. The operation 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 (20 V AC ... 264 V AC).

- Version WO open while potential-free up
- Version WS closed while potential-free up

Features
- Switching element float switch with initiator
- Electrical connections 2-wire, 20 V AC ... 264 V AC
- Determination of limiting values for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

Electrical connection

<table>
<thead>
<tr>
<th>Cable colours</th>
<th>L1</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>brown or black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>blue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Version</th>
<th>L1</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimensions

- Sleeve design LFL1-CK
- Ball design LFL1-BK
## Technical data

<table>
<thead>
<tr>
<th>Application</th>
<th>LFL1-WS/WO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>inductive sensor with operation ball</td>
</tr>
<tr>
<td>WS = floating up closing (normally open)</td>
<td></td>
</tr>
<tr>
<td>WO = floating up opening (normally closed)</td>
<td></td>
</tr>
</tbody>
</table>

### Function and system design

#### Equipment architecture

A measuring system consists of a float switch LFL1-WS/WO and load switched in series.

### Auxiliary energy

| Supply voltage | 20 ... 264 V AC |
| Current consumption | 5 ... 200 mA |
| Voltage drop | approx. 8 V |
| No load current | 1.7 mA |
| Reverse polarity protection | yes |
| Short circuit protection | no |

## Operating conditions

### Mounting conditions

<table>
<thead>
<tr>
<th>Installation instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>range of application and minimum length between mounting and float:</td>
</tr>
<tr>
<td>PVC version: ≥ 50 mm (2 inches), preferred for water, waste water, slightly aggressive liquids</td>
</tr>
<tr>
<td>PUR version: ≥ 100 mm (4 inches), preferred for fuels, heating oils, oily fluids</td>
</tr>
<tr>
<td>CSM/CM version: ≥ 100 mm (4 inches), preferred for many acids and lyes</td>
</tr>
<tr>
<td>mounting:</td>
</tr>
<tr>
<td>the float switch is mounted either from sidewards through a cable gland G1A into the vessel or</td>
</tr>
<tr>
<td>by means of a counter weight or rods (e.g. float switch assembly) from the top</td>
</tr>
<tr>
<td>the pivot of the cable should always be horizontal.</td>
</tr>
</tbody>
</table>

### Ambient conditions

#### Protection class

DIN EN 60529, IP68

#### Process conditions

<table>
<thead>
<tr>
<th>Process temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC version: 5 ... 70 °C (278 ... 343 K)</td>
</tr>
<tr>
<td>PUR version: -20 ... +70 °C (253 ... 343 K)</td>
</tr>
<tr>
<td>CSM/CM version: -20 ... +70 °C (253 ... 343 K)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>sleeve design: ≤ 3 bar at 20 °C (293 K)</td>
</tr>
<tr>
<td>ball design: ≤ 2 bar at 20 °C (293 K)</td>
</tr>
</tbody>
</table>

#### Density

| sleeve design: 0.8 g/cm³ |
| ball design: 0.6 g/cm³ |

### Mechanical construction

#### Versions

| LFL1-CK-W*-PVC3 |
| LFL1-CK-W*-PUR3 |
| LFL1-CK-W*-CSM3 |
| LFL1-BK-W*-PVC3 |
| LFL1-BK-W*-PUR3 |
| LFL1-BK-W*-CSM3 |

#### Material

| float: PP (Polypropylene) |
| cable: |
| PVC version: PVC cable, highly flexible (2 x 0.75 mm²) |
| PUR version: PUR cable, highly flexible (2 x 0.50 mm²) |
| CSM/CM version: CSM/CM cable (chlorinated polyethylene, (2 x 0.75 mm²) |

#### Switch point

| switch angle: upper switching point +12°, lower switching point -12°, measured against the horizontal |

### General information

#### Directive conformity

<table>
<thead>
<tr>
<th>Directive 89/336/EC (EMC)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Directive 73/23/EC (Low Voltage Directive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 50178: 1997</td>
</tr>
</tbody>
</table>

#### 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 switch

### LFL1-WS/WO

#### Technical data

**Accessories**
- **Designation**
  - LFL-Z231, counter nut, G1A, PVC
  - LFL-Z232, counter weight, grey cast iron with plastic coating (Polycarbonate)
  - LFL-Z233, counter weight, grey cast iron with ECTFE coating (Halar)

- LFL-Z131, cable gland G1A, PVC
- LFL-Z132, cable gland G1A, brass
- LFL-Z431, cable gland 1 NPT, PVC
- LFL-Z432, cable gland 1 NPT, brass

#### Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>F</th>
<th>L</th>
<th>-</th>
<th>K</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Cable length**
  - 3 m (10 ft)
  - 5 m (16.5 ft)
  - 10 m (33 ft)

- **Cable material**
  - PVC
  - PVC cable
  - PUR
  - PUR cable
  - CSM
  - CSM cable

- **Electrical output**
  - WS: normally open 250 V AC
  - WO: normally closed 250 V AC

- **Switching element**
  - 1: initiator with operation ball

- **Float material**
  - K: plastic PP

- **Float form**
  - C: sleeve
  - B: ball

- **Diagram of float switch LFL1-WS/WO**
<table>
<thead>
<tr>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float switches</td>
</tr>
<tr>
<td>LFL1-WS/WO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Limit value immersion probes</th>
<th>Capacitive limit switches</th>
<th>Conductive limit switches</th>
<th>Vibration limit switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrostatic pressure sensors</td>
<td>Continuous immersion probes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date of issue 11/05/03 – Catalogue Field Devices 2004
Float switch

LFL2-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 operation ball in the float, which moves along an axis, activates the microswitch.

Features

- Switching element: microswitch
- Determination of limiting values for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

Electrical connection

Connection

<table>
<thead>
<tr>
<th>Cable colours</th>
<th>when potential-free</th>
</tr>
</thead>
<tbody>
<tr>
<td>black-brown</td>
<td>contact open</td>
</tr>
<tr>
<td>black-blue</td>
<td>contact closed</td>
</tr>
</tbody>
</table>

Dimensions

- Sleeve design LFL2-CK-U
- Ball design LFL2-BK-U

Hydraulic pressure sensors

Continuous immersion probes

Limit value immersion probes

Capacitive limit switches

Conductive limit switches

Vibration limit switches

Float switches
## Technical data

<table>
<thead>
<tr>
<th>LFL2-U</th>
<th>Float switch LFL2-U</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application</strong></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>switching element: microswitch with operation ball, change-over contact</td>
</tr>
<tr>
<td><strong>Auxiliary energy</strong></td>
<td></td>
</tr>
<tr>
<td>Electrical connection</td>
<td>this device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements</td>
</tr>
<tr>
<td>Connectable load</td>
<td>max. 250 V AC, 150 V DC, max. 3 (1) A</td>
</tr>
<tr>
<td><strong>Operating conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Installation instructions</td>
<td>range of application and minimum length between mounting and float:</td>
</tr>
<tr>
<td></td>
<td>• PVC version: ≥ 50 mm (2 inches), preferred for water, waste water, slightly aggressive liquids</td>
</tr>
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<td></td>
<td>• PUR version: ≥ 100 mm (4 inches), preferred for fuels, heating oils, oily fluids</td>
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<tr>
<td></td>
<td>• CSM/CM version: ≥ 100 mm (4 inches), preferred for many acids and lyes</td>
</tr>
<tr>
<td>Mounting conditions</td>
<td>mounting:</td>
</tr>
<tr>
<td></td>
<td>• the float switch is mounted either from sidewards through a cable gland ≤ G1A into the vessel or</td>
</tr>
<tr>
<td></td>
<td>• by means of a counter weight or rods (e.g. float switch assembly) from the top</td>
</tr>
<tr>
<td></td>
<td>• the pivot of the cable should always be horizontal.</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Protection class</td>
<td>DIN EN 60529, IP68</td>
</tr>
<tr>
<td>Process conditions</td>
<td></td>
</tr>
<tr>
<td>Process temperature</td>
<td>PVC version: 5 ... 70 °C (278 ... 343 K)</td>
</tr>
<tr>
<td></td>
<td>PUR version: 5 ... 70 °C (278 ... 343 K)</td>
</tr>
<tr>
<td></td>
<td>CSM/CM version: -20 ... +90 °C (253 ... 363 K)</td>
</tr>
<tr>
<td>Process pressure</td>
<td>sleeve design: ≤ 3 bar at 20 °C (293 K)</td>
</tr>
<tr>
<td></td>
<td>ball design: ≤ 2 bar at 20 °C (293 K)</td>
</tr>
<tr>
<td>Density</td>
<td>sleeve design: ≥ 0.8 g/cm³</td>
</tr>
<tr>
<td></td>
<td>ball design: ≥ 0.6 g/cm³</td>
</tr>
<tr>
<td><strong>Mechanical construction</strong></td>
<td></td>
</tr>
<tr>
<td>Versions</td>
<td>LFL2-CK-U-PVC3</td>
</tr>
<tr>
<td></td>
<td>LFL2-CK-U-PUR3</td>
</tr>
<tr>
<td></td>
<td>LFL2-CK-U-CSM3</td>
</tr>
<tr>
<td></td>
<td>LFL2-BK-U-PVC3</td>
</tr>
<tr>
<td></td>
<td>LFL2-BK-U-PUR3</td>
</tr>
<tr>
<td></td>
<td>LFL2-BK-U-CSM3</td>
</tr>
<tr>
<td>Material</td>
<td>float: PP (Polypropylene)</td>
</tr>
<tr>
<td></td>
<td>cable: PVC version: PVC cable, highly flexible (3 x 0.75 mm²)</td>
</tr>
<tr>
<td></td>
<td>PUR version: PUR cable, highly flexible (3 x 0.50 mm²)</td>
</tr>
<tr>
<td></td>
<td>CSM/CM version: CSM/CM cable (chlorinated polyethylene, (3 x 0.75 mm²)</td>
</tr>
<tr>
<td>Switch point</td>
<td>switch angle: upper switching point +25° (±10°), lower switching point -14° (±6°), measured against the horizontal</td>
</tr>
<tr>
<td><strong>General information</strong></td>
<td></td>
</tr>
<tr>
<td>Supplementary information</td>
<td>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>.</td>
</tr>
</tbody>
</table>
Float switch
LFL2-U

Technical data

Accessories

Designation

- 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-Z431, cable gland 1 NPT, PVC
- LFL-Z432, cable gland 1 NPT, brass

Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>F</th>
<th>L</th>
<th>2</th>
<th>-</th>
<th>K</th>
<th>-</th>
<th>U</th>
<th>-</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFL2</td>
<td>K</td>
<td>U</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Cable length
  - 3 m (10 ft)
  - 5 m (16.5 ft)
  - 10 m (33 ft)

- Cable material
  - PVC
  - PVC cable
  - PUR
  - PUR cable
  - CSM
  - CSM cable

- Electrical output
  - U: change-over contact 250 V AC, 150 V DC

- Float material
  - K: plastic PP

- Float form
  - C: sleeve
  - B: ball

- Switching element
  - 2: microswitch with operation ball
<table>
<thead>
<tr>
<th>Hydrostatic pressure sensors</th>
<th>Continuous immersion probes</th>
<th>Limit value immersion probes</th>
<th>Capacitive limit switches</th>
<th>Conductive limit switches</th>
<th>Vibration limit switches</th>
<th>Float switches</th>
</tr>
</thead>
</table>

**Float switch LFL2-U**

**Technical data**

- **Float switch**
- **LFL2-U**

**Vibration limit switches**

**Conductive limit switches**

**Continuous immersion probes**

**Limit value immersion probes**

**Hydrostatic pressure sensors**
Float switch

**Dimensions**

<table>
<thead>
<tr>
<th>135</th>
</tr>
</thead>
</table>

- **Sleeve design LFL3-CK-U**
- **Ball design LFL3-BK-U**

**Function**

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

**Features**

- Switching element: Hg
- Determination of limiting values for fluids
- Sleeve design: small diameter, mounting through G1 tap hole possible
- Ball design: high buoyancy

**Electrical connection**

<table>
<thead>
<tr>
<th>Connection</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable colours</td>
<td>when potential-free</td>
</tr>
<tr>
<td>black-brown</td>
<td>contact open</td>
</tr>
<tr>
<td>black-blue</td>
<td>contact closed</td>
</tr>
</tbody>
</table>

**LFL3-U**

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

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

- **Features**
  - Switching element: Hg
  - Determination of limiting values for fluids
  - Sleeve design: small diameter, mounting through G1 tap hole possible
  - Ball design: high buoyancy

- **Electrical connection**
  - Cable colours when potential-free
  - black-brown = contact open
  - black-blue = contact closed
## Technical data

### Float switch LFL3-U

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
<th>Auxiliary energy</th>
</tr>
</thead>
</table>

- **Description:** switching element: Hg, change-over contact

- **Auxiliary energy:** this device may be used with any sequential circuit, as long as the circuit can support the electrical circuit values of the switching elements

### Connectable load

- max. 250 V AC, 150 V DC, max. 4 A

### Operating conditions

#### Mounting conditions

- **Installation instructions:** range of application and minimum length between mounting and float:
  - PVC version: ≥ 50 mm (2 inches), preferred for water, waste water, slightly aggressive liquids
  - PUR version: ≥ 100 mm (4 inches), preferred for fuels, heating oils, oily fluids
  - CSM/CM version: ≥ 100 mm (4 inches), preferred for many acids and lyes

- **Mounting:** the float switch is mounted either from sidewards through a cable gland or 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.

#### Ambient conditions

- **Protection class:** DIN EN 60529, IP68

### Process conditions

#### 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

- sleeve design: ≤ 3 bar at 20 °C (293 K)
- ball design: ≤ 2 bar at 20 °C (293 K)

#### Density

- sleeve design: ≥ 0.8 g/cm³
- ball design: ≥ 0.6 g/cm³

### Mechanical construction

#### Versions

- LFL3-CK-U-PVC3
- LFL3-CK-U-PUR3
- LFL3-CK-U-CSM3
- LFL3-BK-U-PVC3
- LFL3-BK-U-PUR3
- LFL3-BK-U-CSM3

#### Materials

- **float:** PP (Polypropylene)
- **cable:**
  - PVC version: PVC cable, highly flexible (3 x 0,75 mm²)
  - PUR version: PUR cable, highly flexible (3 x 0.50 mm²)
  - CSM/CM version: CSM/CM cable (chlorinated polyethylene, 3 x 0.75 mm²)

#### Switch point

- switch angle: upper switching point +5°, lower switching point -5°, measured against the horizontal

### General information

#### Directive conformity


#### 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 switch
LFL3-U

Technical data

Accessories
Designation
- 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-Z431, cable gland 1 NPT, PVC
- LFL-Z432, cable gland 1 NPT, brass

Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>F</th>
<th>L</th>
<th>3</th>
<th>K</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Cable length
  - 3 3 m (10 ft)
  - 5 5 m (16.5 ft)
  - 10 10 m (33 ft)

- Cable material
  - PVC PVC cable
  - PUR PUR cable
  - CSM CSM cable

- Electrical output
  - U change-over contact 250 V AC, 150 V DC

- Float material
  - K plastic PP

- Float form
  - C sleeve
  - B ball

- Switching element
  - 3 mercury change-over contact with operation ball
### Technical data

<table>
<thead>
<tr>
<th>Float switch</th>
<th>LFL3-U</th>
</tr>
</thead>
</table>

#### Limit switches
- Conductive
- Capacitive
- Vibration

#### Immersion probes
- Continuous
- Limit value

#### Hydrostatic pressure sensors
**Float switch**

**Dimensions**

**LFLC**

- Fully adjustable float switch assembly for up to 5 float switches
- Position of the switch points adjustable by the customer
- Different types of float switches 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 previous datasheets.

---

![Diagram of LFLC assembly](image)
## Technical data

### Float switch LFLC

<table>
<thead>
<tr>
<th>Description</th>
<th>LFLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>switching element</td>
</tr>
</tbody>
</table>

### Auxiliary energy

#### 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

#### Connectable load
- LFL1: 8 V, to EN 60947-5-6 (NAMUR)
- LFL2: max. 250 V AC, max. 3 (1) A
- LFL3: max. 250 V AC, 150 V DC, max. 4 A

### Operating conditions

#### Mounting conditions
- 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)

#### Range of application and minimum length of the cable between mounting and float
- PVC version: /g179 50 mm (2 inches), preferred for water, waste water, slightly aggressive liquids
- PUR version: /g179 100 mm (4 inches), preferred for fuels, heating oils, oily fluids
- CSM / CM version: /g179 100 mm (4 inches), preferred for many acids and lyes

### Ambient conditions

#### Protection class
- DIN EN 60529, IP68

#### Process conditions
- **Process temperature**: -10 ... +70 °C (263 ... 343 K), depending on the used cable
- **Process pressure**: ≤ 1 bar at 20 °C (293 K)

### Mechanical construction

#### Version
- sleeve

#### Dimensions
- guide tube: Ø16 mm, L_max = 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

### General information

#### Directive conformity
- Directive 94/9/EC (ATEX)
- Directive 73/23/EC (Low Voltage Directive)

#### 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.

### Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>F</th>
<th>L</th>
<th>C</th>
<th>-</th>
<th>C</th>
<th>K</th>
<th>-</th>
<th>I</th>
</tr>
</thead>
</table>

#### Terminal box
- A type A with 15 terminals
- B type B with 6 terminals

#### Cable material
- PVC: PVC cable
- PUR: PUR cable
- CSM: CSM cable

#### Number of switches
- 1 switch, float sleeve
- 2 switches, float sleeve
- 3 switches, float sleeve
- 4 switches, float sleeve
- 5 switches, float sleeve

#### Float switch type (switching element)
- 1: initiator, float sleeve, NAMUR output, normally open
- 2: microswitch, float sleeve, 250 V AC, change-over contact
- 3: mercury change-over contact, float sleeve, 250 V AC, 150 V DC, change-over contact
- 4: float sleeve initiator, 24 V DC, normally open (20)
- 5: float sleeve initiator, 24 V DC, normally closed (21)
- 6: float sleeve initiator, 230 V AC, normally open (change-over normally open)
- 7: float sleeve, initiator, 230 V AC, normally open (WO)
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 LVL-**

Product group LVL-M**
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 LVL-A1

Contents

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<th>Page</th>
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<tr>
<td>Vibration limit switch LVL-T1</td>
<td>48</td>
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<tr>
<td>Vibration limit switch LVL-S1</td>
<td>52</td>
</tr>
<tr>
<td>Vibration limit switch LVL-M</td>
<td>56</td>
</tr>
<tr>
<td>Vibration limit switch LVL-MH, hygienic version</td>
<td>66</td>
</tr>
<tr>
<td>Vibration limit switch LVL-M2C, with coating</td>
<td>76</td>
</tr>
</tbody>
</table>
Vibration limit switch

Vibracon LVL-A

Features
- Process temperature up to 100 °C (373 K) (LVL-A1) or up to 150 °C (423 K) (LVL-A5)
- Operational safety, reliability and universal applicability through use of the vibrating fork measuring principle
- Function test with testing magnet under built-in condition
- Function control using external LED display
- Small, slender design allows low space requirement and easy mounting in places with limited access
- Rugged stainless steel housing, allows use in rough ambient conditions
- Low-cost plug connection

Function
The Vibracon Mini 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, hygiene areas and areas where the liquid temperature is over 100 °C (373 K) (LVL-A1) or over 150 °C (423 K) (LVL-A5).

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

Dimensions

<table>
<thead>
<tr>
<th></th>
<th>LVL-A5-V1</th>
<th>LVL-A1-V1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø</td>
<td>31.5 mm</td>
<td>17.1 mm</td>
</tr>
<tr>
<td>Ø</td>
<td>35 mm</td>
<td>26.2 mm</td>
</tr>
<tr>
<td>Ø</td>
<td>35 mm</td>
<td>30 mm</td>
</tr>
</tbody>
</table>

* Switch point for vertical installation
** Switch point for horizontal installation
Switch point at density 0.7 g/cm³, 23 °C (296 K), 0 bar

Operating mode MAX (NC contact)

Operating mode MIN (NO contact)
Technical data

Vibration limit switch
Vibracon LVL-A

Application

Function principle
as in the case of a vibration fork the fork of the LVL-A is excited to its resonance frequency, this frequency
changes when the fork is submerged in liquid
the built-in electronics monitor the resonance frequency and indicate whether the vibrating fork is oscillating
freely or whether fluid is covering the vibration fork

Output characteristics

Fail-safe mode
minimum-maximum-closed circuit safety
the LVL-A can be connected in two operating modes, depending on the operating mode selected (MAX or
MIN safety), the LVL-A 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 LVL-A 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 LVL-A 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

Switching time
approx. 0.5 s when covering the vibration fork
approx. 1.0 s when uncovering the vibration fork

Auxiliary energy

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
output B3: 26.5 ... 31.9 V DC (AS-i)
output E5: 10 ... 35 V DC with safety extra-low voltage
output WA: 19 ... 253 V AC, 50/60 Hz

Current consumption
output B3: 25 mA
output E5: 15 mA
output WA: 3.8 mA

Connectable load
output B3: to EN 50295 and IEC 62026-2
output E5: max. 250 mA (overload proof)
output WA: max. 250 mA (automatical load verification on connection)

Performance characteristics

Hysteresis
approx. 3 mm (0.12 inches) for vertical mounting
approx. 2 mm (0.08 inches) for horizontal mounting

Operating conditions

Mounting conditions
Mounting position
any position

Installation instructions
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.

Ambient conditions

Ambient temperature
outputs E5, WA: -40 ... +70 °C (233 ... 343 K)
output B3: -25 ... +70 °C (248 ... 343 K)

Storage temperature
-40 ... +85 °C (233 ... 358 K)

Climatic temperature
climatic protection to IEC 68, part 2-38, fig. 2a

Protection class
electrical connection V1: DIN EN 60529, IP65
electrical connection P*: DIN EN 60529, IP65/IP67
# Vibration limit switch
## Vibracon LVL-A

### Technical data

<table>
<thead>
<tr>
<th>Process conditions</th>
<th>Vibracon LVL-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process temperature</td>
<td>at ambient temperature ≤ 50 °C (323 K): -40 ... +100 °C (233 ... 373 K) (LVL-A1), -40 ... +150 °C (233 ... 423 K) (LVL-A5)</td>
</tr>
<tr>
<td>Process pressure</td>
<td>-1 ... +40 bar</td>
</tr>
<tr>
<td>Density</td>
<td>min. 0.7 g/cm³</td>
</tr>
<tr>
<td>Viscosity</td>
<td>max. 10000 mm²/s (10000 cSt)</td>
</tr>
</tbody>
</table>

### Mechanical construction

| Dimensions          | LVL-A1-V1: diameter 31.5 mm (1.24 inches), length 148.5 mm (5.8 inches)  
|---------------------| LVL-A1-P*: diameter 40 mm (1.57 inches), length 160 mm (6.3 inches)  
|                     | LVL-A5-V1: diameter 31.5 mm (1.24 inches), length 173 mm (6.8 inches)  
|                     | LVL-A5-P*: diameter 40 mm (1.57 inches), length 184.5 mm (7.3 inches)  
| Weight              | approx. 400 g |
| Material            | vibration fork, process connection and housing: 1.4435 (AISI 316L), connection: PSU |
| Process connection  | LVL-A1: thread G½, G¾, ½ NPT, ¾ NPT, R½, R¾  
|                     | LVL-A5: thread G1 |
| Connection          | electrical connection V1: pinning according to DIN EN 50044  
|                     | electrical connection P*: valve plug, cross section max. 1.5 mm² (AWG 16), diameter 6 ... 9 mm (0.24 ... 0.35 inches)  
|                     | electrical connection PS: QUICKON valve plug, cross section 0.34 ... 0.75 mm², diameter 3.5 ... 6.5 mm (0.14 ... 0.26 inches) |

### Indication and operation

| Display elements | the LED display is on the connection side of the LVL-A1  
|                  | green light: indication of ready to operate  
|                  | red light: fault indication, mode indication (E5, WA)  
|                  | yellow light: mode indication (B3) |
| Programming      | AS-i profile: S-1.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 |

### Certificates and approvals

| 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 |
| Oversight protection | Z-65.11-314 (overspill protection WHG)  
|                     | Z-65.40-315 (leak detection system) |
| Other approvals   | CSA certificate in preparation  
|                     | Certificate for AS-i version in preparation |

### General information

| Directive conformity | 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) and NAMUR EMC recommendation (NE 21) output B3: EN 50295 |
|                      | Directive 73/23/EC (Low Voltage Directive)  
|                      | output WA: EN 50178 |
| 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. |

### Accessories

| Designation | LVL-Z65, socket wrench AF32  
|            | 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 |
Technical data

Vibration limit switch
Vibracon LVL-A

Electrical connection

- Output B3 (AS-i) (only with V1 connector M12 x 1 available)
  Two-wire connection for separate switching unit

  AS-interface +
  1: BN
  3: BU

  AS-interface -

Programming instruction

AS-i-Profile: S-1.A.E

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

<table>
<thead>
<tr>
<th>D0:1 Sensor covered</th>
<th>D1:1 State = OK</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0:0 Sensor free</td>
<td>D1:0 State = error</td>
</tr>
<tr>
<td>D2 and D3 are not used.</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Operating mode MAX (NC contact)</th>
<th>Operating mode MIN (NO contact)</th>
<th>Valve plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: BN</td>
<td>1: BN</td>
<td>1: BN</td>
</tr>
<tr>
<td>2: WT</td>
<td>2: BU</td>
<td>2: BK</td>
</tr>
<tr>
<td>3: BU</td>
<td>3: BK</td>
<td>3: BK</td>
</tr>
<tr>
<td>0.5 A</td>
<td>0.5 A</td>
<td>0.5 A</td>
</tr>
<tr>
<td>(Ground)</td>
<td>(Ground)</td>
<td>(Ground)</td>
</tr>
<tr>
<td>1: BN</td>
<td>1: BN</td>
<td>1: BN</td>
</tr>
<tr>
<td>2: BT</td>
<td>2: BK</td>
<td>2: BK</td>
</tr>
<tr>
<td>3: BK</td>
<td>3: BK</td>
<td>3: BK</td>
</tr>
<tr>
<td>0.5 A</td>
<td>0.5 A</td>
<td>0.5 A</td>
</tr>
<tr>
<td>(Ground)</td>
<td>(Ground)</td>
<td>(Ground)</td>
</tr>
</tbody>
</table>

Valve plug

<table>
<thead>
<tr>
<th>Operating mode MAX</th>
<th>Operating mode MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

- Output WA
  Two-wire AC connection

Valve plug

<table>
<thead>
<tr>
<th>Operating mode MAX</th>
<th>Operating mode MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>0.5 A</td>
<td>0.5 A</td>
</tr>
<tr>
<td>(Ground)</td>
<td>(Ground)</td>
</tr>
<tr>
<td>&gt; 19 V</td>
<td>&gt; 19 V</td>
</tr>
</tbody>
</table>
Vibration limit switch
Vibracon LVL-A

Technical data

Type code/model number

<table>
<thead>
<tr>
<th>LVL-A</th>
<th>S-</th>
</tr>
</thead>
</table>

Approvals
WH  overspill protection WHG
CG  CSA general purpose

Electrical connection
V1  connector V1, M12 x 1
PG  valve plug PG11
PN  valve plug ½ NPT
PS  valve plug with QUICKON connection

Electrical output
WA  AC, 2-wire
E5  DC, PNP 3-wire
B3  AS-i bus

Fork surface
S  standard surface, Ra < 3.2 μm

Process connection
G1  thread G½
G2  thread G¾
G3  thread G1
N1  thread ½ NPT
N2  thread ¾ NPT
R1  thread R½ DIN 2999
R2  thread R¾ DIN 2999

Process temperature
1  up to 100 °C (373 K)
5  up to 150 °C (423 K)
<table>
<thead>
<tr>
<th>Technical data</th>
<th>Vibration limit switch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vibracon LVL-A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Float switches</th>
<th>Conductive limit switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration limit switches</td>
<td></td>
</tr>
<tr>
<td>Capactive limit switches</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Limit value immersion probes</th>
<th>Continuous immersion probes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrostatic pressure sensors</td>
<td></td>
</tr>
</tbody>
</table>
Vibration limit switch

Vibracon LVL-T1

**Dimensions**

| A) PG11 cable gland (IP65/IP67) |
| B) Test magnet |
| C) G1A (cylindrical), 1 NPT (conical), R1 (conical), made of corrosion resistant steel |
| D) Vibration fork made of heavy duty corrosion resistant steel |
| E) Green light-emitting diode “ready to operate” |
| F) Red light-emitting diode for switch indicator “circuit cut off” |
| G) The connector housing can be mounted at a 90° angle. |

**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.

**Features**

- Vibration limit switch for liquids
- Level limit switch for application in storage tank, stirring container and pipeline with liquids
- Due to its compact construction, it can be directly connected to a miniature contactor, magnet operated valve or programmable logic control (PLC)
- Small, slender design allows low space requirement and easy mounting in places with limited access
- Rugged stainless steel housing, allows use in rough ambient conditions
- Function test with testing magnet under built-in condition
- Function control with outside indication of the switching state and external testing
- Low-cost plug connection

**Electrical connection**

**Connection output WA**

Maximum fail-safe mode

<table>
<thead>
<tr>
<th>1</th>
<th>1 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
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</tr>
<tr>
<td>3</td>
<td></td>
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<tr>
<td>4</td>
<td></td>
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</table>

Minimum fail-safe mode

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>N</td>
</tr>
<tr>
<td>3</td>
<td>PE</td>
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</tbody>
</table>

**Connection output E5**

Maximum

<table>
<thead>
<tr>
<th>1</th>
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</tr>
</thead>
<tbody>
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<td>2</td>
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</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PE</td>
</tr>
</tbody>
</table>

Minimum

<table>
<thead>
<tr>
<th>1</th>
<th>0.5 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>L-</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PE</td>
</tr>
</tbody>
</table>
### Technical data

#### Vibracon LVL-T1

**Application**

- **Description**: level limit switch for application in storage tank, stirring container and pipeline with liquids.

**Output characteristics**

- **Signal on alarm**: output blocked.
- **Fail-safe mode**: minimum or maximum fail-safe mode, determined by the way of connection.
- **Switching time**: approx. 0.5 s when covering, approx. 1.0 s when uncovering the vibration fork.
- **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)  
  - voltage drop via LVL-T1 max. 12 V  
  - 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)

**Auxiliary energy**

- **Electrical connection**:
  - output WA: always connect the Vibracon in series with a load! Take into account the voltage drop via the Vibracon 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 Vibracon does not fall below the permissible value.
  - output E5: should be used in conjunction with programmable logic controllers (PLC), positive signal on the Vibracon 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

**Reverse polarity protection**

- yes

**Performance characteristics**

- **Hysteresis**: approx. 4 mm with vertical mounting.

**Operating conditions**

- **Mounting conditions**
  - **Mounting position**: any position.

**Installation instructions**

- 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.

**Ambient conditions**

- **Ambient temperature**: -40 ... +70 °C (233 ... 343 K)
- **Storage temperature**: -40 ... +85 °C (233 ... 358 K)
- **Climatic class**: climatic protection in acc. with IEC 68, part 2-38, fig. 2a
- **Protection class**: to EN 60529 IP65/IP67 with connector (cable gland PG11)

**Process conditions**

- **Medium temperature**: -40 ... +150 °C (233 ... 423 K)
- **Process pressure**: -1 ... +40 bar
- **Density**: min. 0.7 g/cm³
- **Viscosity**: up to 10000 mm²/s

---

![Diagram](https://via.placeholder.com/150)
Vibration limit switch  
Vibracon LVL-T1

**Technical data**

**Mechanical construction**
- **Design**: compact version, installation with socket spanner or box spanner SW 41
- **Versions**:
  - LVL-T1-G3S-ESP-NA, process connection G1, 1.4571, 10 ... 55 V DC, PNP 3-wire, connector PG11
  - LVL-T1-G3S-ESP-WH, process connection G1, 1.4571, 10 ... 55 V DC, PNP 3-wire, connector PG11, overspill protection WHG
  - LVL-T1-G3S-WAP-Wh, process connection G1, 1.4571, 19 ... 253 V AC, 3-wire, connector PG11, overspill protection WHG
- All above-mentioned versions are also available with thread 1 NPT

**Dimensions**
- See dimension graph

**Weight**
- Approx. 450 g

**Material**
- Process connection and vibration fork: stainless steel 1.4571, 1.4581
- Housing: stainless steel 1.4404, 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

**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 accordance with DIN 2999 Part 1

**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 inches), max. conductor cross section 1.5 mm²

**Certificates and approvals**
- Overspill protection: Z-65.11-302 (overspill protection WHG)

**General information**
- 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) and NAMUR EMC recommendation (NE 21)

- 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.

**Accessories**
- **Designation**:
  - LVL-Z15, test magnet
  - LVL-Z64, socket spanner

- **Sealing** Ø60 x 27 G1

- **Welding bushing** LVL-Z71
  - LVL-Z71, welding bushing for vessels G1, viton sealing
Technical data

Vibration limit switch
Vibracon LVL-T1

Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>V</th>
<th>L</th>
<th>–</th>
<th>T</th>
<th>1</th>
<th>–</th>
<th>S</th>
<th>–</th>
<th>–</th>
<th>–</th>
</tr>
</thead>
</table>

Approvals
- NA: no approval
- WH: overspill protection WHG
- CG: CSA general purpose

Electrical connection
- PG: PG11 connector, ISO 4400, IP65/IP67
- PN: connector 1/2 NPT, ISO 4400, IP65

Electrical output
- WA: 19 V AC ... 253 V AC, 2-wire
- ES: 10 V DC ... 55 V DC, PNP 3-wire

Fork surface
- S: standard surface, Ra < 3.2 \( \mu \)m

Process connection
- G3: thread G1 BSP 1.4571
- N3: thread 1 NPT, 1.4571
- R3: thread R 1 BSP 1.4571, DIN 2999
Vibration limit switch

Vibracon LVL-S1

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.

Features

- Limit switch for liquids in storage tanks, agitators and piping where especially high standards in hygiene are demanded both internally and externally
- 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, allows use in rough ambient conditions
- Function test with testing magnet under built-in condition
- Function control with outside indication of the switching state and external testing

Electrical connection

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"

Maximum fail-safe mode

Minimum fail-safe mode

R = external load, e.g. PLC or miniature contactor

Electrical connection depends on the protective circuit

No protective grounding connection, protection against indirect contact in accordance with EN 60204-1 or EN 61010-1

Viewed from the pin of the plug connector.
## Technical data

### Vibracon LVL-S1

#### Application
**Description**
level limit switch for application in storage tank, stirring container and pipeline with liquids

#### Output characteristics
**Signal on alarm**
output blocked

**Fail-safe mode**
minimum or maximum fail-safe mode, determined by the way of connection

**Switching time**
approx. 0.5 s when covering, approx. 1.0 s when uncovering the vibration fork

**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 \( \mu \text{F} \) at 55 V, max. 1.0 \( \mu \text{F} \) at 24 V
  - residual voltage < 3 V (with closed transistor)
  - residual current < 100 \( \mu \text{A} \) (with open transistor)

#### Auxiliary energy
**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**
10 ... 55 V DC

**Current consumption**
max. 15 mA

**Residual ripple**
max. 1.7 V, 0 ... 400 Hz

**Reverse polarity protection**
yes

#### Performance characteristics
**Hysteresis**
approx. 4 mm (0.16 inches) with vertical mounting

#### Operating conditions
**Mounting conditions**
any position

**Mounting position**

**Installation instructions**
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

#### Ambient conditions
**Ambient temperature**
-40 ... +70 °C (233 ... 343 K)

**Storage temperature**
-40 ... +85 °C (233 ... 358 K)

**Climatic class**
climatic protection to IEC 68, part 2-38, fig. 2a

**Protection class**
to EN 60529 IP66/IP68 (24 h, 1.5 m), when using the correct connector

#### Process conditions
**Medium temperature**
-40 ... +150 °C (233 ... 423 K)

**Process pressure**
-1 ... +40 bar

**Density**
min. 0.7 g/cm³

**Viscosity**
to 10000 mm²/s

#### Mechanical construction
**Design**
compact version

**Versions**
compact version LVL-S1
- LVL-S1-G3S-E5V1-NA, process connection G1, 1.14571, standard fork surface, \( \text{Ra} < 3.2 \mu \text{m} \), 10 ... 55 V DC, PNP, 3-wire, V1-connector
- LVL-S1-G3O-E5V1-NA, polished fork surface, \( \text{Ra} < 1.5 \mu \text{m} \)
- LVL-S1-T5O-E5V1-NA, process connection Triclamp 1½", polished fork surface, \( \text{Ra} < 1.5 \mu \text{m} \)
  all above-mentioned products are also available with thread 1 NPT

**Dimensions**
see dimension graph and process connections

**Weight**
approx. 500 g

**Material**
process connection and vibration fork: stainless steel 1.4571
- housing: stainless steel 1.4404, welded
- plug connector: stainless steel 1.4571
- viewing windows for LEDs: glass

---

[Diagram of Vibracon LVL-S1]

Switching point depending on the installation direction at density 0.7 g/cm³
Vibration limit switch
Vibracon LVL-S1

**Technical data**

**Process connection**
- conical thread 1 NPT in acc. with ANSI B 1.20.1
- cylindrical thread G1A in acc. with DIN ISO 228/I with flat seal 33 x 39 in acc. with DIN 7603
- flush mounted version for welding adapter in acc. with company standard

---

**Connection**
- plug connector M12 x 1, 4-pin (without protective earthing connection)

**General information**

**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) and NAMUR EMC recommendation (NE 21)

**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.

**Accessories**

**Designation**
- LVL-Z15, test magnet
- LVL-Z71, welding bushing for vessels G1, Viton sealing
- 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

**Process connection flush mounted**
- Triclamp 1½", 2" acc. to ISO 2852
- dairy coupling DN 50 in acc. with DIN 11851

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
Vibration limit switch
Vibracon LVL-S1

Type code/model number

<table>
<thead>
<tr>
<th>LVL-S1-E5V1-NA</th>
</tr>
</thead>
</table>

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, Ra < 3.2 μm
O polished version, Ra < 1.5 μm
G high-polished version, Ra < 0.5 μm

Process connection
S1 flush mounted for welding sleeve, 1.4571
G3 thread G1 BSP, 1.4571
M7 DN50 sanitary coupling DIN 1185, 1.4571
T6 Triclamp 2" ISO 2852, 1.4571
T5 Triclamp 1½" ISO 2852, 1.4571
Vibration limit switch

Vibracon LVL-M

Features
- Large selection of process connections: universal use
- Small dimensions of the vibrating fork and process connections ¾"; for areas with difficult access
- Wide variety of electronic modules (e.g. NAMUR, relay, thyristor signal output): 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
- Usable up to SIL 2 acc. to IEC 61508

Function
The Vibracon is a level limit switch for use in all liquids.
- with a temperature between -40 °C (233 K) and +150 °C (423 K)
- with a pressure up to 64 bar
- with a viscosity up to 10000 mm²/s
- with a density up to 0.5 g/cm³.
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.
Compact version, ideal for mounting in pipes (LVL-M1).
With extension tube up to 3 m (10 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.
Instruments with protection EEx ia and EEx d are available for use in explosion hazardous areas.

Electrical connection
Example: connection FEL 52 (E5) 3-wire DC connection
Other connection types see section electrical connection.

3-wire DC connection
Preferably for use with memory programmable controls (PLC).
Positive signal at the switch output of the electronics (PNP).
Output blocked on reaching limit level.

Layout of the connections M12 x 1 connector

Dimensions

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

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

Length L see process connections
Technical data

Vibracon LVL-M

**Application**

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

**Function and system design**

Measuring principle
the forks of the sensor vibrate at their intrinsic frequency, this frequency is reduced when covered with liquid the change in frequency then activates the limit switch

**Input characteristics**

Measured variable
limit level (limit value)
Measurement range
LVL-M1: specified by mounting point.
LVL-M2: specified by length of the sensor with extension tube (max. 3000 mm/115 inches)
Medium density
adjustment on the electronic insert > 0.5 g/cm³ or > 0.7 g/cm³

**Output characteristics**

Fail-safe mode
switchable minimum/maximum closed circuit safety on the electronic insert
  - Max. = maximum fail-safe mode
    - The relay is de-energised when the probe is covered or the power supply fails.
    - application e.g. for overspill protection
  - Min. = minimum fail-safe mode
    - The relay is de-energised when the probe is free or the power supply fails.
    - application e.g. for dry-run protection

Switching time
approx. 0.5 s when covering the vibration fork
approx. 1.0 s when uncovering the vibration fork
additionally settable 0.5 ... 60 s (electronic insert FEL 50 A (PA))

Power up response
when switching on the power supply the output assumes the alarm signal after max. 2 s it assumes the correct switching mode

**Auxiliary energy**

Supply voltage
- electronic insert FEL 51 (AC): 253 V AC, 50/60 Hz
- electronic insert FEL 52 (ES): 10 ... 55 V DC, with M12 x 1 connector max. 35 V DC
- electronic insert 54 (WA): 19 ... 253 V AC, 50/60 Hz or 19 ... 55 V DC
- electronic insert FEL 55 (SI): 11 ... 36 V DC, PLC
- electronic inserts FEL 56 (N1), FEL 58 (N2): isolating amplifier according to IEC 60947-5-6 (NAMUR)

Power consumption
- electronic insert FEL 52 (ES): max. 0.83 W
- electronic insert FEL 54 (WA): max. 1.3 W
- electronic insert FEL 55 (SI): max. 0.83 W
- electrical inserts FEL 56 (N1), FEL 58 (N2): max. 1.3 W

Current consumption
- electronic insert FEL 52 (ES): max. 15 mA, with M12 x 1 connector max. 350 mA
- electronic insert FEL 54 (WA): max. 150 mA
- cable connection: cross section max. 2.5 mm², lace in end splice in accordance with DIN 46228 ground lead in housing: cross section max. 2.5 mm²
- external equipotential bonding: cross section max. 4 mm²

**Operating conditions**

Mounting conditions
Mounting position
LVL-M1: any position
LVL-M2: with short pipe (up to 500 mm/20 inches) any position, with long pipe, vertical
Ambient conditions
Ambient temperature
-40 ... +70 °C (233 ... 343 K)
permissible ambient temperature T₁ at the housing depends on the product temperature T₂ in the vessel:

* additional temperature range for sensors with a temperature separator or pressure-tight bushing (length 140 mm (5.5 inches))

Temperature difference between the flange surface on the process side and the ambient side (T₂ – T₁): max. 60 °C (333 K), flange also to be insulated as required

Ambient temperature limit
-50 ... +70 °C (223 ... 343 K), function with reduced data values
Storage temperature
-50 ... +80 °C (223 ... 353 K)
Climatic class
climatic protection to IEC 68, part 2-38, fig. 2a
Protection class
DIN EN 60529, IP66/67
Vibration resistance
to IEC 68, part 2-6 (10 ... 55 Hz, 0.15 mm, 100 cycles)
### Vibration limit switch

**Vibracon LVL-M**

#### Technical data

<table>
<thead>
<tr>
<th>Process conditions</th>
<th>Vibracon LVL-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium temperature</td>
<td>-40 ... +150 °C (233 ... 423 K), for exceptions see process connections</td>
</tr>
<tr>
<td>Medium pressure</td>
<td>-1 ... +64 bar, over the entire temperature range, for exceptions see process connections</td>
</tr>
<tr>
<td>Process pressure limits</td>
<td>bursting pressure of membrane 200 bar</td>
</tr>
<tr>
<td>Thermal shock resistance</td>
<td>max. 120 °C/s (max. 120 K/s)</td>
</tr>
<tr>
<td>State of aggregation</td>
<td>liquid</td>
</tr>
<tr>
<td>Density</td>
<td>min. 0.5 g/cm³</td>
</tr>
<tr>
<td>Viscosity</td>
<td>max. 10000 mm²/s (max. 10000 cSt)</td>
</tr>
<tr>
<td>Bulk solids content</td>
<td>max. Ø5 mm (max. Ø0.2 inches)</td>
</tr>
</tbody>
</table>

#### Mechanical construction

<table>
<thead>
<tr>
<th>Design</th>
<th>LVL-M1: compact design</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LVL-M2: design with extension tube</td>
</tr>
</tbody>
</table>

| Dimensions | housing: diameter max. 85 mm (3.3 inches), height max. 173 mm (6.8 inches), example |
|------------|---------------------------------------------------------------------------------
|            | temperature spacer, pressure-tight bushing: additional length 140 mm (5.5 inches) |
|            | process connection: length 66.5 ... 80 mm (2.6 ... 3.15 inches) |

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#### Vibration limit switches

#### Conductive limit switches

#### Capacitive limit switches

#### Limit value immersion probes

#### Continuous immersion probes

#### Hydrostatic pressure sensors
Technical data

**Vibracon LVL-M**

extension tube: any length L from 148 ... 3000 mm (6 ... 115 inches), up to 6000 mm (236 inches) on request, depending on the process connection

extension tube: special length L II, with vertical mounting from above the same switchpoint as for the Vibracon LVL1, LVL2

vibration fork: width 17.5 mm (0.7 inches), fork width 10 mm (0.4 inches), max. length 40.7 mm (1.6 inches)

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**Weight**

600 g, basic weight: includes compact sensor, electronic insert, plastic housing, process connection G¾A

additional weight dependent on extension tube, housing type and process connection

---

**Material**

- polyester housing: PBT-FR with cover in PBT-FR or with transparent cover in PA12, seal of cover: EPDM
- steel housing: 1.4435 (AISI 316L), seal of cover silicone
- aluminium housing: EN-AC-AlSi10Mg, plastic coated, seal of cover: EPDM
- cable gland: polyamide or brass, nickel-plated
- temperature spacer: 1.4435 (AISI 316L)
- pressure-tight bushing: 1.4435 (AISI 316L)
- wetted parts:
  - process connections and extension tube: 1.4435 (AISI 316L) or 2.4610 (Alloy C4)
  - vibration fork: 1.4435 (AISI 316L) or 2.4610 (Alloy C4)
  - flat seal for process connections G2° or G3°: elastomer, asbestos free

---

**Process connections**

see type code

**Switch point**

switch points on the sensor depend on the mounting location, with reference to water, density 1 g/cm², 23 °C (296 K), p0 0 bar.

---

**Note:**

The switch points of the Vibracon LVL-M1, LVL-M2 are at other positions to those of the previous version LVL1, LVL2.
## Vibration Limit Switch
### Vibracon LVL-M

#### Indication and Operation

<table>
<thead>
<tr>
<th>Display elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>electronic insert FEL 50 A (PA):</td>
</tr>
<tr>
<td>green LED to display standby, pulsing to display communication</td>
</tr>
<tr>
<td>yellow LED to display switching state, flashing on corrosion damage to sensor or for defective electronics</td>
</tr>
<tr>
<td>electronic inserts FEL 51 (AC), FEL 52 (E5), FEL 54 (WA), FEL 55 (SI):</td>
</tr>
<tr>
<td>green standby LED</td>
</tr>
<tr>
<td>red LED for switch state indication is flashing in case of corrosion failure on the sensor or in case of electronic error</td>
</tr>
<tr>
<td>electronic insert FEL 56 (N1):</td>
</tr>
<tr>
<td>green standby LED flashes</td>
</tr>
<tr>
<td>red LED for switch state indication is flashing in case of corrosion failure on the sensor or in case of electronic error</td>
</tr>
<tr>
<td>electronic insert FEL 58 (N2):</td>
</tr>
<tr>
<td>green standby LED flashes quickly</td>
</tr>
<tr>
<td>green standby LED is slowly flashing in case of corrosion failure on the sensor or in case of electronic error</td>
</tr>
<tr>
<td>yellow LED for switch state indication</td>
</tr>
<tr>
<td>test button interrupts lead</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>electronic insert FEL 50 A (PA): 8 switches for device address setting</td>
</tr>
<tr>
<td>electronic inserts FEL 51 (AC), FEL 52 (E5), FEL 54 (WA), FEL 55 (SI), FEL 56 (N1), FEL 58 (N2): two switches for fail-safe mode and density change</td>
</tr>
</tbody>
</table>

#### Certificates and Approvals

<table>
<thead>
<tr>
<th>Ex approval</th>
<th>see type code</th>
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</thead>
<tbody>
<tr>
<td>Type of protection</td>
<td>see type code</td>
</tr>
<tr>
<td>Overspill protection</td>
<td>Z-65.11-306 (overspill protection WHG)</td>
</tr>
</tbody>
</table>

#### General Information

**Directive conformity**
- Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment
- Interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)
- Directive 94/9/EC (ATEX)
- Directive 73/23/EC (Low Voltage Directive)

**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.

#### Accessories

<table>
<thead>
<tr>
<th>Designation</th>
</tr>
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<tbody>
<tr>
<td>LVL-Z100, welding sleeve G4</td>
</tr>
<tr>
<td>LVL-Z101, welding sleeve G1, flush mounted</td>
</tr>
<tr>
<td>LVL-Z120, sliding sleeve for unpressurised operation G1A</td>
</tr>
<tr>
<td>LVL-Z121, sliding sleeve for unpressurised operation G1½A</td>
</tr>
<tr>
<td>LVL-Z124, high pressure sliding sleeve G1A</td>
</tr>
<tr>
<td>LVL-Z126, high pressure sliding sleeve G1½A</td>
</tr>
<tr>
<td>V1-G, mating connector, straight</td>
</tr>
<tr>
<td>V1-W, mating connector, 90° angled</td>
</tr>
</tbody>
</table>

#### Approval Standards

| KEMA 01 ATEX 2117, II 1/2 G EEx d IIC/IIB T3 ... T6 |
| KEMA 01 ATEX 1089, II 1/2 G (1/2 D T80°C) EEx ia/ib IIC/IIB T3 ... T6 |
| KEMA 01 ATEX 1147 X, II 1 G EEx ia IIC/IIB T3 ... T6 |
| EN 61326-1, EN 61010-1, EN 605284, EN 605024, IEC 60079-14 |
| EN 61326-1, EN 61010-1, EN 605024, EN 50281-1-1 |
| EN 61326-1, EN 61010-1, EN 605024, EN 50281-1-1 |
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| EN 61326-1, EN 61010-1, EN 605024, EN 50281-1-1 |

**Subject to reasonable modifications due to technical advances.**

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**Technical data**

**Vibration limit switch**

**Vibracon LVL-M**

**Electrical connection**

- **Electronic insert FEL50 A (PA)**
  - 2-wire connection to PROFIBUS PA for power supply and data transmission
  - 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, switch-off time, measured value status, and density switch.
    - Security locking of matrix possible.
    - Selection of WHG mode is possible (WHG approval).

- **Electronic insert FEL51 (AC)**
  - 2-wire AC connection
  - Always connect in series with the load!
  - Check the following:
    - the residual current in blocked state (up to 3.8 mA).
    - that for low voltage the voltage across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not too low.
    - the voltage drop across the electronic insert when open is observed (up to 12 V).
    - that a relay cannot de-energise with a retaining current below 3.8 mA
      - If this is the case, a resistor should be connected parallel to the relay.

