

Features

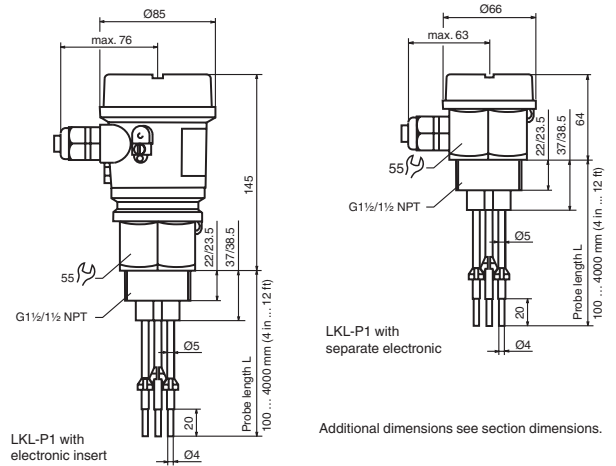
- Level limit switch for conductive liquids
- Detect up to five level limits with one probe
- Flexible instrumentation
- No moving parts in the tank
- No calibration: quick and low-cost start up
- Option between rod or rope version for optimum adaptation to the application
- Two-point control and additional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

Function

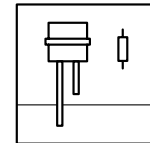
The LKL-P sensor is used in conductive liquids (as of 10 $\mu\text{s/cm}$) for determining level limits. Depending on the number of measuring points (up to 5 rods or ropes), measuring tasks such as overspill protection, dry running protection, two-point control of pumps or multiple point detection can 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

Assembly



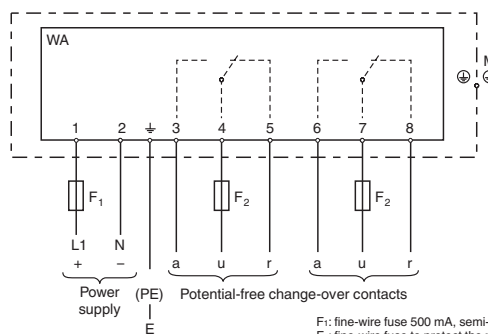
⚠ When placing your order, please specify the length (L) of the electrode rod. The electrode rod can be cropped by the user if necessary.



Connection

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

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



Other connection types see section electrical connection.

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)

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Refer to "General Notes Relating to Pepperl+Fuchs Product Information".

Directive conformity	
Electromagnetic compatibility	
Directive 2014/30/EU	EN 61326-1:2006 , EN 61326-2-3:2006
Low voltage	
Directive 2014/35/EU	EN 61010-1:2001
Conformity	
Electromagnetic compatibility	NE 21
Degree of protection	IEC 60529:2001
Vibration resistance	EN 60068-2-64
Climate class	EN 60068, part 2-38 (test Z/AD)
Function and system design	
Measuring principle	<p>An alternating voltage exists between the probes in an empty tank.</p> <p>As soon as the conductive liquid in the tank creates a connection between the ground probe and, for example, the maximum probe, a measurable current flows and the device switches. With level limit detection, the device switches back as soon as the liquid clears the maximum probe. With two-point control, the device does not switch back until the max and min probe is cleared.</p> <p>Using alternating voltage prevents corrosion of the probes 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 probes and the electronics. There is absolutely no danger if the probes are touched during operation.</p>
Equipment architecture	<p>probe with integrated electronic insert (compact instrument version)</p> <p>probe without integrated electronic insert (separate instrument version) for one, two or multiple point detection respectively, see section measuring system</p>
Input characteristics	
Measured variable	resistance change between two conductors caused by the presence or absence of a conductive product.
Measurement range	<p>The measuring range is dependent on the mounting location of the probes.</p> <p>Rod probes can have a max. length of 4000 mm (13 ft) and rope probes up to 15000 mm (49 ft).</p>
Input signal	<p>probes covered - A measurable current is flowing between the probes.</p> <p>probes uncovered - There is no measurable current flowing between the probes.</p>
Output characteristics	
Output signal	see section electrical connection
Measurement range	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.
Signal on alarm	<p>Output E5 (FEW52): in the event of a power failure or a damaged probe: < 100 μA.</p> <p>output WA (FEW54): output signal in the event of a power failure or a damaged probe: relay de-energised.</p>
Fail-safe mode	<p>Selecting the correct fail-safe mode ensures that the relay/the output always runs in quiescent current fail-safe.</p> <p>output E5 (FEW52):</p> <ul style="list-style-type: none"> - maximum fail-safe: The output signal is < 1 mA if the switch point is exceeded (probe covered), a fault occurs or the power supply fails. - minimum fail-safe: The output signal is < 1 mA if the switch point is undershot (probe uncovered), a fault occurs or the power supply fails. <p>Output WA (FEW54):</p> <ul style="list-style-type: none"> - maximum fail-safe: The relay de-energises when the switch point is exceeded (probe covered), a fault occurs or the power supply fails. - minimum fail-safe: The relay de-energizes when the switch point is undershot (probe uncovered), a fault occurs or the power supply fails. <p>output N1 (FEW58):</p> <ul style="list-style-type: none"> - maximum fail-safe: The output voltage is 0 V if the switch point is exceeded (probe covered), a fault occurs or the power supply fails. - minimum fail-safe: The output voltage is 0 V if the switch point is undershot (probe uncovered), a fault occurs or the power supply fails.
Load	<p>Output E5 (FEW52):</p> <p>The load is switched via a transistor (PNP), cycled overload and short-circuit protection, continuous ≤ 200 mA (short-circuit proof), residual voltage at transistor at I_{max} 2.9 V</p> <p>Output WA (FEW54):</p> <p>Loads are switched via 2 potential-free change-over contacts.</p> <p>I~ max. 4 A, U~ max. 253 V</p> <p>P~ max. 1000 VA, cos φ = 1, P~ max. 700 VA, cos φ > 0.7</p> <p>I- max. 4 A to 30 V, I- max. 0.2 A to 150 V</p> <p>When connecting a functional extra-low voltage circuit with double insulation in accordance with IEC 1010: The sum of the relay output and power supply voltages is max. 300 V.</p> <p>output N1 (FEW58): refer to datasheet of the connected switch amplifier acc. to IEC 60947-5-6 (NAMUR)</p>
Switching delay	<p>A switching delay of 2.0 s can be activated or deactivated via a DIL switch.</p> <p>If the switching delay is set to 0 s, the device switches after approx. 0.3 s.</p>
Galvanic isolation	output WA (FEW54): All input channels, output channels and relay contacts are galvanically isolated from each other.
Lead monitoring	<p>For probes without an electronic insert, an additional printed circuit board must be installed in the housing, which enables cable monitoring. It is always switched or connected between rod/rope 1 and 2.</p> <p>Note!</p> <p>When using switching units (transmitters) that do not support cable monitoring, these must be removed.</p>
Auxiliary energy	

