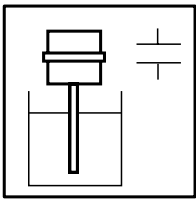


## Capacitive limit switch



### LCL\*

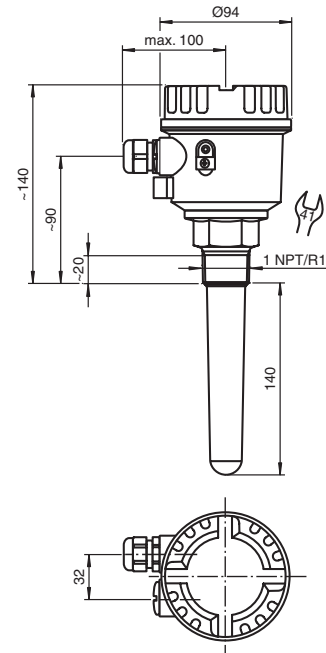


### Features

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

## Dimensions

LCL1, compact version with rod probe



Additional dimensions see section dimensions.

### Function

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

Versions:

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

### Electrical connection

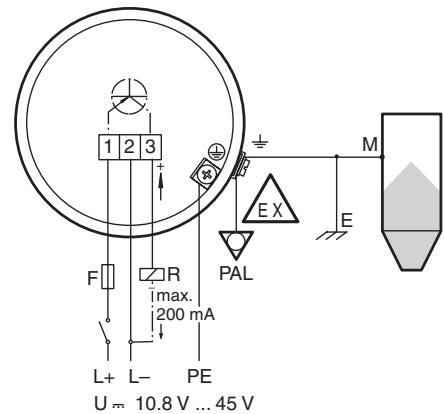
Connection type E5, 3-wire DC connection (example)

3-wire DC connection

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

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

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



Other connection types see section electrical connection.

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

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Technical data	Capacitive limit switch LCL*
Overvoltage protection	overvoltage category III
<b>Process conditions</b>	
Process temperature	LCL1: -40 ... 120 °C (233 ... 393 K) (-40 ... 80 °C (233 ... 353 K), dust-Ex version) LCL2: -20 ... 70 °C (253 ... 343 K) see section temperature ranges
Process temperature limits	LCL1: -40 ... 130 °C (233 ... 403 K) (-40 ... 80 °C (233 ... 353 K), dust-Ex version) LCL2: -40 ... 80 °C (233 ... 353 K) see section temperature ranges , grey background
Medium pressure limits	LCL1: -1 ... 25 bar LCL2: -1 ... 6 bar
<b>Mechanical specifications</b>	
Protection degree	IP66
<b>Mechanical construction</b>	
Construction type	LCL1: compact version with rod probe LCL2: version with rope probe
Dimensions	housing: LCL1 Ø94 x 140 mm (3.7 x 5.5 in), LCL2 Ø94 x 145 mm (3.7 x 5.7 in) process connections: see section dimensions probe: LCL1 length 140 mm (5.5 in), LCL2 length 500 ... 6000 mm (1.7 ... 20 ft)
Mass	LCL1: 560 g LCL2: 1230 g (basic weight for 500 mm probe length)
Material	housing: PBT-FR with cover in PBT-FR or with transparent cover in PA12, seal of cover: EPDM cable gland: polyamide or brass, nickel-plated wetted parts: - rod probe: PPS Polyphenylenesulphide (glass fibre content 40 %) - rope probe: armoured steel with HD-PE coating - other probe components: PPS Polyphenylenesulphide (glass fibre content 40 %)
Mechanical loading	LCL1: flexural strength 1400 N (at probe tip) LCL2: tensile strength max. 3000 N up to 40 °C (313 K), max. 2800 N at 80 °C (353 K)
Switching point	sensor switch points depend on the mounting location, in relation to the reference operating conditions LCL1: horizontal centre of probe -5 mm (-0.2 in), vertical 40 mm (1.6 in) above tip of the probe LCL2: vertical 35 mm (1.4 in) above tip of the probe
Process connection	- conical thread R1, R1½ to DIN 2999, part 1 - conical thread 1 NPT, 1½ NPT to ANSI B 1.20.1
<b>Indication and operation</b>	
Display elements	green LED: standby indication red LED: switch status indication
Operating elements	switch on electronic insert - switching between minimum and maximum fail-safe mode - sensitivity setting (depends on the dielectric constant and build-up). A sensitivity adjustment is normally not required.
<b>Certificates and approvals</b>	
Ex approval	LCL1: DMT 01 ATEX E 122, LCL2: KEMA 01 ATEX 1149 , for additional certificates see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a>
Type of protection	⊕ II 1/3D IP66 T97°C (DMT 01 ATEX E122) ⊕ II 1/3D [EEx ia] IIB T97°C (KEMA 01 ATEX 1149)
Overspill protection	LCL1: Z-65.13-313 (overspill protection in acc. with WHG)
<b>General information</b>	
<b>Directive conformity</b>	
Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1
Directive 89/336/EC (EMC)	emitted interference to EN 61326, class B equipment interference immunity to EN 61326, annex A (industrial sector)
Directive 94/9 EC (ATEX)	EN 50014, EN 50020, EN 50281-1-1
<b>Conformity</b>	
Electromagnetic compatibility	NE 21
Protection degree	EN 60529
Climate class	EN 60068, part 2-38, fig. 2a
Vibration resistance	EN 60068-2-64, 20 ... 2000 Hz, spectral rate of velocity 0.5, 100 min per axis
<b>Supplementary documentation</b>	
	technical information TI-LCL operating instructions KA093O (LCL1) operating instructions KA094O optimising performance (LCL1) operating instructions KA098O adapter for LCL1 (LCL-Z11, LCL-Z12) operating instructions KA099O transparent cover (LCL-Z10) operating instructions KA155O (LCL2) operating instructions KA156O fail-safe mode (LCL2) operating instructions KA157O rope shortening for LCL2 (LCL-Z14) safety information SI092O (LCL2, KEMA 01 ATEX 1149) safety information SI011O (LCL1, DMT 01 ATEX E 122) approval ZE232O overspill protection (Z-65.13-313)
<b>Supplementary information</b>	EC-Type Examination Certificate, Statement of Conformity, Declaration of Conformity and instructions have to be observed. For information see <a href="http://www.pepperl-fuchs.com">www.pepperl-fuchs.com</a> .