- **Electronic insert FEL52 (E5)**
  - 3-wire DC connection
  - Preferably for use with memory programmable controls (PLC).
  - Positive signal at the switch output of the electronics (PNP).
  - Output blocked on reaching limit level.

**Float switches**

**Conductive limit switches**

**Capacitive limit switches**

**Limit value immersion probes**

**Continuous immersion probes**

**Hydrostatic pressure sensors**
### Electrical connection

#### • Electronic insert FEL54 (WA)

- AC/DC connection with relay output
- Auxiliary energy: Note the differences in voltage for AC/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.

#### • Electronic insert FEL55 (SI)

- 2-wire connection for separate switching unit
- For use with memory programmable controls (PLC).
- Output signal jump from high to low current on limit level. (H-L edge)

#### • Electronic insert FEL56 (N1)

- 2-wire connection for separate switching unit
- For connection to transformer isolated barriers to NAMUR (IEC 60947-5-6), e.g., transformer isolated barrier KFD2-SR2:Ex1.W or Remote Process Interface KSD-BI:Ex2 from Pepperl+Fuchs.
- Output signal jump from low to high current on limit level. (L-H edge)
- Connection for multiplexer: Adjust clock time to min. 2 s.

### Technical data

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

### Layout of the connections

- M12 x 1 connector
- Transformer isolated barrier to IEC 60947-5-6 (NAMUR)

---

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Date of issue 11/05/03 - Catalogue Field Devices 2004
**Electrical connection**

- **Electronic insert FEL58 (N2)**

  2-wire connection for separate switching unit.

  For connection to transformer isolated barriers to NAMUR (IEC 60947-5-6), e.g., transformer isolated barrier KFD2-SR2-Ex1.W from Pepperl+Fuchs.

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

  Additional function:
  - Test button on the electronic insert.
  - Key stroke breaks the connection to the transformer isolated barrier.
  
  Note: The test function can be used for EEx d applications provided that no explosive atmosphere is present near the housing.

  Connection for multiplexer:
  - Adjust clock time to min. 2 s.

  Layout of the connections M12 x 1 connector

  Max

  Transformer isolated barrier to IEC 60947-5-6 (NAMUR)
Vibration limit switch
Vibracon LVL-M

Technical data

Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>V</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
</table>

Specification of length without unit for design M2

Certificates
NA

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

[0x0]ubject to reasonable modifications due to technical advances. Copyright Pepperl+Fuchs, Printed in Germany
<table>
<thead>
<tr>
<th>Technical data</th>
<th>Vibration limit switch</th>
<th>Vibracon LVL-M</th>
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<tbody>
<tr>
<td>Float switches</td>
<td>Vibration limit switches</td>
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</tr>
<tr>
<td>Capacitive limit switches</td>
<td>Continuous immersion probes</td>
<td>Limit value immersion probes</td>
</tr>
<tr>
<td>Hydrostatic pressure sensors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Vibration limit switch

Vibracon LVL-MH

Features
- Hygienic version
- Large selection of process connections: universal use
- Small dimensions of the vibrating fork and process connections ¾": for areas with difficult access
- Wide variety of electronic modules (e.g. NAMUR, relay, thyristor signal output): 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
- Process connections in acc. with EHEDG
- PROFIBUS PA protocol: commissioning and maintenance quick and easy
- Usable up to SIL 2 acc. to IEC 61508

Function
The Vibracon is a level limit switch for use in all liquids
- with a temperature between -40 °C (233 K) and +150 °C (423 K)
- with a pressure up to 64 bar
- with a viscosity up to 10000 mm²/s
- with a density up to 0.5 g/cm³.

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.

Compact version, ideal for mounting in pipes (LVL-M1H).
With extension tube up to 3 m (10 ft) (LVL-M2H).

With polished fork and easy-to-clean process connections and housings for food and pharmaceutical applications.

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

Electrical connection
Example: connection FEL 56 (N1) 2-wire connection
Other connection types see section electrical connection.
2-wire connection for separate switching unit
For connection to transformer isolated barriers to NAMUR (IEC 60947-5-6), e.g. transformer isolated barrier KFD2-SR2-Ex1.W or Remote Process Interface KSD-BI-Ex2 from Pepperl+Fuchs.
Output signal jump from low to high current on limit level.
(L-H edge)
Connection for multiplexer:
Adjust clock time to min. 2 s.

Layout of the connections
M12 x 1 connector

Example: connection FEL 56 (N1) 2-wire connection
Other connection types see section electrical connection.
2-wire connection for separate switching unit
For connection to transformer isolated barriers to NAMUR (IEC 60947-5-6), e.g. transformer isolated barrier KFD2-SR2-Ex1.W or Remote Process Interface KSD-BI-Ex2 from Pepperl+Fuchs.
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Output signal jump from low to high current on limit level.
(L-H edge)
Connection for multiplexer:
Adjust clock time to min. 2 s.
## Technical data

### Vibration limit switch Vibracon LVL-MH

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<tr>
<th>Application</th>
<th>Vibracon LVL-MH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function principle</td>
<td>limit detection</td>
</tr>
<tr>
<td>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</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function and system design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring principle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured variable</td>
</tr>
<tr>
<td>Measurement range</td>
</tr>
<tr>
<td>Medium density</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail-safe mode</td>
</tr>
<tr>
<td>• Max.</td>
</tr>
<tr>
<td>The relay is de-energised when the probe is covered or the power supply fails. application e. g. for overspill protection</td>
</tr>
<tr>
<td>• Min.</td>
</tr>
<tr>
<td>The relay is de-energised when the probe is free or the power supply fails. application e. g. for dry-run protection</td>
</tr>
<tr>
<td>Switching time</td>
</tr>
<tr>
<td>approx. 1.0 s when uncovering the vibration fork</td>
</tr>
<tr>
<td>additionally settable 0.5 ... 60 s (electronic insert FEL 50 A (PA))</td>
</tr>
<tr>
<td>Power up response</td>
</tr>
<tr>
<td>after max. 2 s it assumes the correct switching mode</td>
</tr>
</tbody>
</table>

### Auxiliary energy

| Supply voltage | electronic insert FEL 51 (AC): 253 V AC, 50/60 Hz electronic insert FEL 52 (ES): 10 ... 55 V DC, with M12 x 1 connector max. 35 V DC electronic insert FEL 54 (WA): 19 ... 253 V AC, 50/60 Hz or 19 ... 55 V DC electronic insert FEL 55 (SI): 11 ... 36 V DC, PLC electronic inserts FEL 56 (N1), FEL 58 (N2): isolating amplifier according to IEC 60947-5-6 (NAMUR) |
| Power consumption | electronic insert FEL 52 (ES): max. 0.83 W electronic insert FEL 54 (WA): max. 1.3 W |
| Current consumption | electronic insert FEL 52 (ES): max. 15 mA, with M12 x 1 connector max. 350 mA |
| Cable connection | electronic inserts: cross section max. 2.5 mm², lace in end splice in accordance with DIN 46228 ground lead in housing: cross section max. 2.5 mm² external equipotential bonding: cross section max. 4 mm² |

### Operating conditions

<table>
<thead>
<tr>
<th>Mounting conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting position</td>
</tr>
<tr>
<td>Ambient conditions</td>
</tr>
<tr>
<td>Ambient temperature</td>
</tr>
<tr>
<td>permissible ambient temperature T1 at the housing depends on the product temperature T2 in the vessel:</td>
</tr>
</tbody>
</table>

![Diagram](image)

* additional temperature range for sensors with a temperature separator or pressure-tight bushing (length 140 mm (5.5 inches))

<p>| Ambient temperature limit | -50 ... +70 °C (223 ... 343 K), function with reduced data values |
| Storage temperature | -50 ... +80 °C (223 ... 353 K) |
| Climatic class | climatic protection to IEC 68, part 2-38, fig. 2a |
| Protection class | DIN EN 60529, IP66/67 |
| Vibration resistance | to IEC 68, part 2-6 (10 ... 55 Hz, 0.15 mm, 100 cycles) |</p>
<table>
<thead>
<tr>
<th>Process conditions</th>
<th>Vibracon LVL-MH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium temperature</td>
<td>-40 ... +150 °C (233 ... 423 K), for exceptions see process connections</td>
</tr>
<tr>
<td>Medium pressure</td>
<td>-1 ... +64 bar, over the entire temperature range, for exceptions see process connections</td>
</tr>
<tr>
<td>Process pressure limits</td>
<td>bursting pressure of membrane 200 bar</td>
</tr>
<tr>
<td>Thermal shock</td>
<td>max. 120 °C/s (max. 120 K/s)</td>
</tr>
<tr>
<td>State of aggregation</td>
<td>liquid</td>
</tr>
<tr>
<td>Density</td>
<td>min. 0.5 g/cm³</td>
</tr>
<tr>
<td>Viscosity</td>
<td>max. 10000 mm²/s (max. 10000 cSt)</td>
</tr>
<tr>
<td>Bulk solids content</td>
<td>max. Ø5 mm (max. Ø0.2 inches)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical construction</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>LVL-M1H: compact design</td>
</tr>
<tr>
<td></td>
<td>LVL-M2H: version with extension tube</td>
</tr>
<tr>
<td>Dimensions</td>
<td>housing: diameter max. 85 mm (3.3 inches), height max. 173 mm (6.8 inches), example</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Float switches</th>
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<th>Vibration limit switches</th>
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<th>Hydrostatic pressure sensors</th>
<th></th>
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**Vibration limit switch**

**Vibracon LVL-MH**

**Technical data**

**Process conditions**
- Medium temperature: -40 ... +150 °C (233 ... 423 K), for exceptions see process connections
- Medium pressure: -1 ... +64 bar, over the entire temperature range, for exceptions see process connections
- Process pressure limits: bursting pressure of membrane 200 bar
- Thermal shock: max. 120 °C/s (max. 120 K/s)
- State of aggregation: liquid
- Density: min. 0.5 g/cm³
- Viscosity: max. 10,000 mm²/s (max. 10,000 cSt)
- Bulk solids content: max. Ø5 mm (max. Ø0.2 inches)

**Mechanical construction**
- Design: LVL-M1H: compact design, LVL-M2H: version with extension tube
- Dimensions: housing: diameter max. 85 mm (3.3 inches), height max. 173 mm (6.8 inches), example

**Dimensions**
- Housing: diameter max. 85 mm (3.3 inches), height max. 173 mm (6.8 inches), example
- Temperature spacer, pressure-tight bushing: additional length 140 mm (5.5 inches)
- Process connection: length 66.5 ... 80 mm (2.6 ... 3.15 inches)

**Drawing**

[Diagram of Vibracon LVL-MH]
**Technical data**

**Vibration limit switch Vibracon LVL-MH**

extension tube: any length L from 148 ... 3000 mm (6 ... 115 inches), up to 6000 mm (236 inches) on request, depending on the process connection

thread: G¾A
G1A

from sealing surface of thread adapter

thread: ½ NPT
1 NPT
R¾
R1

from lower edge of thread

flange and flange-like process connections

extension tube: special length L II, with vertical mounting from the same switchpoint as for the Vibracon LVL1, LVL2

vibration fork: width 17.5 mm (0.7 inches), fork width 10 mm (0.4 inches), max. length 40.7 mm (1.6 inches)

---

**Weight**

700 g, basic weight: includes compact sensor, electronic insert, plastic housing, process connection G¾A

additional weight dependent on extension tube, housing type and process connection

**Material**

- polyester housing: PBT-FR with cover in PBT-FR or with transparent cover in PA12, seal of cover: EPDM
- steel housing: 1.4435 (AISI 316L), seal of cover silicone
- aluminium housing: EN-AC-AlSi10Mg, plastic coated, seal of cover: EPDM
- cable gland: polyamide or brass, nickel-plated
- temperature spacer: 1.4435 (AISI 316L)
- pressure-tight bushing: 1.4435 (AISI 316L)
- wetted parts:
  - process connections and extension tube: 1.4435 (AISI 316L)
  - vibration fork: 1.4435 (AISI 316L)
  - flat seal for process connections G2" or G3": elastomer, asbestos free

**Process connections**

see type code

**Switch point**

switch points on the sensor depend on the mounting location, with reference to water, density 1 g/cm³, 23 °C (296 K), pₐ = 0 bar.

---

**Note:**

The switch points of the Vibracon LVL-M1, LVL-M2 are at other positions to those of the previous version LVL1, LVL2.
## Vibration limit switch
### Vibracon LVL-MH

<table>
<thead>
<tr>
<th>Indication and operation</th>
<th>Vibracon LVL-MH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display elements</strong></td>
<td>electronic insert FEL 50 A (PA):</td>
</tr>
<tr>
<td></td>
<td>- green LED to display standby, pulsing to display communication</td>
</tr>
<tr>
<td></td>
<td>- yellow LED to display switching state, flashing on corrosion damage to sensor or for defective electronics</td>
</tr>
<tr>
<td></td>
<td>electronic inserts FEL 51 (AC), FEL 52 (ES), FEL 54 (WA), FEL 55 (SI):</td>
</tr>
<tr>
<td></td>
<td>- green standby LED</td>
</tr>
<tr>
<td></td>
<td>- red LED for switch state indication is flashing in case of corrosion failure on the sensor or in case of electronic error</td>
</tr>
<tr>
<td></td>
<td>electronic insert FEL 56 (N1):</td>
</tr>
<tr>
<td></td>
<td>- green standby LED flashes</td>
</tr>
<tr>
<td></td>
<td>- red LED for switch state indication is flashing in case of corrosion failure on the sensor or in case of electronic error</td>
</tr>
<tr>
<td></td>
<td>electronic insert FEL 58 (N2):</td>
</tr>
<tr>
<td></td>
<td>- green standby LED flashes quickly</td>
</tr>
<tr>
<td></td>
<td>- green standby LED is slowly flashing in case of corrosion failure on the sensor or in case of electronic error</td>
</tr>
<tr>
<td></td>
<td>- yellow LED for switch state indication</td>
</tr>
<tr>
<td></td>
<td>- test button interrupts lead</td>
</tr>
</tbody>
</table>

| Operating elements       | electroninc insert FEL 50 A (PA): 8 switches for device address setting |
|                          | electronic inserts FEL 51 (AC), FEL 52 (ES), FEL 54 (WA), FEL 55 (SI), FEL 56 (N1), FEL 58 (N2): |
|                          | two switches for fail-safe mode and density change |

| Certificates and approvals | Ex approval see type code |
|                          | Type of protection see type code |
|                          | Overspill protection Z-65.11-306 (overspill protection WHG) |
|                          | Other approvals EHEGD certificate (from TNO, Netherlands) report no. V99.394-3-A certificate (USA), authorisation no. 459 |

| General information      | Directive conformity Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment |
|                          | Directive 94/9/EC (ATEX) interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21) |
|                          | Directive 73/23/EC (Low Voltage Directive) EN 61010-1 |
|                          | 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. |

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<td>LVL-Z101, welding sleeve G1, flush mounted, sensor not adjustable</td>
</tr>
<tr>
<td></td>
<td>LVL-Z102, welding sleeve G1, flush mounted, sensor adjustable</td>
</tr>
<tr>
<td></td>
<td>LVL-Z103, welding sleeve G1, flush mounted, sensor adjustable</td>
</tr>
<tr>
<td></td>
<td>LVL-Z104, DRD welding flange</td>
</tr>
<tr>
<td></td>
<td>V1-G, mating connector, straight</td>
</tr>
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<td>V1-W, mating connector, 90° angled</td>
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**Technical data**

### Vibration limit switch

#### Vibracon LVL-MH

#### Electrical connection

- **Electronic insert FEL50 A (PA)**
  - 2-wire connection to PROFIBUS PA for power supply and data transmission
  - 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, switch-off time, measured value status, and density switch.
    - Security locking of matrix possible.
    - Selection of WHG mode is possible (WHG approval).

- **Electronic insert FEL51 (AC)**
  - 2-wire AC connection
  - Always connect in series with the load!
  - Check the following:
    - the residual current in blocked state (up to 3.8 mA).
    - that for low voltage the voltage across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not too low.
    - the voltage drop across the electronic insert when open is observed (up to 12 V).
  - A relay cannot de-energise with a retaining current below 3.8 mA. If this is the case, a resistor should be connected parallel to the relay.

- **Electronic insert FEL52 (E5)**
  - 3-wire DC connection
  - Preferably for use with memory programmable controls (PLC).
  - Positive signal at the switch output of the electronics (PNP).
  - Output blocked on reaching limit level.

#### Additional information

- **Hydrostatic pressure sensors**
  - **Float switches**
  - **Conductive limit switches**
  - **Capacitive limit switches**
  - **Limit value immersion probes**
  - **Continuous immersion probes**
  - **Hydrostatic pressure sensors**
Electrical connection

**Vibration limit switch**

**Vibracon LVL-MH**

**Technical data**

### Float switches

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

#### Vibration limit switches

- **Conductive**
- **Capacitive**

#### Limit value immersion probes

- **Continuous**

#### Hydrostatic pressure sensors

**Technical data**

**Electrical connection**

- **Electronic insert FEL54 (WA)**
  - AC/DC connection with relay output
  - Auxiliary energy:
    - Note the differences in voltage for AC/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.

- **Electronic insert FEL55 (SI)**
  - 2-wire connection for separate switching unit
  - For use with memory programmable controls (PLC).
  - Output signal jump from high to low current on limit level.
    - (H-L edge)

- **Electronic insert FEL56 (N1)**
  - 2-wire connection for separate switching unit
  - For connection to transformer isolated barriers to NAMUR (IEC 60947-5-6), e.g. transformer isolated barrier KFD2-SR2-Ex1 W or Remote Process Interface KSD-Bi-Ex2 from Pepperl+Fuchs.
  - Output signal jump from low to high current on limit level.
    - (L-H edge)
  - Connection for multiplexer:
    - Adjust clock time to min. 2 s.

**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.

**Auxiliary energy:**

- Note the differences in voltage for AC/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.

---

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**Technical data**

**Vibration limit switch**

**Vibracon LVL-MH**

**Electrical connection**

- **Electronic insert FEL58 (N2)**

  2-wire connection for separate switching unit

  For connection to transformer isolated barriers to NAMUR (IEC 60947-5-6), e. g. transformer isolated barrier KFD2-SR2:Ex1.W from Pepperl+Fuchs.

  Output signal jump from high to low current on limit level.

  (H-L edge)

  Additional function:

  Test button on the electronic insert.

  Key stroke breaks the connection to the transformer isolated barrier.

  Note: The test function can be used for Ex d applications provided that no explosive atmosphere is present near the housing.

  Connection for multiplexer:

  Adjust clock time to min. 2 s.

  Layout of the connections M12 x 1 connector

  Max 8.2 V DC

  < 1 mA, > 2.1 mA

  Transformer isolated barrier to IEC 60947-5-6 (NAMUR)
Vibration limit switch
Vibracon LVL-MH

Technical data

Type code/model number

| L | V | B | L | V | M | H | - | - | - | - |

Vibration limit switch

Specifications of length without unit design M2

Certificates

- HA for non-hazardous areas
- WHG: WHG exemption protection
- E1: ATEX 6 1G Ex ia IIC T6
- E2: ATEX 6 1G Ex ia IEC T6
- E3: ATEX 6 1G Ex ia IIC T6
- EA: ATEX 6 1G Ex ia IEC T6
- EC: ATEX 6 1G Ex ia IEC T6
- FI: FM, US, CI, I, II, Div1, Group A–G
- FN: FM, NI, CI, Div1, Group A–G
- PX: FM, NI, CI, I, II, Div1, Group A–G
- CG: CSA, General Purpose
- CI: CSA, US, CI, I, II, Div1, Group A–G
- CX: CSA, XP, CI, I, II, Div1, Group A–G

Optional equipment

- NA without optional equipment
- 23: 3.1 B material, wetted parts 1.4435–316L, inspection certificate to EN 10204, according to specification 52005759

Electronic insert

- PA: FEL 50 A, PROFIBUS PA
- AC: FEL 51, contactless 2-wire switch, 19 V ... 253 V AC
- ES: FEL 52, PNP 3-wire, 10 V ... 55 V DC
- WA: FEL 54, potential-free change-over contact, DPDT, 19 V ... 253 V AC, 19 V ... 55 V DC
- SI: FEL 55, 0/15 mA, 11 V ... 36 V DC
- SI: FEL 56, NAMUR, L-edge
- N2: FEL 58, NAMUR with push button, H-L edge

Material, cable entry

- A1: aluminium housing, IP65, cable gland M20
- A2: aluminium housing, Nema, 4 x 1/4 NPT
- A3: aluminium housing, IP65, entry G1/4A
- A4: aluminium housing, IP65, plug connector M12 x 1
- E1: 1.4301 housing, IP65, cable gland M20
- E2: 1.4301 housing, Nema, 4 x 1/4 NPT
- E3: 1.4301 housing, IP65, entry G1/4A
- E4: 1.4301 housing, IP65, plug connector M12 x 1
- P1: polyester housing, IP65, cable gland M20
- P2: polyester housing, Nema, 4 x 1/4 NPT
- P3: polyester housing, IP65, entry G1/4A
- P4: polyester housing, IP65, plug connector M12 x 1

Length, temperature spacer, pressure-tight bushing

- AC: compact, Rs < 1.5 µm/120 grit
- AD: compact, Rs < 0.5 µm/240 grit/3 A
- IC: compact, Rs < 1.5 µm/120 grit
- ID: compact, Rs < 0.5 µm/240 grit
- GC: compact, Rs < 1.5 µm/120 grit, with pressure-tight bushing
- GD: compact, Rs < 0.5 µm/240 grit, with pressure-tight bushing
- BC: mm Rs < 1.5 µm/120 grit
- BD: mm Rs < 0.5 µm/240 grit/3 A
- CC: inch Rs < 1.5 µm/120 grit
- CD: inch Rs < 0.5 µm/240 grit/3 A
- DC: special length L, Rs < 1.5 µm/120 grit, switch point = Vibracon compact
- DD: special length L, Rs < 0.5 µm/240 grit, switch point = Vibracon compact
- JC: mm Rs < 1.5 µm/120 grit, with temperature spacer
- JD: mm Rs < 0.5 µm/240 grit, with temperature spacer
- KC: inch Rs < 1.5 µm/120 grit, with temperature spacer
- KD: inch Rs < 0.5 µm/240 grit, with temperature spacer
- LC: special length L, Rs < 1.5 µm/120 grit, with temperature spacer, switch point = Vibracon compact
- LD: special length L, Rs < 0.5 µm/240 grit, with temperature spacer, switch point = Vibracon compact
- RC: mm Rs < 1.5 µm/120 grit, with pressure-tight bushing
- RD: mm Rs < 0.5 µm/240 grit, with pressure-tight bushing
- SC: inch Rs < 1.5 µm/120 grit, with pressure-tight bushing
- SD: inch Rs < 0.5 µm/240 grit, with pressure-tight bushing
- TC: special length L, Rs < 1.5 µm/120 grit, with pressure-tight bushing, switch point = Vibracon compact
- TD: special length L, Rs < 0.5 µm/240 grit, with pressure-tight bushing, switch point = Vibracon compact

Material, cable entry

- A1: ANSI 316L, 150 lbs RF, 1.4435–316L
- A2: ANSI 316L, 150 lbs RF, 1.4435–316L
- A3: ANSI 316L, 150 lbs RF, 1.4435–316L
- F55: DN32 PN40 Form B, 1.4435–316L
- F75: DN50 PN40 Form B, 1.4435–316L
- F85: DN60 PN40 Form B, 1.4435–316L
- FA5: DN100 PN40 Form B, 1.4435–316L
- D75: DN50 PN40 Form C, 1.4435–316L, sealing strip
- D95: DN60 PN40 Form C, 1.4435–316L, sealing strip
- D153: DN100 PN16 Form C, 1.4435–316L, sealing strip
- D153: DN100 PN16 Form C, 1.4435–316L, sealing strip
- G21: G1/2 BSP, 1.4435–316L, mounting for welding sleeve
- G13: G1/2 BSP, 1.4435–316L, mounting for welding sleeve
- T1: 1/2” Triclamp ISO 2852, 1.4435–316L
- T1: 1/2” Triclamp ISO 2852, 1.4435–316L
- SX1: 2”, SME, 1.4435–316L
- SV1: Variven, DN65, 1.4435–316L
- XXX: special version

Specifications of length without unit design M2

| L | V | B | L | V | M | H | - | - | - | - |

Limit values

- M2: compact design
- M1: extended design (148 mm/6 inches ... 3000 mm/115 inches)

Subject to reasonable modifications due to technical advancements.

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Date of issue 11/05/03 – Catalogue Field Devices 2004
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<td><strong>Vibration limit switches</strong></td>
</tr>
<tr>
<td><strong>Float switches</strong></td>
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</tbody>
</table>
Vibration limit switch

Vibracon LVL-M2C

Dimensions

Function

The Vibracon is a level limit switch for use in all liquids
• with a temperature between -40 °C (233 K) and +120 °C (393 K)
• with a pressure up to 40 bar
• with a viscosity up to 10000 mm²/s
• with a density up to 0.5 g/cm³.

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.

With extension tube up to 3 m (10 ft).

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

Electrical connection

Example: connection FEL 52 (E5) 3-wire DC connection
Other connection types see section electrical connection.

3-wire DC connection

Preferably for use with memory programmable controls (PLC).
Positive signal at the switch output of the electronics (PNP).
Output blocked on reaching limit level.

Hydrostatic pressure sensors

Continuous immersion probes

Limit value immersion probes

Conductive limit switches

Capacitive limit switches

Vibration limit switches

Float switches

Features

• ECTFE coating (Halar)
• Corrosion resistant coating: ideal suited for the process
• Large selection of process connections: universal use
• Small dimensions of the vibrating fork for areas with difficult access
• Wide variety of electronic modules (e. g. NAMUR, relay, thyristor signal output): 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
• Usable up to SIL 2 acc. to IEC 61508
## Technical data

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<th>Vibration limit switch</th>
<th>Vibracon LVL-M2C</th>
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<td><strong>Application</strong></td>
<td>limit detection</td>
</tr>
<tr>
<td><strong>Function principle</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Function and system design</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Measuring principle</strong></td>
<td>the forks of the sensor vibrate at their intrinsic frequency, this frequency is reduced when covered with liquid the change in frequency then activates the limit switch.</td>
</tr>
<tr>
<td><strong>Input characteristics</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Measured variable</strong></td>
<td>limit level (limit value)</td>
</tr>
<tr>
<td><strong>Measurement range</strong></td>
<td>specified by length of the sensor with extension tube (max. 3000 mm/115 inches)</td>
</tr>
<tr>
<td><strong>Medium density</strong></td>
<td>adjustment on the electronic insert &gt; 0.5 g/cm³ or &gt; 0.7 g/cm³</td>
</tr>
<tr>
<td><strong>Output characteristics</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Fail-safe mode</strong></td>
<td>switchable minimum/maximum closed circuit safety on the electronic insert</td>
</tr>
<tr>
<td></td>
<td>• Max. = maximum fail-safe mode</td>
</tr>
<tr>
<td></td>
<td>• Min. = minimum fail-safe mode</td>
</tr>
<tr>
<td></td>
<td>The relay is de-energised when the probe is covered or the power supply fails. application e. g. for overspill protection</td>
</tr>
<tr>
<td></td>
<td>The relay is de-energised when the probe is free or the power supply fails. application e. g. for dry-run protection</td>
</tr>
<tr>
<td><strong>Switching time</strong></td>
<td>approx. 0.5 s when covering the vibration fork</td>
</tr>
<tr>
<td></td>
<td>approx. 1.0 s when uncovering the vibration fork</td>
</tr>
<tr>
<td></td>
<td>additionally settable 0.5 ... 60 s (electronic insert FEL 50 A (PA))</td>
</tr>
<tr>
<td><strong>Power up response</strong></td>
<td>when switching on the power supply the output assumes the alarm signal, after max. 2 s it assumes the correct switching mode</td>
</tr>
<tr>
<td><strong>Auxiliary energy</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Supply voltage</strong></td>
<td>electronic insert FEL 51 (AC): 253 V AC, 50/60 Hz</td>
</tr>
<tr>
<td></td>
<td>electronic insert FEL 52 (E5): 10 ... 55 V DC, with M12 x 1 connector max. 35 V DC</td>
</tr>
<tr>
<td></td>
<td>electronic insert 54 (WA): 19 ... 253 V AC, 50/60 Hz or 19 ... 55 V DC</td>
</tr>
<tr>
<td></td>
<td>electronic insert 55 (SI): 11 ... 36 V DC, PLC</td>
</tr>
<tr>
<td></td>
<td>electronic inserts 56 (N1), 58 (N2): isolating amplifier according to IEC 60947-5-6 (NAMUR)</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>electronic insert FEL 52 (E5): max. 0.83 W</td>
</tr>
<tr>
<td></td>
<td>electronic insert FEL 54 (WA): max. 1.3 W</td>
</tr>
<tr>
<td><strong>Current consumption</strong></td>
<td>electronic insert FEL 52 (E5): max. 15 mA, with M12 x 1 connector max. 350 mA</td>
</tr>
<tr>
<td><strong>Cable connection</strong></td>
<td>electronic inserts: cross section max. 2.5 mm², lace in end splice in accordance with DIN 46228</td>
</tr>
<tr>
<td></td>
<td>ground lead in housing: cross section max. 2.5 mm²</td>
</tr>
<tr>
<td></td>
<td>external equipotential bonding: cross section max. 4 mm²</td>
</tr>
<tr>
<td><strong>Operating conditions</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Mounting conditions</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Mounting position</strong></td>
<td>with short pipe (up to 500 mm/20 inches) any position, with long pipe vertical</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>-40 ... +70 °C (233 ... 343 K)</td>
</tr>
</tbody>
</table>

permissible ambient temperature \( T_1 \) at the housing depends on the product temperature \( T_2 \) in the vessel:

\[
\begin{align*}
T_1 &= T_2 \\
&= 70^\circ C \\
&= 60^\circ C \\
&= 50^\circ C \\
&= 20^\circ C \\
&= 0^\circ C \\
&= -10^\circ C \\
&= -20^\circ C \\
&= -30^\circ C \\
&= -40^\circ C
\end{align*}
\]

* additional temperature range for sensors with a temperature spacer or pressure-tight bushing (length 140 mm (5.5 inches))

temperature difference between the flange surface on the process side and the ambient side (\( T_2 - T_1 \)) max. 60 °C (333 K), flange also to be insulated as required

- Ambient temperature limit -50 ... +70 °C (223 ... 343 K), function with reduced data values
- Storage temperature -50 ... +80 °C (223 ... 343 K)
- Climatic class climatic protection to IEC 68, part 2-38, fig. 2a
- Protection class DIN EN 60529, IP66/IP67
- Vibration resistance to IEC 68, part 2-6 (10 ... 55 Hz, 0.15 mm, 100 cycles)
Vibration limit switch
Vibracon LVL-M2C

Technical data

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<th>Process conditions</th>
<th>Medium temperature</th>
<th>-40 ... +120 °C (233 ... 393 K)</th>
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</thead>
<tbody>
<tr>
<td>Medium pressure</td>
<td>-1 ... +40 bar, over the entire temperature range</td>
<td></td>
</tr>
<tr>
<td>Process pressure limits</td>
<td>bursting pressure of membrane 200 bar</td>
<td></td>
</tr>
<tr>
<td>Thermal shock</td>
<td>max. 120 °C/s (max. 120 K/s)</td>
<td></td>
</tr>
<tr>
<td>State of aggregation</td>
<td>liquid</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>min. 0.5 g/cm³</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>max. 10000 mm²/s (max. 10000 cSt)</td>
<td></td>
</tr>
<tr>
<td>Bulk solids content</td>
<td>max. Ø5 mm (max. Ø0.2 inches)</td>
<td></td>
</tr>
</tbody>
</table>

**Mechanical construction**

**Design**
limit switch with flange and extension tube, both coated with ECTFE

**Dimensions**
- housing: diameter max. 85 mm (3.3 inches), height max. 173 mm (6.8 inches), example
- aluminium housing A*
- temperature spacer, pressure-tight bushing: additional length 140 mm (5.5 inches)
- process connection: length 115 mm (4.5 inches)
- extension tube: any length L from 148 ... 3000 mm (6 ... 115 inches), up to 6000 mm (236 inches) on request
- flange and flange-like process connections
- extension tube: special length L II 115 mm (4.5 inches), with vertical mounting from above the same switchpoint as for the Vibracon LVL2
# Technical Data

## Vibracon LVL-M2C

Vibration limit switch

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
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<tr>
<td>Length fork</td>
<td>20.6 mm (0.8 inches)</td>
</tr>
<tr>
<td>Width fork</td>
<td>6.5 mm (0.25 inches)</td>
</tr>
<tr>
<td>Max. length</td>
<td>25 mm (1 inch)</td>
</tr>
</tbody>
</table>

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

## Weight

- 800 g, basic weight: includes compact sensor (special length L II), without flange, with electronic insert and polyester housing
- Additional weight dependent on extension tube, housing type and process connection

## Material

- Aluminium housing: EN-AC-AlSi10Mg, plastic coated, seal of cover: EPDM
- Polyester housing: PBT-FR with cover in PBT-FR or with transparent cover in PA12, seal of cover: EPDM
- Steel housing: 1.4435 (AISI 316L), seal of cover silicone
- Cable gland: polyamide or brass, nickel-plated
- Temperature spacer: 1.4435 (AISI 316L)
- Pressure-tight bushing: 1.4435 (AISI 316L)
- Wetted parts:
  - Process connections and extension tube: 1.4435 (AISI 316L) with ECTFE coating
  - Vibration fork: 1.4435 (AISI 316L) with ECTFE coating

## Process Connections

See type code

## Switch Point

Switch points on the sensor depend on the mounting location, with reference to water, density 1 g/cm³, 23 °C (296 K), pₑ 0 bar.

## Indication and Operation

### Display Elements

- Electronic insert FEL 50 A (PA):
  - Green LED to display standby, pulsing to display communication
  - Yellow LED to display switching state, flashing on corrosion damage to sensor or for defective electronics
- Electronic inserts FEL 51 (AC), FEL 52 (E5), FEL 54 (WA), FEL 55 (SI):
  - Green standby LED
  - Red LED for switch state indication is flashing in case of corrosion failure on the sensor or in case of electronic error
- Electronic insert FEL 56 (N1):
  - Green standby LED flashes
  - Red LED for switch state indication is flashing in case of corrosion failure on the sensor or in case of electronic error
- Electronic insert FEL 58 (N2):
  - Green standby LED flashes quickly
  - Green standby LED is slowly flashing in case of corrosion failure on the sensor or in case of electronic error
  - Yellow LED for switch state indication
  - Test button interrupts lead

### Operating Elements

- Electronic insert FEL 50 A (PA): 8 switches for device address setting
- Electronic inserts FEL 51 (AC), FEL 52 (E5), FEL 54 (WA), FEL 55 (SI), FEL 56 (N1), FEL 58 (N2): two switches for fail-safe mode and density change

## Certificates and Approvals

### Ex Approval

See type code

### Type of Protection

See type code

### Overspill Protection

Z-65.11-306 (overspill protection WHG)
### Vibration limit switch
**Vibracon LVL-M2C**

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<td>interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)</td>
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<tr>
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<tr>
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<td>EN 61326-1, EN 61010-1, EN 50021, EN 50281-1-1</td>
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<tr>
<td>Directive 73/23/EC (Low Voltage Directive)</td>
<td>EN 61010-1</td>
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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.

### Accessories
- V1-G, mating connector, straight
- V1-W, mating connector, 90° angled
**Technical data**

### Vibration limit switch

**Vibracon LVL-M2C**

#### Electrical connection

- **Electronic insert FEL50 A (PA)**
  - 2-wire connection to PROFIBUS PA for power supply and data transmission.
  - 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, switch-off time, measured value status, and density switch.
    - Security locking of matrix possible.
    - Selection of WHG mode is possible (WHG approval).

- **Electronic insert FEL51 (AC)**
  - 2-wire AC connection
    - Always connect in series with the load!
    - Check the following:
      - the residual current in blocked state (up to 3.8 mA).
      - that for low voltage the voltage across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not too low.
      - the voltage drop across the electronic insert when open is observed (up to 12 V).
      - that a relay cannot de-energise with a retaining current below 3.8 mA.
    - If this is the case, a resistor should be connected parallel to the relay.

- **Electronic insert FEL52 (E5)**
  - 3-wire DC connection
    - Preferably for use with memory programmable controls (PLC).
    - Positive signal at the switch output of the electronics (PNP).
    - Output blocked on reaching limit level.

**Layout of the connections M12 x 1 connector**

- Max
  - 10 V DC...35 V DC max. 350 mA
  - 0.5 A
  - U – 10 V DC...55 V DC

---

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**Technical data**

**Electrical connection**

- **Electronic insert FEL54 (WA)**

  AC/DC connection with relay output

  **Auxiliary energy:**
  Note the differences in voltage for AC/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.

- **Electronic insert FEL55 (SI)**

  2-wire connection for separate switching unit

  For use with memory programmable controls (PLC).
  Output signal jump from high to low current on limit level.
  (H-L edge)

- **Electronic insert FEL56 (N1)**

  2-wire connection for separate switching unit

  For connection to transformer isolated barriers to NAMUR (IEC 60947-5-6), e.g. transformer isolated barrier KFD2-SR2-Ex1.W or Remote Process Interface KSD-Bi-Ex2 from Pepperl+Fuchs.
  Output signal jump from low to high current on limit level.
  (L-H edge)

  Connection for multiplexer:
  Adjust clock time to min. 2 s.

  Layout of the connections M12 x 1 connector

  Transformer isolated barrier to IEC 60947-5-6 (NAMUR)

  **Hydrostatic pressure sensors**

  **Limit value immersion probes**

  **Continuous immersion probes**

  **Conductive limit switches**

  **Capacitive limit switches**

  **Vibration limit switches**

  **Float switches**

---

Subject to reasonable modifications due to technical advances.

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**Technical data**

**Vibration limit switch**

**Vibracon LVL-M2C**

### Electrical connection

- **Electronic insert FEL58 (N2)**

  2-wire connection for separate switching unit

  For connection to transformer isolated barriers to NAMUR (IEC 60947-5-6), e.g. transformer isolated barrier KFD2-SR2:Ex1.W from Pepperl+Fuchs.

  Output signal jump from high to low current on limit level.

  (H-L edge)

  Additional function:
  Test button on the electronic insert.
  Key stroke breaks the connection to the transformer isolated barrier.
  Note: The test function can be used for EEx d applications provided that no explosive atmosphere is present near the housing.

  Connection for multiplexer:
  Adjust clock time to min. 2 s.

  Layout of the connections M12 x 1 connector

![Connection diagram](image)
## Vibration limit switch

**Vibracon LVL-M2C**

### Technical data

#### Type code/model number

<table>
<thead>
<tr>
<th>LVL-M2C</th>
<th>Specification of length without unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Certificates**

- NA: for non-hazardous areas
- WH: WHG overspill protection
- EC: ATEX II 1/2G EEx ia IIC T6, ÜS WHG
- EB: ATEX II 1/2G EEx ia IIC T6, ÜS WHG
- EG: ATEX II 1/2G EEx ia IIC T6, ÜS WHG
- EI: ATEX II 1/2G EEx ia IIC T6, ÜS WHG
- FI: FM, IS, Cl I, II, III, Div1, Group A–G
- FN: FM, Ni, Cl I, Div2, Group A–D
- FX: FM, XP Cl I, II, III, Div1, Group A–G
- CG: CSA, General Purpose
- CI: CSA, IS, Cl I, II, III, Div1, Group A–G
- CX: CSA, XP Cl I, II, III, Div1, Group A–G

### Electrical output

- PA: FEL 50 A, PROFIBUS PA
- AC: FEL 51, contactless 2-wire switch, 19 V ... 253 V AC
- E5: FEL 52, PNP 3-wire, 10 V ... 55 V DC
- WA: FEL 54, potential-hex change-over contact, DPDT, 19 V ... 253 V AC, 19 V ... 55 V DC
- Si: FEL 55, 8/16 mA, 11 V ... 36 V DC
- N1: FEL 56, NAMUR, L-H edge
- N2: FEL 58, 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 G1/4
- A4: aluminium housing, IP66, plug connector M12 x 1
- E1: 1.4301-housing, IP66, cable gland M20
- E2: 1.4301-housing, Nema 4x ¾ NPT
- E3: 1.4301-housing, IP66, entry G1/4
- E4: 1.4301-housing, IP66, plug connector M12 x 1
- P1: polyester housing, IP66, cable gland M20
- P2: polyester housing, Nema 4x ¾ NPT
- P3: polyester housing, IP66, entry G1/4
- P4: polyester housing, IP66, plug connector M12 x 1

### Temperature spacer, pressure-tight bushing

- A: without
- B: temperature spacer
- C: pressure-tight bushing
- Y: special version

### Length, material extension pipe

- BK: mm L, ECTFE
- CK: inch L, ECTFE

### Process connection and material

- A3H: ANSI 1 1/4, 150 lbs RF, ECTFE
- A5H: ANSI 1 1/2, 150 lbs RF, ECTFE
- A6H: ANSI 2, 150 lbs RF, ECTFE
- A6I: ANSI 2, 300 lbs RF, ECTFE
- A8H: ANSI 3, 150 lbs RF, ECTFE
- H35: DN25 PN16 Form B, ECTFE
- H65: DN40 PN40 Form B, ECTFE
- H71: DN50 PN6 Form B, ECTFE
- H75: DN50 PN40 Form B, ECTFE
- H95: DN80 PN40 Form B, ECTFE
- H63: DN100 PN16 Form B, ECTFE
- J1H: JIS RF 10 K 50, ECTFE
- XXX: special version

### Design

- M2: extended design (148 mm/6 inches ... 3000 mm/115 inches)
### Vibracon LVL-M2C

#### Technical data

<table>
<thead>
<tr>
<th>Float switches</th>
<th>Vibration limit switches</th>
<th>Conductive limit switches</th>
<th>Capacitive limit switches</th>
<th>Limit value immersion probes</th>
<th>Continuous immersion probes</th>
<th>Hydrostatic pressure sensors</th>
<th>Continuous pressure sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date of issue 11/05/03 — Catalogue Field Devices 2004
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

Product group HR-6**1

Product group HR-6*5*

Product group HR-6901
Conductive limit switches

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 µS/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-P

Contents

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1-rod electrode HR-6**1 ................................................................. 96
Multiple-rod electrode HR-65* ......................................................... 98
Suspension electrode HR-6901 .......................................................... 100
**Conductive limit switch**

**Dimensions**

<table>
<thead>
<tr>
<th>Specification</th>
<th>LKL-P with electronic insert</th>
<th>LKL-P with separate electronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length L</td>
<td>100 mm - 1450 mm</td>
<td>G1 1/2 or G1 1/4 NPT</td>
</tr>
<tr>
<td>Probe length</td>
<td>AF55</td>
<td>Ø5 Ø4</td>
</tr>
<tr>
<td>Mains potential-free change-over contacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mains (PE)</td>
<td>L1</td>
<td>F1</td>
</tr>
<tr>
<td>Potential-free change-over contacts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Features**

- Detect up to five level limits with one probe
- Two-point control and additional maximum and minimum detection
- Option between rod or rope version for optimum adaptation to the application
- WHG approval
- Four measuring ranges can be set 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ
- Cost-effective probe for conductive liquids

**Function**

The LKL-P sensors are 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 (compact instrument version), AC/DC connection with relay output. Other connection types see section electrical connections.

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.

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)
**Technical data**

### LKL-P

#### Function and system design

**Measuring principle**

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. 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.

**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.

- probes without integrated electronic insert (separate-instrument version)

  The measuring system consists of:
  - LKL-P1, LKL-P2 with two/three rods or ropes
  - electrode relais KF**-ER-**.**
  - control units, switches or signal transmitters, e.g. process control systems PLC, relays, etc.

#### Input characteristics

**Measured variable**

Resistance change between two conductors caused by the presence or absence of a conductive product.

**Measurement range**

The measuring range is dependent on the mounting location of the probes. Rod probes can have a max. length of 4000 mm (13.2 ft) and rope probes up to 15000 mm (49.4 ft). 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.

**Input signal**

- probes covered => a measurable current is flowing between the probes
- probes uncovered => there is no measurable current flowing between the probes

**Switching delay**

A switching delay of 2.0 s can be activated or deactivated via a DIL switch, if the switching delay is set to 0 s, the device switches after approx. 0.3 s.

#### Output characteristics

**Description**

- **output E5 (with two/three rods or ropes):**
  - three-wire direct current version
  - 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
- **output WA (with two/three rods or ropes):**
  - AC/DC connection with relay output
  - 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
<table>
<thead>
<tr>
<th>Conductive limit switch</th>
<th>LKL-P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail-safe mode</td>
<td>selecting the correct fail-safe mode ensures that the relay always runs in quiescent current fail-safe.</td>
</tr>
<tr>
<td></td>
<td>• maximum fail-safe: the relay de-energises when the switch point is exceeded (probe covered), a fault occurs or the power supply fails</td>
</tr>
<tr>
<td></td>
<td>• minimum fail-safe: the relay de-energises when the switch point is undershot (probe uncovered), a fault occurs or the power supply fails</td>
</tr>
<tr>
<td>Signal on alarm</td>
<td>output E5: in the event of a power failure or a damaged probe: &lt; 100 µA. output WA: output signal in the event of a power failure or a damaged probe: relay de-energised.</td>
</tr>
<tr>
<td>Load</td>
<td>output E5: the load is switched via a transistor and a separate PNP connection</td>
</tr>
<tr>
<td></td>
<td>max. 1 A, max. 55 V (cycled overload and short-circuit protection): continuous ≤ 200 mA (short-circuit proof)</td>
</tr>
<tr>
<td></td>
<td>output WA: loads are switched via 2 potential-free change-over contacts</td>
</tr>
<tr>
<td></td>
<td>I~ max. 4 A, U~ max. 253 V;</td>
</tr>
<tr>
<td></td>
<td>P~ max. 1000 VA, cos φ = 1, P~ max. 700 VA, cos φ &gt; 0.7;</td>
</tr>
<tr>
<td></td>
<td>I~ max. 4 A to 30 V, I~ max. 0.2 A to 150 V.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Galvanic isolation</td>
<td>all input channels, output channels and relay contacts are galvanically isolated from each other</td>
</tr>
<tr>
<td>Cable monitoring</td>
<td>output NA: 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</td>
</tr>
<tr>
<td></td>
<td>Note! When using switching units (transmitters) that do not support cable monitoring, these must be removed.</td>
</tr>
<tr>
<td>Auxiliary energy</td>
<td>Output voltage U = 10.8 V ... 45 V DC</td>
</tr>
<tr>
<td></td>
<td>load connection: open collector, PNP</td>
</tr>
<tr>
<td></td>
<td>switching voltage: max. 45 V</td>
</tr>
<tr>
<td></td>
<td>connected load, continuous: max. 200 mA</td>
</tr>
<tr>
<td></td>
<td>protected against reverse polarity</td>
</tr>
<tr>
<td></td>
<td>output WA: supply voltage U = 20 V ... 55 V DC or U ~ 20 V ... 253 V AC, 50/60 Hz</td>
</tr>
<tr>
<td></td>
<td>peak inrush current: max. 2 A, max. 400 µs</td>
</tr>
<tr>
<td></td>
<td>output: two potential-free change-over contacts</td>
</tr>
<tr>
<td></td>
<td>contact load capacity: U~ max. 253 V, I~ max. 4 A, U = 30 V/4 A; 150 V/ 0.2 A</td>
</tr>
<tr>
<td>Power consumption</td>
<td>output E5: P &lt; 1.1 W</td>
</tr>
<tr>
<td></td>
<td>output WA: P &lt; 2.0 W</td>
</tr>
<tr>
<td>Current consumption</td>
<td>output E5: I &lt; 25 mA (without load)</td>
</tr>
<tr>
<td></td>
<td>output WA: 60 mA</td>
</tr>
<tr>
<td>Cable connection</td>
<td>M20 x 1.5</td>
</tr>
<tr>
<td></td>
<td>• degree of protection: IP66</td>
</tr>
<tr>
<td></td>
<td>• quantity in housing: 2 (compact-instrument version)</td>
</tr>
<tr>
<td></td>
<td>½ NPT</td>
</tr>
<tr>
<td></td>
<td>• quantity in housing: 2 (compact-instrument version)</td>
</tr>
<tr>
<td></td>
<td>• conductor cross-section (including wire end sleeve): 2.5 mm²</td>
</tr>
<tr>
<td></td>
<td>G½</td>
</tr>
<tr>
<td></td>
<td>• quantity in housing: 2 (compact-instrument version)</td>
</tr>
<tr>
<td></td>
<td>• conductor cross-section (including wire end sleeve): 2.5 mm²</td>
</tr>
<tr>
<td>Cable specification</td>
<td>use a commercially available cable (25 Ω per wire)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Measuring error ± 10 % at 100 Ω ... 100 kΩ</td>
</tr>
<tr>
<td></td>
<td>± 5 % at 1kΩ ... 10 kΩ</td>
</tr>
<tr>
<td>Repeatability</td>
<td>± 5 % at 100 Ω ... 100 kΩ</td>
</tr>
<tr>
<td></td>
<td>± 1 % at 1kΩ ... 10 kΩ</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>-10 % for the max probe, in reference to the switch point. A ± function deactivated.</td>
</tr>
<tr>
<td>Influence of ambient temperature</td>
<td>&lt; 3 s</td>
</tr>
<tr>
<td>Switch-on delay</td>
<td>&lt; 0.05 %/K</td>
</tr>
<tr>
<td>Mounting conditions</td>
<td>the rod and rope probes are mounted predominantly in tanks made of plastic or metal</td>
</tr>
</tbody>
</table>
## Conductive limit switch LKL-P

### Example applications

**LKL-P**

level limit detection (standard applications)

- **Ambient conditions**
  - Ambient temperature: -40 ... +70 °C (233 ... 343 K) (non-hazardous area)
  - Storage temperature: -40 ... 80 °C (233 ... 353 K)
  - Climatic class: tropicalised as per DIN EEC 68, part 2-38
  - Protection class: DIN EN 60529, IP66
  - Shock resistance: practical test
  - Vibration resistance: DIN 6068-2-64/IEC 68-2-64: 20 ... 2000 Hz, 1 (m/s²)²/Hz at minimum rod length
  - Electromagnetic compatibility
    - interference emission to EN 61326, electrical equipment class B
    - interference immunity to EN 61326, annex A (industrial) and NAMUR recommendation EMC (NE21)
    - use a screened cable between the probe and the switching unit
  - Process conditions
    - Medium temperature limits: -20 ... 100 °C (253 ... 373 K)
    - Conductivity: \( \geq 10 \mu\Omega \cdot \mathrm{m} \)
    - Medium pressure limits: -1 ... +6 bar

### Mechanical construction

**Design**

- LKL-P1: rod version with G1½, 1½ NPT
- LKL-P2: rope version with G1½, 1½ NPT

**Dimensions**

- **LKL-P1:** housing: diameter max. 85 mm (3.3 inches), height max. 145 mm (5.7 inches)
  - rod: length max. 4000 mm (13.2 ft)
- **LKL-P2:** housing: diameter max. 85 mm (3.3 inches), height max. 145 mm (5.7 inches)
  - rope: length max. 15000 mm (49.4 ft)

**Weight**

- 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
- **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**
  - G1½, PPS
  - 1½ NPT, PPS

### Indication and operation

**Display elements**

- compact instrument version:
  - one red light emitting diode: fault message, switching status
  - one green light emitting diode: operation
- separate instrument version: dependent on the connected switching unit

**Operating elements**

- one DIL switch for min/max position
- one DIL switch for 0 s or 2 s switching delay
- two DIL switches for setting the measuring ranges 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ

---

**Note:** Subject to reasonable modifications due to technical advances.
Conductive limit switch
LKL-P

Technical data

Certificates and approvals
LKL-P
see type code
Ex approval
Overspill protection
approvals in preparation
• WHG
• leak test (leakage)

General information

Directive conformity
Directive 89/336/EC (EMC)
interference emission to EN 61326, electrical equipment class B
interference immunity to EN 61326, annex A (industrial) and NAMUR recommendation EMC (NE21)

Directive 94/9/EC (ATEX)
approvals
TÜV 03 ATEX 2295, TÜ 2 G Ex ia/ib IIC/IIB T5 ... T6
TÜV 3 G Ex nA[L]/nC[L] IIC T6
EN 50014, EN 50020,
EN 50024
EN 50014, EN 50021

Directive 73/23/EC
(Low Voltage Directive)
EN 61010-1

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

Float switches

Vibration limit switches

Conductive limit switches

Capacitive limit switches

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Conductive limit switches

LKL-P

Function and system design
Function diagram
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 WA (compact instrument version)

Output characteristics
Output signal

Fail-safe mode
Switch point
Output signal
rd

Max.