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Electrical connection	see section electrical connection
Supply voltage	Output E5 (FEW52): supply voltage 10.8 ... 45 V DC load connection: open collector; PNP switching voltage: max. 45 V Output WA (FEW54): supply voltage 20 ... 55 V DC or 20 ... 253 V AC, 50/60 Hz peak inrush current: max. 2 A, max. 400 µs output: two potential-free change-over contacts output N1 (FEW58): refer to datasheet of the connected switch amplifier acc. to IEC 60947-5-6 (NAMUR)
Power consumption	Output E5 (FEW52): P < 1.1 W output WA (FEW54): P < 2.0 W
Current consumption	Output E5 (FEW52): I < 25 mA (without load) output WA (FEW54): 60 mA
Reverse polarity protection	output E5 (FEW52)
Contact loading	output WA (FEW54): 253 V AC/4 A, 30 V DC/4 A, 150 V/ 0.2 A
Signal on alarm	output N1 (FEW58): output signal with damaged sensor < 1 mA
Measurement accuracy	
Reference operating conditions	ambient temperature: 23 °C (296 K), medium temperature: 23 °C (296 K), medium viscosity: medium must release the probe again (drain off), medium pressure pe: 0 bar, probe installation: vertically from above
Maximum measured error	± 10 % at 0.1 ... 100 kΩ ± 5 % at 1 ... 10 kΩ
Non-repeatability	± 5 % at 0.1 ... 100 kΩ ± 1 % at 1 ... 10 kΩ
Hysteresis	-10 % for the max probe, in reference to the switch point, Δs function deactivated
Influence of ambient temperature	< 0.05 %/K
Switching time	< 3 s
Operating conditions	
Installation conditions	
Mounting location	The rod and rope probes are mounted predominantly in tanks made of plastic or metal.
Mounting examples	see section example applications
Ambient conditions	
Ambient temperature	-40 ... 70 °C (-40 ... 158 °F) -40 ... 60 °C (233 ... 333 K) for output N1 (FEW58)
Storage temperature	-40 ... 80 °C (-40 ... 176 °F)
Climate class	tropicalized
Shock resistance	practical test
Vibration resistance	20 ... 2000 Hz, 1 (m/s ²) ² /Hz
Process conditions	
Medium temperature	-40 ... 100 °C (-40 ... 212 °F)
Medium pressure	-1 ... 10 bar (-14.5 ... 145 psi)
Conductivity	≥ 10 µS
Mechanical specifications	
Degree of protection	IP66
Data for application in connection with hazardous areas	
EU-Type Examination Certificate	TÜV 03 ATEX 2295
Marking	⊕ II 2G Ex ia/ib IIC T4
Directive conformity	
Directive 2014/34/EU	EN 60079-0:2009 , EN 60079-11:2007
Mechanical construction	
Construction type	LKL-P1: rod version LKL-P2: rope version
Dimensions	LKL-P1: - housing: max. Ø85 mm (3.3 inch), height max. 145 mm (5.7 inch) - rod: length 100 ... 4000 mm (4 in ... 13 ft) LKL-P2: - housing: max. Ø85 mm (3.3 inch), height max. 145 mm (5.7 inch) - rope: length 250 ... 15000 mm (10 in ... 49 ft)
Mass	separate instrument version: - rod, 1 m (3 ft) long, LKL-P1 with 2, 3 or 5 rods: 415 g, 530 g, 760 g - rope, 1 m (3 ft) long, LKL-P2 with 2, 3 or 5 ropes: 390 g, 470 g, 640 g compact instrument version: - rod, 1 m (3 ft) long, LKL-P1 with 2 or 3 rods (600 g/720 g) - rope, 1 m (3 ft) long, LKL-P2 with 2 or 3 ropes (710 g/800 g)