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Electrical connection

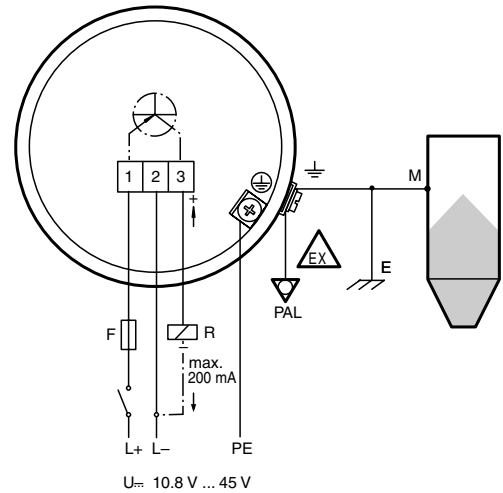
Electronic insert E5

3-wire DC connection

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

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

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

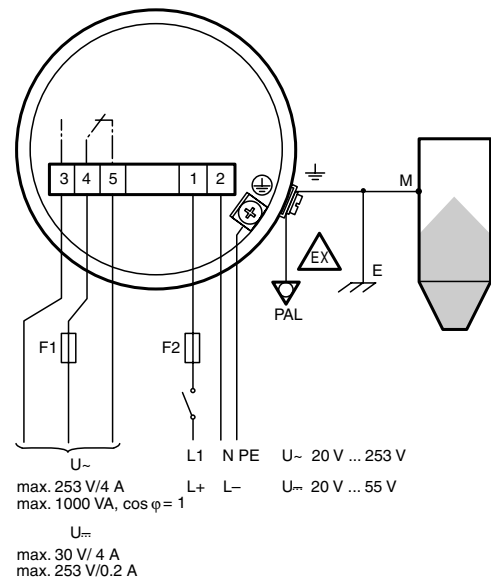


Electronic insert WA

AC/DC connection with relay output

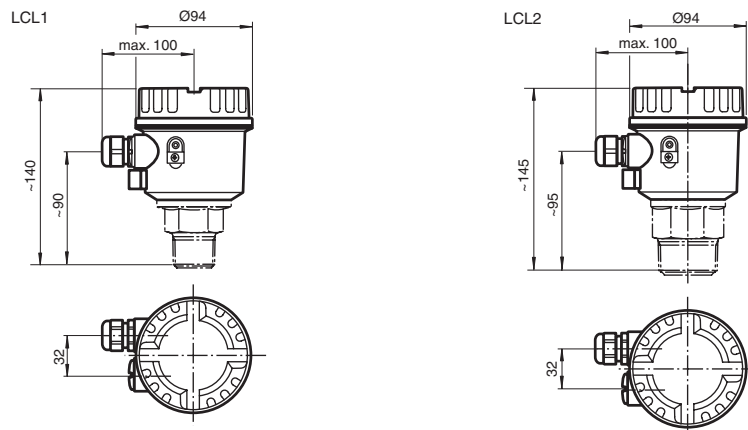
- F1: fine-wire fuse for the protection of the relay contact, dependent on the connected load
- F2: fine-wire fuse, 500 mA
- M: connection to ground, silo or metal parts silo
- E: grounding