MIN

the red LED flashes when the liquid reaches the measuring range limit and the switch point is not exceeded or undershot, or the switch point is reached and the conductivity of the liquid drifts out of the set sensitivity range
## Technical data

### Conductive limit switch LKL-P

### Output E5 (compact instrument version)

#### Function and system design

**Function diagram**

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.

![Function Diagram](image)

**Output characteristics**

**Output signal**

<table>
<thead>
<tr>
<th>Fail-safe mode</th>
<th>Switch point</th>
<th>Output signal</th>
<th>$i_d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td><img src="image" alt="Max Switch" /></td>
<td>$i^1$ L+ 3</td>
<td>$i^2$</td>
</tr>
<tr>
<td>MIN</td>
<td><img src="image" alt="Min Switch" /></td>
<td>$i^2$ L+ 3</td>
<td>$i^3$</td>
</tr>
</tbody>
</table>

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

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

#### Output characteristics

**Output signal**

<table>
<thead>
<tr>
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<th>Output signal</th>
<th>$i_d$</th>
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</thead>
<tbody>
<tr>
<td>MAX</td>
<td><img src="image" alt="Max Switch" /></td>
<td>$i^1$ L+ 3</td>
<td>$i^2$</td>
</tr>
<tr>
<td>MIN</td>
<td><img src="image" alt="Min Switch" /></td>
<td>$i^2$ L+ 3</td>
<td>$i^3$</td>
</tr>
</tbody>
</table>

*1: load current (connected); *2: residual current (disconnected); *3: LED not lit; *4: LED lit
Conductive limit switch
LKL-P

Output NA (separate instrument version)

Function and system design

Function diagram
separate instrumentation for two-rod or two-rope probes with cable monitoring

separate instrumentation for three-rod or three-rope probes with cable monitoring

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

LKL–P

Technical data

Type code/model number

L K L – P 1 – – – – – – – – – – – –

Certificates and approvals
NA version for non-explosion hazardous area
WH overspill protection WHG with leakage approval
EC ATEX II 3 G Ex nA/nC (L) IIC T6, WHG

Additional equipment
N without additional equipment
Y special version

Electrical output
NA without electronic insert (separate instrument version)
E5 FEWS2, PNP output, 10.8 V DC ... 45V DC (compact instrument version)
WA FEWS4, relay output, 20 V AC ... 253 V AC (compact instrument version)
N1 NAMUR

Housing, cable entry
P1 plastic housing, IP66, cable gland M20 x 1.5
P2 plastic housing, IP66, ½ NPT
P3 plastic housing, IP66, G½

Probe length
A 1000 mm (3 ft)
B in mm, 100 mm ... 4000 mm*
C in inch, 3.9 inches ... 157.5 inches*

Quantity and rod type
2 2 rods, 1.4435/316L
3 3 rods, 1.4435/316L
5 5 rods, 1.4435/316L

Process connection
G5 G½ PPS thread
N5 ½ NPT PPS thread

Version
1 rod version

L K L – P 2 – – – – – – – – – – – –

Certificates and approvals
NA version for non-explosion hazardous area
WH overspill protection WHG with leakage approval
EC ATEX II 3 G Ex nA/nC (L) IIC T6, WHG

Additional equipment
N without additional equipment
Y special version

Electrical output
NA without electronic insert (separate instrument version)
E5 FEWS2, PNP output, 10.8 V DC ... 45V DC (compact instrument version)
WA FEWS4, relay output, 20 V AC ... 253 V AC (compact instrument version)
N1 NAMUR

Housing, cable entry
P1 plastic housing, IP66, cable gland M20 x 1.5
P2 plastic housing, IP66, ½ NPT
P3 plastic housing, IP66, G½

Probe length
A 15000 mm
B 590.6 inches

Quantity and rope type
2 2 ropes, 1.4571/316TI
3 3 ropes, 1.4571/316TI
5 5 ropes, 1.4571/316TI

Process connection
G5 G½ PPS thread
N5 ½ NPT PPS thread

Version
2 rope version

* price is independent from length

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Date of issue 11/05/03 – Catalogue Field Devices 2004

95
1-rod electrode

**Features**

- Sensors for conductive limit value detection
- Electrode Ø6 mm (0.24 inches) for lengths over 1.5 m (5 ft)
- 1-rod electrode with electrode socket or terminal box
- Different rod and thread materials

**Function**

An electrode relay provides the measuring AC voltage for the electrode. If the product comes into contact with conductive batch, the measuring circuit between electrode and wall of vessel is closed and the electrode relay is switched.

**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.
## 1-rod electrode

### Technical data

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</tr>
<tr>
<td>Process pressure</td>
<td>thread 6: ≤ 30 bar</td>
</tr>
<tr>
<td></td>
<td>thread 7: ≤ 16 bar</td>
</tr>
<tr>
<td></td>
<td>thread 8: ≤ 6 bar</td>
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<td><strong>Mechanical construction</strong></td>
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<tr>
<td>Dimensions</td>
<td>length L max. 3000 mm (10 ft)</td>
</tr>
<tr>
<td>Material</td>
<td>housing: stainless steel 1.4571, PP or PTFE</td>
</tr>
<tr>
<td></td>
<td>thread: stainless steel 1.4571, PP or PTFE</td>
</tr>
<tr>
<td></td>
<td>electrode rod: stainless steel 1.4571, Hastelloy C, titanium or tantalum</td>
</tr>
<tr>
<td>Process connection</td>
<td>G½A thread</td>
</tr>
<tr>
<td>Connection</td>
<td>terminal in electrode socket or in terminal box</td>
</tr>
<tr>
<td></td>
<td>electrode socket: connection, max. 1 mm²</td>
</tr>
<tr>
<td></td>
<td>terminal box: connection, max. 2.5 mm²</td>
</tr>
</tbody>
</table>

### Type code/model number

```
H | R – | 6 | 1 |
```

- **Electrode rod material (with PTFE coating)**
  - 1 stainless steel 1.4571
  - 4 Hastelloy C (only for Ø4 mm (0.16 inches))
  - 7 Titanium (only for Ø4 mm (0.16 inches))
  - 8 Tantalum (only for Ø4 mm (0.16 inches))

- **Housing and thread material**
  - 6 stainless steel 1.4571
  - 7 plastic PP
  - 8 plastic PTFE

- **Number of electrodes**
  - 1 1-rod electrode

- **Electrical connection**
  - 0 G½A with spark plug socket
  - 1 G½A with terminal box

- **Electrode diameter**
  - 0 Ø4 mm (0.16 inches)
  - 1 Ø6 mm (0.24 inches)

- **Principle of measurement**
  - 6 conductive rod type electrode
Multiple-rod electrode

Dimensions

HR-6*5*

Function
An electrode relay provides the measuring AC voltage for the electrode. If the product comes into contact with conductive batch, the measuring circuit between electrode and wall of vessel is closed and the electrode relay is switched.

Features
- Sensors for conductive limit value detection
- 1 to 5 electrode rods
- Electrodes Ø4 mm (0.16 inches) or Ø6 mm (0.24 inches)
- Different rod and thread materials

When placing your order, please specify the length (L1 ... L5) of the electrode rods. The electrode rods can be cropped by the user if necessary.
### Technical data

#### HR-6*5*

#### Application
- Description: sensors for conductive limit value detection

#### Function and system design
- Equipment architecture: a measuring system consists of a rod electrode HR-6*5* with electrode relay KFA6-ER 1.6, KFD2-ER 1.6, KFD2-ER-Ex1.W.LB or KFA6-ER-Ex1.W.LB

#### Input characteristics
- Measured variable: measuring voltage directly from the electrode relay

#### Output characteristics
- Output signal: electrode relay creates switch signal corresponding to the selected responsiveness

#### Operating conditions
- Ambient conditions: in acc. with IEC 60529 IP65 with terminal box
- Process conditions:
  - Process temperature:
    - thread 6: $\leq 150 ^\circ C (423 K)$
    - thread 7: $\leq 90 ^\circ C (363 K)$
    - thread 8: $\leq 150 ^\circ C (423 K)$
  - Process pressure:
    - thread 6: 40 bar
    - thread 7: 10 bar
    - thread 8: 6 bar

#### Mechanical construction
- Dimensions: length L1 ... L5 max. 3000 mm (10 ft)
- Material:
  - Housing: stainless steel 1.4571, PP or PTFE
  - Thread: stainless steel 1.4571, PP or PTFE
  - Electrode rod: stainless steel 1.4571, Hastelloy C, titanium or tantalum
- Process connection: G1¼A thread
- Connection terminals in the terminal box: max. 2.5 mm²

#### Accessories
- Designation:
  - spacer, PTFE for Ø4 mm (0.16 inches) rods
  - spacer with clamp screw, PTFE, for Ø4 mm (0.16 inches) rods
  - spacer with clamp screw, PTFE, for Ø6 mm (0.24 inches) rods
  - Counter nut G1¼A made of PVC
  - Counter nut G1¼A made of stainless steel
  - LZ-1203, mounting angle of stainless steel 1.4571 with G1¼A drilling

### Type code/model number

```
HR – 6 5 [ ]
```

- Optional:
  - K: sealing material Kalrez for every electrode rod

- Electrode rod material (with PTFE coating):
  - 1: stainless steel 1.4571
  - 4: Hastelloy C (only for rods Ø4 mm (0.16 inches))
  - 7: Titanium (only for rods Ø4 mm (0.16 inches))
  - 8: Tantalum (only for rods Ø4 mm (0.16 inches))

- Housing and thread material:
  - 6: stainless steel 1.4571
  - 7: plastic PP
  - 8: plastic PTFE

- Number of electrodes:
  - 1: 1 rod
  - 2: 2 rods
  - 3: 3 rods
  - 4: 4 rods
  - 5: 5 rods

- Process connection:
  - 5: G1¼A thread

- Electrode diameter:
  - 0: Ø4 mm (0.16 inches)
  - 1: Ø6 mm (0.24 inches)

- Principle of measurement:
  - 6: conductive rod type electrode
Suspension electrode

Function

An electrode relay provides the measuring AC voltage for the electrode. If the product comes into contact with conductive batch, the measuring circuit between electrode and wall of vessel is closed and the electrode relay is switched.

Features

- Sensors for conductive limit value detection
- Simple and robust construction
- Application: deep well, drainage shafts

Dimensions

When placing your order, please specify the length (L) of the electrode rod.

HR-6901

PVC version HR690121

When placing your order, please specify the length (L) of the electrode rod.

Sensors for conductive limit value
detection

Simple and robust construction

Application: deep well, drainage shafts

Limit value immersion probes

Continuous immersion probes

Hydrostatic pressure sensors

Conductive limit switches

Capacitive limit switches

Vibration limit switches

Float switches

Suspension electrode
### Technical data

<table>
<thead>
<tr>
<th>Application</th>
<th>HR-6901</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>sensors for conductive limit value detection</td>
</tr>
</tbody>
</table>

## Function and system design

- a measuring system consists of a suspension electrode HR-690121 with an electrode relay KFA6-ER 1,6, KFD2-ER 1,6, KFD2-ER-Ex1.W.LB or KFA6-ER-Ex1.W.LB

## Input characteristics

- Measured variable: measuring voltage directly from the electrode relay

## Output characteristics

- Output signal: electrode relay creates switch signal corresponding to the selected responsiveness

## Operating conditions

- Process conditions:
  - Process temperature: -20 ... +60 °C (253 ... 333 K)

## Mechanical construction

- Versions:
  - HR-690121/5 m, suspension electrode, 5 m (16.5 ft) cable, PVC
  - HR-690121/10 m, suspension electrode, 10 m (33 ft) cable, PVC
  - HR-690121/20 m, suspension electrode, 20 m (66 ft) cable, PVC

## Dimensions

- Length L max.: 20 m (66 ft)

## Materials

- Thread: PVC
- Cable insulation: PVC
- Electrode: PVC
- Electrode tip: Stainless steel 1.4571

### Type code/model number

| HR-690121 / Cable length in m |

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101
Type code of hydrostatic pressure switches

The figure below shows the used characters and numbers of the hydrostatic pressure switches type code. Not all characters and numbers can be combined. The possible combinations are shown on the according data sheet of the hydrostatic pressure switches.

Product group HR-021**1
The pressure generated in the probe tube when the liquid level rises acts on a membrane switch. Once a set pressure threshold is reached, the changeover switch is actuated. Due to the high switching capacity, not only contactors and relays, but also signal devices and valves can be switched directly.

The membrane switch returns to its original position when the liquid level and thus the air pressure fall again.

In addition to various processing connections, stainless steel and plastic versions are available.

Hydrostatic pressure switch HR-021**1

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</thead>
<tbody>
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<td>Hydrostatic pressure switch HR-021**1</td>
<td>104</td>
</tr>
</tbody>
</table>
Hydrostatic pressure switch

HR-021**1

The membrane switch (changeover) in the terminal box switches, when a hydrostatic pressure of 15 mbar caused by the rising liquid rises up. The switch falls back with a pressure drop of 6 mbar.

The switching points are factory-set and fixed.

This device may be used with any circuit, if this circuit complies with the connection values of the switching element.

Features

- Limit value detection for liquids as maximum detection
- High switching capacity
- Used in open or pressureless vessels

Function

Electrical connection

Please specify the pipe length (L) when ordering.

Flat plug and sleeve 6.3 x 0.8 DIN 46244

Pipe length (L): ~75 ~80 ~90 ~100 ~110

PVC: Ø15
Stainless steel: Ø15/Ø28

Limit value detection for liquids as maximum detection

High switching capacity

Used in open or pressureless vessels
## Technical data

### Function and system design

| Equipment architecture | switching element: changeover switching on point: 15 mbar ± 3 mbar, switching off point: 9 mbar ± 3 mbar max. hydrostatic pressure: 500 mbar |

### Auxiliary energy

| Supply voltage | max. 253 V AC, 50/60 Hz |
| Current consumption | max. 1 A |

### Operating conditions

| Ambient conditions | 
|                   | 
|                   | 
|                   | 

| Process conditions | 
|                   | 
|                   | 
|                   | 

<table>
<thead>
<tr>
<th>Mechanical construction</th>
</tr>
</thead>
</table>

### Dimensions

| Length L | 180 ... 1000 mm (7.1 ... 39.4 inches) |
|-----------|

### Material

<table>
<thead>
<tr>
<th>Terminal box</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe material</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>plastic PVC</td>
</tr>
<tr>
<td>3</td>
<td>stainless steel 1.4571</td>
</tr>
</tbody>
</table>

### Process connection

| Flat plug | 6.3 mm x 0.8 mm, DIN 46244 |

### Type code/model number

**HR–021**

- **Process connection**
  - 1 G½A thread

- **Pipe diameter**
  - 1 Ø15 mm (0.59 inches), stainless steel version
  - 2 Ø16 mm (0.62 inches), plastic version
  - 4 Ø28 mm (1.1 inches), stainless steel version

- **Pipe material**
  - 1 plastic PVC
  - 3 stainless steel 1.4571

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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**

<table>
<thead>
<tr>
<th>L</th>
<th>C</th>
<th>L</th>
<th>–</th>
<th>–</th>
<th>–</th>
<th>–</th>
</tr>
</thead>
</table>

Certificates
Optional equipment
Electrical output
Housing
Process connection
Length
Versions
Limit
Capacitive Level
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 $\varepsilon_r$ of the medium.

### Capacitive limit switches LCL1

**Contents**

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<td>Limit value immersion probes</td>
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<td></td>
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<tr>
<td>Continuous immersion probes</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic pressure sensors</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic pressure sensors</td>
<td></td>
</tr>
<tr>
<td>Conductive limit switches</td>
<td></td>
</tr>
<tr>
<td>Conductive limit switches</td>
<td></td>
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<td>Vibration limit switches</td>
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<td>Float switches</td>
<td></td>
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<tr>
<td>Float switches</td>
<td></td>
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<tr>
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<td>108</td>
</tr>
<tr>
<td>Capacitive limit switches LCL1</td>
<td>108</td>
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</table>

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**Capacitive limit switch**

**Features**
- Complete unit consisting of the probe and electronic insert: simple mounting, no calibration on start-up
- Integrated active build-up compensation: accurate switching point, even with heavy build-up on the probe, high operational safety
- Mechanically rugged: no wearing parts, long operating life, maintenance-free
- Rope probe of the LCL2 can be shortened: optimum matching to the measuring point in the silo, simple storage

**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 inches) 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

**Dimensions**

**Features**
- Complete unit consisting of the probe and electronic insert: simple mounting, no calibration on start-up
- Integrated active build-up compensation: accurate switching point, even with heavy build-up on the probe, high operational safety
- Mechanically rugged: no wearing parts, long operating life, maintenance-free
- Rope probe of the LCL2 can be shortened: optimum matching to the measuring point in the silo, simple storage

**Electrical connection**
Example: connection type E5, 3-wire DC connection

Other connection types see section electrical connections.

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.
## Technical data

### Capacitive limit switch LCL

<table>
<thead>
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<th>Application</th>
<th>LCL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function principle</strong></td>
<td>limit detection maximum or minimum detection in silo with all types of solid granulates, even in dust explosion hazardous areas</td>
</tr>
</tbody>
</table>

| **Function and system design** | |
|-------------------------------| |
| **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 signal transmission occurs in the binary format |

| **Input characteristics** | |
|---------------------------| |
| **Measured variable** | limit level (limit value) |
| **Measurement range** | LCL1: \( r > 1.6 \)  
LCL2: \( r > 1.5 \) |
| **Measured medium** | bulk solids, grain size max. 30 mm (1.2 inches), density min. 200 g/l, \( r > 1.6 \) |

| **Output characteristics** | |
|---------------------------| |
| **Fail-safe mode** | switchable minimum/maximum closed circuit safety on the electronic insert |
| **Switching time** | LCL1: approx. 0.5 s when covering and uncovering  
LCL2: approx. 0.8 s when covering and uncovering |
| **Power up response** | LCL1: correct switching after max. 1.5 s  
LCL2: correct switching after max. 2 s |

| **Auxiliary energy** | |
|----------------------| |
| **Supply voltage** | connection E5: 10.8 ... 45 V DC, short-term pulse on 55 V DC  
connection WA: 20 ... 235 V AC, 50/60 Hz or 20 ... 55 V DC |
| **Current consumption** | connection E5: max. 30 mA, reverse voltage protection  
connection WA: max. 130 mA |
| **Cable connection** | terminal connection: lace max. 1.5 mm² in end splice, wire max. 2.5 mm² |

| **Operating conditions** | |
|--------------------------| |
| **Mounting conditions** | |
| **Mounting 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 |
| **Mounting location** | the limit switch switches when the probe tip is covered by a few centimeters of material or when it is free material flow should not be directed at the probe |
| **Ambient conditions** | the capacitive limit switch can be installed in silos made of different materials (e. g. metal, plastic, concrete) |
| **Ambient temperature** | -20 ... +70 °C (253 ... 343 K), -20 ... +60 °C (253 ... 333 K) dust-Ex version |

| **Process conditions** | |
|------------------------| |
| **Medium temperature** | LCL1: -40 ... +120 °C (233 ... 393 K), -40 ... +60 °C (233 ... 333 K) dust-Ex version  
LCL2: -20 ... +70 °C (253 ... 343 K) |
| **Medium temperature limit** | LCL1: -40 ... +130 °C (233 ... 403 K), -40 ... +80 °C (233 ... 353 K) dust-Ex version  
LCL2: -40 ... +80 °C (233 ... 353 K) |
| **Medium pressure limits** | LCL1: -1 ... +25 bar  
LCL2: -1 ... +6 bar |

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Capacitive limit switch

LCL

Technical data

Construction

Design

LCL1: compact version with rod probe
LCL2: compact version with rope probe

Dimensions

housing:
LCL1: Ø94 mm x 140 mm (3.7 inches x 5.5 inches), LCL2: Ø94 mm x 145 mm (3.7 inches x 5.7 inches)

Dimensions

length:
LCL1: 140 mm (5.5 inches), LCL2: 500 ... 6000 mm (1.6 ... 20 ft)

probe length variations LCL2:

<table>
<thead>
<tr>
<th>probe length</th>
<th>variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 1000 mm (3 ft)</td>
<td>+0 mm, -10 mm (0.39 inches)</td>
</tr>
<tr>
<td>up to 6000 mm (20 ft)</td>
<td>+0 mm, -30 mm (1.18 inches)</td>
</tr>
</tbody>
</table>

Weight

LCL1: 560 g, LCL2: 1230 g (basic weight probe length 500 mm (1.6 ft))

Material

- polyester 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 %)
## Technical data

### Capacitive limit switch LCL

**Switch point**
- LCL sensor switch points depend on the mounting location, in relation to the reference operating conditions
- LCL1: horizontal centre of probe -5 mm (-0.2 inches), vertical 40 mm (1.6 inches) above tip of the probe
- LCL2: vertical 35 mm (1.4 inches) above tip of the probe

### Indication and operation

**Display elements**
- green standby LED
- red LED for switch state indication

**Operating elements**
- switch on electronic insert:
  - switching between minimum and maximum fail-safe mode
  - sensitivity adjustment (dependent on dielectric constant $\varepsilon_r$ and build-up). Normally a sensitivity adjustment is unnecessary.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>N $\varepsilon_r &gt; 1.6$</td>
<td>M $–$</td>
<td>N $\varepsilon_r &gt; 2.0$</td>
<td>M $\varepsilon_r &gt; 1.6$</td>
<td>N $\varepsilon_r &gt; 2.5$</td>
</tr>
<tr>
<td>M $\varepsilon_r &gt; 2.0$</td>
<td>N $\varepsilon_r &gt; 1.6$</td>
<td>M $\varepsilon_r &gt; 2.0$</td>
<td>M $\varepsilon_r &gt; 2.5$</td>
<td></td>
</tr>
<tr>
<td>N $\varepsilon_r &gt; 3.5$</td>
<td>M $\varepsilon_r &gt; 2.5$</td>
<td>N $\varepsilon_r &gt; 2.5$</td>
<td>M $\varepsilon_r &gt; 2.5$</td>
<td></td>
</tr>
</tbody>
</table>

### Certificates and approvals

**Ex approval**
- see type code

**Type of protection**
- see type code

**Overspill protection**
- LCL1: Z-65.13-313 (DIBt, general design approval)

### General information

**Directive conformity**

- Directive 89/336/EC (EMC)
  - emitted interference to EN 61326, class B equipment
  - interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)

- Directive 94/9/EC (ATEX)
- Directive 73/23/EC (Low Voltage Directive)
- EN 61010-1

**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.

### Accessories

**Designation**
- LCL-Z10, glass 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)
Capacitive limit switch
LCL

**Technical data**

**Electrical connection**

- **Electronics 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.

  ![Electrical connection diagram]

- **Electronics 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.

  ![Electrical connection diagram]
## Technical data

### Capacitive limit switch LCL

#### Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>C</th>
<th>L</th>
<th>–</th>
<th>–</th>
</tr>
</thead>
</table>

- **Certificates**
  - NA: version for non-explosion hazardous areas
  - EX: ATEX II 1/3 D, zone 20
  - WH: WHG overspill protection
  - CS: CSA, DiP, Cl. II, Gr. E - G, Cl. III
  - CG: CSA General Purpose

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

- **Electronical output**
  - E5: PNP, 10.8 V DC ... 45 V DC
  - WA: with 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

- **Length and material**
  - K: 140 mm (5.5 inches), compact version, PPS (Polyphenylensulphide)
  - 3: 1500 mm (5 ft), steel, HD-PE coated
  - 4: 2500 mm (8 ft), steel, HD-PE coated
  - 6: 6000 mm (20 ft), steel, HD-PE coated

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

### Optional equipment

- **Electronical output**
  - 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

### Length and material

- **K**: 140 mm (5.5 inches), compact version, PPS (Polyphenylensulphide)
- **3**: 1500 mm (5 ft), steel, HD-PE coated
- **4**: 2500 mm (8 ft), steel, HD-PE coated
- **6**: 6000 mm (20 ft), steel, HD-PE coated

### Process connection

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

```
L M L - - -
```

- Electrical output
- Thread material
- Process connection
- Float
- Tube material
- Number of contacts
- Limit
- Magnet-operated
- Level
- Special features

Product group LML - - -

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Date of issue 11/05/03 – Catalogue Field Devices 2004
Limit value magnet-operated immersion probes

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

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<tr>
<td>Limit value magnet-operated immersion probe LML-Ex</td>
<td>120</td>
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</table>
Limit value magnet-operated immersion probe

LML-Plastic

Features
- Limit value detection in liquids
- Media contacting parts of PP or PVDF
- Mounting without de-mounting of the float (G1½A and G2A)

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

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.
### Technical data

<table>
<thead>
<tr>
<th>Application</th>
<th>LML-Plastic</th>
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<tbody>
<tr>
<td><strong>Description</strong></td>
<td>ring magnet as switching element in the float, reed contact, change-over contact</td>
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<tr>
<td>number of contacts:</td>
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<tr>
<td>design LML1: 1 contact</td>
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<tr>
<td>design LML2: 2 contacts</td>
<td></td>
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</tbody>
</table>

| Auxiliary energy | |
|------------------| |
| **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 |
| **Connectable load** | 250 V AC/DC, 1 A, 40 VA |

| Operating conditions | |
|----------------------| |
| **Ambient conditions** | |
| **Ambient temperature** | -20 ... +70 °C (253 ... 343 K) |
| **Protection class** | in accordance with IEC 60529 IP65 |
| **Process conditions** | |
| **Process temperature** | design PP: -20 ... +80 °C (253 ... 353 K) |
| | design PVDF: -20 ... +100 °C (253 ... 373 K) |
| **Density** | ≥ 0.8 g/cm³ |

| Mechanical construction | |
|-------------------------| |
| **Versions** | float Ø44 mm (1.73 inches), PP, G1½A, terminal box |
| LMLP7-G5P-DW, LMLP7-G5P-DW | |
| float Ø55 mm (2.16 inches), PVDF, G2A, terminal box |
| LML1D5-G6D-DW, LML2D5-G6D-DW | |
| float Ø44 mm (1.73 inches), PP, G3/8A, cable connector 1m (39.4 inches) |
| LML1P7-G1P-DW-PVC1, LML2P7-G1P-DW-PVC1 | |

| Dimensions | |
|-------------| |
| **float:** | |
| design PP: cylinder Ø44 mm (1.73 inches), height 44 mm (1.73 inches) |
| design PVDF: cylinder Ø55 mm (2.16 inches), height 70 mm (2.75 inches) |
| guide tube: Ø12 mm (0.47 inches), max. length 500 mm (19.7 inches) |
| terminal box: 80 x 80 x 55 mm (3.15 x 3.15 x 2.16 inches) |
| **Material** | float: |
| design PP: PP (Polypropylene) | |
| design PVDF: PVDF (Polyvinylidenfluoride) | |
| guide tube: | design PP: PP (Polypropylene) |
| design PVDF: PVDF (Polyvinylidenfluoride) | |
| connection cable: PVC | |
| terminal box: Polyester | |
| **Switching point** | distance min. 80 mm (3.15 inches) |
| **Connection** | design LML: terminal box, max. 9 terminals |
| design LML-PVC1: connection cable 1 m, 0.75 mm² |

| Accessories | |
|-------------| |
| **Designation** | LML-FD5, PVDF float Ø55 mm (2.16 inches) |
| LML-FP7, float PP Ø44 mm (1.73 inches) | |
| LML-Z21, set collar, PP | |
| LML-Z22, set collar, PVDF | |

### Limit value immersion probe

<table>
<thead>
<tr>
<th>LML-Plastic</th>
</tr>
</thead>
</table>

| **Type code/model number** | |
|-----------------------------| |
| L | M | L | - | - | - | - |

| **PVC1** | PVC cable (with process connection G1), 1 m (39.4 inches) |
| **Electrical output** | DT changeover contact, directly |
| **Thread material** | P PP (with G1 or G5 process connection) |
| | D PVDF (with G6 process connection) |
| **Process connection** | G1 thread G3/8 with PVDF cable, 1 m (39.4 inches) |
| | G5 thread G1½A |
| | G6 thread G2A |
| **Float** | 5 PVDF (cylinder, Ø55 mm x 70 mm (2.16 inches x 2.75 inches)), only with tube material PVDF |
| | 7 PP (cylinder, Ø44 mm x 44 mm (1.73 inches x 1.73 inches)), only with tube material PP |
| **Tube material** | P PP (pipe length in accordance with specification) |
| | D PVDF (pipe length in accordance with specification) |

| **Number of contacts** | |
|------------------------| |
| 1 | 1 contact |
| 2 | 2 contacts |
Limit value magnet-operated immersion probe

**Features**
- Limit value detection in liquids
- Media contacting parts of stainless steel 1.4571
- Mounting without de-mounting of the float (G1½A and G2A)

**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

![Electrical connection diagram for 1 contact](image)

BU  
BN  
BK

3 contacts

![Electrical connection diagram for 3 contacts](image)

BU/RD  
O  
RD  
O  
WH  
O  
YE  
O  
GN  
O  
BN  
O  
BU  
O  
PK  
O  
GY

2 contacts

![Electrical connection diagram for 2 contacts](image)

YE  
O  
GN  
O  
BN  
O  
BU  
O  
PK  
O  
GY  
L1  
L2

**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.
## Technical data

### Application

**Description**
- ring magnet as switching element in the float, reed contact, change-over contact
- number of contacts:
  - design LML1: 1 contact
  - design LML2: 2 contacts
  - design LML3: 3 contacts

### Auxiliary energy

**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

**Connectable load**
- 250 V AC/DC, 1 A, 40 VA

### Operating conditions

#### Ambient conditions

**Ambient temperature**
- -20 ... +70 °C (253 ... 343 K)

**Protection class**
- in accordance with IEC 60529 IP65

### Process conditions

#### Process temperature
- design LML: -20 ... +150 °C (253 ... 423 K)
- design LML-PVC1: -20 ... +90 °C (253 ... 363 K)

#### Process pressure
- ≤ 25 bar

#### Density
- design S2: ≥ 0.8 g/cm³
- design S3: ≥ 0.7 g/cm³

### Mechanical construction

#### Versions
- float Ø44 mm (1.73 inches), terminal box G1½A
- LML1S2-G5S-D, LML2S2-G5S-D, LML3S2-G5S-DW
- float Ø52 mm (2.05 inches), terminal box G2A
- LML1S3-G6S-D, LML2S3-G6S-D, LML3S3-G6S-DW
- float Ø44 mm (1.73 inches), cable connector 1 m (39.4 inches), G3/8A
- LML1S2-G1S-DW-PVC1, LML2S2-G1S-DW-PVC1, LML3S2-G1S-DW-PVC1
- float Ø52 mm (2.05 inches), cable connector 1 m (39.4 inches), G3/8A
- LML1S3-G1S-DW-PVC1, LML2S3-G1S-DW-PVC1, LML3S3-G1S-DW-PVC1

#### Dimensions
- float:
  - design S2: cylinder Ø44 mm (1.73 inches), height 52 mm (2.05 inches)
  - design S3: ball Ø52 mm (2.05 inches)
- guide tube: Ø12 mm (0.47 inches), max. length 3 m (118 inches)
- terminal box: 64 x 58 x 55 mm (2.52 x 2.28 x 2.16 inches)

#### Material
- float, guide tube: stainless steel 1.4571
- connection cable: PVC
- terminal box: aluminium die-casting

#### Switching point
- L1 ... L2 ≥ 100 mm (3.94 inches)
- L2 ... L3 ≥ 20 mm (0.79 inches)

### Connection
- design LML: terminal box, max. 9 terminals
- design LML-PVC1: terminal box 1 m, 0.75 mm²

### Accessories
- LML-FS2, stainless steel float, Ø44 mm (1.73 inches), cylindrical
- LML-FS3, stainless steel float, Ø55 mm (2.16 inches), spherical
- LML-Z11, set collar

### Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>M</th>
<th>L</th>
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</table>

<table>
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<tr>
<th>Number of contacts</th>
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<th>2</th>
<th>3</th>
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<tbody>
<tr>
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<tr>
<td>DT</td>
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<tr>
<td>S</td>
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<tr>
<td>G1</td>
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<td>G3</td>
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<td>G6</td>
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<td>3</td>
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</tr>
</tbody>
</table>

- Special features (optional)
- PVC cable (with process connection G1), 1 m (39.4 inches)
- changeover contact, directly
- stainless steel 1.4571
- G3/8 thread with PVC cable, 1 m (39.4 inches)
- G1½A thread
- G2A thread
- stainless steel 1.4571 (cylinder, Ø44 mm x 52 mm (1.73 inches x 2.05 inches))
- stainless steel 1.4571 (ball Ø52 mm (2.05 inches))
- stainless steel 1.4571 (pipe length in accordance with specifications)
Limit value magnet-operated immersion probe

LML-Ex

Features
- Approved for hazardous area zone 0
- Limit value detection in liquids
- Media contacting parts of stainless steel 1.4571
- Mounting without de-mounting of the float

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.

Electrical connection

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 \( L_1 \) and \( L_2 \) - 100 mm and between \( L_2 \) and \( L_3 \) - 20 mm.
## Technical data

### Application

**Description**
- ring magnet as switching element in the float, reed contact, change-over contact
- number of contacts:
  - design LML1: 1 contact
  - design LML2: 2 contacts
  - design LML3: 3 contacts
- design DO: with rising level: normally closed
- design DS: with rising level: normally open

### Function and system design

**Equipment architecture**
a measuring system consists of a magnet-operated immersion probe LML-Ex and a (up to 3) transformer isolated barrier with certified intrinsically safe circuit, for example, KFD2-SR2-Ex1.W

### Auxiliary energy

**Connectable load**
- EEx ia

### Operating conditions

#### Ambient conditions

- **Ambient temperature**
  - ≤ 80 °C (353 K) (T6)
  - ≤ 95 °C (368 K) (T5)
  - ≤ 130 °C (403 K) (T4)
  - ≤ 180 °C (453 K) (T3)

- **Protection class**
in accordance with IEC 60529 IP65

#### Process conditions

- **Process temperature**
- -20 ... +180 °C (253 ... 453 K), according to certificate

- **Process pressure**
- ≤ 25 bar

- **Density**
  - design S2: ≥ 0.8 g/cm³
  - design S3: ≥ 0.7 g/cm³

### Mechanical construction

#### Versions
- float Ø44 mm (1.73 inches), normally closed, thread G1½A
- float Ø44 mm (1.73 inches), normally open, thread G1½A
- float Ø52 mm (2.05 inches), normally closed, thread G2A
- float Ø52 mm (2.05 inches), normally open, thread G2A

#### Dimensions
- float:
  - design S2: cylinder Ø44 mm (1.73 inches), height 52 mm (2.05 inches)
  - design S3: ball Ø52 mm (2.05 inches)
- guide tube: Ø12 mm (0.47 inches), max. length 3 m (118 inches)
- terminal box: 80 x 75 x 57 mm (3.15 x 2.95 x 2.24 inches)

#### Material
- float, guide tube, process connection: stainless steel 1.4571
- terminal box: aluminium die-casting

#### Switching point
- position of the contacts min. 45 mm (1.77 inches) across the pipe end

#### Process connection
- design G5: thread G1½A
- design G6: thread G2A

#### Connection
- max. 6 terminals, max. 2.5 mm²

### Certificates and approvals

**Ex approval**
- see type code

### General information

**Directive conformity**
- Directive 94/9/EC (ATEX)
- EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see www.pepperl-fuchs.com.
### Limit value immersion probe

**LML-Ex**

#### Technical data

<table>
<thead>
<tr>
<th>Type code/model number</th>
<th>L</th>
<th>M</th>
<th>L</th>
<th>-</th>
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<td><strong>Special features (optional)</strong></td>
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<td>ATEX II 1/2 G EEx ia IIC T3 ... T6</td>
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<td>G6</td>
<td>G2A thread</td>
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</table>
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

![Type code diagram]

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.
Continuous magnet-operated immersion probes

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

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</table>
Continuous magnet-operated immersion probe

**Features**
- Sensor for continuous level measurement in liquids
- Media contacting parts of PP or PVDF
- 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 by the isolated transformer. This output signal is proportional to the level of the measured medium.

**Electrical connection**

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

**Dimensions**

```
<table>
<thead>
<tr>
<th>L1</th>
<th>ø14</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2</td>
<td>ø55</td>
</tr>
<tr>
<td>100 % indication</td>
<td>0 %</td>
</tr>
<tr>
<td>Guide tube</td>
<td></td>
</tr>
<tr>
<td>Float</td>
<td></td>
</tr>
<tr>
<td>LMC12&quot;G6&quot;-O</td>
<td></td>
</tr>
</tbody>
</table>
```

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

Application
Description
Function and system design
Equipment architecture
Auxiliary energy
Electrical connection
Performance characteristics
Accuracy
Operating conditions
Ambient conditions
Process conditions
Process temperature
Design PP: -20 ... +80 °C (253 ... 353 K)
Design PVDF: -20 ... +100 °C (253 ... 373 K)
Process pressure
Density
Mechanical construction
Versions
Dimensions
Material
Process connection
Connection
Accessories
Designation
Type code/model number

Continuous immersion probe LMC-Plastic

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

Date of issue 11/05/03 - Catalogue Field Devices 2004

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## Continuous magnet-operated immersion probe

### Features
- Sensor for continuous level measurement in liquids
- Media contacting parts of stainless steel 1.4571
- Mounting without de-mounting of the float

### Electrical connection

```
<table>
<thead>
<tr>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

### LMC-Stainless steel

![LMC-Stainless steel](image)

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

### Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>KFD2-STC4-1</td>
</tr>
<tr>
<td>KFD2-PT2-Ex1</td>
</tr>
<tr>
<td>MI04</td>
</tr>
<tr>
<td>MI100%</td>
</tr>
<tr>
<td>MI0%</td>
</tr>
<tr>
<td>BU</td>
</tr>
<tr>
<td>BN</td>
</tr>
<tr>
<td>BK</td>
</tr>
<tr>
<td>4 mA ... 20 mA</td>
</tr>
</tbody>
</table>

### Guide tube

- Tube length L
- Ø 80
- G1½A
- Ø 12
- PG11
- Ø55
- LMC*S*-G2S

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

### Continuous immersion probe

<table>
<thead>
<tr>
<th>LMC-Stainless steel</th>
</tr>
</thead>
</table>

### Application

**Description**

Sensor for continuous level measurement in liquids

### Function and system design

**Equipment architecture**

A measuring system consists of a magnet-operated immersion probe LMC-I with built-in converter and transmitter power supply KFD2-SC4-1 or a magnet-operated immersion probe LMC-O4 and isolated transformer KFD2-PT2-Ex1

### Auxiliary energy

**Electrical connection**

Design I: 2-wire connection 4 ... 20 mA
Design O4: 3-wire-potentiometer connection approx. 40 kΩ for connection to an isolated transformer

### Performance characteristics

**Accuracy**

Resolution:
- Design LMC8: 8 mm (0.31 inches)
- Design LMC16: 16 mm (0.63 inches)

### Operating conditions

**Ambient conditions**

- **Ambient temperature**: -20 ... +70 °C (253 ... 343 K)
- **Protection class**: In accordance with IEC 60529 IP65

**Process conditions**

- **Process temperature**: -20 ... +120 °C (253 ... 393 K)
- **Process pressure**: ≤ 16 bar
- **Density**
  - Design S1: ≥ 0.6 g/cm³
  - Design S2: ≥ 0.8 g/cm³

### Mechanical construction

**Dimensions**

- **Float**
  - Design S1: Ball Ø80 mm (3.15 inches)
  - Design S2: Cylinder Ø44 mm x 52 mm (1.73 inches x 2.05 inches)
- **Guide tube**
  - Design LMC8: Ø14 mm (0.55 inches), max. length 3 m (118 inches)
  - Design LMC16: Ø12 mm (0.47 inches), max. length 3 m (118 inches)
  - Terminal box: 64 x 58 x 55 mm (2.52 x 2.28 x 2.16 inches)

**Material**

- Float, guide tube, process connection: Stainless steel 1.4571
- Terminal box: Aluminium die-casting

**Process connection**

- Design G2: G½A thread
- Design G5: G1½A thread

**Connection**

- Design I: 2 terminals, max. 2.5 mm²
- Design O4: 3 terminals, max. 2.5 mm²

### Accessories

**Designation**

- LML-FS1, Stainless steel float Ø80 mm (3.15 inches), spherical
- LML-FS2, Stainless steel float Ø44 mm (1.73 inches), cylindrical

### Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>M</th>
<th>C</th>
<th>-</th>
<th>S</th>
<th>-</th>
</tr>
</thead>
</table>

**Electrical output**

- Design I: 2-wire 4 mA ... 20 mA
- Design O4: 3-wire-potentiometer circuit approx. 40 kΩ

**Thread material**

- Stainless steel 1.4571

**Process connection**

- G2: G½A thread
- G5: G1½A thread

**Float**

- Stainless steel 1.4571 (ball, Ø80 mm (3.15 inches))
- Stainless steel 1.4571 (cylinder, Ø44 mm x 52 mm (0.47 inches x 2.05 inches))

**Tube material**

- Stainless steel 1.4571 (pipe length in accordance with specifications)

**Resolution**

- 8 mm (0.31 inches) resolution
- 16 mm (0.63 inches) resolution
Continuous magnet-operated immersion probe

**Features**
- Approved for hazardous area 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**

---

**Dimensions**

![Diagram of Continuous magnet-operated immersion probe](image)

When placing your order, specify the length (L) of the guide tube.
## Technical data

### Application
- **Description**: sensor for continuous level measurement in liquids

### Function and system design
- **Equipment architecture**: a measuring system consists of a magnet-operated immersion probe LMC-I-Ex with built-in converter and transmitter power supplies KFD2-STC4-Ex.1 or of a magnet-operated immersion probe LMC-O4-Ex and an isolated transformer KFD2-PT2-Ex1

### Auxiliary energy
- **Electrical connection**:
  - design I: 2-wire connection 4 ... 20 mA
  - design O4: 3-wire-potentiometer connection approx. 40 kΩ

### Performance characteristics
- **Accuracy**: resolution: design LMC8: 8 mm (0.31 inches), design LMC16: 16 mm (0.63 inches)

### Operating conditions
- **Ambient conditions**:
  - Ambient temperature: -20 ... +70 °C (253 ... 343 K) (T5)
  - Ambient temperature: -20 ... +50 °C (253 ... 323 K) (T6)

- **Protection class**: in accordance with IEC 60529 IP65

### Process conditions
- **Process temperature**: -20 ... +120 °C (253 ... 393 K)
- **Process pressure**: 16 bar

### Mechanical construction
- **Dimensions**:
  - float:
    - design S2: cylinder Ø44 mm (1.73 inches), height 52 mm (2.05 inches)
    - design S3: ball Ø52 mm (2.05 inches)
  - guide tube:
    - design LMC8: Ø14 mm (0.55 inches), max. length 3 m (118 inches)
    - design LMC16: Ø12 mm (0.47 inches), max. length 3 m (118 inches)
  - terminal box: 80 x 75 x 57 mm (3.15 x 2.95 x 2.24 inches)

- **Material**:
  - float, guide tube, process connection: stainless steel 1.4571
  - terminal box: aluminium die-casting

### Connection design
- **Electrical connection**:
  - design I: 2 terminals, max. 2.5 mm²
  - design O4: 3 terminals, max. 2.5 mm²

### Certificates and approvals
- **Ex approval**: see type code

### Accessory designation
- **LML-FS1**, stainless steel float Ø80 mm (3.15 inches), spherical
- **LML-FS2**, stainless steel float Ø44 mm (1.73 inches), cylindrical

---

**Type code/model number**