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Material	<p>probes:</p> <ul style="list-style-type: none"> - rods: rod 1.4404/316L, insulation: PP - ropes: rope 1.4571/316Ti, insulation FEP, weight 1.4435/316L <p>housing:</p> <ul style="list-style-type: none"> - output NA (separate instrument version): housing PPS, cover PBT - output E5/WA/N1 (compact instrument version): housing PBT, cover PBT, adapter PBT <p>process connections: PPS</p>
Process connection	<ul style="list-style-type: none"> - cylindrical thread G1½A to DIN ISO 228/1 - conical thread 1½ NPT to ANSI B 1.20.1
Probe	<p>rod probes: compact instrument version 2 or 3 rods, separate instrument version 2, 3 or 5 rods</p> <ul style="list-style-type: none"> - diameter without insulation: Ø4 mm (0.16 inch) - rod length: 100 ... 4000 mm (4 in ... 13 ft) - thickness of insulation: 0.5 mm (0.02 inch) - length of non-insulated area (tip of rod): 20 mm (0.8 inch) - extraction forces: 1000 N <p>rope probes: compact instrument version 2 or 3 ropes, separate instrument version 2, 3 or 5 ropes</p> <ul style="list-style-type: none"> - diameter without insulation: Ø1 mm (0.04 inch) - rope length: 250 ... 15000 mm (10 inch ... 49 ft) - thickness of insulation: 0.75 mm (0.03 inch) - weight length: 100 mm (4 inch) (not insulated) - weight diameter: Ø10 mm (0.4 inch) - extraction forces: 500 N
Electrical connection	cable connection M20x1.5, 1/2NPT, G1/2
Indication and operation	
Display elements	<p>separate instrument version: dependent on the connected switching unit</p> <p>compact instrument version:</p> <p>output E5 (FEW52), WA (FEW54):</p> <ul style="list-style-type: none"> - one red light emitting diode: fault message, switching status - one green light emitting diode: operation <p>output N1 (FEW58):</p> <ul style="list-style-type: none"> - one yellow light emitting diode: fault message, switching status - one green light emitting diode: operation
Control elements	<ul style="list-style-type: none"> - 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
Certificates and approvals	
Overspill protection	see approval (ZE)
General information	
Supplementary documentation	<p>technical information TI375O</p> <p>operating instructions KA203O (LKL-P* without electronic insert)</p> <p>operating instructions KA204O (LKL-P* with integrated electronic insert)</p> <p>safety information SI230O (TÜV 03 ATEX 2295)</p> <p>safety information SI226O (Ex) II 3G EEx nA [L] IIC T6 or nC [L]</p> <p>approval ZE043O overspill protection acc. to WHG (Z-65.13-378)</p> <p>approval ZE257O leak detection system (Z-65.40-379)</p>
Supplementary information	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity, Attestation of Conformity and instructions have to be observed where applicable. For information see www.pepperl-fuchs.com .

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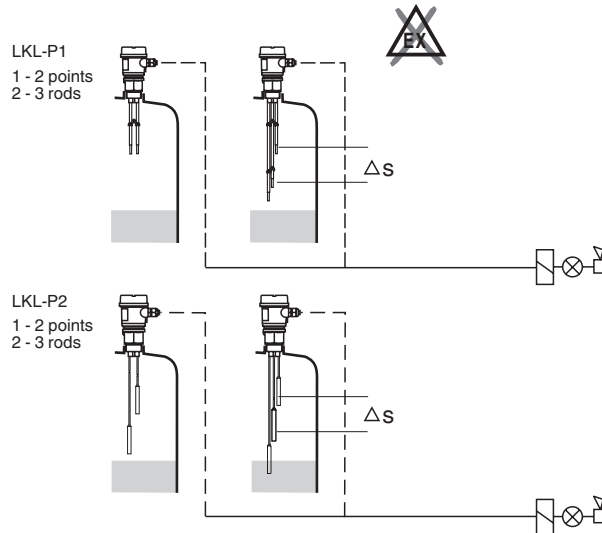
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Measuring system