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

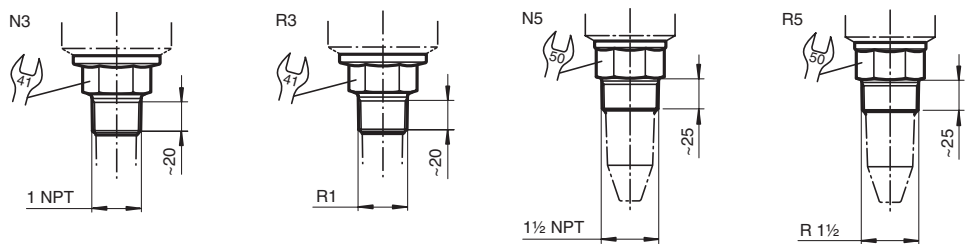


Dimensions

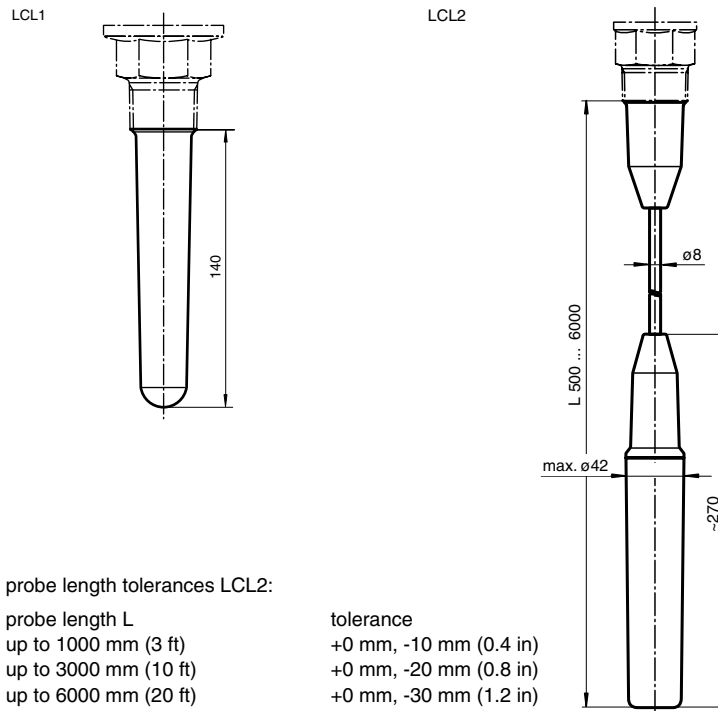
Housing



Process connections

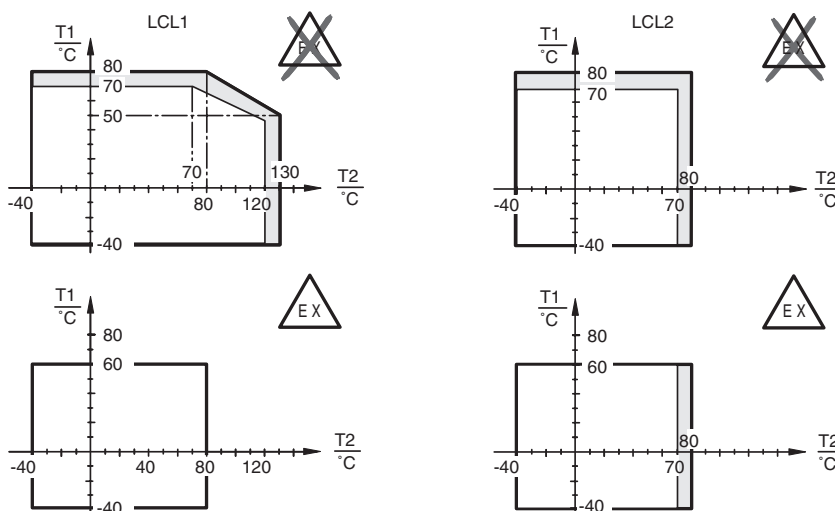


Probe length



Temperature ranges

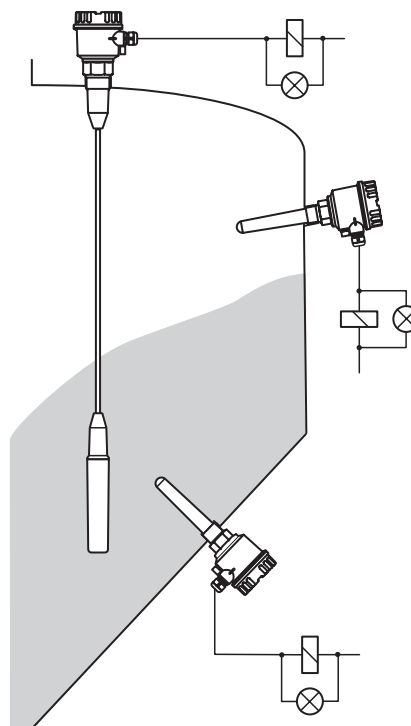
T1 = ambient temperature range  
T2 = process temperature range



Measuring system

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

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



Accessories

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

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Type code/model number



**Certificates**

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

**Optional equipment**

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

**Electronical output**

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

**Housing**

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

**Length and material**

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

**Process connection**

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

**Versions**

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