```
LMC-Ex
```

- **Electrical output**:
  - 2-wire 4 mA ... 20 mA
  - 3-wire-potentiometer circuit approx. 40 kΩ

- **Process connection**:
  - design G5: G1½A thread
  - design G6: G2A thread

- **Material**:
  - float: stainless steel 1.4571
  - guide tube: stainless steel 1.4571
  - terminal box: aluminium die-casting

- **Resolution**:
  - design S2: 0.8 g/cm³
  - design S3: 0.7 g/cm³

- **Approval standards**:
  - KEMA 03 ATEX 1497 X, II 1/2 G EEx ia IIC T4 ... T6
  - EN 50014, EN 50020, EN 50282-1, EN 50282-2

**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.
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 LHC and LHC-M (hydrostatic pressure sensors)

Product group PPC-M (process pressure transmitter)
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.

### Contents

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<tr>
<td>Hydrostatic pressure sensor LHC-M</td>
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</tr>
<tr>
<td>Process pressure transmitter PPC-M</td>
<td>148</td>
</tr>
</tbody>
</table>
**Hydrostatic pressure sensor**

### BARCON LHC

- **Features**
  - Continuous, hydrostatic level control in liquids, pastes and muds
  - 2-wire transmitter
  - Sensor can be used in Ex zone 0
  - Easiest on-site calibration with push buttons
  - Menu-driven display for indication and parameterisation of a wide functionality
  - 32 point vessel linearisation
  - Designed as externally mounted type, rod type and rope type
  - Convertible, compact housing
  - Extremely high piezoresistive, overload resistant and long-term stable measurement cell
  - Parameterisation via HART communication

### Function

The pressure transducer is designed as externally mounted type, rod type or rope type and has a fully welded piezoresistive measurement cell. The level in various liquid or paste-like media is measured via conversion of the hydrostatic pressure which develops at the measurement point.

The voltage and temperature compensated measuring transducer guarantees an accuracy of the output signal higher than 0.2 % of the measurement range as well as the highest linearity and measurement value stability.

### Electrical connection

- **Current measurement device**

- **Power supply for 2-wire measuring transformer 4 mA … 20 mA (HART)**

---

**Dimensions**

- **Rod type**
  - Ø17.5
  - M20 x 1.5
  - SW60
- **Rope type**
  - Ø17.5
  - SW60

---

Subject to reasonable modifications due to technical advances.

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### Technical data

**BARCON LHC**

**Application**

**Description**
device for relative and absolute pressure measurement in gases, vapours and liquids

**Function and system design**

- **Equipment architecture**
  - Ex version: a measuring system consists of LHC and a transmitter power supply, e.g. KFD2-SC4-Ex1 (1 channel) or KFD2-SC4-Ex2 (2 channel)
  - Non-Ex version: a measuring system consists of LHC and a transmitter power supply, e.g. KFD2-CRG-1.D

**Input characteristics**

- **Measuring range**
  - overload limit: 0 ... 0.4 bar, 2 bar, 2 bar
  - bursting limit: 0 ... 1.6 bar, 10 bar, 10 bar
  - adjustment of the measuring span: 1:20 (Turndown)
  - zero point adjustment: 0 ... 100 %

- **Measurement conditions**
  - measurement frequency: 100 Hz, 10 Hz for Ex

**Output characteristics**

- **Output signal**
  - 2-wire 4 ... 20 mA (max. load: < (U_B - 12 V)/23 mA) optionally with overvoltage protection

- **Integration time**
  - 0 ... 40 s, adjustable

**Auxiliary energy**

- **Electrical connection**
  - observe the installation criteria to EN 60079-14, the terminal voltage must not exceed 36 V (30 V for Ex devices)

- **Supply voltage**
  - 30 V DC

- **Power consumption**
  - T5/T6: 697 mW, T4: 750 mW

- **Current consumption**
  - T5/T6: 93 mA, T4: 100 mA

- **Connectable load**
  - R_L = < 9 nF, L_I = negligible

**Performance characteristics**

- **Accuracy**
  - < 0.2 % of measuring range
  - < 0.1 %/10 K temperature influence
  - < 0.1 %/year long-time drift

**Operating conditions**

- **Ambient conditions**
  - Ambient temperature: -40 ... +85 °C (233 ... 358 K), Non-Ex
  - -40 ... +60 °C (233 ... 333 K), T6
  - -40 ... +70 °C (233 ... 343 K), T4

- **Protection class**
  - DIN EN 60529, IP65

**Process conditions**

- **Medium temperature**
  - -30 ... +100 °C (243 ... 373 K) for silicone oil
  - -10 ... +100 °C (263 ... 373 K) for vegetable oil

- **Cleaning temperature**
  - max. 120 °C (393 K) (10 min)

**Mechanical construction**

- **Design**
  - convertible housing, with view direction to top or front

- **Versions**
  - LHC1DR2-G5S1-EMPI2D, rod version with display
  - LHC1DR2-G5S1-EMPI2B, rod version without display
  - LHCS1DR2-G5S1-EMPI2D-Ex, rope version with display EEx ia version

- **Dimensions**
  - rod version: length L max. 3 m (10 ft)
  - rope version: length L max. 20 m (66 ft)

- **Material**
  - housing: plastic PBT, glass-fibre-reinforced
  - process connection: stainless steel 1.4571
  - wetted parts: stainless steel 1.4571, Hastelloy C4 (diaphragm only)

- **Connection**
  - cable gland 2 x M20 x 1.5, inside terminal block

**Indication and operation**

- **Display elements**
  - LCD-display, installable at a later date

- **Operating elements**
  - The calibration of zero point and span is easily performed via the integrated programming keys and can be performed when completely fitted as well as when dismounted.

  In case of versions with display (optionally) the calibration as well as the complete parameterisation of a wide functionality (such as tank lineairisation, alarm setting, service functions, temperature display, minimum/maximum value display etc.) can be performed via the display as well as the programming keys. The clearance of the push buttons for programming is performed by pressing the two keys ok + esc (2 s). For the exact procedure of calibration, please refer to the instructions.
# Hydrostatic pressure sensor
## BARCON LHC

### Technical data

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<th>BARCON LHC</th>
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<tr>
<td>Ex approval</td>
<td>DMT 99 ATEX E070</td>
</tr>
<tr>
<td>Type of protection</td>
<td>ATEX II 1/2 G EEx ia IIC T4/T6</td>
</tr>
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</table>

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<tr>
<td>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>.</td>
</tr>
</tbody>
</table>

### Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>H</th>
<th>C</th>
<th>R</th>
<th>2</th>
<th>E</th>
<th>M</th>
<th>EX</th>
</tr>
</thead>
</table>

- **Display**: 
  - EX: ATEX II 1/2 G EEx ia IIC T4/T6

- **Sensor filling media**:
  - 1: standard filling
  - 2: filling for food application

- **Sensor touching materials**:
  - S: stainless steel 1.4571
  - H: Hastelloy C4 (diaphragm only)

- **Process connection**:
  - G5: G1/4A with flush mounted diaphragm, stainless steel 1.4571
  - N5: 1½ NPT with flush mounted diaphragm, stainless steel 1.4571
  - M4: sanitary coupling DN40
  - T2: Triclamp 2"
  - F1: flange DN50 PN40
  - A2: flange ANSI 2", 150 psi

- **Pressure type/accuracy**:
  - R2: accuracy < 0.2 %

- **Pressure measurement range**:
  - 1D: 0 bar ... 0.4 bar
  - 2B: 0 bar ... 1.6 bar
  - 2E: 0 bar ... 6 bar
  - 5B: 0 bar ... 16 bar
  - SX: special range (default settings in acc. with customer specifications)

- **Version**:
  - R: rod version (extension acc. to the specification, max. 3 m (10 ft))
  - S: rope version (extension acc. to the specification, max. 20 m (66 ft))
<table>
<thead>
<tr>
<th>Technical data</th>
<th>Hydrostatic pressure sensor BARCON LHC</th>
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</thead>
</table>

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-M**

### Features
- Accuracy of measurement:
  - Linearity better than 0.3 % of set span, adjustable measuring range with TD 10:1, long-term stability better than 0.1 %
- Sensors: Dry capacitive ceramic sensor up to 40 bar – corrosion and abrasion resistant with high overload protection and vacuum-tightness piezoresistive metal sensor for measuring ranges up to 400 bar.
- Electronics: Analogue, SMART or PROFIBUS PA
- Housing: fulfills the special hygienic requirements of the foodstuff and pharmaceutical industries. The polyester-epoxy coated aluminium housing has been field-proven in the process industry
- Process connections: Change of media-touched material by replacing the sensor with a pressure transmitter is possible.
- Process connection in acc. to EHEDG

### Function
The hydrostatic pressure sensor LHC measure absolute and relative pressure in gases, vapours, liquids and 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.

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
Example: connection I2/IB analogue electronics
More connection types see section electrical connections.

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

Application

Description
device for absolute and relative pressure measuring in gases, vapours and liquids

Function principle

**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 mm³
advantages:
- guaranteed resistance to overload up to 40 times nominal pressure (max. 60 bar)
- extremely high resistance, comparable with Hastelloy or tantalum
- for use with vacuum
- ideal for hygienic processes as the Al₂O₃ ceramic material is recognised as safe (FDA listed)

**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 mm³.
advantages:
- for process pressures up to 400 bar
- excellent long-term stability
- guaranteed resistance to overload up to 4 times nominal pressure (max. 600 bar)
- a compact solution for small hygienic connections

Function and system design

Equipment architecture
- measuring system with analogue output 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
- measuring system with SMART electronics with current output 4 ... 20 mA and HART communication signal and auxiliary energy, e. g. via transmitter power pack, calibration via two keys on the device, handheld terminal or PC, e. g. with operating program PACTware™, optional digital display for measured variable indication
- measuring system with PROFIBUS PA electronics with digital communication signal PROFIBUS PA and segment coupler for connection to PLC or PC with operating program, e. g. PACTware™ from Pepperl+Fuchs, optional digital display for measured variable indication

Input characteristics

Measured variable
absolute or relative pressure

<table>
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<tr>
<th>Measuring range</th>
<th>LHC-M20</th>
<th>LHC-M40</th>
</tr>
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<td>pressure type</td>
<td>meas. limits</td>
<td>min. span</td>
</tr>
<tr>
<td>gauge</td>
<td>in bar</td>
<td>in bar</td>
</tr>
<tr>
<td>gauge</td>
<td>0 ... 0.1</td>
<td>0.01</td>
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<td>1.1</td>
</tr>
<tr>
<td>gauge</td>
<td>0 ... 1</td>
<td>0.1</td>
</tr>
<tr>
<td>gauge</td>
<td>0 ... 4</td>
<td>0.4</td>
</tr>
<tr>
<td>gauge</td>
<td>0 ... 10</td>
<td>1</td>
</tr>
<tr>
<td>gauge</td>
<td>0 ... 40</td>
<td>4</td>
</tr>
<tr>
<td>abs. pressure</td>
<td>0 ... 0.4</td>
<td>0.04</td>
</tr>
<tr>
<td>abs. pressure</td>
<td>0 ... 1</td>
<td>0.1</td>
</tr>
<tr>
<td>abs. pressure</td>
<td>0 ... 4</td>
<td>0.4</td>
</tr>
<tr>
<td>abs. pressure</td>
<td>0 ... 10</td>
<td>1</td>
</tr>
<tr>
<td>abs. pressure</td>
<td>0 ... 40</td>
<td>4</td>
</tr>
<tr>
<td>abs. pressure</td>
<td>0 ... 0.4</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*absolute pressure sensors

Output characteristics

Output signal
- analogue electronics: 4 ... 20 mA
- SMART electronics: 4 ... 20 mA with HART protocol, resolution 1 µA
- PROFIBUS PA electronics: digital communication signal

Signal on alarm
- analogue electronics: signal overrun (>20.5 mA) or signal underrun (<3.6 mA)
- SMART electronics: optional 3.6 mA, 22 mA or last current value will be hold

Load
- analogue electronics, SMART electronics:
  - max. 1522 Ω
  - max. 840 Ω, EEX ia IIC T6

Integration time
- analogue electronics: directly on device using DIP switches, switch position "off" 0 s, "on" 2 s
- SMART electronics: directly on device using DIP switches, switch position "off" 0 s, "on" 2 s
- or with handheld terminal or using operating program, e. g. PACTware™: 0 ... 40 s
- PROFIBUS PA electronics: 0 ... 40 s via communication

Vacuum resistance: to 10 mbar_{abs}
## Hydrostatic pressure sensor

### BARCON LHC-M

### Technical data

<table>
<thead>
<tr>
<th>Auxiliary energy</th>
<th>BARCON LHC-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>analogue electronics: 11.5 ... 45 V DC</td>
</tr>
<tr>
<td></td>
<td>SMART electronics: 11.5 ... 45 V DC, 11.5 ... 30 V DC (Ex i)</td>
</tr>
<tr>
<td></td>
<td>PROFIBUS PA electronics: 9 ... 32 V DC, 9 ... 24 V DC (Ex i)</td>
</tr>
<tr>
<td>Current consumption</td>
<td>PROFIBUS PA electronics: 10 mA ±1 mA</td>
</tr>
</tbody>
</table>

### Float switches

- **Limit value immersion probes**
- **Continuous immersion probes**
- **Limit value immersion probes**

### Vibration limit switches

### Conductive limit switches

### Capacitive limit switches

### Limit value immersion probes

### Continuous immersion probes

### Hydrostatic pressure sensors

### Performance characteristics

#### Linearity
- including hysteresis and repeatability (based on the limit point method to DIN IEC 770) ±0.2 % of set span
- special information for the linearity at low absolute pressure ranges are necessary (due to the performance limits of currently available DKD calibration rigs), for \( \geq 40 \text{ mbar}_{\text{abs}} \) up to \( <100 \text{ mbar}_{\text{abs}} \): ±0.3 % of set span

#### Long-time drift
- with reference to the span
- \( \leq 0.1 \% \) per year, \( \leq 0.25 \% \) per 3 years

#### Setting time
- analogue electronics: 180 ms
- SMART electronics: 600 ms
- PROFIBUS PA electronics: 600 ms

#### Warming-up time
- analogue electronics: 200 ms
- SMART electronics: 1 s
- PROFIBUS PA electronics: 1 s

#### Rise time
- analogue electronics: 60 ms
- SMART electronics: 220 ms
- PROFIBUS PA electronics: 220 ms

### Operating conditions

#### Mounting conditions
- any position, zero point shift due to position can be corrected

#### Vibration conditions
- without influence (4 mm in path peak-to-peak 5 Hz ... 15 Hz, 2 g; 15 Hz ... 150 Hz, 1 g; 150 Hz ... 2000 Hz)

#### Ambient conditions
- Ambient temperature:
  - LHC-M40: -40 ... +85 °C (233 ... 358 K)
  - LHC-M20: -40 ... +100 °C (233 ... 373 K)
- Storage temperature:
  - -40 ... +85 °C (233 ... 358 K)
- Climatic class: 4K4H to DIN EN 60721-3
- Protection class:
  - IP66 for devices with cable gland, cable entry or Harting plug Han7D
  - IP68 for devices with assembled cable or M12 plug
- Electromagnetic compatibility:
  - emitted interference to EN 61326, CLASS B equipment
  - interference immunity to EN 61326; annex A (industrial sector) and NAMUR EMC recommendation (NE 21)
  - EMC influence: \( \leq 0.5 \% \)
  - HART and PROFIBUS PA electronics: twisted, screened pairs must be used.

#### Process conditions
- Medium temperature:
  - LHC-M40: -40 ... +85 °C (233 ... 358 K)
  - LHC-M20: -40 ... +100 °C (233 ... 373 K)
- Medium temperature range:
  - LHC-M40 with filling made of:
    - silicone oil max. 250 °C (523 K), high temperature oil max. 350 °C (623 K), fluorolube max. 175 °C (448 K),
    - glycerine max. 200 °C (473 K), vegetable oil max. 200 °C (473 K)
  - corresponds to permissible overload, see section measuring range

### Mechanical construction

#### Dimensions
- LHC-M20:
  - measure L depends on process connection and lid.

---

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Hydrostatic pressure sensor

BARCON LHC-M

Technical data

process connections with threads

G1/4, G1/2

NS, 1 1/4 NPT

M4, M4 x 1.25

process connections with sanitary couplings

M65, dairy coupling DIN 11851

M75, dairy coupling DIN 11851

DIN 11864-1-A

process connections with flange on demand at Pepperl+Fuchs

SA7, DN50, aseptic

SA6, DN40, aseptic

S65, SMS 1 1/2", PN40

SP6, APV-Inline

V1M, V1M DN 1 1/2"

T96, T-Inflex 2"
Hydrostatic pressure sensor
BARCON LHC-M

BARCON LHC-M
LHC-M40:
process connections with threads

Process connection G**

Process connection N**

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<tr>
<th>process connection</th>
<th>threads</th>
<th>housing</th>
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<td></td>
<td>diameter</td>
<td>SW</td>
</tr>
<tr>
<td></td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>G31</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>G51</td>
<td>44</td>
<td>30</td>
</tr>
<tr>
<td>G61</td>
<td>56</td>
<td>30</td>
</tr>
<tr>
<td>N31</td>
<td>1 NPT</td>
<td>-</td>
</tr>
<tr>
<td>N51</td>
<td>1 ½ NPT</td>
<td>-</td>
</tr>
<tr>
<td>N61</td>
<td>2 NPT</td>
<td>-</td>
</tr>
</tbody>
</table>

Material
- housing:
  stainless steel 1.4404 or cast aluminium housing with protective polyester based powder coating
- nameplates:
  engraved on housing with laser (stainless steel housing) or 1.4301 (aluminium housing)
- process connections (in contact with the medium):
  stainless steel 1.4435
- slotted nuts:
  stainless steel 1.4307
- process diaphragm (in contact with the medium):
  LHC-M20: Al₂O₃ aluminium oxide ceramic (FDA listet), 96 %, extremely clean 99.9 %
  LHC-M40: stainless steel 1.4435, Hastelloy C276, tantalum, PTFE folio 0.09 mm on 1.4435 (not for vacuum), PTFE folio 0.25 mm on 1.4435 (not for vacuum)
- 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
- measurement cell:
  LHC-M20: without oil filling, dry sensor,
  LHC-M40: oil filling: optional silicone oil, vegetable oil, glycerine, high temperature oil, fluorolube grease-free for oxygen use

Surface quality
standard surface roughness of parts in contact with the medium Ra < 0.8 µm, reduces surface roughness on request.

Process connection
all customary versions of diaphragm seal, thread versions and flush mounted connections, see type code.

Housing
stainless steel or aluminium housing

Connection
housing *1: cable gland M 20 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 inches)
## Hydrostatic pressure sensor
### BARCON LHC-M

#### Technical data

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<th>BARCON LHC-M</th>
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<td>plug-in display in two versions:</td>
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<tr>
<td></td>
<td>• analogue electronics:</td>
</tr>
<tr>
<td></td>
<td>the analogue display gives the current pressure value related to the measuring range in the form of a bar graph (30 segments)</td>
</tr>
<tr>
<td></td>
<td>• SMART electronics:</td>
</tr>
<tr>
<td></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>• PROFIBUS PA electronics:</td>
</tr>
<tr>
<td></td>
<td>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)</td>
</tr>
<tr>
<td></td>
<td>display resolution:</td>
</tr>
<tr>
<td></td>
<td>• analogue display: bar graph, 1 segment equals 3.33 % of the set span</td>
</tr>
<tr>
<td></td>
<td>• digital display: 0.1 %, bar graph, 1 segment equals 3.57 % of the set span.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating elements</th>
<th>three versions of BARCON operations are available, depending on the electronics</th>
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<tr>
<td></td>
<td>• analogue: 4 ... 20 mA operation directly at the measuring point with one potentiometer each for lower range value and upper range value and a three-step range switch as well as an on/off switch for damping</td>
</tr>
<tr>
<td></td>
<td>• SMART: 4 ... 20 mA with HART protocol</td>
</tr>
<tr>
<td></td>
<td>operation mode:</td>
</tr>
<tr>
<td></td>
<td>- 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, or</td>
</tr>
<tr>
<td></td>
<td>- via the handheld terminal at any point along the 4 ... 20 mA line, or</td>
</tr>
<tr>
<td></td>
<td>- via a PC with an operating program, e.g. PACTware from Pepperl+Fuchs.</td>
</tr>
<tr>
<td></td>
<td>• PROFIBUS PA:</td>
</tr>
<tr>
<td></td>
<td>operation mode:</td>
</tr>
<tr>
<td></td>
<td>- using a PC with an operating program, e.g. PACTware from Pepperl+Fuchs</td>
</tr>
<tr>
<td></td>
<td>- with two keys for lower-range value and upper-range value.</td>
</tr>
</tbody>
</table>

#### Certificates and approvals

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<th>see type code</th>
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<tr>
<td>Type of protection</td>
<td>see type code</td>
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#### General information

<table>
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<th>Directive conformity</th>
<th>emitted interference to EN 61326, class B equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directive 89/336/EC (EMC)</td>
<td>interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Directive 94/9/EC (ATEX)</th>
<th>approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMT 02 ATEX E137, II 1/2 G Ex ia IIC T4/T6</td>
<td>EN 61326-1, EN 61010-1, EN 50014, EN 50020, EN 50081-1, EN 50082-1, EN 50284</td>
</tr>
<tr>
<td>II 3 G Ex nA II T5</td>
<td>EN 61326-1, EN 61010-1, EN 50021</td>
</tr>
</tbody>
</table>

| Directive 73/23/EC (Low Voltage Directive) | EN 61010-1 |

#### 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. |

#### Accessories

<table>
<thead>
<tr>
<th>Designation</th>
<th>LHC-Z10, cover with glass window for intrinsically safe units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LHC-Z11, cover with glass window of polycarbonate for standard units</td>
</tr>
<tr>
<td></td>
<td>LHC-Z10, cover with glass window for intrinsically safe units</td>
</tr>
<tr>
<td></td>
<td>LHC-Z30, set for wall and pipe mounting LHC-M40</td>
</tr>
<tr>
<td></td>
<td>LHC-Z40, digital display for electrical outputs IA and PB</td>
</tr>
<tr>
<td></td>
<td>LHC-Z41, analogue display for electrical output IB</td>
</tr>
</tbody>
</table>
Hydrostatic pressure sensor
BARCON LHC-M

Technical data

Electrical connection

- Connection with analogue electronics

Connection with SMART electronics

Connection with PROFIBUS PA electronics

Internal ground terminal

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

Subject to reasonable modifications due to technical advances.

Date of issue 11/05/03 – Catalogue Field Devices 2004
## Technical data

### Hydrostatic pressure sensor

**BARCON LHC-M**

### Type code/model number

<table>
<thead>
<tr>
<th>L</th>
<th>H</th>
<th>C</th>
<th>M</th>
<th>2</th>
<th>0</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
</table>

### Certificates

- NA for safe areas
- EX [ATEX II 1/2G, EEx ia IIC T6]
- E1 [ATEX II 2G, EEx ia IIC T6]
- CG CSA General Purpose
- C1 CSA IS (suitable for Div. 2), CI, I, II, III, Div. 1, Group A - G
- FM FM IS, CI, I, II, III, NI, Div. 1, Group A - G

### Optional equipment

- Z 3.1 B material, wetted parts 1.4435, inspection certificate to EN10204, acc. to specification 52005759

### Electrical output, indication

- NA without electronics/without display
- I2 4 mA ... 20 mA, analogue electronics
- IB 4 mA ... 20 mA, analogue electronics with display 0 % ... 100 % bar
- IH 4 mA ... 20 mA, SMART electronics, HART protocol
- IA 4 mA ... 20 mA, SMART electronics, HART protocol with display quadruple and 0 % ... 100 % bar
- PA PROFBUS PA electronics P3.0, in the PNO certification process
- PB PROFBUS PA electronics P3.0 with four-character display and 0 % ... 100 % bar, in the PNO certification process

### Housing, cable entry

- E1 stainless steel housing (1.4404/316L), M20 x 1.5 thread, IP66
- E2 stainless steel housing (1.4404/316L), ½ NPT entry, IP66
- E5 stainless steel housing (1.4404/316L), M12 x 1 plug, metal, IP66
- A1 aluminium housing, M20 x 1.5 thread, IP66
- A2 aluminium housing, ½ NPT entry, IP66
- A5 aluminium housing, M12 x 1 plug, metal, IP66

### Seal, diaphragm

- 1 FPM-Viton sensor sealing
- 2 NBR sensor sealing
- 4 EPDM sensor sealing
- A FPM-Viton sealing, oil- and grease-free

### Process connection

- G51 G1¼A thread, 1.4435, sealing not changeable
- N51 ½ NPT thread, 1.4435, sealing not changeable
- G61 G2A thread, 1.4435
- N61 2 NPT thread, 1.4435
- T65 Triclamp 2", ISO 2852, PN40, 1.4435
- S65 SMS 1½", PN40, 1.4435
- M65 dairy DIN 11851, DN40, PN40, 1.4435
- S66 aseptic DIN 11864-1-A, DN40, 1.4435
- SP6 APV inline, PN40, 1.4435
- V11 VariVent D = 68 mm (2.72 inches) for pipes DN40 ... 125, 1.4435
- F75 flange DIN, DN50, PN40, 1.4435
- F95 flange DIN, DN80, PN40, 1.4435
- A51 flange ANSI 1½", 150 lbs, 1.4435
- A61 flange ANSI 2", 150 lbs, 1.4435
- H21 flange ANSI 2", 150 lbs with Halar coating
- H95 flange DIN, DN80, PN40, 1.4435 with Halar coating
- XXX special version

### Calibration and technical units

<table>
<thead>
<tr>
<th>Calibration in sensor limits: mbar/bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 calibration in sensor limits: mbar/bar</td>
</tr>
<tr>
<td>B calibrated from ... to ..., technical unit ...</td>
</tr>
</tbody>
</table>

### Pressure measuring range

| R1A | 0 mbar ... 100 mbar gauge sensor, 10 kPa, 1.5 psi | 400 inches H2O, overload 40-fold |
| R1D | 0 mbar ... 400 mbar gauge sensor, 40 kPa, 6 psi | 160 inches H2O, overload 15-fold |
| R2A | 0 bar ... 1 bar gauge sensor, 100 kPa, 15 psi | 400 inches H2O, overload 10-fold |
| R2D | 0 bar ... 4 bar gauge sensor, 400 kPa, 60 psi | overload six-fold |
| R3A | 0 bar ... 10 bar gauge sensor, 1 MPa, 150 psi | overload quadruple |
| R3D | 0 bar ... 40 bar gauge sensor, 4 MPa, 600 psi | overload 1.5-fold |
| N1A | -100 mbar ... +100 mbar, -1 kPa ... +1 kPa, 40 inches H2O | overload 40-fold |
| N1D | -400 mbar ... +400 mbar, -4 kPa ... +4 kPa, -6 psi | +6 psi, overload 15-fold |
| N2A | -1 bar ... +1 bar sensor, -100 kPa ... +100 kPa, -15 psi | +15 psi, overload 10-fold |
| N2D | -1 bar ... +4 bar sensor, -400 kPa ... +400 kPa, -60 psi | +60 psi, overload 6-fold |
| N3A | -1 bar ... +10 bar sensor, -0.1 MPa ... +1 MPa, -15 psi | +15 psi, overload quadruple |
| A1D | 0 mbar ... 400 mbar absolute pressure sensor, 10 kPa, 6 psi, overload 15-fold |
| A2A | 0 bar ... 1 bar absolute pressure sensor, 100 kPa, 15 psi, overload 10-fold |
| A2D | 0 bar ... 4 bar absolute pressure sensor, 400 kPa, 60 psi, overload 6-fold |
| A3A | 0 bar ... 10 bar absolute pressure sensor, 1 MPa, 150 psi, overload quadruple |
| A3D | 0 bar ... 40 bar absolute pressure sensor, 4 MPa, 600 psi, overload 1.5-fold |

### Transmitter

| M20 | ceramic sensor |

---

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Hydrostatic pressure sensor
BARCON LHC-M

### Technical data

| Type code/model number | L | H | C | - | M | 4 | 0 | - | - | - | - | - | - |

**Certificates**

- NA for safe areas
- EX ATEX II 1G, Ex ia IIC T6
- E1 ATEX II 2G, Ex ia IIC T6
- E2 ATEX II 3G, Ex ia IIC T5
- CG CSA General Purpose

**C1** CSA IS (suitable for Div. 2), CI, II, II, III, Div. 1, Group A - G

**FM** FM IS, CI, II, III, NI, Div. 1, Group A - G

**S2** ATEX 1/0D

**Optional equipment**

- N without optional equipment
- M with mounting bracket for wall and pipe mounting
- Z 3.1.B material, wetted parts 1.4435, inspection certificate to EN10204, acc. to specification S205759

**Electrical output, indication**

- NA without electronics/without display
- I2 4 mA ... 20 mA, analogue electronics
- IB 4 mA ... 20 mA, SMART electronics, HART protocol
- IA 4 mA ... 20 mA, SMART electronics, HART protocol with display

**Electrical output, indication**

- PA PROFIBUS PA electronics P3.0, in the PNO certification process
- PB PROFIBUS PA electronics P3.0 with four-character display and 0 % ... 100 % bar

**Housing, cable entry**

- E1 stainless steel housing (1.4404/316L), M20 x 1.5 thread, IP66
- E2 stainless steel housing (1.4404/316L), ½ NPT entry, IP66
- E5 stainless steel housing (1.4404/316L), M12 x 1 plug, metal, IP68
- A1 aluminium housing, M20 x 1.5 thread, IP66
- A2 aluminium housing, ½ NPT entry, IP66
- A5 aluminium housing, M12 x 1 plug, metal, IP68

**Seal, diaphragm**

- 1 diaphragm seal 1.4435
- 2 diaphragm seal Hastelloy C276
- 5 diaphragm seal Tantal

**Sensor filling media**

- A silicone oil, direct coupling
- D vegetable oil, direct coupling
- G high temperature oil, temperature decoupling 100 mm (3.9 inches)
- K 1 m (39.4 inches) capillary with high temperature oil

**Process connection**

- G31 G1A thread, 1.4435
- G51 G1½A thread, 1.4435
- G61 G2A thread, 1.4435
- N31 1 NPT thread, 1.4435
- N52 ½ NPT thread, 1.4435
- N61 2 NPT thread, 1.4435
- F35 flange DIN, DN25, PN10/40
- F75 flange DIN, DN50, PN10/40
- F78 flange DIN, DN50, PN100/160
- F7A flange DIN, DN50, PN10/40 with tubus 50 mm (1.97 inches)
- F9B flange DIN, DN50, PN10/40 with tubus 100 mm (3.9 inches)
- F9C flange DIN, DN50, PN10/40 with tubus 200 mm (7.9 inches)
- A31 flange ANSI 1", 150 lbs
- A31 flange ANSI 2", 150 lbs
- A81 flange ANSI 3", 150 lbs
- A32 flange ANSI 4", 300 lbs
- A6A flange ANSI 2", 150 lbs with tubus 2"
- A6A flange ANSI 3", 150 lbs with tubus 2"
- A6A flange ANSI 4", 150 lbs with tubus 2"
- XXX special version

**Pressure measuring range**

- R2A 0 bar ... 1 bar gauge sensor, 100 kPa, 15 psig, overload quadruple
- R2D 0 bar ... 4 bar gauge sensor, 400 kPa, 60 psig, overload quadruple
- R3A 0 bar ... 10 bar gauge sensor, 1 MPa, 150 psig, overload quadruple
- R3D 0 bar ... 40 bar gauge sensor, 4 MPa, 600 psig, overload quadruple
- R4A 0 bar ... 100 bar gauge sensor, 10 MPa, 1500 psig, overload quadruple
- R4D 0 bar ... 400 bar gauge sensor, 40 MPa, 6000 psig, overload 1.5-fold
- N2A -1 bar ... +1 bar sensor, -100 kPa ... +100 kPa, -15 psig ... +15 psig, overload quadruple
- N2D -1 bar ... +4 bar sensor, -100 kPa ... +400 kPa, -15 psig ... +60 psig, overload quadruple
- N3A -1 bar ... +10 bar sensor, -0.1 MPa ... +1 MPa, -15 psig ... +150 psig, overload quadruple
- A2A 0 bar ... 1 bar absolute pressure sensor, 100 kPa, 15 psia, overload quadruple
- A2D 0 bar ... 4 bar absolute pressure sensor, 400 kPa, 60 psia, overload quadruple
- A3A 0 bar ... 10 bar absolute pressure sensor, 1 MPa, 150 psia, overload quadruple
- A3D 0 bar ... 40 bar absolute pressure sensor, 4 MPa, 600 psia, overload quadruple
- A4A 0 bar ... 100 bar absolute pressure sensor, 10 MPa, 1500 psia, overload quadruple
- A4D 0 bar ... 400 bar absolute pressure sensor, 40 MPa, 6000 psia, overload 1.5-fold

**Calibration and technical units**

- A calibration in the sensor limits: mbar/bar
- B calibrated from ... to ..., technical unit ...

**Transmitter**

- M40 metal sensor, piezoresistive

Subject to reasonable modifications due to technical advances.
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<th>Conductive limit switches</th>
<th>Capacitive limit switches</th>
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<th>Limit value immersion probes</th>
<th>Continuous immersion probes</th>
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</table>

Hydrostatic pressure sensors
The BARCON pressure transmitter measures the gauge and absolute pressure of gases, vapours, liquids and can be used in all areas of process engineering. The modular design of the BARCON pressure transmitter enables it to be used in all industrial environments.

**Features**

- **Accuracy of measurement:** Linearity better than 0.2 % of set span, adjustable measurement range with TD 10:1, long-term stability better than 0.1 %
- **Sensors:** Dry capacitive ceramic sensor for measurement ranges up to 40 bar – overload resistant, alternating load resistant, vacuum resistant piezoresistive metal sensor for measurement ranges up to 400 bar.
- **Electronic:** Analogue, SMART or PROFIBUS PA
- **Housing:** With its stainless steel housing without dead volume, the BARCON fulfils all the special hygienic requirements of the food and pharmaceutical industries. The polyester-epoxy coated aluminium housing has been field-proven in the process industry.
- **Process connections:** All customary thread versions and flanges are available

**Function**

Example: connection I2/IB analogue electronics
More connection types see section electrical connections.

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

BARCON PPC-M

Application
Description
device for measuring the gauge and absolute pressure of gases, vapours, liquids and dusts

Function principle

- **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 sensors, volume of chamber: approx. 2 mm³
  - advantages:
    - guaranteed resistance to overload up to 40 times nominal pressure (max. 60 bar)
    - extremely high resistance, comparable to Hastelloy or tantalum
    - for use with vacuum
    - ideal for hygienic processes as the Al₂O₃ ceramic material is generally recognised as safe (FDA listed)

- **metal sensor (PPC-M10)**
  - the process pressure deflects the separating diaphragm with a fill liquid transmitting the pressure to a resistance bridge
  - the bridge output voltage, which is proportional to pressure, is then measured and evaluated, volume of chamber: smaller than 1 mm³
  - advantages:
    - usable for process pressures up to 400 bar
    - excellent long-term stability
    - guaranteed resistance to overload up to 4 times nominal pressure (max. 600 bar)
    - a compact solution for small hygienic connections

Function and system design

Equipment architecture
- measuring system with analogue output 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
- measuring system with SMART electronics with current output 4 ... 20 mA and HART communication signal and auxiliary energy, e. g. via transmitter power pack, calibration via two keys on the device, handheld terminal or PC, e. g. with operating program PACTware™, optional digital display for measured variable indication
- measuring system with PROFIBUS PA electronics with digital communication signal PROFIBUS PA and segment coupler for connection to PLC or PC with operating program, e. g. PACTware™ from Pepperl+Fuchs, optional digital display for measured variable indication

Input characteristics

Measured variable
absolute or gauge pressure

Measuring range

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<td>0 ... 0.1</td>
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<tr>
<td>gauge</td>
<td>0 ... 0.4</td>
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<tr>
<td>gauge</td>
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<tr>
<td>abs. pressure</td>
<td>0 ... 10</td>
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<tr>
<td>abs. pressure</td>
<td>0 ... 40</td>
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Output characteristics

Output signal
analogue electronics: 4 ... 20 mA
SMART electronics: 4 ... 20 mA with HART protocol, resolution 1 µA
PROFIBUS PA electronics: digital communication signal

Signal on alarm
analogue electronics: Signal overrun (> 20.5 mA) or signal underrun (< 3.6 mA)
SMART electronics: optional 3.6 mA, 22 mA or last current value will be hold

Load
analogue electronics, SMART electronics:
max. 1522 Ω
max. 840 Ω, EEx i IIC T6

*absolute pressure sensors
Process pressure transmitter
BARCON PPC-M

**Technical data**

**BARCON PPC-M**

- analogue electronics: directly on device using DIP switches, switch position "off" 0 s, "on" 2 s
- SMART electronics: directly on device using DIP switches, switch position "off" 0 s, "on" 2 s
- or with handheld terminal or using operating program, e.g. PACTware: 0 ... 40 s via communication

| Float switches | Integration time | analogue electronics: directly on device using DIP switches, switch position "off" 0 s, "on" 2 s
SMART electronics: directly on device using DIP switches, switch position "off" 0 s, "on" 2 s
or with handheld terminal or using operating program, e.g. PACTware: 0 ... 40 s via communication |
---|---|---|
| Vibration limit switches | Auxiliary energy | Supply voltage analogue electronics: 11.5 ... 45 V DC
SMART electronics: 11.5 ... 45 V DC, 11.5 ... 30 V DC (Ex i)
PROFIBUS PA electronics: 9 ... 32 V DC, 9 ... 24 V DC (Ex i) |
| Conductive limit switches | Current consumption | PROFIBUS PA electronics: 10 mA ±1 mA |
| Capacitive limit switches | Accuracy of measurement | Linearity • including hysteresis and repeatability (based on the limit point method to DIN IEC 770) ±0.2 % of set span
• special information for the linearity at low absolute pressure ranges are necessary (due to the performance limits of currently available DKD calibration rigs), for ≥ 40 mbar\(\text{abs}\) up to <100 mbar\(\text{abs}\): ±0.3 % of set span |
| Limit value immersion probes | Linearity Long-time drift | with reference to the span ±0.1 % per year, ±0.25 % per 3 years |
| Continuous immersion probes | Setting time | analogue electronics: 180 ms
SMART electronics: 600 ms
PROFIBUS PA electronics: 600 ms |
| Hydrostatic pressure sensors | Warming-up time | analogue electronics: 200 ms
SMART electronics: 1 s
PROFIBUS PA electronics: 1 s |
| | Rise time | analogue electronics: 60 ms
SMART electronics: 220 ms
PROFIBUS PA electronics: 220 ms |

**Operating conditions**

- Mounting conditions
  - Mounting position any position, zero point shift due to position can be corrected

- Vibration conditions
  - without influence (4 mm in path peak-to-peak 5 ... 15 Hz, 2 g: 15 ... 150 Hz, 1g: 150 ... 2000 Hz)

- Ambient conditions
  - Ambient temperature -40 ... +85 °C (233 ... 358 K)
  - Ambient temperature limit -40 ... +100 °C (233 ... 373 K)
  - Storage temperature -40 ... +85 °C (233 ... 358 K)
  - Climatic class 4K4H to DIN EN 60721-3

- Protection class
  - IP66 for devices with cable gland, cable entry or Harting plug Han7D
  - IP68 for devices with assembled cable or M12 plug

- Electromagnetic compatibility
  - emitted interference to EN 61326, CLASS B equipment
  - interference immunity to EN 61326; annex A (industrial sector) and NAMUR EMC recommendation (NE 21)
  - EMC influence: ≤ 0.5 %
  - HART and PROFIBUS PA electronics: twisted, screened pairs must be used.

- Process conditions
  - Medium temperature -40 ... +100 °C (233 ... 373 K)
  - Medium pressure limits corresponds to permissible overload, see section measurement range

- Mechanical construction
  - Dimension housing: max. 117 x 74 x 160 mm (4.6 x 2.9 x 6.3 inches)

- Limit value immersion probes the values in brackets apply for housings with raised cover

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**Technical data**

**BARCON PPC-M**

**PPC-M10 A**

- Process connections: max. length 25 mm (1 inches)

**PPC-M20**:

- G11, G1C, G½ external
- G14, G½ external, G¼ internal

**PPC-M10**:

- G1G, G½ external
- N1A, ½ NPT external
- N1I, ½ NPT internal

**Process pressure transmitter BARCON PPC-M**

- Values in brackets apply for housings with raised cover
- Values in italics apply to devices with an aluminium housing

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Process pressure transmitter
BARCON PPC-M

Technical data

BARCON PPC-M

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<th>G10, G1/2 external with O-ring for welding nozzles</th>
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Viton sealing ring

O-ring 14 x 1.78 Viton or NBR

G1F, G1/2 external screw-in bolt DIN 3852-E-G1/2

Viton sealing ring

PTFE sealing ring

Teflon spring

Teflon back-up ring

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

Weight

housing:
PPC-M20: stainless steel 1400 g, aluminium 1600 g, PPC-M10: stainless steel 900 g, aluminium 1200 g

Materials

housing:
stainless steel 1.4404 or cast aluminium housing with protective polyester based powder coating

nameplates:
engraved on housing with laser (stainless steel housing) or 1.4301 (aluminium housing)

process connections (in contact with the medium):
PPC-M10: stainless steel 1.4435, adapter stainless steel 1.4435
PPC-M20: stainless steel 1.4435 or 2.4819 (Hastelloy C276)

slotted nuts: stainless steel 1.4307

process diaphragm (in contact with the medium):
Al2O3 aluminium oxide ceramic (FDA listed), PPC-M20: 96%

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

measuring cell:
PPC-M20: without oil filling, dry sensor
PPC-M10: oil filling; optional mineral oil, inert oil (Voltalef) for oxygen use or vegetable oil (FDA listed)

Process connection

customary thread versions and flush mounted connections, see type code

Connection

housing "1": cable gland M20 x 1.5
housing "2": cable entry 1/2 NPT
housing "3": cable entry G1/2
housing "4": Harting plug (Han7D)
housing "5": plug M 12 x 1
housing "6": assembled cable with pressure compensation, 5 m (16.5 ft)

Indication and operation

Display elements

plug-in display in two versions:
• analogue electronics:
  the analogue display gives the current pressure value related to the measuring range in the form of a bar graph (30 segments)
  SMART electronics:
  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:
  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.
## Technical data

### BARCON PPC-M

**Operating elements**

- Three versions of BARCON operations are available, depending on the electronics
  - Analogue: 4 ... 20 mA operation directly at the measuring point with one potentiometer each for lower range value and upper range value and a three-step range switch as well as an on/off switch for damping
  - SMART: 4 ... 20 mA 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, or
    - Via the handheld terminal at any point along the 4 ... 20 mA line, or
    - Via a PC with an operating program, e.g. PACTware from Pepperl+Fuchs.
  - PROFIBUS PA:
    - Operation mode:
      - Using a PC with an operating program, e.g. PACTware from Pepperl+Fuchs
      - With two keys for lower-range value and upper-range value.

### Certificates and approvals

- Ex approval: see type code
- Type of protection: see type code

### General information

**Directive conformity**

- Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment and interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)

- Directive 94/9/EC (ATEX) approvals:
  - DMT 02 ATEX E137, II 1/2 G Ex ia IIC T4/T6
  - II 3 G Ex nA II T5

- Directive 73/23/EC (Low Voltage Directive) EN 61010-1

**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.

### Accessories

**Designation**

- LHC-Z10, cover with glass window for intrinsically safe units
- LHC-Z11, cover with glass window of polycarbonate for standard units
- LHC-Z20, pressure sensor dummy G½A for welding nozzle LHC-Z22
- LHC-Z21, pressure sensor dummy G½A for welding nozzle LHC-Z23
- LHC-Z22, welding nozzle for process connection G10
- LHC-Z23, welding nozzle for process connection G30
- 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
Process pressure transmitter
BARCON PPC-M

Technical data

Electrical connection

- Connection 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 II 1/3 D (non Ex supply voltage) the device must always be protected by a 50 mA (slow-blow) fuse.

- Connection with SMART electronics

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

- Connection with PROFIBUS PA electronics

9 V DC ... 32 V DC
9 V DC ... 24 V DC (Ex i)
Test 4 mA ... 20 mA

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# Technical data

## Type code/model number

| P | P | C | M | 1 | 0 | - | - | - | - | - | - |

## Certificates
- NA for non-hazardous areas
- EX ATEX II 2G, EEx ia IIC T6
- E1 ATEX II 2G, EEx ia IIC T6
- S2 ATEX II 3D
- E2 ATEX II 3G, EEx ia IIC T5
- CG CSA General Purpose
- C1 CSA IS (suitable for Div. 2, Cl. I, II, III, Div.1, Group A - G)
- FM FM IB, CI. I, II, III, NI, Div.1, Group A - G

## Optional equipment
- N without optional equipment
- M with mounting bracket for wall and pipe mounting
- Z 3.1B material, welded parts

## Technical data

### Electrical output, indication
- NA without electronics/without display
- I2 4 mA ... 20 mA, analogue electronics
- IB 4 mA ... 20 mA, analogue electronics with display
- IH 4 mA ... 20 mA, SMART electronics, HART protocol
- IA 4 mA ... 20 mA, SMART electronics, HART protocol with display
- PA PROFINET PA electronics P3.0
- PB PROFINET PA electronics P3.0

### Housing, cable entry
- E1 stainless steel housing (1.4404/316L), M20 x 1.5 thread, IP66
- E2 stainless steel housing (1.4404/316L), ½ NPT entry, IP66
- E5 stainless steel housing (1.4404/316L), M12 x 1 plug, metal, IP68
- A1 aluminium housing, M20 x 1.5 thread, IP66
- A2 aluminium housing, M12 x 1 plug, metal, IP68

### Seal, diaphragm
- 1 diaphragm 1.4435, Viton, mineral oil
- A diaphragm 1.4435, welded, mineral oil
- D diaphragm 1.4435, welded, Teflon, grease-free

### Process connection
- G1F G1A, flush mounted diaphragm
- G1G G1A, EN 837, internal diaphragm
- N1A ½ NPT external, internal diaphragm
- N1I ½ NPT internal, internal diaphragm
- J12 PT1/8 external, JIS B 0203, internal diaphragm
- M21 M20 x 1.5 external, EN 837, internal diaphragm
- G1O G1A flush mounted with O-ring, for welding nozzles (with vegetable oil only)
- XXX special version

### Calibration and units
- 1 calibration in sensor limits: mbar/bar
- B calibrated from ... to ..., technical unit ...

### Pressure range
- R2A 0 bar ... 1 bar absolute pressure sensor, 100 kPa, 15 psig/400 inches H2O, overload quadruple
- R2D 0 bar ... 4 bar absolute pressure sensor, 400 kPa, 60 psig, overload quadruple
- R3A 0 bar ... 10 bar absolute pressure sensor, 1 MPa, 150 psig, overload quadruple
- R3D 0 bar ... 40 bar absolute pressure sensor, 4 MPa, 600 psig, overload quadruple
- R4A 0 bar ... 100 bar absolute pressure sensor, 10 MPa, 1500 psig, overload quadruple
- R4D 0 bar ... 400 bar absolute pressure sensor, 40 MPa, 6000 psig, overload 1.5-fold
- N2A -1 bar ... +1 bar sensor, -100 kPa ... +100 kPa, -15 psig ... +15 psig, overload quadruple
- N2D -1 bar ... +4 bar sensor, -100 kPa ... +400 kPa, -60 psig ... +60 psig, overload quadruple
- N3A -1 bar ... +10 bar sensor, 0.1 MPa ... +1 MPa, -15 psig ... +15 psig, overload quadruple
- N3D -1 bar ... +10 bar sensor, 0.1 MPa ... +1 MPa, -15 psig ... +15 psig, overload quadruple
- A2A 0 bar ... 1 bar absolute pressure sensor, 100 kPa, 15 psig, overload quadruple
- A2D 0 bar ... 4 bar absolute pressure sensor, 400 kPa, 60 psig, overload quadruple
- A3A 0 bar ... 10 bar absolute pressure sensor, 1 MPa, 150 psig, overload quadruple
- A3D 0 bar ... 40 bar absolute pressure sensor, 4 MPa, 600 psig, overload quadruple
- A4A 0 bar ... 100 bar absolute pressure sensor, 10 MPa, 1500 psig, overload quadruple
- A4D 0 bar ... 400 bar absolute pressure sensor, 40 MPa, 6000 psig, overload 1.5-fold

### Transmitter
- M10 metal sensor, piezoresistive

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## Type code/model number

| PPC | M | 2 | 0 |

## Technical data

### Certificates
- **NA** for safe areas
- **EX** ATEX II 1G, Ex ia IIC T6
- **E1** ATEX II 2G, Ex ia IIC T6
- **S2** ATEX II 1G, Ex nA IIC T5
- **CG** CSA General Purpose
- **C1** CSA IIS (suitable for Div. 2), CI, II, III, Div. 1, Group A - G
- **FM** FM II, CI, II, III, NI, Div. 1, Group A - G

### Electrical output, indication
- **NA** without electronics, without indication
- **I2** 4 mA ... 20 mA, analogue electronics
- **IB** 4 mA ... 20 mA, analogue electronics with display 0 % ... 100 % bar
- **IH** 4 mA ... 20 mA, SMART electronics, HART protocol
- **IA** 4 mA ... 20 mA, SMART electronics, HART protocol with display and 0 % ... 100 % bar

### Housing, cable entry
- **E1** stainless steel housing (1.4404/316L), M20 x 1.5 thread, IP66
- **E2** stainless steel housing (1.4404/316L), ½ NPT entry, IP66
- **E5** stainless steel housing (1.4404/316L), M12 x 1 plug, metal, IP68
- **A1** aluminium housing, M20 x 1.5 thread, IP66
- **A2** aluminium housing, ½ NPT entry, IP66
- **A5** aluminium housing, M12 x 1 plug, metal, IP68

### Seal, diaphragm
- **1** FPM-Viton sensor sealing
- **4** EPDM sensor sealing
- **C** Chemraz sensor sealing
- **7** Kalrez sensor sealing
- **A** FPM-Viton sealing, oil- and grease-free

### Process connection
- **G11** G1/4A EN 837, 1.4435
- **G1C** G1/4A EN 837, Hastelloy C
- **G14** G1/4A G1/4 internal, 1.4435
- **G1M** G1/4A 11.4 mm (0.45 inches) internal, 1.4435
- **N14** 1/4 NPT external, 1/4 NPT internal, 1.4435

### Pressure range
- **R1A** 0 mbar ... 100 mbar absolute pressure sensor, 10 kPa, 1.5 psig/40 inches H2O, overload 40-fold
- **R1D** 0 mbar ... 400 mbar absolute pressure sensor, 40 kPa, 6 psig/160 inches H2O, overload 15-fold
- **R2A** 0 bar ... 1 bar absolute pressure sensor, 100 kPa, 15 psig/400 inches H2O, overload 10-fold
- **R2D** 0 bar ... 4 bar absolute pressure sensor, 400 kPa, 60 psig, overload 6-fold
- **R3A** 0 bar ... 10 bar absolute pressure sensor, 1 MPa, 150 psig, overload quadruple
- **R3D** 0 bar ... 40 bar absolute pressure sensor, 4 MPa, 600 psig, overload 1.5-fold
- **N1A** -100 mbar ... +100 mbar sensor, -10 kPa ... +10 kPa, -40 inches ... +40 inches H2O, overload 40-fold
- **N1D** -400 mbar ... 400 mbar sensor, -40 kPa ... +40 kPa, -6 psig, overload 15-fold
- **N2A** -1 bar ... +1 bar sensor, -100 kPa ... +100 kPa, -15 psig ... +15 psig, overload 10-fold
- **N2D** -1 bar ... +4 bar sensor, -100 kPa ... +400 kPa, -15 psig ... +60 psig, overload 6-fold
- **N3A** -1 bar ... +10 bar sensor, -0.1 MPa ... +1 MPa, -15 psig ... +150 psig, overload quadruple
- **N3D** -1 bar ... +10 bar sensor, -1 MPa ... +10 MPa, -15 psig ... +150 psig, overload quadruple
- **A1D** 0 mbar ... 400 mbar absolute pressure sensor, 40 kPa, 6 psia, overload 15-fold
- **A2D** 0 bar ... 1 bar absolute pressure sensor, 100 kPa, 15 psia, overload 10-fold
- **A2D** 0 bar ... 4 bar absolute pressure sensor, 400 kPa, 60 psia, overload 6-fold
- **A3A** 0 bar ... 10 bar absolute pressure sensor, 1 MPa, 150 psia, overload quadruple
- **A3D** 0 bar ... 40 bar absolute pressure sensor, 4 MPa, 600 psia, overload 1.5-fold

### Transmitter
- **M20** ceramic sensor
### Technical data

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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
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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Level probe

### LGC

**Function**

The level probe LGC is a hydrostatic pressure sensor for measuring the level of fresh water, drinking water and waste water. With nine permanently calibrated measuring ranges from 0.1 bar to 20 bar ensures the level probe use in all standard applications including fresh water and waste water treatment plants.

Due to its compact outside diameter of only 22 mm (0.87 inch) it is ideal for use in small-diameter probe tubes.

There is also an optionally function permitting the simultaneous measurement of level and temperature.

### Features

- Permanent hermetically sealed level probe
- High mechanical resistance to overload and aggressive media
- High-precision and long-term stability ceramic measuring cell
- Potted electronics and 2-filter pressure compensation system provide resistance to climatic changes
- Electronics comprising 4 mA ... 20 mA output signal and integrated overvoltage protection
- Simultaneous level and temperature measuring by optional integrated temperature probe Pt100
- Drinking water approvals: KTW and NSF
- Certified to ATEX II 2 G/Ex ia, FM and CSA
- Rugged terminal housing (IP66/IP67) with GORE-TEX® filter for pressure compensation
- Complete measuring point solution through comprehensive accessories from Pepperl+Fuchs

### Dimensions

- **Floating switches:** Vibration limit switches
- **Conductive limit switches:** Conductive limit switches
- **Capacitive limit switches:** Capacitive limit switches
- **Level value probes:** Continuous immersion probes
- **Hydrostatic pressure sensors:** Level probe LGC

### Electrical connection

Example: Level probe LGC with Pt100 and temperature transmitter LGC-Z13

(4 mA ... 20 mA)

Other connection types see section electrical connections.

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

**Example diagram:**

- **Extension cable Pressure compensating tube**
- **Level probe LGC**
- **Protective cap Ø22 ± 0.1**
- **10 V DC ... 30 V DC**
- **4 mA ... 20 mA**
- **8 V DC ... 35 VDC**
- **Temperature transmitter LGC-Z13**
- **Pt100**
- **Core colours:**
  - RD = red
  - BK = black
  - WH = white
  - YE = yellow
  - BU = blue
  - BR = brown

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Technical data

LGC

Application
Function principle
hydrostatic level control
level measuring and temperature control (optional) of freshwater drinking water and wastewater

Function and system design
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.

Equipment architecture
the measuring system consists of a LGC level probe and a transmitter power pack with a supply voltage between 10 ... 30 V DC or with a transmitter power supply KFD2-STC4-Ex1

Input characteristics
Measured variable
hydrostatic pressure of liquid
optional: temperature of a liquid (Pt100)
optional: temperature of a liquid (Pt100 and temperature transmitter)

Measuring range
nine fixed pressure measuring ranges in bar and psi, see ordering information customer specified measuring ranges between 0 ... 20 bar, factory-calibrated
optional: temperature control from -10 ... +70 °C (263 ... 343 K) (Pt100)
optional: temperature control from -20 ... +80 °C (253 ... 353 K) (with 4-wire temperature transmitter)
Special measuring ranges on demand
Input signal
change in capacitance
optional: change in resistance (Pt100)
optional: resistance signal, 4-wire (Pt100 and temperature transmitter)

Output characteristics
Output signal
4 ... 20 mA for hydrostatic pressure measured value, 2-wire optional: temperature-dependent resistance variable (Pt100)
optional: temperature-dependent resistance variable (Pt100), 4 ... 20 mA for temperature measured value, 2-wire (Pt100 and temperature transmitter)

Load
$R_{\text{tot}} = \left( \frac{U_b - 10 \text{ V}}{0.0225 \text{ A}} \right) \cdot \left( \frac{U_b - 8 \text{ V}}{0.022 \text{ A}} \right) - R_{\text{add}}$
optional: $R_{\text{tot}} = \left( \frac{U_b - 10 \text{ V}}{0.0225 \text{ A}} \right) - R_{\text{add}}$ (with temperature transmitter)
$R_{\text{add}} = \text{Max. load resistance} \left[ \Omega \right]$
$R_{\text{add}} = \text{additional resistance, e.g. resistance of evaluating device and/or display instruments, line resistance} \left[ \Omega \right]$
$U_b = \text{supply voltage} \left[ \text{V} \right]$
$I = \text{simple length of extension cable} \left[ \text{m} \right]$ (cable resistance per wire $\leq 0.09 \Omega \text{m}$)

Auxiliary energy
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
10 ... 30 V DC, EEx nA and EEx ia: 10 ... 30 V DC optional: 10 ... 30 V DC, EEx nA: 10 ... 30 V DC (Pt100) optional: 8 ... 35 V DC (Pt100 and temperature transmitter)

Cable connection
extension cable:
Cross section:
• optional equipment N/2/4: 3 x 0.227 mm² and pressure compensating tube with Teflon filter
• optional equipment 1/3: 7 x 0.227 mm² and pressure compensating tube with Teflon filter
• total outer diameter: 8.0 mm ± 0.25 mm
• pressure compensating tube with Teflon filter: DA = 2.5 mm, di = 1.5 mm
commercially available installation cable, terminals, terminal housing LGC: 0.08 ... 2.5 mm²
optional: for direct connection of the Pt100 signal to a display or/and evaluation unit, Pepperl+Fuchs recommended the use of screened cables. (Pt100)
optional: connection transmitter max. 1.75 mm² (Pt100 and temperature transmitter)

Power consumption
$\leq 0.675 \text{ W at } 30 \text{ V DC}$
optional: $\leq 0.675 \text{ W at } 30 \text{ V DC}, \leq 0.77 \text{ W at } 35 \text{ V DC}$ (with temperature transmitter)

Current consumption
max. current consumption: $\leq 22.5 \text{ mA}$, min. current consumption: $\leq 3.5 \text{ mA}$
optional: $\leq 0.6 \text{ mA}$ (Pt100)
optional: $\leq 0.6 \text{ mA}$ (Pt100 and temperature transmitter)

Residual ripple
without influence for 4 ... 20 mA signal up to $\leq 5 \%$ residual ripple within the permitted voltage range
optional: $U_{\text{ss}} \leq 5 \text{ V at } U_b \geq 13 \text{ V}$, $f_{\text{max.}} = 1 \text{ kHz}$ (Pt100 and temperature transmitter)

Performance characteristics
Accuracy
linearity including hysteresis and repeatability according to DIN EN 60770: $\pm 0.2 \%$ from full scale (FS) optional: max. $\pm 0.7 \text{ K}$ (CLASS B according to DIN EN 60751) (Pt100)
optional: $\pm 0.2 \text{ K}$ (temperature transmitter), max. $\pm 0.9 \text{ K}$ (CLASS B according to DIN EN 60751) (Pt100 and temperature transmitter)

Long-time drift
$\pm 0.1 \%$ from full scale (FS) per year
optional: $\leq 0.1 \text{ K per year}$ (Pt100 and temperature transmitter)
Level probe
LGC

Technical data

Influence of the medium temperature
- 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
- 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)
- temperature coefficient (T_K) in zero signal and output span: 0.15 %/10 K (0.3 %/10 K)* of the measuring span (Pt100 and temperature transmitter)

* specifications for sensors 0.1 bar (1 mH2O, 1.5 psi, 3 ftH2O) and 0.6 bar (6 mH2O, 10 psi, 20 ft H2O)

Warming-up time 20 ms, 4 s (Pt100 and temperature transmitter)
Rise time 80 ms, 160 s (Pt100)
Setting time 150 ms, 300 s (Pt100)

Operating conditions
Mounting conditions
Mounting position vertical from above

Ambient conditions
Ambient temperature -10 ... +70 °C (263 ... 343 K) (= product temperature)
optional: -40 ... +85 °C (233 ... 358 K) (Pt100 and temperature transmitter)

Storage temperature -40 ... +80 °C (233 ... 353 K)
optional: -40 ... +100 °C (233 ... 373 K) (Pt100 and temperature transmitter)

Protection class IP68, permanent hermetically sealed, optional terminal housing IP66/IP67
optional: IP00, permitted moisture condensation, for installation in the optional terminal housing IP66/IP67 (Pt100 and temperature transmitter)

Overvoltage protection integrated overvoltage protection to EN 61000-4-5 ≤ 1.2 kV, overvoltage protection ≤ 1.2 kV under certain circumstances external realisation
optional: overvoltage protection under certain circumstances external realisation

Process conditions
Medium temperature -10 ... +70 °C (263 ... 343 K), for Ex devices see safety informations or section "supplementary documentation"
optional: -40 ... +85 °C (233 ... 358 K) (= ambient temperature), mounting the temperature transmitter outside of the measuring medium (Pt100 and temperature transmitter)

Medium temperature limit -20 ... +70 °C (253 ... 343 K) (For this temperature range the level probe LGC may be operated.)
the specification values such as e. g. accuracy of measuring may be exceeded, see also DIN 16086

Mechanical construction
Design rod probe
Dimensions level probe LGC: diameter 22 mm (0.87 inches), length 230 mm (9.05 inches)
terminal housing LGC-Z11: width 120 mm (4.7 inches), depth 55 mm (2.16 inches), height 80 mm (3.15 inches)
temperature transmitter LGC-Z13: diameter 44 mm (1.7 inches), height 21 mm (0.8 inches)
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 Do non-Ex and EEx nA IIC T6, see section Load
- max. length for EEx ia IIC T6: see related Safety information (SI)

Weight level probe LGC: 290 g
terminal housing LGC-Z11: 235 g
temperature transmitter LGC-Z13: 40 g
extension cable: 52 g/m

Material level probe LGC: 1.4435 (AISI 316L)
ceramic: Al2O3 aluminium oxide ceramic
seal: EPDM or viton (inside)
protective cap: PE-HD (Polyethylene with high density)
terminal housing LGC-Z11: PC (Polycarbonate)
temperature transmitter LGC-Z13: PC housing (Polycarbonate)
extension cable XM, 2A, 2C: isolation PE (Polyethylene), copper wire, twisted
tension cable CM, 3A, 3C: isolation FEP (Fluorethylenpropylene), copper wire, twisted

Mechanical demands extension cable:
- minimum bend radius: 120 mm (4.7 inches)
- tensile strength: ≥ 1200 N
- cable extraction force: ≥ 450 N (the extension cable could be extracted from the cable probe at a tensile force ≥ 450 N)
- approved for use with drinking water
- increased resistance to UV light
- cable resistance per wire: ≤ 0.09 Ω/m

Connection 3 terminals in terminal housing as standard
4 terminals in block, accessories LGC-Z15 for conductor cross section 0.08 ... 2.5 mm²
optional: terminal housing including 3 terminals
optional: terminal housing including 7 terminals for level probe LGC with Pt100
optional: terminal housing including 3 terminals for level probe LGC and temperature transmitter LGC-Z13 with Pt100
### Technical data

#### Level probe

**LGC**

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<td>Type of protection</td>
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#### General information

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<td>Directive 73/23/EC (Low Voltage Directive)</td>
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#### Accessories

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<tr>
<td></td>
<td>LGC-Z11, terminal housing 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)</td>
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<tr>
<td></td>
<td>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</td>
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<td></td>
<td>LGC-Z13, temperature transmitter 2-wire for level probe LGC</td>
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<tr>
<td></td>
<td>LGC-Z14, cable mounting screw G with cylindrical threading G1(\frac{1}{2})A for simple mounting of the level probe LGC and for locking the extension cable</td>
</tr>
<tr>
<td></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>LGC-Z16, cable mounting screw N with tapered thread 1(\frac{1}{2}) NPT for simple mounting of the level probe LGC and for locking the extension cable</td>
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</tbody>
</table>

**Certificates and approvals**

- Ex approval: see type code
- Type of protection: see type code

**General information**

- Directive 89/336/EC (EMC)
  - Interference emission to EN 61326, electrical equipment class B
- Directive 94/9/EC (ATEX)
  - Interference immunity to EN 61326, annex A (industrial) and NAMUR recommendation EMC (NE21)
- Directive 73/23/EC (Low Voltage Directive)
  - EN 61010-1

**Accessories**

- LGC-Z10, mounting clamp A for simple mounting of the level probe LGC
- LGC-Z11, terminal housing 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
- LGC-Z14, cable mounting screw G with cylindrical threading G1\(\frac{1}{2}\)A 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 1\(\frac{1}{2}\) NPT for simple mounting of the level probe LGC and for locking the extension cable
Level probe LGC

Electrical connection
- Level probe LGC, standard, optional equipment N/2

- Level probe LGC with Pt100, optional equipment 1/3

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

### Type code/model number

| L | G | C | – | – | – | – | – | – | – |

Length extension cable without unit

### Certificates

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

### Optional equipment

- N: without optional equipment
- T: with integrated Pt100 temperature probe (4-wire)
- 1: 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: 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: 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 material

- S: stainless steel 1.4435/316L
- T: 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, SS304
- N: extension cable mounting screw 1½ NPT, SS304
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**

![LUC4 diagram]

**Product group LUC-T**

![LUC-T diagram]
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 sensor

**LUC4**

### Function

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

**V15 or V1 plug connection**

- Output signal 4 mA ... 20 mA/
  0 V ... 10 V

### Features

- Active fixed target suppression
- Temperature compensation
- 12 bit DA converter
- Compact version
- Connector
- Simple calibration
- Function monitoring
- Fail-safe behaviour for missing echo
- Output signal 4 mA ... 20 mA/
  0 V ... 10 V

### Dimensions

![Dimensions Diagram]
### Technical data

<table>
<thead>
<tr>
<th>Application</th>
<th>LUC4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>device for sending and evaluation of ultrasonic pulse reflection</td>
</tr>
</tbody>
</table>

#### Function and system design

| Equipment architecture | a measuring system consists of an ultrasonic level sensor LUC4T and a display unit DAS or a power supply, but can also be connected directly to a PLC |

#### Input characteristics

| Measuring range | 0.3 ... 4 m (1 ... 13.2 ft), for liquids |

#### Output characteristics

| Output signal | 4 ... 20 mA, R_L ≤ 500 Ω, 0 ... 10 V, R_L ≥ 1 kΩ |

#### Auxiliary energy

| Supply voltage | 10 ... 30 V DC (3-wire) |
| Power consumption | ≤ 1200 mW |
| Residual ripple | ±10 % ss, Ū_B = 33 V |

#### Performance characteristics

| Accuracy | 0.5 % of the measuring range final value, resolution 2 mm |

#### Operating conditions

| 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 | atmospheric |

#### Mechanical construction

| Material | housing: PBT |
| membrane surface: PTFE |
| process connection: |
| design S: stainless steel 1.4571 |
| design P: Polypropylene |
| Process connection | design G5: G1½A thread |
| design N5: 1½ NPT thread |
| Connection | V15 connector (M12 x 1) |

#### Indication and operation

| Display elements | operation: LED, green |
| fault: LED, red, 2 Hz flashing at current output ≥ 21 mA, voltage output ≤ 10.5 V |
| Operating elements | calibration and configuration plug position: |

#### General information

| Directive 73/23/EC (Low Voltage Directive) | EN 50178 |
| 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. |

#### Accessories

| Designation | LUC4-Z30-G2V, external temperature probe, G1½A |
| LUC4-Z30-N2V, external temperature probe, ½ NPT |
| V1-G-2M-PVC, cable box, straight, 2 m (6.6 ft) cable, PVC |
| V1-W-2M-PVC, cable box, 90° angle, 2 m (6.6 ft) cable, PVC |
| external temperature probe |

![M8 plug connection](image)

Cable length: 300 mm
**Ultrasonic level sensor**

**LUC4**

### Technical data

- **Ultrasonic level sensors**
- **Guided microwave**
- **Level signal conditioning electronics**
- **Level control accessories**
- **Sensors for hazardous area**
- **Pressurised enclosure system**

#### Type code/model number

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>LUC4</td>
<td>Ultrasonic level sensor</td>
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</table>

#### Special features

- **V15**
- **IU**
- **P**
- **S**
- **T**

#### Electronic output

- 4 mA ... 20 mA and 0 V ... 10 V

#### Threading material

- **S**
- **P**

#### Process connection

- **G5**
- **N5**

#### Material membrane surface

- **PTFE**

#### Measuring range

4 0.3 m ... 4 m (1 ... 6.6 ft)
## Technical data

<table>
<thead>
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<th>Ultrasonic level sensor</th>
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<td>LUC4</td>
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**Ultrasonic level sensors**

- Guided microwave
- Level signal conditioning electronics
- Level control accessories
- Sensors for hazardous area
- Pressurised enclosure system
Ultrasonic level sensor

**LUC-T**

---

**Features**

- Optimised for the process:
  - Can be mounted with thread from G1½ or 1½ NPT or with DN 100 or 4"
- Rotatable housing:
  - Status information even if the housing cover is closed - LED can be seen from outside
- Intelligent operation and evaluation:
  - Simple local push button operation, with optional plug-in display, HART protocol for remote operation, digital communication with PROFIBUS PA
- Integrated temperature compensation
- First echo detection
- Linearising function
- Active fixed target suppression

**Function**

The ultrasonic sensor LUC is a compact ultrasonic measurement instrument for continuous non-contact level measurement in liquids and in coarse-grained or pelleted solids. The LUC series consists of three sensors, which can be equipped with one of several electronic inserts, with graduated measuring ranges from 0.25 m (9.8 inches) upwards.

- **LUC-T**: in coarse-grained solids (grain size from 4 mm (0.16 inches)) up to 2 m (6.6 ft), in liquids up to 5 m (16.5 ft) (2-wire devices up to 4 m (13.2 ft))
- **LUC-T**: in coarse-grained solids (grain size from 4 mm (0.16 inches)) up to 3.5 m (11.5 ft), in liquids up to 8 m (26.4 ft) (2-wire device up to 7 m (23 ft))
- **LUC-T**: in coarse-grained solids (grain size from 4 mm (0.16 inches)) up to 7 m (23 ft), in liquids up to 15 m (49 ft)

All sensors are equipped with an integrated temperature probe for ultrasonic time-of-flight compensation.

**Dimensions**

---

**Example: connection type I2 (2-wire connection "loop powered" for ultrasonic level sensor LUC-T10, LUC-T20)**

Other connection types see section electrical connections.
# Technical data

## Application

Function principle: non-contact continuous level measuring in liquids and coarse-grained solids

## Function and system design

### Measuring principle

Ultrasonic depth sounder, measuring of elapsed time.

The compact LUC-T ultrasonic sensor is a complete measuring point within itself. The simplest version allows access to all functions required for basic operation. Calibration can be carried out using the four push buttons on the device. With a plug-in display, the complete Pepperl+Fuchs user matrix can be accessed. The basic functionality may be enhanced by other optional operating possibilities or integration into a process control system.

## Input characteristics

### Measured variable

Level, obtaining from a distance between the ultrasonic and bulk surface

### Measuring range

LUC-T**-**5: 0.25 ... 4 m (0.8 ... 13.2 ft), for 4-wire 0.25 ... 5 m (0.8 ... 16.5 ft)

LUC-T**-**6: 0.4 ... 7 m (1.3 ... 23 ft), for 4-wire 0.4 ... 8 m (1.3 ... 26.4 ft)

LUC-T30: 0.6 ... 15 m (2 ... 49 ft)

### Blocking distance

LUC-T**-**5: 0.25 m (9.8 inches)

LUC-T**-**6: 0.4 m (15.7 inches)

LUC-T30: 0.6 m (23.6 inches)

### Measuring conditions

- **Frequency:**
  - LUC-T**-**5: approx. 70 kHz
  - LUC-T**-**6: approx. 50 kHz
  - LUC-T30: approx. 35 kHz

- **Pulse frequency:**
  - 0.5 ... 3 Hz, depending on sensor and electronics

## Output characteristics

### Output signal

- 4 ... 20 mA, 8 mA/16 mA or 4 mA/20 mA selectable digital current output, output span 16 mA for analogue signal, for output "H" additional digital communication signal (HART)

### Signal on alarm

- 4 ... 20 mA or 4/20 mA: selectable -10 % < 2.4 mA (with 4-wire only), +110 % > 21.6 mA or "hold"
- Last valid current value will be held
- Output PA: selectable -10999, +9999 or HOLD (hold last value)

### Switching time

- 2-wire connection: approx. 5 s
- 4-wire connection: approx. 1 s

### Power up response

- When switching on the power supply the output assumes the alarm signal after max. 2 s it assumes the correct switching mode

### Auxiliary energy

**Supply voltage**

- Output I2/IH: 12 ... 36 V DC; Ex version: 12 ... 30 V DC
- Output DC/DH: 18 ... 36 V DC
- Output AC/AH: 180 ... 250 V AC
- Output UC/UH: 90 ... 127 V AC
- Output PA: 9 ... 30 V DC

**Cable connector**

- Screened commercial 2- or 4-wire cable for signal transmission and power, depending on electrical output

**Power consumption**

- Output DC/DH: < 2.5 W
- Output AC/AH/UC/UH: < 4 VA

**Current consumption**

LUC-T20: 12 mA ±1 mA, LUC-T30: 16 mA ±1 mA

## Performance characteristics

### Reference operating conditions

Ideal reflection from calm, flat surface at 20 °C (293 K)

### Maximum measured error

0.25 % for max. measuring span

### Hysteresis

- 2-wire connection: 3 mm (0.12 inches)
- 4-wire connection: 2 mm (0.08 inches)

## Operating conditions

### Mounting conditions

- **Mounting position:** at right angles to the product surface

### Ambient conditions

- **Temperature:** -20 ... +60 °C (253 ... 333 K) (only for electronics)
- **Storage temperature:** -40 ... +80 °C (233 ... 353 K)
- **Climatic class:** type of protection in acc. with IEC 68, part 2-30 Db
- **Protection class:** DIN EN 60529, IP67
- **Vibration resistance:** in acc. with IEC 68, part 2-6, tab. 2.C (10 ... 55 Hz)

### Explosion protection

LUC-T10 (2-wire connection Ex): EEx ia IIC T6, zone 1 (PTB in Germany only)

LUC-T20 (2-wire connection not Ex and 4-wire connection): without

LUC-T30 (4-wire connection): Dust Ex, zone 20 (BVS Germany only)

### Process conditions

- **Process temperature:** -40 ... +80 °C (233 ... 353 K) (built-in temperature probe)
- **Process pressure:** LUC-T10, LUC-T20: 0.7 ... 3 bar absolute pressure
- LUC-T30 with slip-on flange or mounting bracket: 0.7 ... 2.5 bar absolute pressure
### Ultrasonic level sensor LUC-T

#### Technical data

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</tr>
<tr>
<td>Versions with threaded connection can be installed with 60 AF box spanner, max. torque 15 ... 20 Nm</td>
<td></td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>housing: width 105 mm (4.1 inches), depth 112 mm (4.4 inches), height 125 mm (4.9 inches)</td>
</tr>
<tr>
<td><strong>process connection:</strong></td>
<td>*5: AF 60, height 22 mm (0.87 inches), *6: AF 60, height 22 mm (0.87 inches), FA: flange DN 100 or 4&quot;</td>
</tr>
</tbody>
</table>

#### Mechanical construction

<table>
<thead>
<tr>
<th><strong>Design</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>compact version</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Dimensions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>housing: width 105 mm (4.1 inches), depth 112 mm (4.4 inches), height 125 mm (4.9 inches)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Process connection:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>*5: AF 60, height 22 mm (0.87 inches), *6: AF 60, height 22 mm (0.87 inches), FA: flange DN 100 or 4&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Sensor:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>diameter max. 158 mm (6.2 inches), height max. 215 mm (8.5 inches)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Weight</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>LUC-T10-*5: 1500 g</td>
</tr>
<tr>
<td>LUC-T10-*6: 1600 g</td>
</tr>
<tr>
<td>LUC-T20-*5: 2200 g</td>
</tr>
<tr>
<td>LUC-T20-*6: 2300 g</td>
</tr>
<tr>
<td>LUC-T30: 2600 g</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Material</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>housing: PBT-FR glass fibre-reinforced, flame resistant</td>
</tr>
<tr>
<td>process connections *5, *6: PVDF, process connection FA: UP (unsaturated polyester)</td>
</tr>
<tr>
<td>sensor: steel VA</td>
</tr>
<tr>
<td>seals: EPDM</td>
</tr>
</tbody>
</table>

---

**Ultrasonic level sensors**

**Guided microwave**

**Level signal conditioning electronics**

**Level control accessories**

**Sensors for hazardous area**

**Pressurised enclosure system**
Technical data

Ultrasonic level sensor LUC-T

Indication and operation
Overview indication and operation

Display elements
4-character display of the values, with segment display for current, dimension L x B x H: 40 x 20 x 10 mm (1.6 x 0.8 x 0.4 inches)
red LED indicates alarm or warning
green LED indicates power on (with 4-wire versions only) and entry acknowledgement

Operating elements
matrix operation across keypad, plug-in display, HART modem, handheld terminal or PROFIBUS PA

Certificates and approvals
Ex approval see type code
Type of protection see type code

General information
Directive conformity
Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment
interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)

Directive 94/9/EC (ATEX)
Directive 73/23/EC (Low Voltage Directive)

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.

Accessories
Designation
• LUC-Z10, plug-in LCD display
• LUC-Z11, protective cover for electronics housing
• LUC-Z12, mounting bracket for LUC-T30 installation
• LUC-Z13, mounting angle for G5 installation
• LUC-Z14, mounting angle for G6 installation
• LUC-Z-F, cylindrical flange connection for G5, G6
• LUC-Z-A, conical flange connection for N5, N6
• LUC-Z-*, slip-on flange for LUC-T30

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Electrical connection

- connection I2: 2-wire connection "loop powered" for ultrasonic sensor LUC-T10, LUC-T20
- connection IH: 2-wire connection "loop powered" for ultrasonic sensor LUC-T10, LUC-T20
- communication via HART modem

- connection DC: 4-wire DC connection for ultrasonic sensor LUC-T20, LUC-T30
- connection DH: 4-wire DC connection for ultrasonic sensor LUC-T20, LUC-T30
- communication via HART modem

- connection AC: 4-wire AC connection for ultrasonic sensor LUC-T20, LUC-T30
- connection AH: 4-wire AC connection for ultrasonic sensor LUC-T20, LUC-T30
- communication via HART modem
Electrical connection

- connection UC: 4-wire AC connection for ultrasonic sensor LUC-T20, LUC-T30
- connection UH: 4-wire AC connection for ultrasonic sensor LUC-T20, LUC-T30
- communication via HART modem

Each device receives a unique bus address.

on: Software address
off: Hardware address
### Ultrasonic level sensor

#### LUC-T

### Technical data

#### Type code/model number

<table>
<thead>
<tr>
<th>Type code/model number</th>
<th>Certificates</th>
<th>Display</th>
<th>Electrical output</th>
<th>Housing, cable gland</th>
<th>Process connection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LUC-T10</strong></td>
<td>EX ATEX II 2 G, Ex ia IIIC T6</td>
<td>B no display selected</td>
<td>2 wire, 4 mA ... 20 mA</td>
<td>C polyester housing, NEMA 6, ½ NPT</td>
<td>G5 G1½ thread (range 4 m (13.2 ft))</td>
</tr>
<tr>
<td></td>
<td>FM IS, Ex I, II, III, Div. 1, G, A - G</td>
<td>D display: 4 character LCD</td>
<td>2 wire, 4 mA ... 20 mA</td>
<td>Q polyester housing, GI/GA</td>
<td>G6 G2 thread (range 7 m (23 ft))</td>
</tr>
<tr>
<td></td>
<td>CS CSA, IS, Ex I, II, III, Div. 1, G, A - G</td>
<td></td>
<td>2 wire, 4 mA ... 20 mA, HART</td>
<td>M polyester housing, M12 PROFIBUS plug</td>
<td>N5 1½ NPT thread (range 4 m (13.2 ft))</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PROFIBUS PA</td>
<td></td>
<td>N6 2 NPT thread (range 7 m (23 ft))</td>
</tr>
<tr>
<td><strong>LUC-T20</strong></td>
<td>NA version for non-explosion hazardous areas</td>
<td>B no display selected</td>
<td>2 wire, 4 mA ... 20 mA (max. range 4 m (13.2 ft) or 7 m (23 ft))</td>
<td>C polyester housing, NEMA 6, ½ NPT</td>
<td>G5 G1½ thread (range 5 m (16.5 ft))</td>
</tr>
<tr>
<td></td>
<td>CG CSA General Purpose</td>
<td>D display: 4 character LCD</td>
<td>2 wire, 4 mA ... 20 mA</td>
<td>Q polyester housing, GI/GA</td>
<td>G6 G2 thread (range 8 m (26.4 ft))</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 wire, 24 V DC, 4 mA ... 20 mA</td>
<td>M polyester housing, M12 PROFIBUS plug</td>
<td>N5 1½ NPT thread (range 5 m (16.5 ft))</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 wire, 24 V DC, 4 mA ... 20 mA, HART</td>
<td></td>
<td>N6 2 NPT thread (range 8 m (26.4 ft))</td>
</tr>
<tr>
<td><strong>LUC-T30-FA</strong></td>
<td>SX ATEX II 1/3 D, BVS/DMT (St-Ex), zone 10</td>
<td>B no display selected</td>
<td>4-wire, 24 V DC, 4 mA ... 20 mA</td>
<td>C polyester housing, NEMA 6, ½ NPT</td>
<td>G5 G1½ thread (range 4 m (13.2 ft))</td>
</tr>
<tr>
<td></td>
<td>F1 IS, Ex I, II, Div. 1, Group E, F, G</td>
<td>D display: 4 character LCD</td>
<td>4-wire, 24 V DC, 4 mA ... 20 mA</td>
<td>Q polyester housing, GI/GA</td>
<td>G6 G2 thread (range 7 m (23 ft))</td>
</tr>
<tr>
<td></td>
<td>C1 CSA, Ex I, II, Div. 1, Group E, F, G</td>
<td></td>
<td>4-wire, 230 V AC, 4 mA ... 20 mA</td>
<td>M polyester housing, M12 PROFIBUS plug</td>
<td>N5 1½ NPT thread (range 4 m (13.2 ft))</td>
</tr>
<tr>
<td></td>
<td>CG CSA General Purpose</td>
<td></td>
<td>4-wire, 230 V AC, 4 mA ... 20 mA</td>
<td></td>
<td>N6 2 NPT thread (range 7 m (23 ft))</td>
</tr>
</tbody>
</table>

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Pepperl+Fuchs Group • Tel.: Germany +49 621 776-0 • USA +1 330 4253555 • Singapore +65 67799091 • Internet http://www.pepperl-fuchs.com
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<thead>
<tr>
<th>Pressurised enclosure system</th>
<th>Sensors for hazardous area</th>
<th>Level control accessories</th>
<th>Level signal conditioning electronics</th>
<th>Guided microwave</th>
<th>Ultrasonic level sensors</th>
</tr>
</thead>
</table>
The figure below shows the used characters and numbers of the guided microwave type code. Not all characters and numbers can be combined. The possible combinations are shown on the according data sheets of the guided microwave.

**Product group LTC**

![Guided microwave type code diagram]

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Remote electronic</td>
</tr>
<tr>
<td>T</td>
<td>Display</td>
</tr>
<tr>
<td>C</td>
<td>Electrical output</td>
</tr>
<tr>
<td></td>
<td>Housing, cable gland</td>
</tr>
<tr>
<td></td>
<td>Certificates</td>
</tr>
<tr>
<td></td>
<td>Specification of length without unit</td>
</tr>
<tr>
<td></td>
<td>Probe version and material</td>
</tr>
<tr>
<td></td>
<td>Time domain reflectometry</td>
</tr>
<tr>
<td></td>
<td>Probe length</td>
</tr>
<tr>
<td></td>
<td>Sealing</td>
</tr>
<tr>
<td></td>
<td>Process connections</td>
</tr>
<tr>
<td></td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>Level</td>
</tr>
<tr>
<td></td>
<td>Continuous</td>
</tr>
</tbody>
</table>

**Product Group LTC**

- Remote electronic
- Display
- Electrical output
- Housing, cable gland
- Certificates
- Specification of length without unit
- Probe version and material
- Time domain reflectometry
- Probe length
- Sealing
- Process connections
- Continuous
- Level

---

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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 LTC with coax probe

Contents

<table>
<thead>
<tr>
<th></th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type code of guided microwaves</td>
<td>180</td>
</tr>
<tr>
<td>Guided microwave LTC</td>
<td>182</td>
</tr>
</tbody>
</table>
Pulscon LTC

The Pulscon LTC serves as continuous level measurement of powdery to granular bulk solids and liquids. Fluctuations in the density, the temperature or build-up of dust in the gas compartment do not have any influence on the measurement.

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.

- The Pulscon LTC is also suitable for measuring in liquids, in case of foam formation and for changing media. The level in liquefied gases can be measured by a coax probe.
- The Pulscon LTC is suitable for measuring ranges up to 35 m (115 ft).

**Features**

- Simple and quick commissioning, without changing of the level.
- Safe and quick parameterisation by menu driven operation.
- HART or PROFIBUS PA or Foundation Fieldbus protocol.
- The measurement is independent of product properties such as density, solid weight, grain size.
- 2-wire technique, low cost: 2-wire technique saves on cabling and allows a simple integration to existing systems.
- Simple on-site operation via menu driven four-line plain text display. Documentation and diagnosis via an operating program (PACTware™).
- No restriction for vessel forms and materials.

**Electrical connection**

Example: 2-wire connection IH

More connection types see section electrical connections.

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