Probes with integrated electronic insert (compact instrument version)

The measuring system consists of:

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

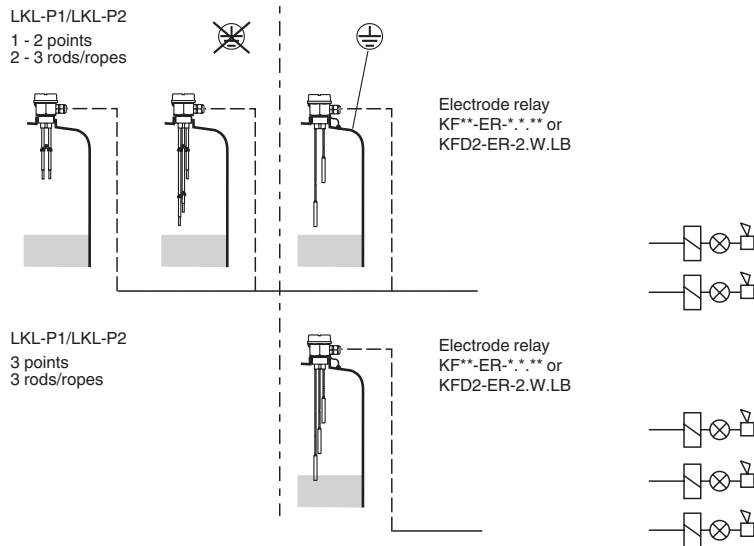


Switch points independent of the tank material.

Probes without integrated electronic insert (separate instrument version) for one or two point detection respectively

The measuring system consists of:

- LKL-P1, LKL-P2 with two/three rods or ropes
- Electrode relays KF**-ER-*.**.**. or KFD2-ER-2.W.LB
- Control units, switches or signal transmitters, e. g. process control systems PLC, relays, etc.
- systems PLC, relays, etc.

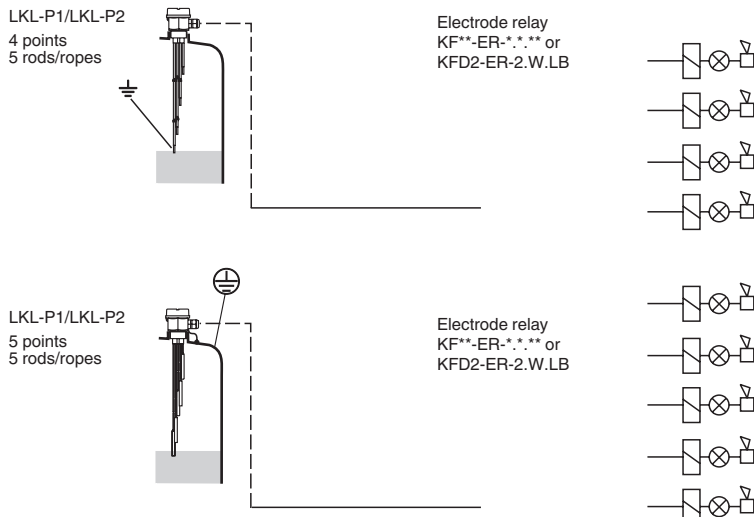


Switch points dependent of the tank material.

Probes without integrated electronic insert (separate instrument version) with multiple point detection

The measuring system consists of:

- LKL-P1, LKL-P2 with five rods or ropes
- Electrode relays KF**-ER-*.**.**. or KFD2-ER-2.W.LB
- Control units, switches or signal transmitters, e. g. process control systems PLC, relays, etc.
- systems PLC, relays, etc.



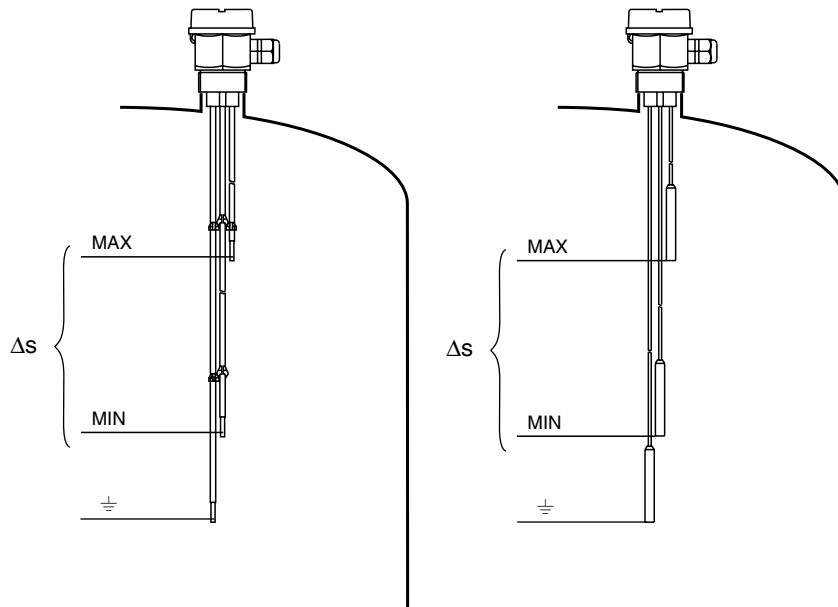
Switch points dependent of the tank material.