```
<table>
<thead>
<tr>
<th>Auxiliary energy</th>
<th>HART modem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication resistance (&gt; 250 Ω)</td>
<td>Test socket (output current)</td>
</tr>
</tbody>
</table>
```

---

**Dimensions**

**Pulscon LTC compact version with rope probe**

- **Dimensions**
  - Ø 22 (on 4 mm rope)
  - Probe length 1000 ... 35000 mm (3 ... 115 ft)

**Pulscon LTC compact version with coax probe**

- **Dimensions**
  - Ø 21.3 (¾" thread)
  - Ø 42.4 (1½" thread)
  - Probe length 300 ... 4000 mm (8 ... 157 inches)

---

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### Technical data

#### Pulscon LTC

<table>
<thead>
<tr>
<th>Application</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function principle</td>
<td>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.</td>
</tr>
</tbody>
</table>

#### Function and system design

| Measuring principle | 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 |
| Equipment architecture | the Pulscon LTC is usable as single measuring cell or integrated in PROFIBUS PA or Foundation Fieldbus systems |

#### Input characteristics

| Measured variable | the measured variable is the distance between a reference point and a reflective surface (e.g. medium surface) |
| Measuring range | max. 35 m (115 ft), dependent on the medium, the probe type and the probe length |
| rod probe 6 mm with process connection ¾": 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) |
| Blocking distance | at DK ≥ 1.6: top min. 200 mm (3.9 inches), below min. 250 mm (9.8 inches) (rope probe), 50 mm (2 inches) (rod probe, coax probe) |
| at DK > 10: top min 100 mm (3.9 inches), below min. 250 mm (9.8 inches) (rope probe), 50 mm (2 inches) (rod probe, coax probe) |

#### Measuring conditions

| Measuring condition | used frequency spectrum: 0.1 ... 1.5 GHz |
| Output characteristics | 4 ... 20 mA with HART protocol |
| Output signal | PROFIBUS PA, Foundation Fieldbus (FF) |
| Signal on alarm | error information can be accessed via the following interfaces: local display with error symbol, plain text display, current output, digital interface |
| Load | connection IH, AH, DH: 250 Ω |

---

The diagram shows the measurement point, upper blocking distance (UB), lower blocking distance (LB), and the probe length (LN) in relation to the reference point. The table lists the minimum distances for different wall materials and probe lengths.
### Guided microwave

#### Pulscon LTC

<table>
<thead>
<tr>
<th>Auxiliary energy</th>
<th>Pulscon LTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical connection</td>
<td>terminal assignment:</td>
</tr>
<tr>
<td>connection IH: 4 ... 20 mA with HART, 2-wire</td>
<td></td>
</tr>
<tr>
<td>connection AH: 4 ... 20 mA with HART, 4-wire active, AC version</td>
<td></td>
</tr>
<tr>
<td>connection DH: 4 ... 20 mA with HART, 4-wire active, DC version</td>
<td></td>
</tr>
<tr>
<td>connection PA: PROFIBUS PA</td>
<td></td>
</tr>
<tr>
<td>connection FF: Foundation Fieldbus</td>
<td></td>
</tr>
</tbody>
</table>

| Supply voltage                   |             |
| connection IH: 7.5 ... 36 V DC; Ex version: 7.5 ... 30 V DC |             |
| connection AH: 85 ... 250 V AC   |             |
| connection DH: 10.5 ... 32 V DC  |             |

| Cable connection                 |             |
| connection AH, DH, IH:           |             |
| cable gland: M20 x 1.5           |             |
| cable entry: G½ or ½ NPT         |             |
| connection PA: M12 plug           |             |
| connection FF: 7/8” plug          |             |
| Ex d and XP version: only with cable entry |            |

| Power consumption                | 60 ... 900 mW |
| Current consumption              | connection IH, AH, DH: 3.6 ... 22 mA |
|                                  | connection PA: max. 11 mA |
|                                  | connection FF: max. 15 mA |

| Performance characteristics      |             |
| Maximum measured error           | reference operating conditions contain linearity, repeatability and hysteresis: |
|                                 | up to 4 m (13.2 ft): ±5 mm (0.2 inches), from 4 m (13.2 ft): ±10 mm (0.4 inches) |
| Linearity                        | up to 4 m (13.2 ft): ±5 mm (0.12 inches), from 4 m (13.2 ft): ±5 mm (0.2 inches) |
| Hysteresis                       | ≤ 1 mm (0.04 inches) |
| Resolution                       | digital: 1 mm (0.04 inches), analogue: 5 µA |
| Reaction time                    | the reaction time depends on the configuration (min. 1 s), the reaction time is the time the device needs to display a new value after a rapid modification of the level indication |

| Operating conditions             |             |
| Mounting conditions              |             |
| Mounting position                | vertical from above or diagonally (only with remote electronic) |
| Ambient conditions               |             |
| Ambient temperature              | F12 housing: -40 ... +80 °C (233 ... 353 K) |
|                                  | T12 housing: +10 °C (233 ... 353 K) |
|                                  | the functionality of the LCD display may be limited for temperatures $T_u < -20 ^\circ C$ (253 K) and $T_u > +60 ^\circ C$ (333 K), a weather protection cover should be used for outdoor operation if the instrument is exposed to direct sunlight |
| Storage temperature              | -40 ... +80 °C (233 ... 353 K) |
| Climatic class                   | DIN EN 60068-2-38 (test Z/AD) |
| Protection class                 | housing: IP65, NEMA 4X (open housing: IP20, NEMA 1) |
|                                  | probe: IP68 (NEMA 6P) |
| Vibration resistance             | DIN EN 60068-2-64/IEC 68-2-64: 20 ... 2000 Hz, 1 (m/s²)/Hz |
| Electromagnetic compatibility    | emitted interference to EN 61326, CLASS B equipment |
|                                  | interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21) |
|                                 | if the antenna signal is to be used exclusively a conventional cable is sufficient |
|                                 | if the superimposed communication signal (HART/Intensor) is to be used, use a screened cable |
|                                 | when mounting in metal containers and coax probes always NAMUR NE 21, otherwise EN 61326 |

| Process conditions               |             |
| Process temperature              | -40 ... +150 °C (233 ... 423 K) |
| Process pressure limit           | -1 ... +40 bar |
| Dielectric constant              | with coax probe: $\varepsilon_r \geq 1.4$ |
|                                  | with rod and rope probe: $\varepsilon_r \geq 1.6$ |

| Mechanical construction          |             |
| Design                           | LTC1 and LTC5 with rope probe |
|                                  | LTC2 and LTC3 with rod probe |
|                                  | LTC4 with coax probe |
| Dimensions                       | housing: max. 162 x 162 x 150 mm (6.4 x 6.4 x 5.9 inches) |
**Technical data**

### Guided microwave

**Pulscon LTC**

- Distance sleeve: diameter 60 mm (2.36 inches), height 400 mm (15.7 inches)
- Remote electronics: length 3000 mm (9.9 ft)

---

**Ultrasonic level sensors**

**Level signal conditioning electronics**

**Level control accessories**

**Sensors for hazardous area**

**Pressurised enclosure system**

---

**Weight**

- Basic weight: approx. 6000 g
- Rope probe Ø4 mm (0.16 inches): approx. 200 g/m
- Rod probe Ø6 mm (0.24 inches): approx. 300 g/m
- Rod probe Ø16 mm (0.63 inches): approx. 300 g/m
- Coax probe: approx. 1200 g/m
- Process connections: depending on the design

---

**Material**

- Housing: aluminium, seawater repellent, chromated, powder-coated
- Sight windows: glass (optional)
- Seal: silicone (solid application), VITON, EPDM, Kalrez (liquid application)
- Rope probe: 1.4401/304
- Rod probe, coax probe: 1.4435/316L
- Process connections: 1.4435/316L

---

**Mechanical demands**

- Tension load: rope probe Ø4 mm (0.16 inches): 12 kN, rope probe Ø6 mm (0.24 inches): 30 kN

---

**Housing**

- Housing F12: with sealed terminal compartment for standard or EEx ia
- Housing T12: separate terminal compartment for increased safety or pressurised enclosure

---

**Process connection**

- See type code

---

**Connection**

- Cable entry: M20 x 1.5 (cable entry delivered), ½ NPT or G½ internal thread
- PROFIBUS PA: M12 plug
- Fieldbus Foundation: 7/8" plug
## Guided microwave Pulscon LTC

### Technical data

<table>
<thead>
<tr>
<th>Indication and operation</th>
<th>Pulscon LTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview indication and operation</td>
<td>The display of the process value and the configuration of the Pulscon LTC occur locally by means of a large 4-line alphanumeric display with plain text information. The guided menu system with integrated help texts ensures a quick and safe commissioning. Remote commissioning, including documentation of the measuring point and in-depth analysis functions, is supported via the graphical operating program PACTware™.</td>
</tr>
</tbody>
</table>

| Display elements | liquid crystal display (LCD), four lines with 20 characters each, display contrast adjustable across key combination |

| Operating elements | • operation on the device after opening the housing cover  
• on-site operation with LC-display  
• on-site operation with handheld terminal  
• remote operation with PACTware™ connections:  
  - HART or HART multiplexer  
  - PROFIBUS PA  
• remote operation with NI-FBUS configurator (only Foundation Fieldbus) |

| Certificates and approvals | Ex approval see type code  
Type of protection see type code  
Overspill protection Z-65.16-368 (overspill protection WHG) |

| General information | Directive conformity  
Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment  
interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)  
Directive 94/9/EC (ATEX)  
Directive 73/23/EC (Low Voltage Directive) EN 61010-1  
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. |

| Directive 94/9/EC (ATEX) | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |

| Directive 73/23/EC (Low Voltage Directive) | EN 61010-1 |

| KEMA 02 ATEX 1254, II 1/2 G EEx ia IIC T3 ... T6 | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |

| Ex approval | see type code |
| Type of protection | see type code |
| Overspill protection | Z-65.16-368 (overspill protection WHG) |
| Directive conformity | Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment  
interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)  
Directive 94/9/EC (ATEX)  
Directive 73/23/EC (Low Voltage Directive) EN 61010-1  
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. |

| Directive 94/9/EC (ATEX) | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |

| Directive 73/23/EC (Low Voltage Directive) | EN 61010-1 |

| KEMA 02 ATEX 1254, II 1/2 G EEx ia IIC T3 ... T6 | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |

| Directive conformity | Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment  
interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)  
Directive 94/9/EC (ATEX)  
Directive 73/23/EC (Low Voltage Directive) EN 61010-1  
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. |

| Directive 94/9/EC (ATEX) | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |

| Directive 73/23/EC (Low Voltage Directive) | EN 61010-1 |

| Certificate of Conformity | see type code |
| Type of protection | see type code |
| Overspill protection | Z-65.16-368 (overspill protection WHG) |
| Directive conformity | Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment  
interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)  
Directive 94/9/EC (ATEX)  
Directive 73/23/EC (Low Voltage Directive) EN 61010-1  
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. |

| Directive 94/9/EC (ATEX) | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |

| Directive 73/23/EC (Low Voltage Directive) | EN 61010-1 |

| Certificate of Conformity | see type code |
| Type of protection | see type code |
| Overspill protection | Z-65.16-368 (overspill protection WHG) |
| Directive conformity | Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment  
interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)  
Directive 94/9/EC (ATEX)  
Directive 73/23/EC (Low Voltage Directive) EN 61010-1  
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. |

| Directive 94/9/EC (ATEX) | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |

| Directive 73/23/EC (Low Voltage Directive) | EN 61010-1 |

| Certificate of Conformity | see type code |
| Type of protection | see type code |
| Overspill protection | Z-65.16-368 (overspill protection WHG) |
| Directive conformity | Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment  
interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)  
Directive 94/9/EC (ATEX)  
Directive 73/23/EC (Low Voltage Directive) EN 61010-1  
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. |

| Directive 94/9/EC (ATEX) | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |

| Directive 73/23/EC (Low Voltage Directive) | EN 61010-1 |

| Certificate of Conformity | see type code |
| Type of protection | see type code |
| Overspill protection | Z-65.16-368 (overspill protection WHG) |
| Directive conformity | Directive 89/336/EC (EMC) emitted interference to EN 61326, class B equipment  
interference immunity to EN 61326, annex A (industrial sector) and NAMUR EMC recommendation (NE 21)  
Directive 94/9/EC (ATEX)  
Directive 73/23/EC (Low Voltage Directive) EN 61010-1  
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. |

| Directive 94/9/EC (ATEX) | EN 61326, EN 61010-1, EN 60014, EN 50202, EN 50281-1-1, EN 50284, EN 50018, EN50019, EN 50028 |
Electrical connection

- 2-wire connection with HART (DC)
  - 4 mA ... 20 mA with HART, 2-wire

- 4-wire connection with HART (AC), 4-wire connection with HART (DC)
  - 4 mA ... 20 mA with HART, 4-wire active

- PROFIBUS PA connection

- Foundation Fieldbus connection
Guided microwave
Pulscon LTC

## Technical data

### Type code/model number

| LTC | - | - | - | - | - |

### Specification of length without unit

<table>
<thead>
<tr>
<th>Certificates</th>
<th></th>
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<tbody>
<tr>
<td>NA</td>
<td>version for non-hazardous area</td>
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<tr>
<td>WH</td>
<td>overspill protection WHG</td>
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<td>C2</td>
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<tr>
<td>CG</td>
<td>CSA General Purpose</td>
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<tr>
<td>CS</td>
<td>CSA DIP, CI, II, Div. 1, group G and coal dust, N.I.</td>
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<td>ES</td>
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<tr>
<td>EW</td>
<td>ATEX II 1/2G EE ex ia IIC T6 with WHG</td>
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<tr>
<td>F1</td>
<td>FM IS, CI, II, III, Div. 1, group A - G, N.I.</td>
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<td>F2</td>
<td>FM XP, CI, II, Div. 1, group E - G, N.I.</td>
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<tr>
<td>F3</td>
<td>FM DIP, CI, II, Div. 1, group E - G, N.I.</td>
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<tr>
<td>S2</td>
<td>ATEX II 1/2D transparent cover, dust</td>
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<td></td>
</tr>
<tr>
<td>SX</td>
<td>ATEX II 1/2D aluminium cover, dust-Ex</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Remote electronic

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

### Display

| 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, 85 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 |
| A4 | Aluminium housing F12, IP68, PROFIBUS PA M12 x 1 plug |
| A5 | Aluminium housing F12, IP68, connector 7/8” |

### Sealing

| 2 | VITON O-ring (liquid application) |
| 3 | EPDM O-ring (liquid application) |
| 4 | KALREZ O-ring (liquid application) |

### Probe length

| A | rope Ø4 mm, length in mm, 1000 mm ... 35000 mm, 1.4401/304 |
| B | rope Ø6 mm, length in mm, 1000 mm ... 35000 mm, 1.4401/304 |
| C | rope Ø1/6”, length in inches, 40 inches ... 1378 inches, 1.4401/304 |
| D | rope Ø1/4”, length in inches, 40 inches ... 1378 inches, 1.4401/304 |
| K | rod probe Ø16 mm (0.6 inches), 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 inches), length in inch, 8 inches ... 157 inches, 1.4435/316L |
| N | coax probe, length in inch, 8 inches ... 157 inches, 1.4435/316L |
| P | rod probe Ø6 mm (0.24 inches), length in mm, 300 mm ... 2000 mm, 1.4435/316L |
| R | rod probe Ø6 mm (0.24 inches), length in inch, 8 inches ... 80 inches, 1.4435/316L |

### Process connections

| A51 | ANSI 1 1/2”, 150 lbs RF, 1.4435/316L |
| A61 | ANSI 2”, 150 lbs RF, 1.4435/316L |
| A81 | ANSI 3”, 150 lbs RF, 1.4435/316L |
| A91 | ANSI 4”, 150 lbs RF, 1.4435/316L |
| D65 | DN40 PN40 Form C, 1.4435/316L, sealing strip |
| D75 | DN50 PN40 Form C, 1.4435/316L, sealing strip |
| D93 | DN80 PN16 Form C, 1.4435/316L, sealing strip |
| DA3 | DN100 PN16 Form C, 1.4435/316L, sealing strip |
| G21 | G1½ BSP, 1.4435/316L |
| G51 | G1½ BSP, 1.4435/316L |
| N21 | ½ NPT, 1.4435/316L |
| H51 | 1½ NPT, 1.4435/316L |
| XXX | special version |

### Probe version

<p>| 1 | rope probe Ø4 mm/1/6”, 1.4401/304 |
| 2 | rod probe Ø16 mm (0.6 inches), 1.4435/316L |
| 3 | rod probe Ø6 mm (0.24 inches), 1.4435/316L with short block distance |
| 4 | coax probe, 1.4435/316L |
| 5 | rope probe Ø6 mm (1/4”), 1.4401/304 |</p>
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<thead>
<tr>
<th>Technical data</th>
<th>Guided microwave</th>
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</thead>
<tbody>
<tr>
<td>Pulscon LTC</td>
<td></td>
</tr>
</tbody>
</table>

- **Ultrasonic level sensors**
- **Guided microwave**
- **Level signal conditioning electronics**
- **Level control accessories**
- **Sensors for hazardous area**
- **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**

![Type code diagram]

- **K**
- __-__
- __-__
- __-__
- __-__
- __-__
- **Special function**
- **Number of channels**
- **Device function**
- **Level of power supply**
- **Type of power supply**
- **Version**
- **K-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 and VbF.

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.

Transformer isolated barrier KFD2-SR2-Ex1.W

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<td>Electrode relay, KFA*-ER-1.*</td>
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</tr>
<tr>
<td>Electrode relay, KF**-ER-1.W.LB.</td>
<td>196</td>
</tr>
<tr>
<td>Electrode relay, KF**-ER-Ex1.W.LB.</td>
<td>200</td>
</tr>
<tr>
<td>Electrode relay, KF**-ER-2.W.LB</td>
<td>204</td>
</tr>
<tr>
<td>Current/voltage trip amplifier, KFD2-GS-1.2W</td>
<td>208</td>
</tr>
<tr>
<td>SMART transmitter power supply, KFD2-STC4-1</td>
<td>212</td>
</tr>
<tr>
<td>SMART transmitter power supply, KFD2-STC4-Ex1</td>
<td>214</td>
</tr>
<tr>
<td>Transformer isolated barrier for potentiometer, KFD2-PT2-Ex1**</td>
<td>218</td>
</tr>
<tr>
<td>Transformer isolated barrier for 3-wire sensors, KFA6-SR-2.3L</td>
<td>222</td>
</tr>
<tr>
<td>Transformer isolated barrier for NAMUR sensors, KFD2-SR2-Ex1.W</td>
<td>226</td>
</tr>
<tr>
<td>Transformer isolated barrier for NAMUR sensors, KFA6-SR2-Ex2.W.IR</td>
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</tr>
<tr>
<td>Transmitter power supply with limit value output, KF**-CRG-1.D</td>
<td>234</td>
</tr>
<tr>
<td>Transmitter power supply with limit value output, KF**-CRG-Ex1.D</td>
<td>238</td>
</tr>
</tbody>
</table>
Electrode relay

**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.

**Composition**

- 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

24 V DC

**KFD2-ER-1.5**

24 V DC

**KFD2-ER-1.6**

<table>
<thead>
<tr>
<th>Function</th>
<th>Connection</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td><img src="image" alt="Connection Diagram" /></td>
<td><img src="image" alt="Composition Diagram" /></td>
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Technical data

<table>
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<th>KFD2-ER-1.5</th>
<th>KFD2-ER-1.6</th>
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</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>Power Rail or terminals 11+, 12-</td>
<td></td>
</tr>
<tr>
<td>Rated voltage</td>
<td>20 ... 30 V DC</td>
<td></td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 1 (mass), 2 (min), 3 (max)</td>
<td>terminals 1 (mass), 2 (min), 3 (max)</td>
</tr>
<tr>
<td>Control input</td>
<td>min./max. control system: terminals 1, 2, 3 on/off control system: terminals 1, 3</td>
<td>min./max. control system: terminals 1, 2, 3 on/off control system: terminals 1, 3</td>
</tr>
<tr>
<td>Potentiometer</td>
<td>response sensitivity: 1 ... 30 kOhms, adjustable (20 turns)</td>
<td>response sensitivity: 5 ... 150 kOhms, adjustable (20 turns)</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 7, 8, 9</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>1 changeover contact</td>
<td></td>
</tr>
<tr>
<td>Contact loading</td>
<td>253 V AC/2 A/cos $\varphi &gt; 0.7$; 40 V DC/2 A resistive load</td>
<td></td>
</tr>
<tr>
<td>Energised/De-energised delay</td>
<td>approx. 1 s/approx. 1 s</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input/Output</td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V$_{\text{eff}}$</td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V$_{\text{eff}}$</td>
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<tr>
<td>Input/Power supply</td>
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<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V$_{\text{eff}}$</td>
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<tr>
<td>Output/Power supply</td>
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<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V$_{\text{eff}}$</td>
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<td><strong>Directive conformity</strong></td>
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<tr>
<td><strong>Ambient conditions</strong></td>
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<tr>
<td>Ambient temperature</td>
<td>-20 ... 60 °C (253 ... 333 K)</td>
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<td><strong>Mechanical specifications</strong></td>
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<tr>
<td>Protection degree</td>
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<tr>
<td>Connection</td>
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<tr>
<td>Mass</td>
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<tr>
<td>Dimensions</td>
<td>20 x 107 x 115 mm (0.8 x 4.2 x 4.5 inches)</td>
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<tr>
<td>Mounting</td>
<td>Power Rail or pull-out latches using for screw mounting</td>
<td></td>
</tr>
<tr>
<td><strong>Indication and operation</strong></td>
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<td></td>
</tr>
<tr>
<td>Operating elements</td>
<td>switch S1</td>
<td>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</td>
</tr>
</tbody>
</table>

**Accessories**

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

The devices are supplied with 24 V DC through the KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail. Each power feed module monitors and provides protection for groups of as many as 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.

If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.
Electrode relay

**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.

**Composition**

- 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

**Connection**

115 V AC

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<th>KFA5-ER-1.6</th>
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<td>115 V AC</td>
<td>230 V AC</td>
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<tr>
<th>KFA6-ER-1.5</th>
<th>KFA6-ER-1.6</th>
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<tr>
<td>230 V AC</td>
<td>230 V AC</td>
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# Technical data

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<th>KFA5-ER-1.6</th>
<th>KFA6-ER-1.5</th>
<th>KFA6-ER-1.6</th>
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<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 11 (L1), 12 (N)</td>
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</tr>
<tr>
<td>Rated voltage</td>
<td>103.5 ... 126 V AC, 45 ... 65 Hz</td>
<td>207 ... 253 V AC, 45 ... 65 Hz</td>
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</tr>
<tr>
<td>Power consumption</td>
<td>approx. 0.8 W</td>
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<tr>
<td><strong>Input</strong></td>
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</tr>
<tr>
<td>Connection</td>
<td>terminals 1 (mass), 2 (min), 3 (max)</td>
<td>min./max. control system: terminals 1, 2, 3</td>
<td>on/off control system: terminals 1, 3</td>
</tr>
<tr>
<td>Control input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potentiometer</td>
<td>response sensitivity: 1 ... 30 kOhms, adjustable (20 turns)</td>
<td>response sensitivity: 5 ... 150 kOhms, adjustable (20 turns)</td>
<td>response sensitivity: 1 ... 30 kOhms, adjustable (20 turns)</td>
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<tr>
<td><strong>Output</strong></td>
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<tr>
<td>Connection</td>
<td>terminals 7, 8, 9</td>
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<td></td>
</tr>
<tr>
<td>Output</td>
<td>1 changeover contact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact loading</td>
<td>253 V AC/2 A/cos ϕ &gt; 0.7; 40 V DC/2 A resistive load</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energised/De-energised delay</td>
<td>approx. 1 s/approx. 1 s</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V&lt;sub&gt;eff&lt;/sub&gt;</td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V&lt;sub&gt;eff&lt;/sub&gt;</td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V&lt;sub&gt;eff&lt;/sub&gt;</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td>ambient temperature</td>
<td>-20 ... 60 °C (253 ... 333 K)</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical specifications</strong></td>
<td>protection degree</td>
<td>IP20</td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>screw connection, max. 2.5 mm&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>approx. 110 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>20 x 107 x 115 mm (0.8 x 4.2 x 4.5 inches)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>pull-out latches using for screw mounting</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Indication and operation</strong></td>
<td>operating elements</td>
<td>switch S1 position 1 open circuit current: in the open circuit current principle, the relay becomes active when the limit is reached</td>
<td>position 11 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</td>
</tr>
</tbody>
</table>
Electrode relay

**KF**-ER-1.W.LB

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 signal delay is adjustable from between 0.5 s and 10 s and works for the on/off switching of the output relays.

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.

Composition

Connection

*Resistor inevitably by activated lead breakage monitoring.
## Technical data

<table>
<thead>
<tr>
<th></th>
<th>KFD2-ER-1.W.LB</th>
<th>KFA5-ER-1.W.LB</th>
<th>KFA6-ER-1.W.LB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>Power Rail or terminals 14+, 15-</td>
<td>terminals 14, 15</td>
<td>terminals 14, 15</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>20 ... 30 V DC</td>
<td>103.5 ... 126 V AC, 45 ... 65 Hz</td>
<td>207 ... 253 V AC, 45 ... 65 Hz</td>
</tr>
<tr>
<td>Rated current</td>
<td>30 ... 40 mA</td>
<td>12 mA</td>
<td>&lt; 7 mA</td>
</tr>
<tr>
<td>Power consumption</td>
<td>-</td>
<td>&lt; 1.2 W</td>
<td>&lt; 1.2 W</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 1 (mass), 2 (min), 3 (max)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control input</td>
<td>min./max. control system: terminals 1, 2, 3</td>
<td>on/off control system: terminals 1, 3</td>
<td></td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 7, 8, 9, 10, 11, 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch power</td>
<td>max. 192 W, 2000 VA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>signal; relay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact loading</td>
<td>253 V AC/2 A/cos φ &gt; 0.7; 40 V DC/2 A resistive load</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energised/De-energised delay</td>
<td>0.5 s, 2 s, 5 s, 10 s</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td></td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V$_{\text{eff}}$</td>
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</tr>
<tr>
<td>Input/Output</td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V$_{\text{eff}}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input/Power supply</td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V$_{\text{eff}}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output/Power supply</td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V$_{\text{eff}}$</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>screw connection, max. 2.5 mm$^2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>approx. 150 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)</td>
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<tr>
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<td>Power Rail or pull-out latches using for screw mounting</td>
<td>pull-out latches using for screw mounting</td>
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</table>
Operating elements

DIP switch function on side of device

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<thead>
<tr>
<th>DIP switch S1</th>
<th>Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off</td>
<td>open circuit current</td>
</tr>
<tr>
<td></td>
<td>On</td>
<td>closed circuit current</td>
</tr>
<tr>
<td>2</td>
<td>Off</td>
<td>LB deactivated</td>
</tr>
<tr>
<td></td>
<td>On</td>
<td>LB activated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIP switch 3</th>
<th>DIP switch 4</th>
<th>Energised and de-energised delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td>0.5 s</td>
</tr>
<tr>
<td>Off</td>
<td>On</td>
<td>2 s</td>
</tr>
<tr>
<td>On</td>
<td>Off</td>
<td>5 s</td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td>10 s</td>
</tr>
</tbody>
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- 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

PR-03 Power Rail

UPR-03 Power Rail

KFD2-EB2 power feed module

The KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail are used to supply the devices with 24 VDC and at the same time to evaluate collective error message.

Each power feed module monitors and provides protection for up to 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.

If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.
Electrode relay

**KF**-ER-Ex1.W.LB

**Connection**

- Min control
- Max control
- Min/max control

**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 signal delay is adjustable from between 0.5 s and 10 s and works for the on/off switching of the output relays.

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.

**Composition**

- Front View
- Housing type C
- Removable terminals blue
- DIP switch S1
- Functions see operating elements
- LED yellow: Relais output I
- LED green: Power supply
- LED red: LB/SC output II
- Potentiometer Response sensitivity
- Removable terminals green
## Technical data

<table>
<thead>
<tr>
<th>KFD2-ER-Ex1.W.LB</th>
<th>KFA5-ER-Ex1.W.LB</th>
<th>KFA6-ER-Ex1.W.LB</th>
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<tbody>
<tr>
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<td></td>
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<td>20 ... 30 V DC</td>
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<td>30 ... 40 mA</td>
<td>12 mA &lt; 7 mA</td>
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<td>Power consumption</td>
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<td>&lt; 1.2 W</td>
</tr>
<tr>
<td><strong>Input</strong></td>
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<tr>
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<td><strong>Output</strong></td>
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<tr>
<td>Connection</td>
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<tr>
<td>Output</td>
<td>signal; relay</td>
<td></td>
</tr>
<tr>
<td>Contact loading</td>
<td>253 V AC/3 A/cos φ &gt; 0.7; 40 V DC/2 A resistive load</td>
<td></td>
</tr>
<tr>
<td>Energised/De-energised delay</td>
<td>0.5 s, 2 s, 5 s, 10 s</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td>basic insulation according to DIN EN 50178, rated insulation voltage 253 V&lt;sub&gt;eff&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Directive conformity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>Directive 89/336/EEC, EN 61326, EN 50081-2, NE 21</td>
<td></td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-20 ... 60 °C (253 ... 333 K)</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP20</td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>screw connection, max. 2.5 mm&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>approx. 150 g</td>
<td></td>
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<tr>
<td>Dimensions</td>
<td>20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)</td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>Power Rail or pull-out latches using for screw mounting</td>
<td>pull-out latches using for screw mounting</td>
</tr>
<tr>
<td><strong>Data for application in conjunction with hazardous areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC-Type Examination Certificate</td>
<td>DMT 00 ATEX E033, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a></td>
<td>DMT 00 ATEX E032, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a></td>
</tr>
<tr>
<td>Group, category, type of protection</td>
<td>II (1) G [EEx ia] IIC [circuit(s) in zone 0/1/2]</td>
<td>II (1) G [EEx ia] IIC [circuit(s) in zone 0/1/2]</td>
</tr>
<tr>
<td>Input Voltage U&lt;sub&gt;0&lt;/sub&gt;</td>
<td>10 V</td>
<td>10 V</td>
</tr>
<tr>
<td>Input Current I&lt;sub&gt;0&lt;/sub&gt;</td>
<td>2.5 mA</td>
<td>2.5 mA</td>
</tr>
<tr>
<td>Input Power P&lt;sub&gt;0&lt;/sub&gt;</td>
<td>6 mW</td>
<td>6 mW</td>
</tr>
<tr>
<td><strong>Supply</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety maximum voltage U&lt;sub&gt;m&lt;/sub&gt;</td>
<td>40 V DC (Attention! U&lt;sub&gt;m&lt;/sub&gt; is no rated voltage)</td>
<td>265 V AC/150 V AC (Attention! U&lt;sub&gt;m&lt;/sub&gt; is no rated voltage)</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact loading</td>
<td>253 V AC/2 A/cos φ &gt; 0.7; 40 V DC/2 A resistive load</td>
<td></td>
</tr>
<tr>
<td>Electrical isolation</td>
<td>safe electrical isolation acc. to EN 50020, voltage peak value 375 V</td>
<td></td>
</tr>
<tr>
<td>Input/Output</td>
<td>safe electrical isolation acc. to EN 50020, voltage peak value 375 V</td>
<td></td>
</tr>
<tr>
<td>Input/Power supply</td>
<td></td>
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</tr>
<tr>
<td><strong>Directive conformity</strong></td>
<td>Directive 94/9 EC</td>
<td></td>
</tr>
<tr>
<td>EN 50014, EN 50020, EN 50284</td>
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<td></td>
</tr>
</tbody>
</table>
Operating elements

DIP switch function on side of device

<table>
<thead>
<tr>
<th>DIP switch S1</th>
<th>Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off</td>
<td>open circuit current</td>
</tr>
<tr>
<td></td>
<td>On</td>
<td>closed circuit current</td>
</tr>
<tr>
<td>2</td>
<td>Off</td>
<td>LB deactivated</td>
</tr>
<tr>
<td></td>
<td>On</td>
<td>LB activated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIP switch 3</th>
<th>DIP switch 4</th>
<th>energised and de-energised delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td>0.5 s</td>
</tr>
<tr>
<td>Off</td>
<td>On</td>
<td>2 s</td>
</tr>
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<td>Off</td>
<td>5 s</td>
</tr>
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<td>On</td>
<td>On</td>
<td>10 s</td>
</tr>
</tbody>
</table>

- 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.

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.
<table>
<thead>
<tr>
<th>Technical data</th>
<th>KF**-ER-Ex1.W.LB</th>
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</thead>
<tbody>
<tr>
<td>Date of issue</td>
<td>11/05/03</td>
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<tr>
<td>Catalogue</td>
<td>Field Devices 2004</td>
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<thead>
<tr>
<th>Ultrasonic level sensors</th>
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<tbody>
<tr>
<td>Guided microwave</td>
</tr>
<tr>
<td>Level signal conditioning electronics</td>
</tr>
<tr>
<td>Level control accessories</td>
</tr>
<tr>
<td>Sensors for hazardous area</td>
</tr>
<tr>
<td>Pressurised enclosure system</td>
</tr>
</tbody>
</table>
Electrode relay
KF**-ER-2.W.LB

**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 signal delay is adjustable from between 0.5 s and 10 s and works for the on/off switching of the output relays.

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.

**Composition**

- 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

24 V DC
KF2-ER-2,W.LB
KFD2-ER-2,W.LB

115 V AC
KFA5-ER-2,W.LB
KFA5-ER-2,W.LB

230 V AC
KFA6-ER-2,W.LB
KFA6-ER-2,W.LB

*Resistor inevitably by activated lead breakage monitoring.*

Connection

(2. channel in clips)
## Technical data

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<tr>
<td>Ambient temperature</td>
<td>-20 ... 60 °C (253 ... 333 K)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical specifications</strong></td>
<td></td>
<td>screw connection, max. 2.5 mm&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>screw connection, max. 2.5 mm&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>approx. 150 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>Power Rail or pull-out latches using for screw mounting</td>
<td>pull-out latches using for screw mounting</td>
<td>pull-out latches using for screw mounting</td>
</tr>
</tbody>
</table>

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Date of issue 11/05/03 — Catalogue Field Devices 2004
Operating elements

DIP switches function on side of device

<table>
<thead>
<tr>
<th>Dip switch S1</th>
<th>Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Off</td>
<td>Open circuit current</td>
</tr>
<tr>
<td></td>
<td>On</td>
<td>Closed circuit current</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dip switch S1</th>
<th>Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Off</td>
<td>LB deactivated</td>
</tr>
<tr>
<td></td>
<td>On</td>
<td>LB activated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dip switch 3</th>
<th>Dip switch 4</th>
<th>Energised and de-energised delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td>0.5 s</td>
</tr>
<tr>
<td>Off</td>
<td>On</td>
<td>2 s</td>
</tr>
<tr>
<td>On</td>
<td>Off</td>
<td>5 s</td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td>10 s</td>
</tr>
</tbody>
</table>

- 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

PR-03 Power Rail
UPR-03 Power Rail
KFD2-EB2 power feed module

The KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail are used to supply the devices with 24 VDC and at the same time to evaluate collective error message.

Each power feed module monitors and provides protection for up to 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.

If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.
Current/voltage trip amplifiers

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.

Composition

- 1-channel
- 24 V DC nominal 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

KFD2-GS-1.2W
Standard model, replaces model KFD2-GS-1.EU

Connection

- Voltage supply 0 V ... 10 V
- Current source 0 mA ... 20 mA
- Limiting value 1 0 V ... 10 V
- Limiting value 2 4 mA ... 20 mA
- Feedback value 0 V ... 10 V

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-STOP-GN

Device connectors with test sockets.
### Technical data

#### Supply
- **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)

#### Input
- **Measurement range**: terminals 1+, 3-; voltage: 0/1 ... 5 V; 50 kOhms or 0/2 ... 10 V; 100 kOhms; terminals 2+, 3-; current: 0/4 ... 20 mA; 50 Ohms

#### Output
- **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

#### Transfer characteristics
- **Deviation**: ≤ 0.5 %
- **Temperature**: 0.01 %/K of adjusted limit value
- **Input delay**: 100 ms

#### Electrical isolation
- **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>

#### Standard conformity
- **Coordination of insulation**: acc. to DIN EN 50178
- **Electrical isolation**: acc. to DIN EN 50178
- **Electromagnetic compatibility**: acc. to EN 50081-2/EN 50082-2, NAMUR NE 21
- **Climatic conditions**: acc. to DIN IEC 721

#### Ambient conditions
- **Ambient temperature**: -20 ... 60 °C (253 ... 333 K)

#### Mechanical specifications
- **Protection degree**: IP20
- **Mass**: approx. 120 g
- **Dimensions**: 20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)
**Notes**

DIP switch function on the side of device

Delivery status of S1 DIP switch

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

**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+ or 6+ for limit 1 or to terminals 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+ or 6+ 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+ or 6+ for limit 1 or to terminals 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.

  \[ y = ( SP - lower input value) / (upper input value - lower input value) \]

  The limit value (LV) is calculated using the following formula: \( LV = (y \times 8 \text{ V}) + 2 \text{ V} \)

**Example:**

- **Input signal** 
  4 mA ... 20 mA
- **Switch point (SP)** 
  12 mA
- \( y = (12 \text{ mA} - 4 \text{ mA}) / (20 \text{ mA} - 4 \text{ mA}) \), \( y = 50 \% \)
- \( LV = (50 \% \times 8 \text{ V}) + 2 \text{ V}, LV = 6 \text{ V} \)
- 12 mA represent 50 % of the input measurement range. The voltage (LV) between terminals 5+ or 6+ should be adjusted to 6 V (represent 50 %).

**Accessories**

**PR-03 Power Rail**

**UPR-03 Power Rail**

**KFD2-EB2 power feed module**

The devices are supplied with 24 V DC through the KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail. Each power feed module monitors and provides protection for groups of as many as 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact. If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.
SMART transmitter power supplies

Function

SMART transmitter power supplies provide a 2-wire SMART transmitter and transfer the analogue values. Digital signals may be superimposed on the analogue values, which may be transferred bidirectionally. Handheld terminals should be connected as shown in the block diagram. In case of a too low loop resistance, an internal resistance of approx. 274 Ohms between terminals 8 (11) and 9 (12) is available, which can be used as HART resistor. SMART transmitter power supplies are delivered standard with terminals KF-STP-GN. Jacks are integrated in these terminals for the connection of the handheld units.

Composition

- 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
  - Yokogawa

Connection
### Technical data

**Supply**
- **Connection**: Power Rail or terminals 14+, 15-
- **Rated voltage**: 20 ... 35 V DC
- **Ripple**: within the supply tolerance
- **Power consumption**: 1.9 W

**Input**
- **Connection**: terminals 1+, 2-, 3 or 5-, 6+
- **Input signal**: 0 ... 20 mA
- **Input resistance**: ≤ 64 Ω terminals 2-, 3
- **Connection to gateway**: ≥ 16 V at 20 mA terminals 1+, 3

**Output**
- **Connection**: terminals 7-, 8+, 9
- **Output signal**: 0 ... 20 mA; load: 0 ... 550 Ω
- **Ripple**: ≤ 50 μA eff

**Transfer characteristics**
- **Deviation**: at 20 °C/4 ... 20 mA ± 20 μA incl. calibration, linearity, hysteresis, loads and fluctuations of supply voltage
- **Temperature**: ± 20 ppm/K
- **Frequency range**: bandwidth at 0.5 VSS-signal 0 ... 7.5 kHz (-3 dB)
  - bandwidth at 0.5 VSS-signal 0.3 ... 7.5 kHz (-3 dB)

**Electrical isolation**
- **Input/Output**: basic insulation according to DIN EN 50178, rated insulation voltage 253 V eff
- **Input/Power supply**: basic insulation according to DIN EN 50178, rated insulation voltage 253 V eff
- **Output/Power supply**: basic insulation acc. to DIN EN 50178, rated insulation voltage of AC 50 V

**Ambient conditions**
- **Ambient temperature**: -20 ... 60 °C (253 ... 333 K)

**Mechanical specifications**
- **Protection degree**: IP20
- **Mass**: approx. 200 g
- **Dimensions**: 20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)

### Accessories

**PR-03 Power Rail**
**UPR-03 Power Rail**
**KFD2-EB2 power feed module**
The devices are supplied with 24 V DC through the KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail. Each power feed module monitors and provides protection for groups of as many as 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.

If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.
SMART transmitter power supplies

**Function**
SMART transmitter power supplies provide 2- or 3-wire SMART transmitters with power in hazardous areas and transfer the analogue values from the hazardous to the safe area. Digital signals may be superimposed on the analogue values in the hazardous or safe area, which may be transferred bidirectionally. Handheld terminals should be connected as shown in the block diagram.

If the loop resistance is too low, an internal resistor of approx. 274 Ohms between terminals 8 and 9 is available, which may be used as HART resistor.

SMART transmitter power supplies are delivered standard with terminals KF-STP-BU and KF-STP-GN. Jacks are integrated in these terminals for the connection of the handheld units.

**Composition**

**Application**
- Power supply for SMART transmitters and transfer of the measurement current 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
  - Yokogawa
### Technical data

#### Supply
- **Connection**: Power Rail or terminals 14+, 15-
- **Rated voltage**: 20 ... 35 V DC
- **Ripple**: within the supply tolerance
- **Power consumption**: 1.9 W

#### Input
- **Connection**: terminals 1+, 2-, 3 or 5-, 6+
- **Input signal**: 0 ... 20 mA
- **Input resistance**: ≥ 64 Ω terminals 2-, 3
- **Available voltage**: ≥ 16 V at 20 mA terminals 1+, 3

#### Output
- **Connection**: terminals 7-, 8+, 9
- **Output signal**: 0 ... 20 mA; load 0 ... 800 Ω
- **Ripple**: ≤ 50 μA rms

#### Transfer characteristics
- **Deviation**: at 20 °C/4 ... 20 mA ± 20 μA incl. calibration, linearity, hysteresis, loads and fluctuations of supply voltage
- **Temperature**: 0.4 mA/°C
- **Frequency range**: hazardous area into the safe area: bandwidth with 0.5 V SS-signal 0 ... 7.5 kHz (-3 dB)
  - safe area into the hazardous area: bandwidth with 0.5 V SS-signal 0.3 ... 7.5 kHz (-3 dB)
- **Rise time**: 20 μs

#### Electrical isolation
- **Output/Power supply**: basic insulation acc. to DIN EN 50178, rated insulated voltage of AC 50 V

#### Directive conformity
- **Electromagnetic compatibility standards**: Directive 89/336/EEC, EN 61326, EN 50081-2, NE 21

#### Standard conformity
- **Climatic conditions**: acc. to DIN IEC 721
- **Ambient conditions**: Ambient temperature -20 ... 60 °C (253 ... 333 K)

#### Mechanical specifications
- **Protection degree**: IP20
- **Mass**: approx. 200 g
- **Dimensions**: 20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)

#### Data for application in conjunction with hazardous areas
- **EC-Type Examination Certificate**: BAS 99 ATEX 7060, for additional certificates see www.pepperl-fuchs.com
- **Group, category, type of protection**: II (1) G [EEx ia] IIC (-20 °C ≤ Tamb ≤ 60 °C) [circuit(s) in zone 0/1/2]

#### Input
- **Supply**: EEx ia IIC
- **Safety maximum voltage U_m**: 250 V (Attention! The rated voltage can be lower)

#### Apparatus
- **terminals 1+, 3-**
  - **Voltage U_i**: 30 V
  - **Current I_i**: 115 mA
  - **Voltage U_o**: 25.4 V
  - **Current I_o**: 88.2 mA
  - **Power P_0**: 560 mW
  - **Internal capacitance C_i**: 12 nF
  - **Internal inductance L_i**: 0
- **terminals 2-, 3**
  - **Current I_0/Current I_i**: 74 mA/115 mA
  - **Current I_i**: 115 mA
  - **Voltage U_o**: 3.5 V
  - **Current I_o**: 74 mA
  - **Power P_0**: 64 mW
- **terminals 1+, 3/2-**
  - **Voltage U_o**: 25.4 V
  - **Current I_0**: 115 mA
  - **Power P_0**: 584 mW
- **terminals 5-, 6+**
  - **Voltage U_i**: 30 V
  - **Current I_i**: 115 mA
  - **Voltage U_o**: 8.7 V
  - **Current I_o**: terminals 6: 0 mA
  - **terminals 5: 33 mA

#### Statement of conformity
- **TÜV 99 ATEX 1499 X, observe statement of conformity**
KFD2-STC4-Ex1 Technical data

Group, category, type of protection, Temperature classification
Ⅱ 3 G 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 standards
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.

Accessories

PR-03 Power Rail
UPR-03 Power Rail
KFD2-EB2 power feed module

The devices are supplied with 24 V DC through the KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail. Each power feed module monitors and provides protection for groups of as many as 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.

If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.

Supplementary information

Accessories
**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 kOhm, 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 Ohms up to 1 kOhm the adjustment value is 50 Ohms. 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.
## Technical data

### Supply
- **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

### Input
- **Connection**: terminals 4-, 5-, 3+, 2+, 1+
- **Lead resistance**: ≤ 50 Ohms at potentiometer resistance ≤ 1 kΩ; 5 % of the potentiometer resistance at ≥ 1 kΩ (can be equalised by user)
- **Potentiometer resistance**: ≥ 800 Ohms
- **Potentiometer voltage**: approx. 4.7 V

### Output
- **Voltage output**: 0/1 ... 5 V or 0/2 ... 10 V
- **Connection**: terminals 7-, 8+
- **Current output**: 0/4 ... 20 mA; load ≤ 1 kΩ
- **Safety maximum voltage** $U_m$: 250 V
- **Output resistance**: ≤ 30 Ω

### Transfer characteristics
- **Deviation**
  - **Linearity**: ≤ ± 5 mV in case of voltage output/≤ ± 10 μA in case of current output
  - **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

### 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
- **Output/Power supply**: basic insulation acc. to DIN EN 50178, rated insulation voltage of AC 50 V

### Directive conformity
- **Electromagnetic compatibility**: standards
- **Standard conformity**
  - **Coordination of insulation**: acc. to DIN EN 50178
  - **Electrical isolation**: acc. to DIN EN 50178
  - **Electromagnetic compatibility**: acc. to EN 50081-2/EN 50082-2, NAMUR NE 21, DIN IEC 801-6 intensity level 2
  - **Climatic conditions**: acc. to DIN IEC 721
- **Ambient temperature**: -20 ... 60 °C (253 ... 333 K)

### Mechanical specifications
- **Protection degree**: IP20
- **Mass**: approx. 120 g
- **Dimensions**: 20 x 107 x 115 mm (0.8 x 4.2 x 4.5 inches)

### Data for application in conjunction with hazardous areas
- **EC-Type Examination Certificate**: BAS 00 ATEX 7171X; for additional certificates see www.pepperl-fuchs.com
  - **Group, category, type of protection**: IIC (-20 °C ≤ $T_a$ ≤ 60 °C)
  - **Voltage** $U_0$: 10.4 V
  - **Current** $I_0$: 31.4 mA
  - **Power** $P_0$: 82 mW
- **Supply**: Safety maximum voltage $U_m$: 250 V
- **Electrical isolation**: safe electrical isolation acc. to EN 50020, voltage peak value 375 V
- **Directive conformity**: standards
- **Directive 94/9 EC**: on request
- **Entity parameter**
  - **Certification number**: 4Z6A5.AX
  - **FM control drawing**: No. 116-0129
  - **Suitable for installation in division 2**: yes
  - **Connection**: terminals 1, 2, 3, 4, 5
  - **Input I**
    - **Current** $I_t$: 33 mA
    - **Voltage** $V_t$: 10.5 V
    - **Explosion group**: A&B C&E D, F&G
    - **Max. external capacitance** $C_a$: 2.66 μF 7.99 μF 21.33 μF
    - **Max. external inductance** $L_a$: 31.9 mH 95.7 mH 272.2 mH

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Subject to reasonable modifications due to technical advances.

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**KFD2-PT2-Ex1**

### Technical data

#### Safety parameter
- CSA control drawing: LR 65756-13
- Control drawing: No. 116-0132
- Connection: terminals 1, 2, 3, 4, 5

#### Input
- Voltage $V_{DC}$: 10.6 V
- Current $I_{SC}$: 31.7 mA
- Explosion group: A&B, C&E, D, F&G
- Max. external capacitance $C_a$: 2.6 µF, 7.8 µF, 20.8 µF
- Max. external inductance $L_a$: 34 mH, 121 mH, 291 mH

### Notes

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

<table>
<thead>
<tr>
<th>Model number</th>
<th>Output</th>
<th>Model number</th>
<th>Output</th>
<th>Model number</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>KFD2-PT2-Ex1</td>
<td>0 V ... 10 V</td>
<td>KFD2-PT2-Ex1-2</td>
<td>2 V ... 10 V</td>
<td>KFD2-PT2-Ex1-4</td>
<td>0 mA ... 20 mA</td>
</tr>
<tr>
<td>KFD2-PT2-Ex1-1</td>
<td>0 V ... 5 V</td>
<td>KFD2-PT2-Ex1-3</td>
<td>1 V ... 5 V</td>
<td>KFD2-PT2-Ex1-5</td>
<td>4 mA ... 20 mA</td>
</tr>
</tbody>
</table>

### Accessories

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

The devices are supplied with 24 V DC through the KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail. Each power feed module monitors and provides protection for groups of as many as 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.

If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.

### 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.
**Isolated switch amplifiers**

**KFA6-SR-2.3L**

**Output:** relay

### Connection

- 2-channel
- Control circuit of 3-wire sensors PNP/NPN and push-pull output stages
- Relay output with 1 pole, indication of the switching state LED yellow
- Reversible mode of operation
- Selectable min/max function (bistable response)
- All operation modes for both channels are separate selectable
- Signal doubling jumper 2 - 5, one input is switching both relay outputs (not for min/max function)

**KFA6-SR-2.3L**

### Function

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

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

### 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 S2:
  - (mode of operation input II)
- Switch S3:
  - (mode of operation)
- Switch S4:
  - (sensor type input I)
- Switch S5:
  - (sensor type input II)

- Removable terminals green
- LED green: Power
### Technical data

**Supply**
- **Connection**: terminals 14, 15
- **Rated voltage**: 90 ... 253 V AC, 45 ... 65 Hz
- **Rated current**: ≤ 150 mA
- **Power consumption**: ≤ 1.3 W

**Input**
- **Connection**: Input I: terminals 1+, 2, 3-; Input II: terminals 4+, 5, 6-
- **Rated values**: 22 ... 24 V DC/100 mA
- **Short-circuit current**: 110 mA

**Output**
- **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 φ > 0.7; 40 V DC/2 A resistive load
- **Energised/De-energised delay**: max. 6 ms
- **Mechanical life**: 10⁷ switching cycles

**Transfer characteristics**
- **Switching frequency**: ≤ 10 Hz

**Electrical isolation**
- **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 DIN EN 50178, rated insulation voltage 253 Vₑff

**Standard conformity**
- **Electromagnetic compatibility**: acc. to EN 50081-2/EN 50082-2, NAMUR NE 21

**Ambient conditions**
- **Ambient temperature**: -20 ... 60 °C (253 ... 333 K)

**Mechanical specifications**
- **Protection degree**: IP20
- **Mass**: approx. 150 g
- **Dimensions**: 20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)

### 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 level control (min/max control). The input switchings are designed in a way, that the signals of sensors which have PNP or NPN output transistors as well as push-pull output stages, can be processed correctly. In the case of sensors with push-pull output stages the switches S4 or S5 have to be set to position /g73. For sensors with PNP or NPN output transistors, the switches S4 or S5 have to be set to position /g73/g73.
The operating behaviour of the sensor can be selected: NO S1/S2 in position /g73; NC S1/S2 in position /g73/g73.

**Dual channel isolated amplifier for binary sensors**
With this function (S3 in position I) signals are transmitted galvanically isolated via binary sensors for each channel (2- or 3-wire).
Parallel operation (1 input, 2 outputs)
A signal duplication can be realized by the following measures:
- jumper 2 to 5
- sensor to input I or II

**Two-point level control (min/max control) with storage of status**
On this setting (S3 in position II) the information from the two channels is combined.
When applying the supply voltage, relay 1 is energised until input 2 is activated (reset input). Input 1 works as set input.
**Truth table (min/max control)**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activation of the supply voltage</td>
<td>EI: not activated</td>
<td>EII: not activated</td>
</tr>
<tr>
<td></td>
<td>EI: activated</td>
<td>EII: not activated</td>
</tr>
<tr>
<td>Normal operation</td>
<td>EI: activated</td>
<td>EII: transition: not activated/activated</td>
</tr>
<tr>
<td></td>
<td>transition: activated/not activated</td>
<td>EII: not activated</td>
</tr>
</tbody>
</table>

**Sensor circuit**

**PNP output stage**

\[ S_4 = \text{II} \]

\[ S_5 = \text{II} \]

**NPN output stage**

\[ S_4 = \text{I} \]

\[ S_5 = \text{II} \]

**Push-pull output stage**

\[ S_4 = \text{I} \]

\[ S_5 = \text{I} \]

**Function of the DIP switches**

<table>
<thead>
<tr>
<th>Group function</th>
<th>Switch function</th>
<th>Switch/position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>dual channel independent</td>
<td>S3/I</td>
</tr>
<tr>
<td></td>
<td>min/max function with storage of the status</td>
<td>S3/II</td>
</tr>
<tr>
<td>Operating behaviour of the sensor</td>
<td>input 1 is activated whenever sensor 1 switches</td>
<td>S1/I</td>
</tr>
<tr>
<td></td>
<td>input 1 is activated whenever sensor 1 does not switch</td>
<td>S1/II</td>
</tr>
<tr>
<td></td>
<td>input 2 is activated whenever sensor 2 switches</td>
<td>S2/I</td>
</tr>
<tr>
<td></td>
<td>input 2 is activated whenever sensor 2 does not switch</td>
<td>S2/II</td>
</tr>
<tr>
<td>Sensor type</td>
<td>input 1: push-pull output stage, NO</td>
<td>S4/I</td>
</tr>
<tr>
<td></td>
<td>input 1: PNP/NPN NO</td>
<td>S4/II</td>
</tr>
<tr>
<td></td>
<td>input 2: push-pull output stage, NO</td>
<td>S5/I</td>
</tr>
<tr>
<td></td>
<td>input 2: PNP/NPN NO</td>
<td>S5/II</td>
</tr>
</tbody>
</table>

**Comments:**

1. The output functions are reversed when a NC is used.
2. NO with push-pull output stage means that the closing contact or transistor is connected to terminal 2 and 3 (5 and 6).
3. NC with push-pull output stage means that the opening contact or transistor is connected to terminal 2 and 3 (5 and 6).
4. In switch position S3/I (dual channel, independent) an output relay is activated if the corresponding input is activated.
Example 1: Filling of a vessel (two-point level control, S3 in position II)
Sensor 1 is connected to input 1 (set input), sensor 2 is connected to input 2 (reset input). S1 and S2 are on position I. A filling pump is connected to output 1 or 2 (connections 7/8 or 10/11).

![Diagram of sensor 1 and 2 positions]

When applying the supply voltage at the KFA6-SR-2.3L the pump is switched on if sensor 2 is not activated (level 1, 2 or 3). During operation the pump is switched off if the level has reached position 4 or 5. If the level has dropped again below 2, the pump is switched on. If the KFA6-SR-2.3L is not active, the pump is switched off.

Example 2: Emptying of a vessel (two-point level control, S3 in position II)
Sensor 1 is connected to input 1 (set input), sensor 2 is connected to input 2 (reset input). S1 and S2 are set to position II. An emptying pump is connected to output 1 or 2 (connections 7/9 or 10/12).

![Diagram of sensor 1 and 2 positions]

When applying the supply voltage at the KFA6-SR-2.3L the pump is switched on if sensor 2 is activated (level 4 or 5). During operation the pump is switched off if the level has reached position 2 or 1. If the level has risen again beyond 4, the pump is switched on. If the KFA6-SR-2.3L is not active, the pump is switched on.
Isolated switch amplifiers

• 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
• Usable up to SIL 2 acc. to IEC 61508

24 V DC
KFD2-SR2-Ex1.W

Function
The transformer isolated barrier transfers digital signals from the hazardous area. Sensors per DIN 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 DIN 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.

Connection

Composition

Front View
Housing type C
(see system description)

LED yellow:
Relay output

LED red:
LB/SC

Switch S2
(no functions)

Removable terminal blue

Removable terminals green

LED green:
Power supply

Switch S1
(Mode of operation)

Switch S3
(LB/SC-monitoring)
## Technical data

### KFD2-SR2-Ex1.W

### Ultrasonic level sensors

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>Power Rail or terminals 14+, 15-</td>
</tr>
<tr>
<td><strong>Rated voltage</strong></td>
<td>20 ... 30 V DC</td>
</tr>
<tr>
<td><strong>Ripple</strong></td>
<td>≤ 10 %</td>
</tr>
<tr>
<td><strong>Rated current</strong></td>
<td>20 ... 23 mA</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>terminals 1+, 2+, 3-</td>
</tr>
<tr>
<td><strong>Rated values</strong></td>
<td>acc. to IEC 60947-5-6 (NAMUR, DIN 19234), see system description for electrical data</td>
</tr>
<tr>
<td><strong>Open circuit voltage/Short-circuit current</strong></td>
<td>approx. 8 V DC/approx. 8 mA</td>
</tr>
<tr>
<td><strong>Switching point/Switching hysteresis</strong></td>
<td>1.2 ... 2.1 mA/approx. 0.2 mA</td>
</tr>
<tr>
<td><strong>Pulse/Pause ratio</strong></td>
<td>≥ 20 ms/≤ 20 ms</td>
</tr>
<tr>
<td><strong>Lead monitoring</strong></td>
<td>breakage I ≤ 0.1 mA, short-circuit I &gt; 6 mA</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>terminals 7, 8, 9</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>signal; relay</td>
</tr>
<tr>
<td><strong>Contact loading</strong></td>
<td>253 V AC/2 A/cos ϕ &gt; 0.7; 126.5 V AC/4 A/cos ϕ &gt; 0.7; 40 V DC/2 A resistive load</td>
</tr>
<tr>
<td><strong>Energised/De-energised delay</strong></td>
<td>approx. 20 ms/approx. 20 ms</td>
</tr>
<tr>
<td><strong>Mechanical life</strong></td>
<td>10⁷ switching cycles</td>
</tr>
<tr>
<td><strong>Transfer characteristics</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Switching frequency</strong></td>
<td>&lt; 10 Hz</td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Output/Power supply</strong></td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V eff</td>
</tr>
<tr>
<td><strong>Directive conformity</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Electromagnetic compatibility</strong></td>
<td>standards</td>
</tr>
<tr>
<td>Directive 89/336/EEC</td>
<td>EN 61326, EN 50081-2, NE 21</td>
</tr>
<tr>
<td><strong>Standard conformity</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Climatic conditions</strong></td>
<td>acc. to DIN IEC 721</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>-20 ... 60 °C (253 ... 333 K)</td>
</tr>
<tr>
<td><strong>Mechanical specifications</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Protection degree</strong></td>
<td>IP20</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>approx. 150 g</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)</td>
</tr>
<tr>
<td><strong>Data for application in conjunction with hazardous areas</strong></td>
<td></td>
</tr>
<tr>
<td><strong>EC-Type Examination Certificate</strong></td>
<td>PTB 00 ATEX 2080, for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a></td>
</tr>
<tr>
<td><strong>Group, category, type of protection</strong></td>
<td>II (1) G D [EEEx ia] IIC [circuit(s) in zone 0/1/2]</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>U₀</td>
</tr>
<tr>
<td><strong>Current</strong></td>
<td>I₀</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>P₀</td>
</tr>
<tr>
<td><strong>Supply</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Safety maximum voltage U_m</strong></td>
<td>253 V AC/125 V DC (Attention! U_m is no rated voltage.)</td>
</tr>
<tr>
<td><strong>Statement of conformity</strong></td>
<td>TÜV 99 ATEX 1493 X, observe statement of conformity</td>
</tr>
<tr>
<td><strong>Group, category, type of protection, Temperature classification</strong></td>
<td>II 3 G EEx nAC IIC T4 [device in zone 2]</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Contact loading</strong></td>
<td>253 V AC/2 A/cos ϕ &gt; 0.7; 126.5 V AC/4 A/cos ϕ &gt; 0.7; 40 V DC/2 A resistive load (PTB 00 ATEX 2080)</td>
</tr>
<tr>
<td><strong>Safety maximum voltage U_m</strong></td>
<td>253 V AC (Attention! The rated voltage can be lower)</td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Input/Output</strong></td>
<td>safe electrical isolation acc. to EN 50020, voltage peak value 375 V</td>
</tr>
<tr>
<td><strong>Input/Power supply</strong></td>
<td>safe electrical isolation acc. to EN 50020, voltage peak value 375 V</td>
</tr>
<tr>
<td><strong>Directive conformity</strong></td>
<td>standards</td>
</tr>
<tr>
<td>Directive 94/9 EC</td>
<td>EN 50014, EN 50020, EN 50021</td>
</tr>
<tr>
<td><strong>Entity parameter</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Certification number</strong></td>
<td>J.I.3002773</td>
</tr>
<tr>
<td><strong>FM control drawing</strong></td>
<td>No. 116-0035</td>
</tr>
<tr>
<td><strong>Suitable for installation in division 2</strong></td>
<td>yes</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>terminals 1, 3; 2, 3; 4; 6; 5; 6</td>
</tr>
<tr>
<td><strong>Input I</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>V_DC</td>
</tr>
<tr>
<td><strong>Current</strong></td>
<td>I₁</td>
</tr>
<tr>
<td><strong>Explosion group</strong></td>
<td>A&amp;B C&amp;E D F&amp;G</td>
</tr>
<tr>
<td><strong>Max. external capacitance C_a</strong></td>
<td>1.273 µF 3.82 µF 10.18 µF</td>
</tr>
<tr>
<td><strong>Max. external inductance L_a</strong></td>
<td>84.8 mH 254.4 mH 678.4 mH</td>
</tr>
</tbody>
</table>
### Technical data

<table>
<thead>
<tr>
<th>Safety parameter</th>
<th>UL control drawing</th>
<th>CSA control drawing</th>
<th>Control drawing</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E 106378</td>
<td>LR 36087-19</td>
<td>No. 116-0047</td>
<td>terminals 1, 3; 2, 3; 4, 6; 5, 6</td>
</tr>
</tbody>
</table>

#### Input I

<table>
<thead>
<tr>
<th>Safety parameter</th>
<th>Voltage $V_{OC}$</th>
<th>Current $I_{SC}$</th>
<th>Explosion group</th>
<th>Max. external capacitance $C_a$</th>
<th>Max. external inductance $L_a$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12.9 V</td>
<td>19.8 mA</td>
<td>A&amp;B C&amp;E D, F&amp;G</td>
<td>1.273 $\mu$F 3.82 $\mu$F 10.18 $\mu$F</td>
<td>84.88 mH 298.7 mH 744.4 mH</td>
</tr>
</tbody>
</table>

#### 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.

### Accessories

**PR-03 Power Rail**

**UPR-03 Power Rail**

**KFD2-EB2 power feed module**

The KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail are used to supply the devices with 24 VDC and at the same time to evaluate collective error message. Each power feed module monitors and provides protection for up to 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact. If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.
**Isolated switch amplifiers**

**KFA6-SR2-Ex2.W.IR**

**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.

**Composition**

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

---

**Hazardous area**

**Safe area**

**Output: relay**

**Connection**

**Application**

230 V AC

**KFA6-SR2-Ex2.W.IR**

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Subject to reasonable modifications due to technical advances.

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### Technical data

#### Supply
- **Connection**: terminals 14, 15
- **Rated voltage**: 207 ... 253 V AC, 45 ... 65 Hz
- **Ripple**: -
- **Rated current**: -
- **Power consumption**: \( \leq 1.5 \) W

#### Input
- **Connection**: terminals 1+, 2+, 3-; 4+, 5+, 6-
- **Rated values**: acc. to IEC 60947-5-6 (NAMUR, DIN 19234)
- **Open-circuit voltage/Short-circuit current**: approx. 8 V DC/approx. 8 mA
- **Pulse/Pause ratio**: \( \geq 10 \) ms/\( \geq 10 \) ms
- **Lead monitoring**: breakage I \( \leq 0.1 \) mA, short-circuit I \( > 6 \) mA

#### Output
- **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 \( \varphi > 0.7 \); 126.5 V AC/4 A/cos \( \varphi > 0.7 \); 40 V DC/2 A resistive load
- **Energised/De-energised delay**: approx. 20 ms/approx. 20 ms
- **Mechanical life**: \( 10^7 \) switching cycles

#### Transfer characteristics
- **Switching frequency**: \( \leq 10 \) Hz

#### Electrical isolation
- **Output/Power supply**: safe isolation acc. to DIN VDE 0106, rated insulation voltage 253 V eff
- **Output/Output**: basic insulation acc. to DIN EN 50178, rated insulation voltage 253 V eff

#### Directive conformity
- **Electromagnetic compatibility standards**: Directive 89/336/EEC, EN 61326, EN 50081-2, NE 21

#### Standard conformity
- **Climatic conditions**: acc. to DIN IEC 721

#### Ambient conditions
- **Ambient temperature**: -20 ... 60 °C (253 ... 333 K)

#### Mechanical specifications
- **Protection degree**: IP20
- **Mass**: approx. 150 g
- **Dimensions**: 20 x 118 x 115 mm (0.8 x 4.6 x 4.5 inches)

#### Data for application in conjunction with hazardous areas
- **EC-Type Examination Certificate**: PTB 00 ATEX 2081, for additional certificates see www.pepperl-fuchs.com
- **Group, category, type of protection**: I (1) G D [EEx ia] IIC [circuit(s) in zone 0/1/2]
- **Input**: EEx ia IIC

#### Input
- **Voltage**: \( U_0 \)
- **Current**: \( I_0 \)
- **Power**: \( P_0 \)
- **Voltage**: 10.6 V
- **Current**: 19.1 mA
- **Power**: 51 mW (linear characteristic)

#### Supply
- **Safety maximum voltage**: \( U_m \)
- **253 V AC/126.5 V AC (Attention! \( U_m \) is no rated voltage.)

#### Output
- **Contact loading**: 253 V AC/2 A/cos \( \varphi > 0.7 \); 126.5 V AC/4 A/cos \( \varphi > 0.7 \); 40 V DC/2 A resistive load
- **Safety maximum voltage**: \( U_m \)
- **253 V AC (Attention! The rated voltage can be lower)

#### Electrical isolation
- **Input/Output**: not available
- **Input/Power supply**: safe electrical isolation acc. to EN 50020, voltage peak value 375 V
- **Directive conformity**: standards

#### Directive 94/9 EC
- **EN 50014, EN 50020

#### Entity parameter
- **Certification number**: J.I.3002773
- **FM control drawing**: No. 116-0035
- **Suitable for installation in division 2**: yes
- **Connection**: terminals 1, 3; 2, 3; 4, 6; 5, 6
- **Input I

#### Voltage
- **Voltage**: \( V_{OC} \)
- **Current**: \( I_1 \)
- **Explosion group**: A&B, C&E, D, F&G
- **Max. external capacitance**: \( C_a \)
- **Max. external inductance**: \( L_a \)
- **Voltage**: 12.9 V
- **Current**: 19.8 mA
- **1.273 \* 3.82 \* 10.18 \* 84.8 mH
- **254.4 mH
- **678.4 mH

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KFA6-SR2-Ex2.W.IR

Technical data

Safety parameter
UL control drawing E 106378
CSA control drawing LR 36087-13
Control drawing No. 116-0047
Connection terminals 1, 3; 2, 3; 4, 6; 5, 6

Input I
Safety parameter 12.6 V/650 Ohms
Voltage $V_{OC}$ 12.9 V
Current $I_{SC}$ 19.8 mA
Explosion group A&B C&E D, F&G
Max. external capacitance $C_a$ 1.273 µF 3.82 µF 10.18 µF
Max. external inductance $L_a$ 84.88 mH 298.7 mH 744.4 mH

Notes

Function of the DIP switches

<table>
<thead>
<tr>
<th>Switch</th>
<th>Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1: Mode of operation Input I</td>
<td>I</td>
<td>Input I active, whenever connected sensor damped</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Input I active, whenever connected sensor undamped</td>
</tr>
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<td>I</td>
<td>Input II active, whenever connected sensor damped</td>
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<tr>
<td></td>
<td>II</td>
<td>Input II active, whenever connected sensor undamped</td>
</tr>
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<td>I</td>
<td>LB/SC monitoring active</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>No LB/SC monitoring</td>
</tr>
</tbody>
</table>

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.
Transmitter supply isolators

KF**-CRG-1.D

Connection

3-wire transmitter

2-wire

2-wire current source

Function

Transmitter power supplies KF**-CRG-1.D are suitable for a lot of measuring tasks. 2- and 3-wire transmitters as well as active power supplies with 0/4 mA ... 20 mA signal can be connected. Two relays and an active 0/4 mA ... 20 mA current output are available as outputs. The relay contacts can be integrated in security relevant circuits. The switch points of the relays are derived from the transmitter signal or the signal of a connected power source. The current output is freely scaleable. The input has a lead breakage and short circuit monitoring. The device is operated by means of a PC software (PACTware™) or via the control surface on the front panel.

Composition

Front View

Housing type B2 (see system description)

LED red: Fault signal
LED yellow: Output I
LED yellow: Output II

Control panel

Programming jack

Removable terminals green

LED green: Power supply

Removable terminal green

Date of issue 11/05/03 – Catalogue Field Devices 2004

Subject to reasonable modifications due to technical advances.
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### Technical data

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<td>terminals 23, 24</td>
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<td>approx. 100 mA</td>
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<td>Connection</td>
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<td>≥ 15 V at 20 mA</td>
<td>&gt; 15 V at 20 mA</td>
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<tr>
<td>Input resistance</td>
<td>45 Ω (terminals 2, 3)</td>
<td>45 Ω (terminals 2, 3)</td>
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<td>Open circuit voltage</td>
<td>24 V/33 mA</td>
<td>24 V/33 mA</td>
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<td></td>
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<td>Breakage I &lt; 0.2 mA; short circuit I &gt; 22 mA acc. to NAMUR NE 43</td>
<td>Breakage I &lt; 0.2 mA; short circuit I &gt; 22 mA acc. to NAMUR NE 43</td>
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<td>Connection</td>
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<td>output II: terminals 16, 17, 18</td>
</tr>
<tr>
<td></td>
<td>output: analogue, terminals 8+, 7-</td>
<td>output: analogue, terminals 8+, 7-</td>
</tr>
<tr>
<td>Output I and II</td>
<td>signal, relay</td>
<td></td>
</tr>
<tr>
<td>Contact loading</td>
<td>250 V AC/2 A/cos ϕ ≥ 0.7; 40 V DC/2 A</td>
<td></td>
</tr>
<tr>
<td>Mechanical life</td>
<td>5 x 10^7 switching cycles</td>
<td></td>
</tr>
<tr>
<td>Energised/De-energised delay</td>
<td>approx. 20 ms/approx. 20 ms</td>
<td></td>
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<td>Output III</td>
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<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Open loop voltage</td>
<td>≥ 24 V DC</td>
<td></td>
</tr>
<tr>
<td>Load</td>
<td>≤ 650 Ohms</td>
<td></td>
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<tr>
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<td>downscale I ≤ 3.6 mA, upscale I ≥ 22 mA acc. to NAMUR NE 43</td>
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<tr>
<td><strong>Transfer characteristics</strong></td>
<td></td>
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<tr>
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<td>Measuring time</td>
<td>&lt; 100 ms</td>
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<tr>
<td>Temperature</td>
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<td></td>
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<td></td>
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<tr>
<td>Accuracy</td>
<td>≤ 20 μA</td>
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<tr>
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<td>0.005 %/°C (50 ppm)</td>
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<td>safe electrical isolation acc. to DIN EN 50178, voltage peak value 375 V</td>
<td>safe electrical isolation acc. to DIN EN 50178, voltage peak value 375 V</td>
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<td>Output I, II, Other circuits</td>
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<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V&lt;sub&gt;eff&lt;/sub&gt;</td>
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<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V&lt;sub&gt;eff&lt;/sub&gt;</td>
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<tr>
<td>Output III, Power supply and collective error</td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V&lt;sub&gt;eff&lt;/sub&gt;</td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V&lt;sub&gt;eff&lt;/sub&gt;</td>
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<tr>
<td>Output III, Power supply</td>
<td>-</td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V&lt;sub&gt;eff&lt;/sub&gt;</td>
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<td>Interface/Power supply</td>
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<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V&lt;sub&gt;eff&lt;/sub&gt;</td>
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<td>Interface/Power supply and collective error</td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V&lt;sub&gt;eff&lt;/sub&gt;</td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V&lt;sub&gt;eff&lt;/sub&gt;</td>
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<td>acc. to DIN EN 50178</td>
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<td>acc. to DIN EN 50178</td>
<td>acc. to DIN EN 50178</td>
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<td>acc. to EN 50081-2/EN 50082-2</td>
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<td>acc. to DIN IEC 721</td>
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<td>acc. to DIN EN 60947-5-6</td>
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<td>Ambient temperature</td>
<td>-20 ... 60 °C (253 ... 333 K)</td>
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<td><strong>Mechanical specifications</strong></td>
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<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP20</td>
<td></td>
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<tr>
<td>Mass</td>
<td>300 g</td>
<td></td>
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<tr>
<td>Dimensions</td>
<td>40 x 107 x 115 mm (1.6 x 4.2 x 4.5 inches)</td>
<td>40 x 107 x 115 mm (1.6 x 4.2 x 4.5 inches)</td>
</tr>
</tbody>
</table>
Accessories

PR-03 Power Rail
UPR-03 Power Rail
KFD2-EB2 power feed module
The KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail are used to supply the devices with 24 VDC and at the same time to evaluate collective error message.
Each power feed module monitors and provides protection for groups of as many as 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail, track. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.
If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.
K-CJC
Removable terminals with integrated temperature measurement sensor for cold junction compensation for thermocouples.
PACT™
Device-specific drivers (DTM)
Adapter K-ADP1
Interface adapter for connection with the serial interface of a PC/Notebook.
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</table>

**Technical data**

Date of issue 11/05/03 – Catalogue Field Devices 2004
Ultrasonic level sensors
Guided microwave Level signal conditioning electronics Level control accessories Sensors for hazardous area Pressurised enclosure system

- 1-channel
- Analogue input 0/4 mA ... 20 mA EEx ia IIC
- Analogue output 0/4 mA ... 20 mA
- 2 relay outputs
- Usable up to SIL 2 acc. to IEC 61508
- Each relay output individually parameterisable as high/low alarm
- Lead breakage (LB) monitoring and short-circuit (SC) monitoring
- Parameterisation with PC or control panel

24 V DC
KFD2-CRG-Ex1.D
48 V AC ... 253 V AC/20 V DC ... 90 V DC
KFU8-CRG-Ex1.D

Function
Transmitter power supplies KF**-CRG-Ex1.D are suitable for a lot of measuring tasks. 2- and 3-wire transmitters as well as active power supplies with 0/4 mA ... 20 mA signal can be connected.
Two relays and an active 0/4 mA ... 20 mA current output are available as outputs.
The relay contacts can be integrated in security relevant circuits. The switch points of the relays are derived from the transmitter signal or the signal of a connected power source.
The current output is freely scaleable. The input has a lead breakage and short circuit monitoring.
The device is operated by means of a PC software (PACTware™) or via the control surface on the front panel.

Composition
Front View
Housing type B2 (see system description)

Connection
3-wire transmitter
2-wire current source

Input EEx ia IIC

2-wire

1+
2-
3+

Hazardous area

Safe area

Collective error message (only KFD2 version)

Power Rail

23+ 24-8+ 7-

GND

TXD

RXD

RS 232

TTL

J

J

1+ 3+

2- 31+

10 11 12 16 17 18 23+ 24-8+ 7-

U

K-ADP1 PC
## Technical data

<table>
<thead>
<tr>
<th>KFD2-CRG-Ex1.D</th>
<th>KFU8-CRG-Ex1.D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>Power Rail or terminals 23+, 24- terminals 23, 24</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>20 ... 30 V DC or 48 ... 253 V AC 20 ... 90 V DC</td>
</tr>
<tr>
<td>Rated current</td>
<td>approx. 130 mA -</td>
</tr>
<tr>
<td>Power loss</td>
<td>2 W 2 W/3 VA</td>
</tr>
<tr>
<td>Power consumption</td>
<td>2.5 W 2.2 W/4 VA</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 1, 2, 3 terminals 1, 2, 3</td>
</tr>
<tr>
<td>Input I</td>
<td></td>
</tr>
<tr>
<td>Input signal</td>
<td>0 ... 20 mA 0 ... 20 mA or 4 ... 20 mA</td>
</tr>
<tr>
<td>Available voltage</td>
<td>≥ 15 V at 20 mA &gt; 15 V at 20 mA</td>
</tr>
<tr>
<td>Input resistance</td>
<td>45 Ω (terminals 2, 3) 45 Ω (terminals 2, 3)</td>
</tr>
<tr>
<td>Open circuit voltage/Short-circuit current</td>
<td>24 V/33 mA 24 V/33 mA</td>
</tr>
<tr>
<td>Lead monitoring</td>
<td>Breakage I &lt; 0.2 mA; short circuit I &gt; 22 mA acc. to NAMUR NE 43 Breakage I &lt; 0.2 mA; short circuit I &gt; 22 mA acc. to NAMUR NE 43</td>
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<tr>
<td><strong>Output</strong></td>
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</tr>
<tr>
<td>Connection</td>
<td>output I: terminals 10, 11, 12 output II: terminals 16, 17, 18 output: terminals 8+, 7-</td>
</tr>
<tr>
<td>Output I and II</td>
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<tr>
<td>Contact loading</td>
<td>250 V AC/2 A/cos ϕ &gt; 0.7; 40 DC/2 A</td>
</tr>
<tr>
<td>Mechanical life</td>
<td>5 x 10^7 switching cycles</td>
</tr>
<tr>
<td>Energised/De-energised delay</td>
<td>approx. 20 ms/approx. 20 ms</td>
</tr>
<tr>
<td>Output III</td>
<td>signal, analogue</td>
</tr>
<tr>
<td>Current range</td>
<td>0 ... 20 mA or 4 ... 20 mA</td>
</tr>
<tr>
<td>Open loop voltage</td>
<td>= 24 V DC</td>
</tr>
<tr>
<td>Load</td>
<td>≤ 650 Ohms</td>
</tr>
<tr>
<td>Fault signal</td>
<td>downscales I &lt; 3.6 mA, upscales I &gt; 21 mA (acc. NAMUR NE 43)</td>
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<tr>
<td><strong>Transfer characteristics</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Input I</strong></td>
<td></td>
</tr>
<tr>
<td>Measuring time</td>
<td>&lt; 100 ms &lt; 100 ms</td>
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<tr>
<td>Temperature</td>
<td>0.003 %/°C (30 ppm) 0.003 %/°C (30 ppm)</td>
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<tr>
<td>Resolution</td>
<td>10 μA -</td>
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<tr>
<td><strong>Output I</strong></td>
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<tr>
<td>Resolution</td>
<td>≤ 10 μA ≤ 10 μA</td>
</tr>
<tr>
<td>Accuracy</td>
<td>≤ 20 μA ≤ 20 μA</td>
</tr>
<tr>
<td>Temperature</td>
<td>0.005 %/°C (50 ppm) 0.005 %/°C (50 ppm)</td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td></td>
</tr>
<tr>
<td>Output I, II/Other circuits</td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V_{eff} reinforced insulation according to IEC 61140, rated insulation voltage 300 V_{eff}</td>
</tr>
<tr>
<td>Mutual output I, II, III</td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V_{eff} reinforced insulation according to IEC 61140, rated insulation voltage 300 V_{eff}</td>
</tr>
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<td>Output III/Power supply and collective error</td>
<td>reinforced insulation according to IEC 61140, rated insulation voltage 300 V_{eff} -</td>
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<tr>
<td>Output III/Power supply</td>
<td>- reinforced insulation according to IEC 61140, rated insulation voltage 300 V_{eff}</td>
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<td>- reinforced insulation according to IEC 61140, rated insulation voltage 300 V_{eff}</td>
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<td>standards</td>
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<td>EN 61326, EN 50081-2, NE 21</td>
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<td>EN 50178</td>
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<td>Coordination of insulation acc. to DIN EN 50178 acc. to DIN EN 50178</td>
<td>acc. to DIN EN 50178 acc. to DIN EN 50178</td>
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<td>Electrical isolation acc. to DIN EN 50178 acc. to DIN EN 50178</td>
<td>acc. to DIN EN 50178 acc. to DIN EN 50178</td>
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<td>acc. to EN 50081-2/EN 50082-2</td>
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<td>acc. to DIN EN 60947-5-6 acc. to DIN EN 60947-5-6</td>
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<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-20 ... 60 °C (253 ... 333 K)</td>
</tr>
</tbody>
</table>
## Technical data

### Mechanical specifications

- **Protection degree**: IP20
- **Mass**: 300 g
- **Dimensions**: 40 x 107 x 115 mm (1.6 x 4.2 x 4.5 inches)

### Data for application in conjunction with hazardous areas

- **EC-Type Examination Certificate**: TÜV 01 ATEX 1701, for additional certificates see www.pepperl-fuchs.com
- **Group, category, type of protection**: EX ia IIC [circuit(s) in zone 0/1/2]

### Ultrasonic level sensors

- **Input**: EEx ia IIC

### Guided microwave level sensor

- **Safety maximum voltage $U_m$**: 40 V DC (Attention! The rated voltage can be lower)
- **Voltage $U_0$**: 25.8 V
- **Current $I_0$**: 93 mA
- **Power $P_0$**: 0.603 W
- **Internal capacitance $C_i$**: 0 µF
- **Internal inductance $L_i$**: 0 mH
- **Apparatus terminals**: 1+, 3-

### Level signal conditioning electronics

- **Output**:
  - Contact loading: 253 V AC/2 A/ cos $\varphi > 0.7$; 40 V DC/2 A resistive load (TÜV 01 ATEX 1701)
  - Analogueoutput: 50 V AC/2 A/ cos $\varphi > 0.7$; 40 V DC/2 A resistive load (TÜV 02 ATEX 1885 X)

### Level control accessories

- **Safety maximum voltage $U_m$**: 40 V (Attention! The rated voltage can be lower)
- **Voltage $U_0$**: 25.8 V
- **Current $I_0$**: 112 mA
- **Power $P_0$**: 720 mW
- **Internal capacitance $C_i$**: 0 µF
- **Internal inductance $L_i$**: 0 mH
- **Apparatus terminals**: 1+, 2/3-

### Pressure vessel enclosure system

- **Safety maximum voltage $U_m$**: 40 V (Attention! The rated voltage can be lower)
- **Voltage $U_0$**: 253 V AC (Attention! The rated voltage can be lower)
- **Current $I_0$**: 93 mA
- **Power $P_0$**: 0.603 W
- **Internal capacitance $C_i$**: 0 µF
- **Internal inductance $L_i$**: 0 mH
- **Apparatus terminals**: 1+, 3-

### 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.**
## Accessories

- **PR-03 Power Rail**
- **UPR-03 Power Rail**
  - **KFD2-EB2 power feed module**
  
  The KFD2-EB2 power feed module and the PR-03 or the UPR-03 Power Rail are used to supply the devices with 24 VDC and at the same time to evaluate collective error message.

  Each power feed module monitors and provides protection for groups of as many as 100 individual devices. The PR-03 Power Rail is an insert component for the DIN rail, track. The UPR-03 Power Rail is a complete unit consisting of an electrical insert and an aluminium DIN rail measuring 35 mm x 15 mm x 2000 mm. The devices are simply snapped in place to make electrical contact.

  If a Power Rail is not being used, power can be supplied to the devices directly through the device terminals.

- **K-CJC**
  - Removable terminals with integrated temperature measurement sensor for cold junction compensation for thermocouples.

- **PACTware™**

- **Device-specific drivers (DTM)**

- **Adapter K-ADP1**
  - Interface adapter for connection with the serial interface of a PC/Notebook.
Level control accessories

Ultrasonic level sensors
Guided microwave
Level signal conditioning electronics
Level control accessories
Sensors for hazardous area
Pressurised enclosure system

Subject to reasonable modifications due to technical advances.
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<tr>
<td>Lightning protection barrier F*-LB-I</td>
<td>252</td>
</tr>
<tr>
<td>Lightning protection barrier P-LB-* .A.13**</td>
<td>254</td>
</tr>
<tr>
<td>Lightning protection barrier P-LB-* .B.12**</td>
<td>256</td>
</tr>
<tr>
<td>Lightning protection barrier P-LB-* .123**</td>
<td>258</td>
</tr>
<tr>
<td>Lightning protection barrier P-LB-* .23**</td>
<td>260</td>
</tr>
<tr>
<td>Lightning protection barrier P-LB-* .123*</td>
<td>262</td>
</tr>
<tr>
<td>Universal head transducer H-UT-Ex1</td>
<td>264</td>
</tr>
<tr>
<td>Digital display DA4/Ex40</td>
<td>268</td>
</tr>
<tr>
<td>Digital display DAS-IU-2K-*</td>
<td>270</td>
</tr>
<tr>
<td>LED display for hazardous area</td>
<td>272</td>
</tr>
</tbody>
</table>
Overvoltage suppressor (lightning-protection barrier)

K-LB-*.30

Connection

- 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)

2-wire protection
K-LB-1.30

4-wire protection
K-LB-2.30

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.

Composition

Front View

Housing type Z1
(see system description)
### Technical data

**K-LB-1.30**

<table>
<thead>
<tr>
<th>Supply</th>
<th>K-LB-1.30</th>
<th>K-LB-2.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>terminals 7, 8; 1, 2</td>
<td>terminals 1, 2; 7, 8/3, 4; 5, 6</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 30 V</td>
<td>≤ 30 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 45 V</td>
<td>≤ 45 V</td>
</tr>
<tr>
<td>Ground insulation</td>
<td>500 V breakdown voltage</td>
<td>500 V breakdown voltage</td>
</tr>
</tbody>
</table>

**Ambient conditions**

<table>
<thead>
<tr>
<th>Condition</th>
<th>K-LB-1.30</th>
<th>K-LB-2.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>-30 ... 80 °C (243 ... 353 K) for applications in safe areas; -30 ... 60 °C for applications in hazardous areas</td>
<td></td>
</tr>
</tbody>
</table>

**Mechanical specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>K-LB-1.30</th>
<th>K-LB-2.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection degree</td>
<td>IP20</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>12.5 x 115 x 110 mm (0.5 x 4.5 x 4.3 inches)</td>
<td></td>
</tr>
</tbody>
</table>

**Data for application in conjunction with hazardous areas**

<table>
<thead>
<tr>
<th>Specification</th>
<th>K-LB-1.30</th>
<th>K-LB-2.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-Type Examination Certificate</td>
<td>PTB 00 ATEX 2176X; for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a></td>
<td></td>
</tr>
<tr>
<td>Group, category, type of protection, Temperature classification</td>
<td>G II 2 (1) G EEx ia IIC T6</td>
<td></td>
</tr>
<tr>
<td>Voltage U_i</td>
<td>30 V</td>
<td></td>
</tr>
<tr>
<td>Current I_i</td>
<td>250 mA</td>
<td></td>
</tr>
</tbody>
</table>

**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**

[Diagram of example installations]
Overvoltage suppressor (lightning-protection barrier)  

Composition

Front View

Housing type Z1  
(see system description)

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.

Connection

- 2- or 4-wire protection
- For insulated C&I circuits up to 6 V
- Also for intrinsically safe control circuits Ex 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)

2-wire protection
K-LB-1.6
4-wire protection
K-LB-2.6

Connection to mounting rail

not protected

protected
**Technical data**

<table>
<thead>
<tr>
<th></th>
<th>K-LB-1.6</th>
<th>K-LB-2.6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 7, 8; 1, 2</td>
<td>terminals 1, 2; 7, 8/3, 4; 5, 6</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 6 V</td>
<td>≤ 6 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 10 μA</td>
<td>≤ 10 μA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 12 V</td>
<td>≤ 12 V</td>
</tr>
<tr>
<td>Ground insulation</td>
<td>500 V breakdown voltage</td>
<td>500 V breakdown voltage</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-30 ... 80 °C (243 ... 353 K) for applications in safe areas; -30 ... 60 °C for applications in hazardous areas</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP20</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>12.5 x 115 x 110 mm (0.5 x 4.5 x 4.3 inches)</td>
<td></td>
</tr>
<tr>
<td><strong>Data for application in conjunction with hazardous areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC-Type Examination Certificate</td>
<td>PTB 00 ATEX 2176X; for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a></td>
<td></td>
</tr>
<tr>
<td>Group, category, type of protection, Temperature classification</td>
<td>II 2 (1) G EEx ia IIIC T6</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>U_i = 6 V</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>I_i = 250 mA</td>
<td></td>
</tr>
<tr>
<td>Type of protection [EEx ia]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal capacitance (EEx ia)</td>
<td>0 nF</td>
<td></td>
</tr>
<tr>
<td>Internal inductance (EEx ia)</td>
<td>200 μH</td>
<td></td>
</tr>
<tr>
<td>Nominal leakage current</td>
<td>10 kA (8/20 μs) per core according to IEC 60-2</td>
<td></td>
</tr>
<tr>
<td>Nominal response time</td>
<td>Symmetrical 1 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asymmetric 100 ns</td>
<td></td>
</tr>
<tr>
<td>Series resistance</td>
<td>≤ 0.3 Ohms per conductor</td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td>≥ 40 kHz</td>
<td></td>
</tr>
</tbody>
</table>

**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**

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](image)
Overvoltage suppressor (lightning-protection barrier) K-LB-*.30G

Connection

- 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)

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.

Composition

Front View

Housing type Z1
(see system description)
### Technical data

**K-LB-1.30G**

<table>
<thead>
<tr>
<th>Supply</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>terminals 7, 8; 1, 2</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 30 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 μA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 45 V</td>
</tr>
</tbody>
</table>

**Ambient conditions**

- Ambient temperature: -30 °C to 80 °C (243 K to 353 K) for applications in safe areas; -30 °C to 60 °C for applications in hazardous areas

**Mechanical specifications**

- Protection degree: IP20
- Dimensions: 12.5 x 115 x 110 mm (0.5 x 4.5 x 4.3 inches)

**Data for application in conjunction with hazardous areas**

- EC-Type Examination Certificate: PTB 00 ATEX 2176X; for additional certificates see www.pepperl-fuchs.com
- Group, category, type of protection, temperature classification: II 2 (1) G EEx ia IIC T6

<table>
<thead>
<tr>
<th>Supply</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage U_i</td>
<td>30 V</td>
</tr>
<tr>
<td>Current I_i</td>
<td>250 mA</td>
</tr>
<tr>
<td>Type of protection</td>
<td>EEx ia</td>
</tr>
<tr>
<td>Internal capacitance (EEx ia)</td>
<td>0 nF</td>
</tr>
<tr>
<td>Internal inductance (EEx ia)</td>
<td>200 μH</td>
</tr>
<tr>
<td>Nominal leakage current</td>
<td>10 kA (8/20 μs) per core according to IEC 60-2</td>
</tr>
<tr>
<td>Nominal response time</td>
<td></td>
</tr>
<tr>
<td>Symmetrical</td>
<td>1 ns</td>
</tr>
<tr>
<td>Asymmetric</td>
<td>100 ns</td>
</tr>
<tr>
<td>Series resistance</td>
<td>≤ 0.3 Ohms per conductor</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>≥ 40 kHz</td>
</tr>
</tbody>
</table>

**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**

- Terminal ZH-Z. USLUG 5
- Equipotential bonding
- Ground connection
- Field
- Switch room
- Sensor
- Connection to ground, when available
- u = unprotected area
- g = protected area
Overvoltage suppressor (lightning-protection barrier)  

K-LB-*.6G

**Connection**

- 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)

**2-wire protection**

K-LB-1.6G

**4-wire protection**

K-LB-2.6G

**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.

**Composition**

**Front View**

Housing type Z1
(see system description)
### Technical data

<table>
<thead>
<tr>
<th></th>
<th>K-LB-1.6G</th>
<th>K-LB-2.6G</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 7, 8; 1, 2</td>
<td>terminals 1, 2; 7, 8/3, 4; 5, 6</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 6 V</td>
<td>≤ 6 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 μA</td>
<td>≤ 5 μA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 12 V</td>
<td>≤ 12 V</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-30 ... 80 °C (243 ... 353 K) for applications in safe areas; -30 ... 60 °C for applications in hazardous areas</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP20</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>12.5 x 115 x 110 mm (0.5 x 4.5 x 4.3 inches)</td>
<td></td>
</tr>
<tr>
<td><strong>Data for application in conjunction with hazardous areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC-Type Examination Certificate</td>
<td>PTB 00 ATEX 2176X; for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a></td>
<td></td>
</tr>
<tr>
<td>Group, category, type of protection, Temperature classification</td>
<td>♂ II 2 (1) G EEx ia IIC T6</td>
<td></td>
</tr>
<tr>
<td>Voltage $U_i$</td>
<td>6 V</td>
<td>6 V</td>
</tr>
<tr>
<td>Current $I_i$</td>
<td>250 mA</td>
<td>250 mA</td>
</tr>
<tr>
<td>Type of protection [EEx ia]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal capacitance (EEx ia)</td>
<td>0 nF</td>
<td></td>
</tr>
<tr>
<td>Internal inductance (EEx ia)</td>
<td>200 μH</td>
<td></td>
</tr>
<tr>
<td>Nominal leakage current</td>
<td>10 kA (8/20 μs) per core according to IEC 60-2</td>
<td></td>
</tr>
<tr>
<td>Nominal response time</td>
<td>Symmetrical 1 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asymmetric 100 ns</td>
<td></td>
</tr>
<tr>
<td>Series resistance</td>
<td>≤ 0.3 Ohms per conductor</td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td>≥ 40 kHz</td>
<td></td>
</tr>
</tbody>
</table>

### 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

Terminal ZH-Z. USLUG 5

Field switch room

Sensor 9 2 1

Connection to ground, when available

$$ u = \text{unprotected area} $$

$$ g = \text{protected area} $$
Overvoltage suppressor (lightning-protection barrier)

F*-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.

Composition

Connection

- 2-wire protection
- For insulated C&I circuits
- 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
- Simple installation in the free cable gland on the field device
- Uninterruptable operation (auto reset)

20 mm ISO thread  
FS-LB-I
PG13.5 thread  
FP-LB-I
½ NPT thread  
FN-LB-I

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Date of issue 11/05/03 – Catalogue Field Devices 2004
## Technical data

**Supply**
- Rated voltage: \( \leq 48 \text{ V} \)
- Rated current: \( \leq 250 \text{ mA} \)
- Leakage current: \( \leq 5 \text{ \( \mu \)A} \)
- On-state voltage: \( \leq 85 \text{ V} \)
- Ground insulation: \( \geq 500 \text{ V breakdown voltage} \)

**Ambient conditions**
- Ambient temperature: \(-30 \ldots 60 \degree \text{C (243 \ldots 333 K)}\) for Ex application; please observe declaration of conformity

## Mechanical specifications
- Housing material: stainless steel 1.4401 (AISI 316)
- Surface finish: all over polished
- Protection degree: IP20
- Dimensions:
  - FS-LB-I: AF22 x 55 mm (2.2 inches)
  - FP-LB-I: PG13.5 x 55 mm (2.2 inches)
  - FN-LB-I: \( \frac{1}{2} \text{ NPT} \) x 55 mm (2.2 inches)

## Data for application in conjunction with hazardous areas
- **EC-Type Examination Certificate**: PTB 00 ATEX 2175, conformity information is to consider
- **Group, category, type of protection, Temperature classification**: Ex II 2 G EEx ia IIIC T6
- **Voltage** \( U_i \): 50 V
- **Internal capacitance (EEx ia)**: negligibly small
- **Internal inductance (EEx ia)**: negligibly small
- **Nominal leakage current**: 10 kA (8/20 \( \mu \)s) per core according to IEC 60-2
- **Nominal response time**:
  - Symmetrical: 1 ns
  - Asymmetric: 100 ns
- **Bandwidth**: \( \leq 40 \text{ kHz} \)

## 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.

**Examples:**
- Terminal box
- Transmitter
Overvoltage suppressor (lightning-protection barrier)  

- 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.A.13**  
**P-LB-2.A.1346**

**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.

**Composition**

Terminal blue  
Connection to earth  
Connection to busbar
## Technical data

### Signal lines

<table>
<thead>
<tr>
<th>P-LB-1.A.13</th>
<th>P-LB-2.A.1346</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>terminals 1, 3</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 30 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 µA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 45 V</td>
</tr>
<tr>
<td>Ground insulation</td>
<td>≤ 500 V breakdown voltage</td>
</tr>
</tbody>
</table>

### Ambient conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>-20 ... 60 °C (253 ... 333 K)</td>
</tr>
</tbody>
</table>

### Mechanical specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection degree</td>
<td>IP20</td>
</tr>
<tr>
<td>Mass</td>
<td>70 g</td>
</tr>
<tr>
<td>Dimensions</td>
<td>20 x 72 x 115 mm (0.8 x 2.8 x 4.5 inches)</td>
</tr>
</tbody>
</table>

### Data for application in conjunction with hazardous areas

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-Type Examination Certificate</td>
<td>PTB 02 ATEX 2044</td>
</tr>
<tr>
<td>Group, category, type of protection</td>
<td>II (1) G [EEx ia] IIC</td>
</tr>
<tr>
<td>Voltage U₀</td>
<td>≤ 30 V</td>
</tr>
<tr>
<td>Current Iᵢ</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Power P₀</td>
<td>≤ 1.3 W</td>
</tr>
<tr>
<td>Type of protection [EEx ia and EEx ib]</td>
<td>negligible</td>
</tr>
<tr>
<td>Internal capacitance (EEx ia)</td>
<td>negligible</td>
</tr>
<tr>
<td>Internal inductance (EEx ia)</td>
<td>≤ 200 µH</td>
</tr>
<tr>
<td>Nominal leakage current</td>
<td>10 kA (8/20 µs) per conductor</td>
</tr>
<tr>
<td>Nominal response time</td>
<td>Symmetrical: 1 ns; Asymmetrical: 100 ns</td>
</tr>
<tr>
<td>Series resistor</td>
<td>≤ 0.5 Ohms per wire</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>≤ 40 kHz</td>
</tr>
</tbody>
</table>

### 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
Overvoltage suppressor (lightning-protection barrier) P-LB-*.B.12**

- 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.B.12**
**P-LB-2.B.1245**

**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-*.B.* 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.

**Composition**

---

**Connection**

Only P-LB-2.B.1245

1. Connection to busbar
2. Connection to earth
3. Terminal blue

**Terminal blue**
Connection to earth

---

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Technical data

<table>
<thead>
<tr>
<th>P-LB-1.B.12</th>
<th>P-LB-2.B.1245</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal lines</strong></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>terminals 2, 1</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 30 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 μA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 45 V</td>
</tr>
<tr>
<td>Ground insulation</td>
<td>≤ 500 V breakdown voltage</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-30 ... 60 °C (243 ... 333 K)</td>
</tr>
<tr>
<td><strong>Mechanical specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP20</td>
</tr>
<tr>
<td>Mass</td>
<td>approx. 70 g</td>
</tr>
<tr>
<td>Dimensions</td>
<td>20 x 72 x 115 mm (0.8 x 2.8 x 4.5 inches)</td>
</tr>
<tr>
<td><strong>Data for application in conjunction with hazardous areas</strong></td>
<td></td>
</tr>
<tr>
<td>EC-Type Examination Certificate</td>
<td>PTB 02 ATEX 2044</td>
</tr>
<tr>
<td>Group, category, type of protection</td>
<td>II (1) G [EEx ia] IIC</td>
</tr>
<tr>
<td>Voltage</td>
<td>U₀</td>
</tr>
<tr>
<td>Current</td>
<td>Iᵢ</td>
</tr>
<tr>
<td>Power</td>
<td>P₀</td>
</tr>
<tr>
<td>Type of protection [EEx ia and EEx ib]</td>
<td></td>
</tr>
<tr>
<td>Internal capacitance (EEx ia)</td>
<td>negligible</td>
</tr>
<tr>
<td>Internal inductance (EEx ia)</td>
<td>≤ 200 μH</td>
</tr>
<tr>
<td>Nominal leakage current</td>
<td>10 kA (8/20 μs) per conductor</td>
</tr>
<tr>
<td>Nominal response time</td>
<td></td>
</tr>
<tr>
<td>Symmetrical</td>
<td>1 ns</td>
</tr>
<tr>
<td>Asymmetric</td>
<td>100 ns</td>
</tr>
<tr>
<td>Series resistor</td>
<td>≥ 0.5 Ohms per wire</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>≥ 40 kHz</td>
</tr>
</tbody>
</table>

**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
- Spacing roller
- Connector
- Mounting block

- ZH-Z.NLS-Cu3/10
- ZH-Z.AR.75 for PR 03 or ZH-Z.AR.125 for UPR 03
- ZH-Z.AK16
- ZH-Z.AB/SS
Overvoltage suppressor (lightning-protection barrier) P-LB-*.*.123***

Connection

![Connection Diagram](image)

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.

Composition