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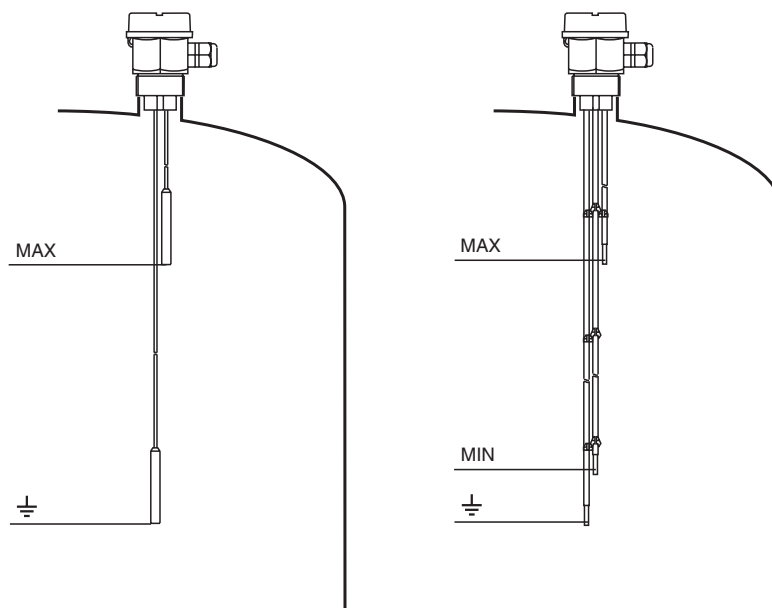
Example applications

Level limit detection (standard applications)



Two-point control (Δs) e. g. pump control

Level limit detection (standard applications)



Level limit detection (MAX)
Maximum and minimum detection for compact-instrument devices only possible with Δs .

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Electrical connection

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

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

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

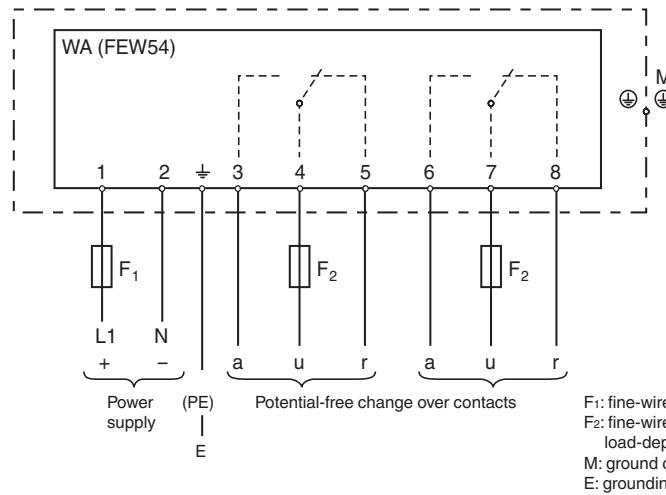
Protection against voltage peaks and short-circuits:

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

Output signal:

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

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



Fail safe mode	Switch point	Output signal	rd
MAX Max.		*1	● *3
		*2	☀ *4
Min. MIN		*1	● *3
		*2	☀ *4

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

Electrical connection

**Output E5 (FEW52)
compact instrument version**

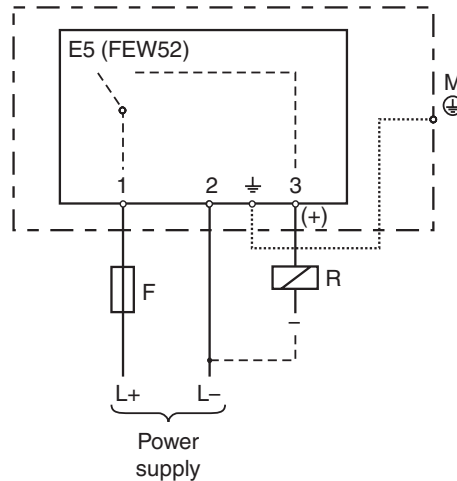
Transistor circuit for load:

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

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

Protection against voltage peaks:

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



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

Output signal:

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

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

Fail safe mode	Switch point	Output signal	rd
Max. 		*1 L+ 1 → I _L → 3	*3 ●
		*2 1 → < 100 μA → 3	*4 ☉
Min. 		L+ 1 → I _L → 3	●
		+ 1 → < 100 μA → 3	☉