```
Terminal blue
Connection to earth
```

- 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**
## Technical data

<table>
<thead>
<tr>
<th>Signal lines</th>
<th>P-LB-1.C.123</th>
<th>P-LB-2.D.123456</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>terminals 1, 2, 3</td>
<td>terminals 1, 2, 3, 4, 5, 6</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 30 V</td>
<td>≤ 30 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 45 V</td>
<td>≤ 45 V</td>
</tr>
<tr>
<td>Ground insulation</td>
<td>≤ 500 V breakdown voltage</td>
<td>≤ 500 V breakdown voltage</td>
</tr>
</tbody>
</table>

### Ambient conditions
- Ambient temperature: -30 ... 60 °C (243 ... 333 K)

### Mechanical specifications
- Protection degree: IP20
- Mass: approx. 70 g
- Dimensions: 20 x 72 x 115 mm (0.8 x 2.8 x 4.5 inches)

### Data for application in conjunction with hazardous areas
- EC-Type Examination Certificate: PTB 02 ATEX 2044
- Group, category, type of protection: II (1) G [EEx ia] IIC
- Voltage $U_0$: ≤ 30 V
- Current $I_i$: ≤ 250 mA
- Power $P_0$: ≤ 1.3 W
- Internal capacitance (EEx ia): negligible
- Internal inductance (EEx ia): ≤ 200 µH
- Nominal leakage current: 10 kA (8/20 µs) per conductor
- Nominal response time:
  - Symmetrical: 1 ns
  - Asymmetrical: 100 ns
- Series resistor: ≤ 0.5 Ohms per wire
- Bandwidth: ≥ 40 kHz

### 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

---

**Mounting block ZH-Z.AB/SS**

**Busbar ZH-Z.NLS-CU3/10**

**Spacing roller ZH-Z.AR.75 or 125**

**Connector**
Overvoltage suppressor (lightning-protection barrier)

**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.

**Composition**

**Connection**

![Connection Diagram]
### Technical data

<table>
<thead>
<tr>
<th>Signal lines</th>
<th>P-LB-1.E.23</th>
<th>P-LB-2.C.2356</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>terminals 2, 3</td>
<td>Terminals 2, 3, 5, 6</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 30 V</td>
<td>≤ 30 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 μA</td>
<td>≤ 5 μA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 45 V</td>
<td>≤ 45 V</td>
</tr>
<tr>
<td>Ground insulation</td>
<td>≤ 500 V breakdown voltage</td>
<td>≤ 500 V breakdown voltage</td>
</tr>
</tbody>
</table>

**Ambient conditions**

- Ambient temperature: -30 ... 60 °C (243 ... 333 K)

**Mechanical specifications**

- Protection degree: IP20
- Mass: approx. 70 g
- Dimensions: 20 x 72 x 115 mm (0.8 x 2.8 x 4.5 inches)

**Data for application in conjunction with hazardous areas**

- EC-Type Examination Certificate: PTB 02 ATEX 2044
- Group, category, type of protection: II (1) G [EEx ia] IIC
- Voltage: $U_0$ ≤ 30 V
- Current: $I_i$ ≤ 250 mA
- Power: $P_0$ = 1.3 W
- Type of protection (EEx ia and EEx ib)
  - Internal capacitance (EEx ia): negligible
  - Internal inductance (EEx ia): ≤ 200 μH
- Nominal leakage current: 10 kA (8/20 μs) per conductor
- Nominal response time
  - Symmetrical: 1 ns
  - Asymmetric: 100 ns
- Series resistor: ≤ 0.5 Ohms per wire
- Bandwidth: ≥ 40 kHz

### 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
Overvoltage suppressor (lightning-protection barrier) P-LB-1.*.123*

**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.

**Composition**

- 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.D.1234
P-LB-1.F.1236

### Connection

![Connection Diagram]

**Terminal blue**

**Connection to earth**

---

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Technical data

<table>
<thead>
<tr>
<th>Signal lines</th>
<th>P-LB-1.D.1234</th>
<th>P-LB-1.F.1236</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>terminals 1, 2, 3, 4</td>
<td>terminals 1, 2, 3, 6</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>≤ 30 V</td>
<td>≤ 30 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>≤ 250 mA</td>
<td>≤ 250 mA</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 μA</td>
<td>≤ 5 μA</td>
</tr>
<tr>
<td>On-state voltage</td>
<td>≤ 45 V</td>
<td>≤ 45 V</td>
</tr>
<tr>
<td>Ground insulation</td>
<td>≤ 500 V breakdown voltage</td>
<td>≤ 500 V breakdown voltage</td>
</tr>
</tbody>
</table>

**Ambient conditions**
- Ambient temperature: -30 ... 60 °C (243 ... 333 K)

**Mechanical specifications**
- Protection degree: IP20
- Mass: approx. 70 g
- Dimensions: 20 x 72 x 115 mm (0.8 x 2.8 x 4.5 inches)

**Data for application in conjunction with hazardous areas**
- EC-Type Examination Certificate: PTB 02 ATEX 2044
- Group, category, type of protection: II (1) G [EEx ia] IIC
- Voltage $U_0$: ≤ 30 V
- Current $I_i$: ≤ 250 mA
- Power $P_0$: ≤ 1.3 W
- Type of protection [EEx ia and EEx ib]:
  - Internal capacitance (EEx ia): negligible
  - Internal inductance (EEx ia): ≤ 300 μH
- Nominal leakage current: 10 kA (8/20 μs) per conductor
- Nominal response time:
  - Symmetrical: 1 ns
  - Asymmetric: 100 ns
- Series resistor: ≤ 0.5 Ohms per wire
- Bandwidth: ≥ 40 kHz

**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
Universal head transducer

H-UT-Ex1

Function

The H-UT-Ex1 linearises the signal from resistance thermometers and thermocouples and provides a 4 mA ... 20 mA current output. The input circuit is galvanically isolated from the output circuit.

The device is intrinsically safe in accordance with EEx ia IIC. The H-UT-Ex1 may be configured in situ with a programming socket to operate over the desired temperature range with a Pt100, Pt1000, Ni100, Ni1000, or with a thermocouple type B, E, J, K, L, N, R, S or T.

The transmitter is polarity protected and will not be damaged by connecting the power supply with the wrong polarity, but the output will be 0 mA. The maximum load in the output loop depends on the supply voltage, see data.

Features

- Installation acc. to DIN terminal heads from Form B
- Low installations costs
- Interference immune measurement value transfer by direct mounting at the terminal head
- Temperature linear output signal
- A device for thermocouples and resistance thermometers
- Parameterisable via PC

Electrical connection

- Thermocouple
- RTD
- RTD
- Input EEx ia IIC
- Signal processor
- Power supply
- e.g. KFD2-STC4-Ex1 and EGT-101
- Safe area
- Hazardous area

Dimensions

- 1.3 x 1.73
- 0.28
- 0.63
- 1.02

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### Technical data

#### Supply
- **H-UT-Ex1**
- **Rated voltage**: 8 ... 30 V DC

#### Input
- **Connection**: terminals 1, 2, 3, 4: resistance thermometers Pt100 acc. to DIN IEC 751, Pt1000, Ni100, Ni1000, thermocouple type B, E, J, K, L, N, R, S, T; U; customer specified characteristic curve
- **Connection to sensor**: 3- or 4-wire connection for resistance thermometers, 2-wire connection for thermocouple

#### Measurement current
- **approx. 0.4 mA**

#### Output
- **Connection**: terminals 5+, 6-
- **Output current**: min. 4 ... 20 mA, temperature linear
- **Output signal**: min. 3 mA
  - at sensor failure: adjustable between 3.6 ... 21.6 mA
  - at sensor short circuit: adjustable between 3.6 ... 21.6 mA

#### Accuracy
- **Temperature drift**: maximum of:
  - ambient temperature 0 ... 50 °C (273 ... 323 K): 0.005 %/K or 0.005 °C of the output signal range
  - ambient temperature < 0 °C (273 K) or > 50 °C (323 K): 0.01 %/K or 0.01 °C of the output signal range
  - whichever is higher
- **Calibration error**: ≤ 0.1 % of the final value or < 0.2 °C (273.2 K) RTD, < 0.1 % (RT = 23 °C (296 K), U_S = 20 V)
- **Linearity**: ≤ 0.1 % of the span RTD, ≤ 0.2 % T/C
- **Measuring time**: ≤ 0.5 s
- **Compensation failure**: failure of cold junction compensation: 0.5 °C (273.5 K)

#### Operating conditions

##### Installation instructions
- When used with a RTD, the H-UT-Ex1 may be configured to provide 3- or 4-wire connection. When used with a thermocouple, the H-UT-Ex1 may be configured to provide cold junction compensation or it can operate in external cold junction thermostat (Reference temperature 0 °C (273 K)).
- The programming via PC must be done in safe area and must not be done in the hazardous area.
- Adjustment/calibration: For the configuration, the programming kit H-PK, consisting of adapter, software and system manual, is required and is executed by means of a PC via adapter to the programming socket. The control display of the configuration software corresponds to VDI/VDE GMA 2187.

##### Ambient conditions
- **Ambient temperature**: -40 ... +85 °C (233 ... 358 K)
- **Ambient temperature range**: max. permissible ambient temperature depends on the temperature class: T6: 50 °C (323 K), T5: 65 °C (338 K), T4: 85 °C (358 K)
- **Storage temperature**: -40 ... +85 °C (233 ... 358 K)

##### Mechanical construction
- **Dimensions**: Ø44 x 26 mm (Ø1.7 x 1 inches)

#### Data for application in conjunction with hazardous areas

##### EC-Type Examination Certificate
- Demko 03 ATEX 134473 X, for additional certificates see www.pepperl-fuchs.com
- **Group, category, type of protection**: II 1 G Ex ia IIC
- **Input Voltage**: U_0 30 V
- **Current**: I_0 25 mA
- **Power**: P_0 188 mW
- **External capacitance**: C_0, 66 nF
- **External inductance**: L_0, 50 mH
- **Output Voltage**: U_0 30 V
- **Current**: I_0 100 mA
- **Power**: P_0 900 mW
- **External capacitance**: C_0, 0 nF
- **External inductance**: L_0, 0 mH

##### Electrical isolation
- **Input/Output**: safe electrical isolation acc. to EN 50020, voltage peak value 1500 V AC/1 min
- **Directive conformity**: Directive 94/9 EG EN 50014, EN 50020, EN 50284

##### General information
- **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.

##### Accessories
- **Designation**: H-PK, programming kit consisting of adapter, software, 9 V battery and system manual
- Necessary for parameterisation without transmitter power supply.

---

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Universal head transducer
H-UT-Ex1

Technical data

Connection and installation

1. Connect power supply and output according to figure 1.
2. Connect the input according to figures 2 ... 9.

![Diagram of connection and installation]

1. Connect the input according to figures 2 ... 9.

- **Fig. 1**
- **Fig. 2**
- **Fig. 3**
- **Fig. 4**
- **Fig. 5**
- **Fig. 6**
- **Fig. 7**
- **Fig. 8**
- **Fig. 9**
- **Fig. 10**
- **Fig. 11**

**Connection and installation details**:

- **Pt100, Pt1000, Ni100, Ni1000**
  - 4-wire connection
- **Pt100, Pt1000, Ni100, Ni1000**
  - 3-wire connection
- **Pt100 "SmartSense"**
  - 3-wire connection
  - *SmartSense wire
- **Pt100**
  - Difference temperature
  - $T_1 > T_2$
  - *Max input
- **Potentiometer**
  - 4-wire connection
- **Potentiometer**
  - 3-wire connection
- **T/C**
  - *SmartSense wire
- **mV**
- **T/C**
  - SmartSense temperature sensor
  - *additional SmartSense wire
- **Pt100**
  - 3-wire connection
  - SmartSense temperature sensor
  - *additional SmartSense wire
### Technical data

**Universal head transducer H-UT-Ex1**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasonic level sensors</td>
<td></td>
</tr>
<tr>
<td>Guided microwave</td>
<td></td>
</tr>
<tr>
<td>Level signal conditioning electronics</td>
<td></td>
</tr>
<tr>
<td>Level control accessories</td>
<td></td>
</tr>
<tr>
<td>Sensors for hazardous area</td>
<td></td>
</tr>
<tr>
<td>Pressurised enclosure system</td>
<td></td>
</tr>
</tbody>
</table>

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Display and evaluation unit

DA4/Ex-40

Function

The DA4/Ex40 has a 4½ digit display and is loop powered, but only introduces a 1 V drop allowing it to be installed in series with almost any 4 mA ... 20 mA loop. The indicator is protected from reverse connection, overrange input current and complies with the European EMC Directive.

Control and calibration of the indicator is performed via the front panel tactile push-buttons. Using the push-buttons the operator can temporarily select the measured variable as a percentage of span, the input current in mA and the calibration at 4 mA and 20 mA. The front panel is a robust, easy to clean Noryl moulding sealed with a non-reflective, scratch resistant polyester membrane.

The two 4 mA ... 20 mA input terminals comply with the requirements for simple apparatus which enable the DA4/Ex40 to be connected in series with most certified intrinsically safe circuits without the need for an additional system certificate.

Main application of the DA4/Ex40 is to display a measured variable or control signal in a hazardous process area. The zero and span of the display are independently adjustable so that the indicator can easily be calibrated on site to display any linear or square signal such as temperature, flow or pressure.

An optional 16-point linearisation allows the DA4/Ex40 also display non linear coherences in simple linear units. A backlight is available which improves the readability of the display.

Electrical connection

Recommended panel cut-out acc. to DIN 43700:
92 mm +0.8 mm x 43.5 mm + 0.6 mm
(3.6 inches x 1.7 inches)

To achieve an IP65 seal between the instrument and the panel:
90 mm +0.5 mm x 43.5 mm + 0.5 mm
(3.5 inches x 1.7 inches)

Terminals for optional backlight and alarms are shown in outline.

<table>
<thead>
<tr>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-wire 4 mA ... 20 mA</td>
</tr>
<tr>
<td>4½ digit display, 10 mm</td>
</tr>
<tr>
<td>Loop powered, only 1 V drop</td>
</tr>
<tr>
<td>Intrinsically safe</td>
</tr>
<tr>
<td>Backlight, alarms, linearisation, and tare optional</td>
</tr>
<tr>
<td>Protection class IP65 (front)</td>
</tr>
<tr>
<td>DIN housing 96 mm x 48 mm</td>
</tr>
</tbody>
</table>

Dimensions

- Recommended panel cut-out: 92 mm x 43.5 mm
- To achieve an IP65 seal: 90 mm x 43.5 mm

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Technical data

<table>
<thead>
<tr>
<th>Parameters</th>
<th>DA4/Ex-40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicators/operating means</td>
<td>4½-segment LCD display with optional backlight</td>
</tr>
<tr>
<td>Type</td>
<td>5</td>
</tr>
<tr>
<td>Display value</td>
<td>digit height 10 mm (0.4 inches)</td>
</tr>
<tr>
<td>Display interval</td>
<td>span: adjustable between 0 ... ±19999 with 4 ... 20 mA input</td>
</tr>
<tr>
<td></td>
<td>zero: adjustable between -19999 ... +19999 with 4 mA input</td>
</tr>
<tr>
<td></td>
<td>polarity: automatic minus sign</td>
</tr>
<tr>
<td>Decimal point</td>
<td>freely adjustable</td>
</tr>
<tr>
<td>Reading rate</td>
<td>2 Hz</td>
</tr>
<tr>
<td>Operating elements</td>
<td>push buttons, function in operating mode:</td>
</tr>
<tr>
<td></td>
<td>▼ button: shows display with 4 mA input</td>
</tr>
<tr>
<td></td>
<td>▲ button: shows display with 20 mA input</td>
</tr>
<tr>
<td></td>
<td>&quot;P&quot; button: displays input current in mA, or as a percentage of span, when tare or alarms are fitted has a modified function</td>
</tr>
<tr>
<td>Accuracy</td>
<td>linear: ± 0.02 % ± 1 digit</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>temperature effect on: span &lt; 50 ppm/°C, zero: &lt; 25 ppm/°C</td>
</tr>
<tr>
<td>Electrical specifications</td>
<td>no external power source required</td>
</tr>
<tr>
<td>Input</td>
<td>terminals 1+, 3-</td>
</tr>
<tr>
<td>Current</td>
<td>4 ... 20 mA</td>
</tr>
<tr>
<td>Voltage drop</td>
<td>&lt; 1 V at 20 °C (293 K)</td>
</tr>
<tr>
<td></td>
<td>&lt; 1.1 V at -20 °C (253 K)</td>
</tr>
<tr>
<td>Current overrange</td>
<td>200 mA (will not cause damage)</td>
</tr>
<tr>
<td>Ambient conditions</td>
<td>-20 ... +60 °C (253 ... 333 K)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-30 ... +80 °C (243 ... 353 K)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>≤ 95 % at 40 °C (313 K) (non-condensing), front</td>
</tr>
<tr>
<td>Mechanical specifications</td>
<td>screw clamp for 0.5 mm² to 1.5 mm² cable, blue removable terminal block</td>
</tr>
<tr>
<td>Connection</td>
<td>front IP65, rear IP20</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 300 g</td>
</tr>
<tr>
<td>Dimensions</td>
<td>96 x 48 x 91 mm (3.8 x 1.9 x 3.6 inches)</td>
</tr>
<tr>
<td>General information</td>
<td>Directive conformity</td>
</tr>
<tr>
<td></td>
<td>emitted interference to EN 61326, class B equipment</td>
</tr>
<tr>
<td></td>
<td>interference immunity to EN 50081-1, EN 50082-2 and NAMUR EMC recommendation (NE 21)</td>
</tr>
<tr>
<td></td>
<td>&lt; 1 % of span error for 10 V/m field strength between 27 MHz and 1 GHz</td>
</tr>
<tr>
<td>Directive 94/9/EG (ATEX)</td>
<td>ITS 02 ATEX 2028, II 1 G Ex ia IIC T5 (firm BEKA)</td>
</tr>
<tr>
<td></td>
<td>EN 50081-1, EN 50082-2</td>
</tr>
<tr>
<td></td>
<td>EN 61326, EN 50014, EN 50020</td>
</tr>
<tr>
<td>Supplementary information</td>
<td>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>.</td>
</tr>
<tr>
<td>Accessories</td>
<td>Designation</td>
</tr>
<tr>
<td></td>
<td>• loop powered backlight: geen, powered from 4/20 mA current, voltage drop of indicator plus backlight &lt; 5 V</td>
</tr>
<tr>
<td></td>
<td>• separately powered backlight: orange, powered from zener barriers or galvanic isolator, 28 V, 300 Ohms</td>
</tr>
<tr>
<td></td>
<td>• two alarms: independent, programmable as NC or NO output</td>
</tr>
</tbody>
</table>

Terminal connections