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

Electrical connection

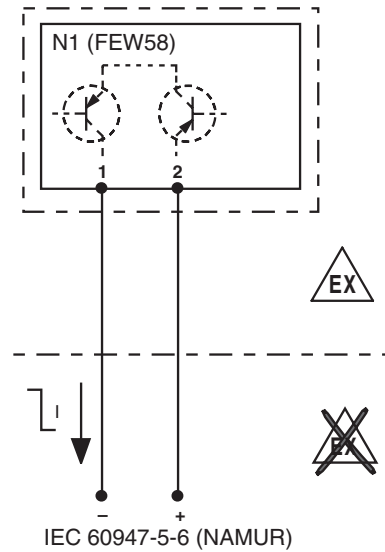
**Output N1 (FEW58)
compact instrument version**

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

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

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

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



Output signal:

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

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

= lit = flashes = unlit

Electrical connection

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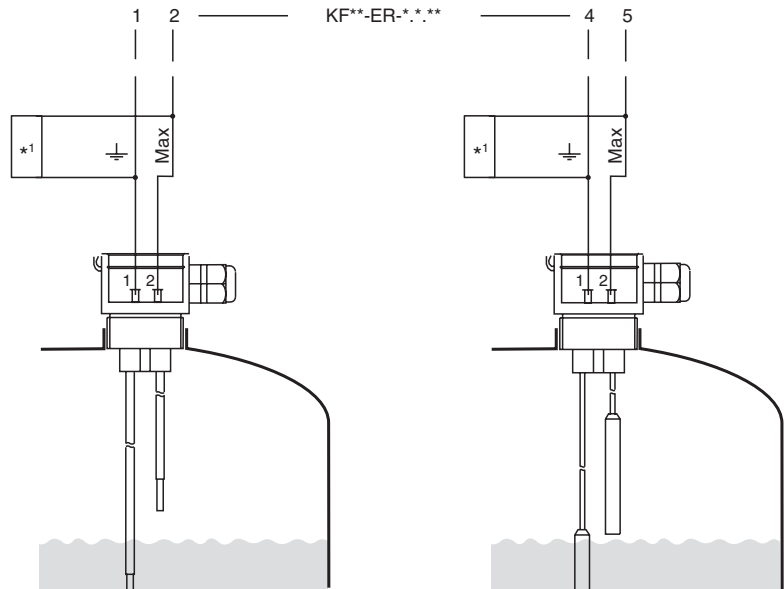
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**Output NA
separate instrument version**

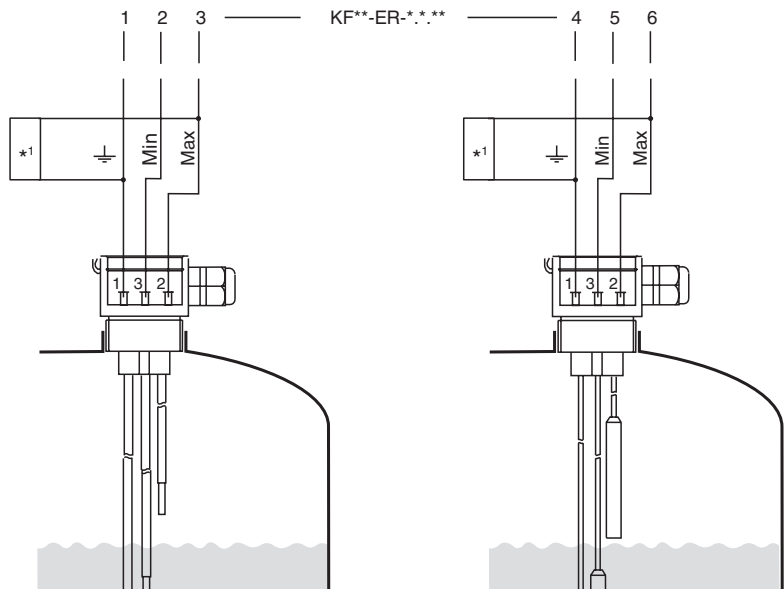
Separate instrumentation for 2-rod or 2-rope probes with cable monitoring

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



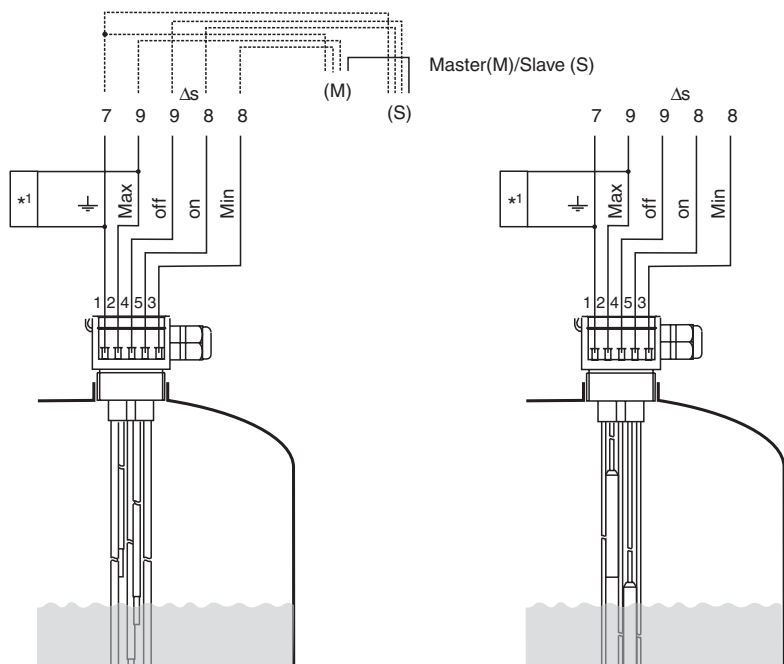
Separate instrumentation for 3-rod or 3-rope probes with cable monitoring

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



Separate instrumentation for 5-rod or 5-rope probes with cable monitoring

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



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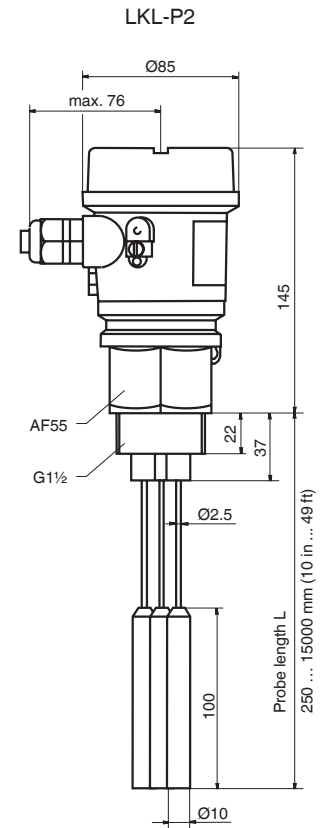
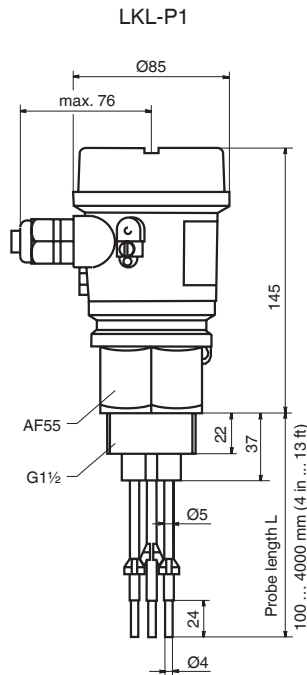
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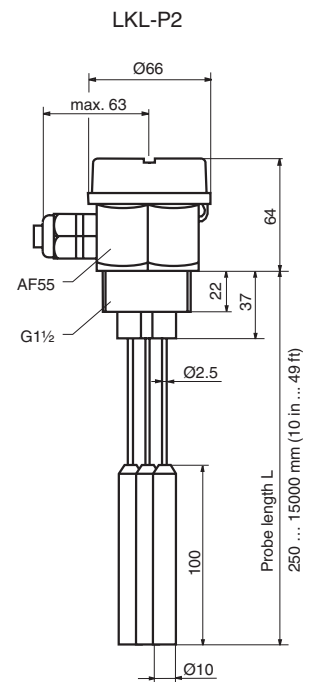
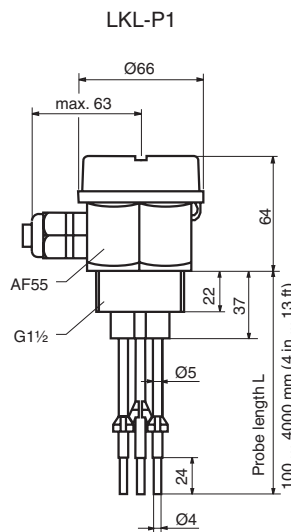
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Dimensions

Rod and rope version with G1½ (compact-instrument version with electronic insert)



Rod and rope version with G1½ (separate-instrument version without electronic insert)



All dimensions in mm! (100 mm = 3.94 in)