```
1 2 3 4
4 mA ... 20 mA

5 6 7 8 9 10 11
Terminals 2 and 4 are internally linked for joining return 4 mA ...
20 mA wire

12 13
Optional alarm terminals

14 15 16 17
Optional backlight terminals
```

Display and evaluation unit DA4/Ex-40
## 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

<table>
<thead>
<tr>
<th></th>
<th>DA5-IU-2K-C</th>
<th>DA5-IU-2K-V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-selection</td>
<td>2-fold</td>
<td></td>
</tr>
<tr>
<td>Data storage</td>
<td>10^6 storage cycles or 10 years, EEPROM</td>
<td></td>
</tr>
<tr>
<td>Programming</td>
<td>keypad-driven menu</td>
<td></td>
</tr>
<tr>
<td><strong>Indicators/operating means</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>7-segment LED display, red</td>
<td></td>
</tr>
<tr>
<td>Number of decades</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Display value</td>
<td>digit height 14.2 mm</td>
<td></td>
</tr>
<tr>
<td>Pre-selection</td>
<td>digit height 14.2 mm</td>
<td></td>
</tr>
<tr>
<td>Display interval</td>
<td>-19999 ... 99999</td>
<td></td>
</tr>
<tr>
<td>Decimal point</td>
<td>freely adjustable</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>14 Bit</td>
<td></td>
</tr>
<tr>
<td>Scale factor</td>
<td>via characteristic curve with up to 24 value pairs</td>
<td></td>
</tr>
<tr>
<td>Reset</td>
<td>manually or external</td>
<td></td>
</tr>
<tr>
<td>Key interlock</td>
<td>with &quot;high&quot;-level at terminal &quot;KEY&quot;</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating voltage</td>
<td>10 ... 30 V DC</td>
<td>90 ... 260 V AC</td>
</tr>
<tr>
<td>Power consumption $P_0$</td>
<td>2 W</td>
<td>7 VA</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>&gt; 1 MΩ for voltage measurement</td>
<td>&lt; 50 Ω for current measurement</td>
</tr>
<tr>
<td>Analogue voltage input</td>
<td>0 ... 10 V DC, 0 ... 10 V DC</td>
<td>-10 ... 10 V DC, -10 ... 10 V DC</td>
</tr>
<tr>
<td>Analogue current input</td>
<td>0 ... 20 mA</td>
<td>0 ... 20 mA</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relay</td>
<td>2 x 250 V AC / 300 V DC, 3 A, changeover contact</td>
<td>2 x 250 V AC / 300 V DC, 3 A, changeover contact</td>
</tr>
<tr>
<td>Sensor supply</td>
<td>-</td>
<td>24 V DC, 100 mA</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-10 ... 50 °C (263 ... 323 K)</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-25 ... 70 °C (248 ... 343 K)</td>
<td></td>
</tr>
<tr>
<td>Relative humidity</td>
<td>&lt; 80 % (non condensing)</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>8-pin and 11-pin connectors with plug-in screw terminals</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>220 g</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>96 mm x 48 mm x 90 mm</td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>mounting frame with latch fastener</td>
<td></td>
</tr>
</tbody>
</table>

## 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
DA5-IU-2K-*  
Process control and indication equipment

**Dimensions**

- Control panel cutout: 96 x 48 mm
- Max. 19 mm

**Electrical connection**

- **Connector S1/**
  - Ammeter input S1/1
  - Reference earth S1/2
  - Voltmeter input S1/3
  - Key lock-out “Key” S1/6
  - Reference earth for reset S1/7
  - Reset S1/8

- **Connector S2/**
  - 90...260 V AC supply (...-V)
  - 10...30 V DC  0 V DC (...-C)

- **Indicator**
  - OUT 1
  - OUT 2

- **Auxiliary power output**
  (only on DA5-IU-2K-C)

- **Pressurised enclosure system**
  - 92+0.8 mm
  - 67.1 mm
  - 4.5 mm

- **Ultrasonic level sensors**
- **Guided microwave**
- **Level signal conditioning electronics**
- **Level control accessories**
- **Sensors for hazardous area**

Subject to reasonable modifications due to technical advances. Copyright Pepperl+Fuchs, Printed in Germany
LED cluster lamp

**Dimensions**

- **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**

- **Yellow LED**
  - **LED-Ex1.A**
- **Blue LED**
  - **LED-Ex1.B**
- **Green LED**
  - **LED-Ex1.G**
- **Red LED**
  - **LED-Ex1.R**
- **White LED**
  - **LED-Ex1.W**
### Technical data

#### Supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>14 ... 30 V DC</td>
</tr>
<tr>
<td>Rated current</td>
<td>18 ... 22 mA</td>
</tr>
</tbody>
</table>

#### Input

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety maximum voltage $U_m$</td>
<td>60 V</td>
</tr>
</tbody>
</table>

#### Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical life</td>
<td>$10^5$ h</td>
</tr>
</tbody>
</table>

#### Directive conformity

**Electromagnetic compatibility**
- Directive 89/336/EEC
- EN 61326, EN 50081-2, NE 21

#### Standard conformity

- Climatic conditions: acc. to DIN IEC 721
- Ambient conditions:
  - Ambient temperature: -20 ... 60 °C (253 ... 333 K)
  - Storage temperature: -55 ... 85 °C (218 ... 358 K)
  - Relative humidity: 5 ... 95 %, non condensing

#### Mechanical specifications

- Protection degree: IP65 (front), IP20 (rear)
- Connection: screw terminals for 1.5 mm²
- Material: housing: polyamid 6.6, lens: polycarbonat
- Mass: 18 g

#### Data for application in conjunction with hazardous areas

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-Type Examination Certificate</td>
<td>BSA 01 ATEX 1062 X (firm BEKA), for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a></td>
</tr>
<tr>
<td>Group, category, type of protection</td>
<td>II 1 G Ex ia IIC T4 [circuit(s) in zone 0/1/2]</td>
</tr>
<tr>
<td>Input</td>
<td>EEx ia IIC T4</td>
</tr>
<tr>
<td>Voltage $U_0$</td>
<td>30 V DC</td>
</tr>
<tr>
<td>Power $P_0$</td>
<td>1.3 W IIA/IIB/1.2 W IIC</td>
</tr>
<tr>
<td>Supply</td>
<td>Safety maximum voltage $U_m$</td>
</tr>
</tbody>
</table>

#### Directive conformity

- Directive 94/9 EC
  - EN 50014, EN 50020, EN 50284

#### Installation

One or two LED-Ex1.* lamps may be powered by any certified Zener barrier or specified galvanic isolator with output parameters within the following limits:
- Voltage $U_0$: 30 V
- Power $P_0$: 1.2 W
- Gas groups IIA, IIB or IIC

Ex. 28 V 300 Ω or 234 Ω with a Zener barrier (Typ Z728) or a specified galvanic isolator (KFD2-SD-Ex1.**)

Up to four LED-Ex1.* lamps may be powered in an ambient temperature up to 40 °C (313 K) by any specified galvanic isolator with output parameters within the following limits:
- Voltage $U_0$: 30 V
- Power $P_0$: 1.3 W
- Gas groups IIA or IIB
Sensors for hazardous area

- Ultrasonic level sensors
- Guided microwave
- Level signal conditioning electronics
- Level control accessories
- Sensors for hazardous area
- Pressurised enclosure system
Sensors are an essential prerequisite if the varying requirements of automated production are also to be met in hazardous areas.

In our wide range of products you will find especially suited products and solutions for your applications:

- inductive, capacitive and magnetic standard sensors in a variety of versions
- position sensors
- photoelectric sensors
- rotary encoders

The complete product selection for proximity switches acc. to NAMUR you will find in the the sensor catalogues and under www.pepperl-fuchs.com.

Contents

<table>
<thead>
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<th>Page</th>
</tr>
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<tr>
<td>Position sensors</td>
<td>278</td>
</tr>
<tr>
<td>Inductive standard sensors</td>
<td>280</td>
</tr>
<tr>
<td>Capacitive and magnetic standard sensors</td>
<td>282</td>
</tr>
<tr>
<td>Photoelectric sensors</td>
<td>283</td>
</tr>
<tr>
<td>Rotary encoders</td>
<td>284</td>
</tr>
</tbody>
</table>
Sensors for hazardous area

Standard sensors for box installation

Box solutions involve integration of sensor systems in connector and distributor boxes in which the mechanical connection between sensors and actuators is also realised. This solution was developed to avoid direct exposure of sensors to ambient influences and to enable utilisation of conventional standard sensors. Different types of sensors are used in these standard boxes:
- cylindrical sensors with a typical design length of 40 mm
- rectangular sensors with standard mechanical micro-switch dimensions
- slot-shaped sensors with a slot width of 3.5 mm

Box solution with slot sensors, cylindrical sensors, rectangular sensors

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Slot width/ Switching dist.</th>
<th>Installation</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot shaped</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC3,5-N0 BLUE</td>
<td>NAMUR NC</td>
<td>3.5 mm</td>
<td>0.5 m, PVC leads</td>
<td>II 2G EEx ia IIC T6</td>
<td>II 1D EEx iaD 20 T 108 °C</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SC3,5-N0 YELLOW</td>
<td>NAMUR NC</td>
<td>3.5 mm</td>
<td>0.5 m, PVC leads</td>
<td>II 2G EEx ia IIC T6</td>
<td>II 2D EEx ia D 20 T 108 °C</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SC3,5-N0 GREEN</td>
<td>NAMUR NC</td>
<td>3.5 mm</td>
<td>0.5 m, PVC leads</td>
<td>II 2G EEx ia IIC T6</td>
<td>II 2D EEx ia D 20 T 108 °C</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SC3,5-N0 WHITE</td>
<td>NAMUR NC</td>
<td>3.5 mm</td>
<td>0.5 m, PVC leads</td>
<td>II 2G EEx ia IIC T6</td>
<td>II 2D EEx ia D 20 T 108 °C</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SJ3,5-SN</td>
<td>NAMUR NC</td>
<td>3.5 mm</td>
<td>0.5 m, LIY leads</td>
<td>II 2G EEx ia IIC T6</td>
<td>II 2D EEx ia D 20 T 108 °C</td>
<td>PTB 00 ATEX 2049 X</td>
</tr>
<tr>
<td>SJ3,5-S1N</td>
<td>NAMUR NO</td>
<td>3.5 mm</td>
<td>0.5 m, LIY leads</td>
<td>II 2G EEx ia IIC T6</td>
<td>II 2D EEx ia D 20 T 108 °C</td>
<td>PTB 00 ATEX 2049 X</td>
</tr>
<tr>
<td>Cylindrical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NJ2-11-N</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ2-11-N-G</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ2-11-N</td>
<td>NAMUR NC</td>
<td>5 mm not flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ2-11-N-G</td>
<td>NAMUR NC</td>
<td>5 mm not flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCN2-12GM35-N0</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB2-12GM35-N0-V1</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>V1 plug connector</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCN4-12GM35-N0</td>
<td>NAMUR NC</td>
<td>4 mm not flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCN4-12GM35-N0-V1</td>
<td>NAMUR NC</td>
<td>4 mm not flush</td>
<td>V1 plug connector</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB2-12GM35-N0</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ2-11-SN</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>2 m, Silicon cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ2-11-SN-G</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>2 m, Silicon cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ2-12GK-SN</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>2 m, Silicon cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ4-12GK-SN</td>
<td>NAMUR NC</td>
<td>4 mm not flush</td>
<td>2 m, Silicon cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NBB4-12GM50-E2-3G-3D</td>
<td>PNP NO</td>
<td>4 mm flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ2-12GM40-E2-3G-3D</td>
<td>PNP NO</td>
<td>2 mm flush</td>
<td>2 m, PUR cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
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<tr>
<td>NJ4-12GM40-E2-3G-3D</td>
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<td>II 1G EEx ia IIC T6</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
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### Sensors for hazardous area

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Slot width/ Switching dist.</th>
<th>Installation</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
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<tbody>
<tr>
<td>Rectangular</td>
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<tr>
<td>NCB2-V3-N0</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>100 mm, PVC cable</td>
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<td>PTB 00 ATEX 2032 X</td>
<td></td>
</tr>
<tr>
<td>NCB2-V3-N0-V5</td>
<td>NAMUR NC</td>
<td>2 mm flush</td>
<td>Faston 4.8 mm</td>
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<tr>
<td>NCN4-V3-N0</td>
<td>NAMUR NC</td>
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<td>110 mm, PVC cable</td>
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<tr>
<td>NCN4-V3-N0-V5</td>
<td>NAMUR NC</td>
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<td>Faston 4.8 mm</td>
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<tr>
<td>Ring shaped sensors</td>
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<tr>
<td>RC10-14-N0</td>
<td>NAMUR NC</td>
<td>10 mm flush</td>
<td>2 m, PVC cable</td>
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<td>PTB 99 ATEX 2128 X</td>
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<tr>
<td>RC10-14-N3</td>
<td>NAMUR bi-stable</td>
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<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
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<tr>
<td>RC15-14-N0</td>
<td>NAMUR NC</td>
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<td>PTB 99 ATEX 2128 X</td>
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<tr>
<td>RC15-14-N3</td>
<td>NAMUR bi-stable</td>
<td>15 mm flush</td>
<td>2 m, PVC cable</td>
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<tr>
<td>Slot shaped sensors</td>
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<tr>
<td>SC2-N0-YELLOW</td>
<td>NAMUR NC</td>
<td>2 mm 0.5 m</td>
<td>PVC leads</td>
<td>II 2G EEx ia IIC T6</td>
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</tr>
<tr>
<td>SC2-N0-GREEN</td>
<td>NAMUR NC</td>
<td>2 mm 0.5 m</td>
<td>PVC leads</td>
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<td>PTB 99 ATEX 2219 X</td>
<td></td>
</tr>
<tr>
<td>SJ2-SN</td>
<td>NAMUR NC</td>
<td>2 mm 0.5 m, Litze LiFYW</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2049 X</td>
<td>ZELM 03 ATEX 0128 X</td>
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</tr>
<tr>
<td>SJ2-S1N</td>
<td>NAMUR NO</td>
<td>2 mm 0.5 m, Litze LiFYW</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2049</td>
<td>ZELM 03 ATEX 0128 X</td>
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</tr>
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</table>

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Date of issue 11/05/03 – Catalogue Field Devices 2004
Sensors for hazardous area

Position sensors for box installation

The F25 sensor series from Pepperl+Fuchs offers an effective alternative for applications involving feedback signalling on valve positioners. These sensors are suitable for both the box solution and direct fitting to the actuator.

The box in this installation version serves as a terminal compartment for both sensor and valve connection. Coded cage clamp plug-in terminals are provided for this purpose. LEDs on the dual sensors enable you to check the switching status. The LED on the PCB enables checking of the valve status. Versions with screen connections (NAMUR only) and 2 valve actuators are also available.

### F25 box solution

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Switching distance</th>
<th>Installation</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCN3-F25-N4-0,14</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush installation</td>
<td>180 mm, PVC cable</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 99 ATEX 1479 X</td>
</tr>
<tr>
<td>NCN3-F25-N4-K</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush installation</td>
<td>MINI-COMBICON</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 99 ATEX 1479 X</td>
</tr>
<tr>
<td>NCN3-F25F-N4-V1</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush installation</td>
<td>V1 plug connector</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 99 ATEX 1479 X</td>
</tr>
</tbody>
</table>

### F25 PCB box solution

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Switching distance</th>
<th>Installation</th>
<th>Connection (system/valve)</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL2-F25-N4-K</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush installation</td>
<td>cage clamp terminals</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 99 ATEX 1479 X</td>
</tr>
<tr>
<td>PL3-F25-N4-K</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush installation</td>
<td>cage clamp terminals</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 99 ATEX 1479 X</td>
</tr>
<tr>
<td>PL4-F25-N4-K</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush installation</td>
<td>cage clamp terminals</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 99 ATEX 1479 X</td>
</tr>
</tbody>
</table>
Position sensors for open construction

The F25, F31 and F31K series from Pepperl+Fuchs are ideally suited for direct installation on positioners without the need for additional material. Position inquiries of any standard actuator, regardless of size or make, can be realised with just two actuating elements.

The F31K series for system and valve connection offers a terminal compartment with cage clamp terminal technology. Various versions are available, without a valve connection, with one valve connection and with two connections.

F25 open solution without valve actuation, rectangular

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Switching distance</th>
<th>Installation</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCN3-F25-N4-V1</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>V1 plug connector</td>
<td>TÜV 99 ATEX 1479 X</td>
<td></td>
</tr>
<tr>
<td>NCN3-F25-N4-5M</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>5 m, PVC cable</td>
<td>TÜV 99 ATEX 1479 X</td>
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</tbody>
</table>

F31 and F31K open solution with valve actuation

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Switching distance</th>
<th>Installation</th>
<th>Connection (system)</th>
<th>Connection (valve)</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCN3-F31-N4-K</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>5 m, PVC cable</td>
<td></td>
<td>TÜV 99 ATEX 1479 X</td>
<td></td>
</tr>
<tr>
<td>NCN3-F31-N4-K-K</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>0,5 m, PVC cable</td>
<td></td>
<td>TÜV 99 ATEX 1479 X</td>
<td></td>
</tr>
<tr>
<td>NCN3-F31-N4-V16-K</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>V16 plug connector</td>
<td>V16 plug socket</td>
<td>TÜV 99 ATEX 1479 X</td>
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<tr>
<td>NCN3-F31-N4-V16-V16</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>V16 plug connector</td>
<td>V16 plug socket</td>
<td>TÜV 99 ATEX 1479 X</td>
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<tr>
<td>NCN3-F31-N4-V18</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>V18 plug connector</td>
<td></td>
<td>TÜV 99 ATEX 1479 X</td>
<td></td>
</tr>
<tr>
<td>NCN3-F31K-N4</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>cage clamp terminals</td>
<td></td>
<td>TÜV 99 ATEX 1479 X</td>
<td></td>
</tr>
<tr>
<td>NCN3-F31K-N4-K</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>cage clamp terminals</td>
<td></td>
<td>TÜV 99 ATEX 1479 X</td>
<td></td>
</tr>
<tr>
<td>NCN3-F31K-N4-V1-V1</td>
<td>DC Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>V1 plug socket</td>
<td></td>
<td>TÜV 99 ATEX 1479 X</td>
<td></td>
</tr>
<tr>
<td>NCN3-F31-N5-V18-V1</td>
<td>NAMUR Dual NC</td>
<td>3 mm</td>
<td>flush</td>
<td>V18 plug connector</td>
<td></td>
<td>TÜV 99 ATEX 1479 X</td>
<td></td>
</tr>
</tbody>
</table>
Sensors for hazardous area

Inductive standard sensors

Cylindrical NAMUR sensors with varying detection distances, different dimensions and well-proven housing materials (e.g. stainless steel) are utilised to meet the demands of a variety of applications. Pepperl+Fuchs provide an extensive range of solutions, both cable and plug versions being available.

<table>
<thead>
<tr>
<th>Cylindrical sensors</th>
<th>Switch element function</th>
<th>Switching distance</th>
<th>Installation</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
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</thead>
<tbody>
<tr>
<td>NJ0.8-4.5-N</td>
<td>NAMUR NC</td>
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<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ0.8-5GM-N</td>
<td>NAMUR NC</td>
<td>0.8 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 1G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ0.8-F-N</td>
<td>NAMUR NC</td>
<td>0.8 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB1.5-6.5M25-N</td>
<td>NAMUR NC</td>
<td>1.5 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB1.5-6.5M25-N-V1</td>
<td>NAMUR NC</td>
<td>1.5 mm</td>
<td>flush</td>
<td>V1 plug connector</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
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<tr>
<td>NCB1.5-6GM25-N</td>
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<td>2 m, PVC cable</td>
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<tr>
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<td>NAMUR NC</td>
<td>1.5 mm</td>
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<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB8-8GM40-N</td>
<td>NAMUR NC</td>
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<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB8-8GM40-N-V1</td>
<td>NAMUR NC</td>
<td>8 mm</td>
<td>flush</td>
<td>V1 plug connector</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
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<tr>
<td>NCB10-8GM40-N-SN</td>
<td>NAMUR NC</td>
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<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ15-18GK-SN</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>2 m, Silicon cable</td>
<td>II 2G EEx ia IIC T6</td>
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<tr>
<td>NJ2-22GK-N</td>
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<td>2 m, Silicon cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ15-18GK-SN</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>2 m, Silicon cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB10-30GM40-N</td>
<td>NAMUR NC</td>
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<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB10-30GM40-N-V1</td>
<td>NAMUR NC</td>
<td>10 mm</td>
<td>flush</td>
<td>V1 plug connector</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB15-30GM40-N</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB15-30GM40-N-V1</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>V1 plug connector</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NCB15-30GM40-N</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ15-30GK-M-N</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>2 m, Silicon cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ15-30GK-M-N</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>2 m, Silicon cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ15-30GK-SN</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>2 m, Silicon cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
<tr>
<td>NJ5-30GK-SN</td>
<td>NAMUR NO</td>
<td>5 mm</td>
<td>flush in St37</td>
<td>2 m, Silicon cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2048 X</td>
</tr>
</tbody>
</table>

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### Rectangular sensors

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Switching distance</th>
<th>Installation</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJ4-F-N</td>
<td>NAMUR NC</td>
<td>4 mm</td>
<td>not flush</td>
<td>2 m, PVC cable</td>
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<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NJ6-F-N</td>
<td>NAMUR NC</td>
<td>6 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NJ10-F-N</td>
<td>NAMUR NC</td>
<td>10 mm</td>
<td>not flush</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NJ2-F1-N</td>
<td>NAMUR NC</td>
<td>2 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
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<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
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<tr>
<td>FJ7-N</td>
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<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NC15-M1K-N0</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>not flush</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NC15+U1-N0</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>flush</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NC20+U1-N0</td>
<td>NAMUR NC</td>
<td>20 mm</td>
<td>not flush</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
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<td>NC30+U1-N0</td>
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<td>30 mm</td>
<td>not flush</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NC40+U1-N0</td>
<td>NAMUR NC</td>
<td>40 mm</td>
<td>not flush</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
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<tr>
<td>NJ651+U1-N1</td>
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<td>6 mm</td>
<td>flush</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2049 X</td>
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<td>NJ155+U1-N</td>
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<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2049 X</td>
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<td>NJ205+U1-N</td>
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<td>not flush</td>
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<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2049 X</td>
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<tr>
<td>NC80-FP-N0-P1</td>
<td>NAMUR NC</td>
<td>40 mm</td>
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<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NC80-FP-N0-P1</td>
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<td>not flush</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NJ40-FP-SN-P1</td>
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<td>40 mm</td>
<td>not flush</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NJ40-FP-A2-B1-P1-3G-3D</td>
<td>PNP antivalent</td>
<td>40 mm</td>
<td>flush</td>
<td>terminal compartment</td>
<td>II 3G EEx na IIC T6 X</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>NJ50-FP-A2-P1-3G-3D</td>
<td>PNP antivalent</td>
<td>50 mm</td>
<td>not flush</td>
<td>terminal compartment</td>
<td>II 3G EEx na IIC T6 X</td>
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### Ring shaped sensors

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Inside diameter</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>RZ21-N</td>
<td>NAMUR NC</td>
<td>21 mm</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 00 ATEX 2032 X</td>
</tr>
<tr>
<td>RJ43-N</td>
<td>NAMUR NC</td>
<td>43 mm</td>
<td>2 m, PUR cable</td>
<td>II 2G EEx ia IIC T6</td>
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</table>

### Slot shaped sensors

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Slot width</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SJ5-N</td>
<td>NAMUR NC</td>
<td>5 mm</td>
<td>0.5 m, LIY leads</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SJ5-G-N</td>
<td>NAMUR NC</td>
<td>5 mm</td>
<td>0.5 m, LIY leads</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SJ5-K-N</td>
<td>NAMUR NC</td>
<td>5 mm</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SJ10-N</td>
<td>NAMUR NC</td>
<td>10 mm</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SJ15-N</td>
<td>NAMUR NC</td>
<td>15 mm</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>SJ30-N</td>
<td>NAMUR NC</td>
<td>30 mm</td>
<td>2 m, PVC cable</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
</tbody>
</table>
Sensors for hazardous area

Capacitive and magnetic standard sensors

Capacitive sensors are always utilised if non-metallic objects are to be identified, whether for filling level recording of liquid or granular substances or where positioning of plastic or wooden container packaging is involved. Various cylindrical and rectangular sensors are also available here, with either cable or connector plugs.

Capacitive sensors, cylindrical and rectangular

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Switching distance</th>
<th>Installation</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
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<tbody>
<tr>
<td>Cylindrical</td>
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<td></td>
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</tr>
<tr>
<td>CJ1-12GK-N</td>
<td>NAMUR NC</td>
<td>1 mm</td>
<td>not flush</td>
<td>2 m, PVC cable</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 03 ATEX 2003 X</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>II 1D Ex ia 20 T 85 °C</td>
<td>ZELM 03 ATEX 0128 X</td>
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<tr>
<td>CJ4-12GK-N</td>
<td>NAMUR NC</td>
<td>4 mm</td>
<td>not flush</td>
<td>2 m, PVC cable</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 03 ATEX 2003 X</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>II 1D Ex ia 20 T 85 °C</td>
<td>ZELM 03 ATEX 0128 X</td>
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<tr>
<td>CJ6-18GK-N</td>
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<td>2 mm</td>
<td>not flush</td>
<td>2 m, PVC cable</td>
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<td>II 1D Ex ia 20 T 85 °C</td>
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<td>CJB-18GK-N</td>
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<td>6 mm</td>
<td>not flush</td>
<td>2 m, PVC cable</td>
<td>II 2G Ex ia IIC T6</td>
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<tr>
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<td>ZELM 03 ATEX 0128 X</td>
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<tr>
<td>CCBl-30GM80-N1</td>
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<td>10 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 03 ATEX 2003 X</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>II 1D Ex ia 20 T 85 °C</td>
<td>ZELM 03 ATEX 0128 X</td>
</tr>
<tr>
<td>CJ15-40-N</td>
<td>NAMUR NO</td>
<td>15 mm</td>
<td>flush</td>
<td>terminal compartment</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 03 ATEX 2003 X</td>
</tr>
<tr>
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<td></td>
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<td></td>
<td>II 1D Ex ia 20 T 85 °C</td>
<td>ZELM 03 ATEX 0128 X</td>
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<tr>
<td>CJ10-30GM-E2-3G-3D</td>
<td>PNP NO</td>
<td>10 mm</td>
<td>flush</td>
<td>2 m, PVC cable</td>
<td>II 3G Ex ia IIC T6 X</td>
<td>TÜV 03 ATEX 2003 X</td>
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<td>II 3D IP67 T 90 °C</td>
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<td>Rectangular</td>
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<tr>
<td>CBN2-F46-N1</td>
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<td>2 mm</td>
<td>not flush</td>
<td>2 m, PUR cable</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 03 ATEX 2003 X</td>
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<tr>
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<tr>
<td>CB5-F46-N1</td>
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<td>2 m, PUR cable</td>
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<td>TÜV 03 ATEX 2003 X</td>
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<tr>
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<td>II 1D Ex ia 20 T 85 °C</td>
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<tr>
<td>CCN5-F46A-N1</td>
<td>NAMUR NO</td>
<td>5 mm</td>
<td>not flush</td>
<td>2 m, PVDF cable</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 03 ATEX 2003 X</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>II 1D Ex ia 20 T 85 °C</td>
<td>ZELM 03 ATEX 0128 X</td>
</tr>
<tr>
<td>CCN10-F46A-N1</td>
<td>NAMUR NO</td>
<td>10 mm</td>
<td>not flush</td>
<td>2 m, PVDF cable</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 03 ATEX 2003 X</td>
</tr>
<tr>
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<td></td>
<td>II 1D Ex ia 20 T 85 °C</td>
<td>ZELM 03 ATEX 0128 X</td>
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<tr>
<td>CJ40-FP-N-P1</td>
<td>NAMUR NC</td>
<td>40 mm</td>
<td>not flush</td>
<td>terminal compartment</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 03 ATEX 2003 X</td>
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<td>II 1D Ex ia 20 T 85 °C</td>
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<td>CBN2-F46-E2-3G-3D</td>
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<td>2 mm</td>
<td>not flush</td>
<td>2 m, PVC cable</td>
<td>II 3G Ex ia IIC T6 X</td>
<td>TÜV 03 ATEX 2003 X</td>
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<td>II 3D IP67 T 99 °C</td>
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<td>CB5-F46-E2-3G-3D</td>
<td>PNP NO</td>
<td>5 mm</td>
<td>not flush</td>
<td>2 m, PVC cable</td>
<td>II 3G Ex ia IIC T6 X</td>
<td>TÜV 03 ATEX 2003 X</td>
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<td>II 3D IP67 T 98 °C</td>
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<td>CJ40-FP-A2-P1-3G-3D</td>
<td>PNP antivalent</td>
<td>40 mm</td>
<td>not flush</td>
<td>terminal compartment</td>
<td>II 3G Ex ia IIC T6 X</td>
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<td>II 3D IP67 T 97 °C</td>
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Magnetic sensors, cylindrical

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Switch element function</th>
<th>Switching distance</th>
<th>Installation</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC60-12GM50-1N</td>
<td>NAMUR NO</td>
<td>60 mm</td>
<td>flush, in non magnetic metal</td>
<td>2 m, PVC cable</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 01 ATEX 1718</td>
</tr>
<tr>
<td>MC60-12GM50-1N-V1</td>
<td>NAMUR NO</td>
<td>60 mm</td>
<td>flush, in non magnetic metal</td>
<td>V1 plug connector</td>
<td>II 2G Ex ia IIC T6</td>
<td>TÜV 01 ATEX 1718</td>
</tr>
</tbody>
</table>
Photoelectric sensors

Modern optical sensors are also an indispensable prerequisite for automated production in hazardous areas. Pepperl+Fuchs now provide a variety of ranges with different photoelectric versions for use in hazardous areas. Products in the MLV11, RL36 and VariKont M series are especially suitable for use in areas where an explosive atmosphere is occasionally encountered (a mixture of air and flammable gases, vapours, mists). These intrinsically-safe sensors enable adjustment during normal operation without reducing the level of explosive safety.

### Light beams and reflection light barriers

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Function</th>
<th>Detection/ sensing range</th>
<th>Light type</th>
<th>Connection</th>
<th>Ex approval</th>
<th>EC-type examination certificate</th>
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<tbody>
<tr>
<td><strong>Photoelectric sensors for hazardous area zone 1</strong></td>
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</tr>
<tr>
<td>M11/MV11-Ex/40b/112</td>
<td>single-path light beam</td>
<td>0 m ... 10 m</td>
<td>red, pulsating light</td>
<td>metal plug M12, 4-pole, 90° rotation</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 01 ATEX 2036 X</td>
</tr>
<tr>
<td>MLV11-54-Ex/40b/112</td>
<td>reflection light barrier with pole filter</td>
<td>0 m ... 3 m</td>
<td>red, pulsating light</td>
<td>metal plug M12, 4-pole, 90° rotation</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 01 ATEX 2036 X</td>
</tr>
<tr>
<td>MLV11-8-500-Ex/40b/112</td>
<td>reflection light scanner</td>
<td>0 m ... 0.5 m</td>
<td>infrared, pulsating light</td>
<td>metal plug M12, 4-pole, 90° rotation</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 01 ATEX 2036 X</td>
</tr>
<tr>
<td>L36/LV36-Ex/40b/116</td>
<td>single-path light beam</td>
<td>0 m ... 30 m</td>
<td>red, pulsating light</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 01 ATEX 2184 X</td>
</tr>
<tr>
<td>RL36-55-Ex/40b/116</td>
<td>reflection light barrier with pole filter</td>
<td>0 m ... 8 m</td>
<td>infrared, pulsating light</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 01 ATEX 2184 X</td>
</tr>
<tr>
<td>RL36-8-2000-Ex/40b/116</td>
<td>reflection light scanner</td>
<td>0 m ... 2 m</td>
<td>infrared, pulsating light</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 01 ATEX 2184 X</td>
</tr>
<tr>
<td>OCS2000-M1K-N2</td>
<td>reflection light barrier with pole filter</td>
<td>0 m ... 2 m</td>
<td>red, pulsating light</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 01 ATEX 2203 X</td>
</tr>
<tr>
<td>OCT300-M1K-N2</td>
<td>reflection light scanner</td>
<td>0 m ... 0.3 m</td>
<td>infrared, pulsating light</td>
<td>terminal compartment</td>
<td>II 2G EEx ia IIC T6</td>
<td>PTB 01 ATEX 2203 X</td>
</tr>
</tbody>
</table>

| **Photoelectric sensors for hazardous area zone 2 and 22** | | | | | | |
| L32/LV32-Ex2/47/73c | single-path light beam | 0 m ... 20 m | red, pulsating light | approx. 500 mm at 10 m | test input | |
| L32/LV32-Ex2/35/47/73c | single-path light beam | 0 m ... 45 m | red, pulsating light | approx. 100 mm at 4 m | test input | |
| RL32-54-Ex2/47/73c | reflection light barrier | 0 m ... 7 m | red, pulsating light | approx. 25 mm at 10 m | polarisation filter for reflection protection | |
| RL32-55-Ex2/47/73c | reflection light barrier | 0 m ... 15 m | red, pulsating light | approx. 25 mm at 800 mm | polarisation filter for reflection protection | |
| RL32-8-H-800-Ex2/47/73c | reflection light scanner with background suppression | 30 mm ... 800 mm, adjustable | infrared, pulsating light | approx. 25 mm at 400 mm | | |
| RL32-8-H-2482-400-Ex2/47/73c | reflection light scanner with background suppression | 30 mm ... 400 mm, adjustable | infrared, pulsating light | approx. 25 mm at 400 mm | | |

| **Colour sensors** | | | | | | |
| **Photoelectric sensors for hazardous area zone 2 and 22** | | | | | | |
| VCS110/133 | colour sensor | max. 100 mm | 5 PNP, short-circuit-proof each with two allocated measuring value memories | white light | II 2/3G EEx nA II T4/EEEx II T4 | TÜV 01 ATEX 1969 X |
| LMR 05-22-5,0-Z1 | reflective glass fibre optic, length 5 m | | | | | |
| LMR 05-22-10,0-Z1 | reflective glass fibre optic, length 10 m | | | | | |
Pepperl+Fuchs provide rotary encoders with two different types of protection. A difference is made between pressure resistant encapsulation (EEx d) and intrinsic safety (EEx i) in this respect.

### Incremental rotary encoders

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Number of pulses</th>
<th>Design</th>
<th>Shaft</th>
<th>Output type</th>
<th>Ex approval 1</th>
<th>Ex approval 2</th>
<th>EC-type examination certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series 14</td>
<td>max. 5000</td>
<td>Ø116 mm</td>
<td>solid shaft Ø12 mm</td>
<td>push-pull, RS 422</td>
<td>II 2G EEx d IIC T6</td>
<td>II 2D IP66 T 80 °C</td>
<td>ZELM 02 ATEX 20078</td>
</tr>
<tr>
<td>RHI74</td>
<td>max. 5000</td>
<td>Ø70 mm</td>
<td>hollow shaft Ø12 mm</td>
<td>push-pull, RS 422</td>
<td>EEx d IIC T6</td>
<td>II 2 G EEx ia IIC T6</td>
<td>ATEX pending</td>
</tr>
<tr>
<td>RV84</td>
<td>max. 25</td>
<td>Ø78 mm</td>
<td>solid shaft Ø10 mm</td>
<td>NAMUR</td>
<td>II 2G EEx ia IIC T6</td>
<td>EEx ib IIC T6</td>
<td>PTB 99 ATEX 2219 X</td>
</tr>
<tr>
<td>TRD-G</td>
<td>max. 100</td>
<td>Ø78 mm</td>
<td>solid shaft Ø10 mm</td>
<td>NAMUR</td>
<td>II 2G EEx ia IIC T6</td>
<td>EEx ib IIC T6</td>
<td>ATEX pending</td>
</tr>
</tbody>
</table>

### Absolute rotary encoders

<table>
<thead>
<tr>
<th>Product designation</th>
<th>Resolution</th>
<th>Design</th>
<th>Shaft</th>
<th>Interface type</th>
<th>Ex approval 1</th>
<th>Ex approval 2</th>
<th>EC-type examination certificate</th>
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<tr>
<td>AHS74</td>
<td>13 Bit singleturn</td>
<td>Ø70 mm</td>
<td>hollow shaft Ø12 mm</td>
<td>SSI (Synchronous Serial Interface)</td>
<td>EEx d IIC T6</td>
<td>II 2G EEx d IIC T6</td>
<td>ATEX pending</td>
</tr>
<tr>
<td>AVE14</td>
<td>12 Bit singleturn</td>
<td>Ø116 mm</td>
<td>solid shaft Ø12 mm</td>
<td>SSI (Synchronous Serial Interface)</td>
<td>EEx d IIC T6</td>
<td>II 2D IP66 T 80 °C</td>
<td>ZELM 02 ATEX 20078</td>
</tr>
<tr>
<td>AVM14</td>
<td>24 Bit multiturn</td>
<td>Ø116 mm</td>
<td>solid shaft Ø12 mm</td>
<td>SSI (Synchronous Serial Interface)</td>
<td>EEx d IIC T6</td>
<td>II 2G EEx d IIC T6</td>
<td>ZELM 02 ATEX 20078</td>
</tr>
<tr>
<td>BVE14</td>
<td>13 Bit singleturn</td>
<td>Ø116 mm</td>
<td>solid shaft Ø12 mm</td>
<td>AS-Interface</td>
<td>II 2G EEx d IIC T6</td>
<td>II 2D IP66 T 80 °C</td>
<td>ZELM 02 ATEX 20078</td>
</tr>
<tr>
<td>BVM14</td>
<td>16 Bit multiturn</td>
<td>Ø116 mm</td>
<td>solid shaft Ø12 mm</td>
<td>AS-Interface</td>
<td>II 2G EEx d IIC T6</td>
<td>II 2D IP66 T 80 °C</td>
<td>ZELM 02 ATEX 20078</td>
</tr>
<tr>
<td>CVE14</td>
<td>13 Bit singleturn</td>
<td>Ø116 mm</td>
<td>solid shaft Ø12 mm</td>
<td>CAN</td>
<td>II 2G EEx d IIC T6</td>
<td>II 2D IP66 T 80 °C</td>
<td>ZELM 02 ATEX 20078</td>
</tr>
<tr>
<td>CVM14</td>
<td>25 Bit multiturn</td>
<td>Ø116 mm</td>
<td>solid shaft Ø12 mm</td>
<td>CAN</td>
<td>II 2G EEx d IIC T6</td>
<td>II 2D IP66 T 80 °C</td>
<td>ZELM 02 ATEX 20078</td>
</tr>
<tr>
<td>SCS14</td>
<td>13 Bit singleturn</td>
<td>Ø116 mm</td>
<td>solid shaft Ø12 mm</td>
<td>push-pull, parallel</td>
<td>II 2G EEx d IIC T6</td>
<td>II 2D IP66 T 80 °C</td>
<td>ZELM 02 ATEX 20078</td>
</tr>
<tr>
<td>SHS74</td>
<td>13 Bit singleturn</td>
<td>Ø70 mm</td>
<td>hollow shaft Ø12 mm</td>
<td>push-pull, parallel</td>
<td>EEx d IIC T6</td>
<td>II 2D IP66 T 80 °C</td>
<td>ATEX pending</td>
</tr>
</tbody>
</table>
Pressurised enclosure system to EN 50016
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.

Control unit FA6-PCU300A-Ex.O14

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<table>
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<tr>
<td>Solenoid valves</td>
<td>293</td>
</tr>
</tbody>
</table>
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:
The following types of purging and operation can be achieved with the components supplied by Pepperl+Fuchs:

### Purging

#### with a digital valve
After purging with a large nozzle cross-section the valve closes. A mechanically adjustable bypass guarantees the minimum pressure necessary for operation.

#### with a proportional valve
The PCU300A control unit (with integrated pressure monitor) adjusts the pressure in the housing to the programmed target value and records the gas discharge volume.

### Operating mode

#### Constant purging
This operating mode with an increased consumption of inert gas is selected if the apparatus mounted in the housing (e.g. an analytical device) itself generates an explosive atmosphere which must be diluted, or if the apparatus requires additional cooling.

#### Leakage compensation
The pressure and flow control equipment which regulates the inlet pressure guarantees that only sufficient purge gas to compensate for the leakage rate passes through the proportional valve.

**Advantages:**
- Minimum inert gas usage,
- Low flow noise,
- Automatic correction of increased leakage rate due to ageing.

Preferred solenoid valves: PV 321 or PV 322 proportional valve, alternative DV 311 digital valve

### 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).

<table>
<thead>
<tr>
<th>PCU 300A orifice meter Ø [mm]</th>
<th>Purge gas volumetric flow [litres/hour] at solenoid valve</th>
<th>DV311-Ex-nozzles Ø [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>1100 1350 1560 1750 1908 2063 2203 1</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>2495 3017 3485 3827 4302 4608 4921 1.5</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>4349 5328 6149 6869 7513 8107 8654 2</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>9634 11772 13532 15070 16448 -  - -</td>
<td>4</td>
</tr>
<tr>
<td>1.5</td>
<td>2 2.5 3 3.5 4 4.5</td>
<td>3</td>
</tr>
</tbody>
</table>

Purge gas admission pressure [bar]
Control unit with integrated pressure switch

Features
- Compact design
- Easy installation
- Economical purging method
- High safety standard
- LCD indication of operating status
- Menu-driven programing

Electrical connection

Function

The 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.
## Technical data

### Input characteristics
- **Measurement range**: Pressure measurement range 0 ... 18 mbar  
  Volumetric flow measurement range depends on the orifice size

### Auxiliary energy
- **Supply voltage**: 24 V DC,  
  115 V AC or 230 V AC, 48 ... 62 Hz
- **Power consumption**: approx. 2.5 VA
- **Connectable load**:  
  Operating circuits (terminals 11/12, 13/14):  
  AC: \( U_{\text{max}} = 250 \text{ V} \), \( I_{\text{max}} = 5 \text{ A} \), \( \cos \varphi = 0.7 \)  
  DC: \( U_{\text{max}} = 50 \text{ V} \), \( I_{\text{max}} = 5 \text{ A} \), \( P = 150 \text{ W} \)  
  Control circuit (terminals 1 ... 10): ignition protection class \( \Box \) EEx ib IIC (intrinsically safe)

### Operating conditions
- **Installation instructions**: inside or outside the enclosure  
  Back-up fuse for solenoid valve in the control unit must be ordered separately (see selection table in section Back-up fuse for solenoid valves)
- **Installation example**: Mounting example: external mounted

<table>
<thead>
<tr>
<th>Hole diameter 34</th>
<th>Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nozzle G 3/8&quot;</td>
<td></td>
</tr>
<tr>
<td>Hole diameter 16.5</td>
<td></td>
</tr>
</tbody>
</table>

### Mechanical construction
- **Ambient conditions**:  
  Ambient temperature: -20 ... +45 °C (253 ... 318 K) bei T6, -20 ... +60 °C (253 ... 333 K) bei T4  
  Protection class: IP65 (without consideration of the air outlet opening)
- **Dimensions**: 220 x 120 x 90 mm (8.7 x 4.7 x 3.5 inches)
- **Material**: painted aluminium
- **Ex approval**: DMT 00 ATEX E004 X
- **Type of protection**: \( \Box \) II 2 G EEx em [ib] IIC T6

### General information
- **Directive conformity**: Directive 94/9/EC (ATEX)
  - **Directives standards**: DMT 00 ATEX E004 X, \( \Box \) II 2 G EEx em [ib] IIC T6  
  - **EN 954-1, category 3**
- **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.
Control unit with integrated pressure switch

**Technical data**

<table>
<thead>
<tr>
<th>Type code/model number</th>
<th>F**PV32*-Ex</th>
</tr>
</thead>
</table>

**Features**

- Minimal purging gas consumption
- High level of operating safety
- Low flow noise
- Defined overpressure during purging
- PTB 00 ATEX 2002 X

**Function**

The valve functions as an actuator for the pressurising system. It admits only sufficient purge gas to compensate for leakage losses from the housing. The defined pressure during purging ensures that pressure-sensitive components such as membrane keypads or viewing windows are not overloaded. The valve can be installed inside or outside the enclosure.

**Dimensions**

- Proportional valve
  - Operating voltage: PV321 0 bar ... 7 bar, PV322 0 bar ... 3.5 bar

- Enclosure volume: < 300 ltr. (NW 4) 1, > 300 ltr. (NW 6) 2

*For use with orifice 18 mm
Control unit with integrated pressure switch

Technical data

Control panel

FD0-T301A-Ex.*

Features

- Intelligent control panel
- Operating and error messages

Function

The 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.

Note

- When the bypass button is pressed, the operating safety instructions must be complied with (e.g. presentation of a fire permit).

Dimensions

Operating elements

Operator panel

FD0-T301A-Ex.*

Front panel mounted ......................... F
Housing IP65 ............................... H

Back-up fuse for solenoid valves

PCU-F-Ex.****mA

Notes

- 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

Type code/model number

<table>
<thead>
<tr>
<th>Back-up fuse for solenoid valves</th>
<th>PCU-F-Ex.****mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV</td>
<td>PV</td>
</tr>
<tr>
<td>80 mA</td>
<td>230 V</td>
</tr>
<tr>
<td>100 mA</td>
<td>115 V</td>
</tr>
<tr>
<td>160 mA</td>
<td>230 V</td>
</tr>
<tr>
<td>200 mA</td>
<td>315 mA</td>
</tr>
<tr>
<td>315 mA</td>
<td>400 mA</td>
</tr>
<tr>
<td>400 mA</td>
<td>115 V</td>
</tr>
<tr>
<td>630 mA</td>
<td>24 V</td>
</tr>
<tr>
<td>1000 mA</td>
<td>1000 mA</td>
</tr>
<tr>
<td>1600 mA</td>
<td>24 V</td>
</tr>
<tr>
<td>2000 mA</td>
<td>2000 mA</td>
</tr>
</tbody>
</table>
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<td>Glossary</td>
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<tr>
<td>List of types</td>
<td>318</td>
</tr>
</tbody>
</table>
## Housing protection class

Protection provided by housings
(DIN VDE 0470 part 1, IEC 60529)

### IP 6 7

<table>
<thead>
<tr>
<th>Protection against contact and foreign bodies</th>
<th>Degree of protection against water</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Not protected</td>
<td>0 Not protected</td>
</tr>
<tr>
<td>1 Protected against contact with hazardous components with the backs of the hand - Protected against solid foreign bodies with a size and diameter of 50 mm (2 inches) and above</td>
<td>1 Protected against dripping water</td>
</tr>
<tr>
<td>2 Protected against contact with hazardous components with fingers - Protected against solid foreign bodies with a size and diameter of 12.5 mm (0.5 inches) and above</td>
<td>2 Protected against dripping water, when housing is tilted up to 15°</td>
</tr>
<tr>
<td>3 Protected against contact with hazardous components with a tool - Protected against solid foreign bodies with a size and diameter of 2.5 mm (0.1 inches) and above</td>
<td>3 Protected against sprayed water</td>
</tr>
<tr>
<td>4 Protected against contact with hazardous components with a wire - Protected against solid foreign bodies with a size and diameter of 1.0 mm (0.04 inches) and above</td>
<td>4 Protected against splash water</td>
</tr>
<tr>
<td>5 Protected against contact with hazardous components with a wire - Protection from dust</td>
<td>5 Protected against water jets</td>
</tr>
<tr>
<td>6 Protected against contact with hazardous components with a wire - Dust tight</td>
<td>6 Protected against strong water jets</td>
</tr>
<tr>
<td></td>
<td>7 Protected against temporary submersion in water</td>
</tr>
<tr>
<td></td>
<td>8 Protected against continuous submersion in water</td>
</tr>
</tbody>
</table>

### 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 ±5 °C (±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/EWG 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 Iib 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:

<table>
<thead>
<tr>
<th>Intrinsically safe apparatus and cable</th>
<th>Demonstration of intrinsic safety</th>
<th>Associated apparatus</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_i</td>
<td>≥</td>
<td>U_0</td>
</tr>
<tr>
<td>I_i</td>
<td>≥</td>
<td>I_0</td>
</tr>
<tr>
<td>P_i</td>
<td>≥</td>
<td>P_0</td>
</tr>
<tr>
<td>L_i + L_c</td>
<td>≤</td>
<td>L_0</td>
</tr>
<tr>
<td>C_i + C_c</td>
<td>≤</td>
<td>C_0</td>
</tr>
</tbody>
</table>

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_0, the maximum output current I_0, the maximum output power P_0 are calculated as follows, depending on the combined circuitry of the individual associated apparatus:

For parallel circuits:

- I_0 from the sum of the individual currents,
- U_0 from the maximum value of the individual voltages.

For series connection:

- I_0 from the maximum value of the individual currents,
- U_0 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:

\[ P_0 = \frac{1}{4} \times U_0 \times I_0 \]

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)

The following table compares important general guidelines for explosion protection as applied in the European Union and North America.
## Explosion protection through intrinsic safety

<table>
<thead>
<tr>
<th>Classification of hazards</th>
<th>European Union</th>
<th>North America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosive mixture in</td>
<td>Group I: mines susceptible to firedamp</td>
<td>Explosive mixtures of air and gas</td>
</tr>
<tr>
<td></td>
<td>Group II: other areas outside of mines</td>
<td>CLASS I: Gases and vapours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CLASS II: Dusts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CLASS III: Fibres</td>
</tr>
</tbody>
</table>

### 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:

<table>
<thead>
<tr>
<th>Group</th>
<th>Gas/Vapour</th>
<th>Dust</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Methane, Acetylene</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Hydrogen, Ethylene</td>
<td>Coal dusts, Metal dusts</td>
</tr>
<tr>
<td>II A</td>
<td>Propane</td>
<td>Grain dusts</td>
</tr>
<tr>
<td>II B</td>
<td>Ethylene</td>
<td>Fiducial, Metal dusts</td>
</tr>
<tr>
<td>II C</td>
<td>Hydrogen, Acetylene</td>
<td></td>
</tr>
</tbody>
</table>

### 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 (313 K), under fault conditions:

- T<sub>1</sub> ≤ 450 °C (723 K)
- T<sub>2</sub> ≤ 300 °C (573 K)
- T<sub>3</sub> ≤ 200 °C (473 K)
- T<sub>4</sub> ≤ 135 °C (408 K)
- T<sub>5</sub> ≤ 100 °C (373 K)
- T<sub>6</sub> ≤ 85 °C (358 K)

### Division of hazardous areas

The following are subdivided according to the probability of the occurrence of a dangerous explosive atmosphere:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>constant or long term</td>
</tr>
<tr>
<td>1</td>
<td>occasionally</td>
</tr>
<tr>
<td>2</td>
<td>seldom and short term</td>
</tr>
</tbody>
</table>

For gases, vapours, mists: (EN 1127-1)

Note (see IEC 60079-10): constant or long term corresponds to > 1000 h/year, occasionally corresponds to 10 h/year ... 1000 h/year, seldom or short term corresponds 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:

- Redeker, Nabert, Schön/intrinsic safety characteristics of flammable gases and vapours
- NFPA 497 M
- CSA No. C22-1

### Approval authorities

- PTB: Physikalisch-Technische Bundesanstalt
- DMT: Deutsche Montan Technologie
- BASEEFA: British Approvals Service for Electrical Equipment in Flammable Atmospheres
- UL: Underwriters Laboratories, USA
- FM: Factory Mutual Research, USA
- CSA: Canadian Standards Association

### Installation requirements

- DIN EN 60079-14 (VDE 0165 part 1) for explosive gas environments
- DIN EN 50281-1-2 (VDE 0165 part 2) for environments with flammable dust
- NFPA 70: National Electrical Code Art. 500
- NFPA 493: Standard for Intrinsically safe operations...
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. 1 µS/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 \( \varepsilon_r \): 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

Elex 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.

F

Field measurement: limit value detection through detection of the changes in an electromagnetic alternating field caused by the presence of the medium.

H

Hastelloy B: \( 2.4617 = \text{NiMo28} \)

Hastelloy C: \( 2.4610 = \text{NiMo16Cr16Ti} \)

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 \(^1 \) 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.

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.

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\(^1 \) EN 60947-5-6 (also IEC 60947-5-6) is identical to EN 50227 and corresponds to DIN 19234.
Glossary

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.

PLM: the measuring sensor is supplied via a 2-wire line from the signal conditioner. The measuring sensor periodically increases its current consumption in proportion to the measured value. This current impulse is between 0.5 ms and 32 ms in duration. The current amplitude is between 5 mA and 15 mA.

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/I 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: polytetrafluoro 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

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

Signal interface: the unit produces analogue output signals from pulse-length-modulated impulses (PLM) e. g. 4 mA ... 20 mA. Example: KFU8-PWC-Ex

T

Transformer isolated barrier: The relay responds to defined current changes in accordance with EN 6094-5-6 (NAMUR), e. g. KHA6-SRÜ-Ex1.W.LB

TRbF: German technical regulations for combustible liquids (annex to VbF)

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

VbF: German ordinance for combustible liquids. The ordinance for combustible liquids (VbF) prescribe that installations which store, drain or transport combustible liquids must be equipped with overspill prevention systems.

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 posses the respective approval.
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