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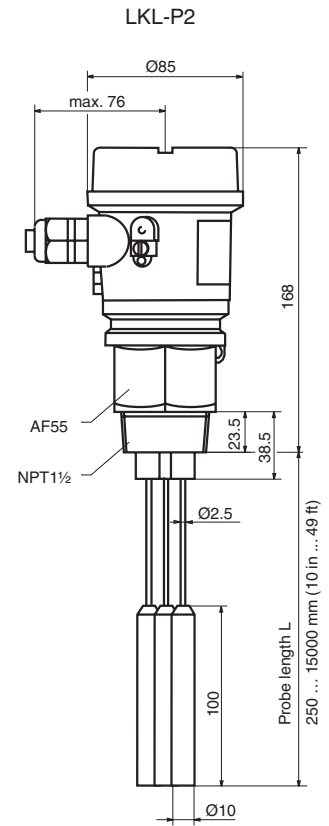
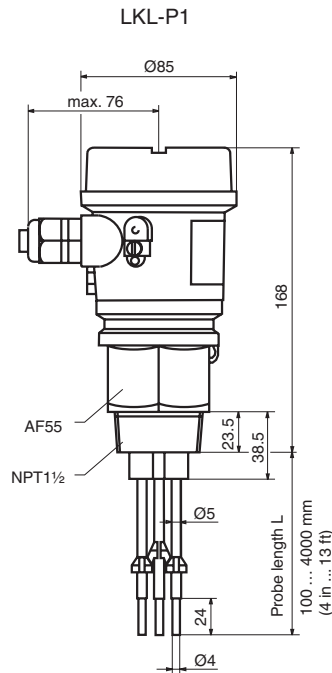
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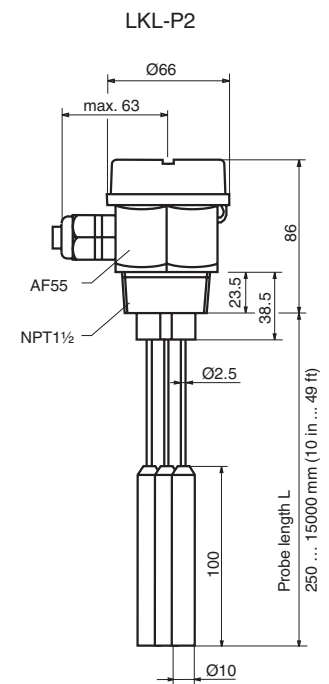
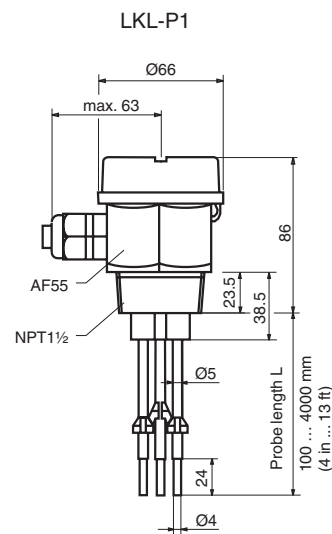
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Dimensions

Rod and rope version with 1½ NPT (compact-instrument version with electronic insert)



Rod and rope version with 1½ NPT (separate-instrument version without electronic insert)



All dimensions in mm! (100 mm = 3.94 in)

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PF PEPPERL+FUCHS

Accessories

- LKL-Z10, lock nut G1½, AF60
- LZ-1204, mounting bracket G1½
- Electronic insert E5 (FEW52), output PNP 10.8 V DC ... 45 V DC
- Electronic insert WA (FEW54), output relay 20 V AC ... 253 V AC, 20 V DC ... 55 V DC
- Electronic insert N1 (FEW58), output NAMUR (IEC 60947-5-6)

Type code/model number

L	K	L	-	P	1	-				-				-			
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Certificates and approvals

NA version for non-explosion hazardous area

WH overspill protection WHG with leakage approval

EB (Ex) II 2G EEx ia/ib IIB/IIC T5 ... T6, WHG

EC (Ex) II 3G EEx 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 FEW52, PNP output, 10.8 V DC ... 45V DC (compact instrument version)

WA FEW54, relay output, 20 V AC ... 253 V AC (compact instrument version)

N1 FEW58, NAMUR, H-L edge (compact instrument version)

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 in mm, 100 mm ... 4000 mm*

B in in, 4 in ... 158 in*

C 1000 mm (3 ft)

D 2000 mm (3 ft)

Quantity and rod type

2 2 rods, 1.4435/316L isolation PP

3 3 rods, 1.4435/316L isolation PP

5 5 rods, 1.4435/316L isolation PP

Process connection

G5 G1½, DIN ISO 228/1, PPS

N5 1½ NPT, ANSI B 1.20.1, PPS

Version

1 rod version

* price is independent from length

L	K	L	-	P	2	-				-				-			
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Certificates and approvals

NA version for non-explosion hazardous area

WH overspill protection WHG with leakage approval

EB (Ex) II 2G EEx ia/ib IIB/IIC T5 ... T6, WHG

EC (Ex) II 3G EEx 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 FEW52, PNP output, 10.8 V DC ... 45V DC (compact instrument version)

WA FEW54, relay output, 20 V AC ... 253 V AC (compact instrument version)

N1 FEW58, NAMUR, H-L edge (compact instrument version)

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 in mm, 250 mm ... 15000 mm

B in in, 10 in ... 590 in

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 G1½, DIN ISO 228/1, PPS

N5 1½ NPT, ANSI B 1.20.1, PPS

Version

2 rope version

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Refer to "General Notes Relating to Pepperl+Fuchs Product Information".