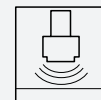




Ultrasonic Level Sensor

LUC-M**



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



Function

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

The system integration is ensured via

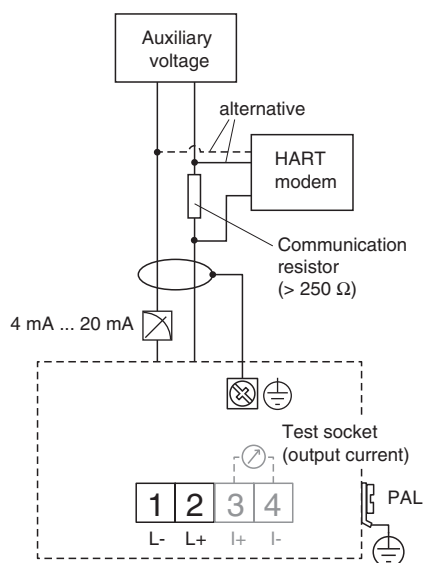
- HART (standard), 4 mA ... 20mA and
- PROFIBUS PA.

The maximum measuring range with

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

Connection

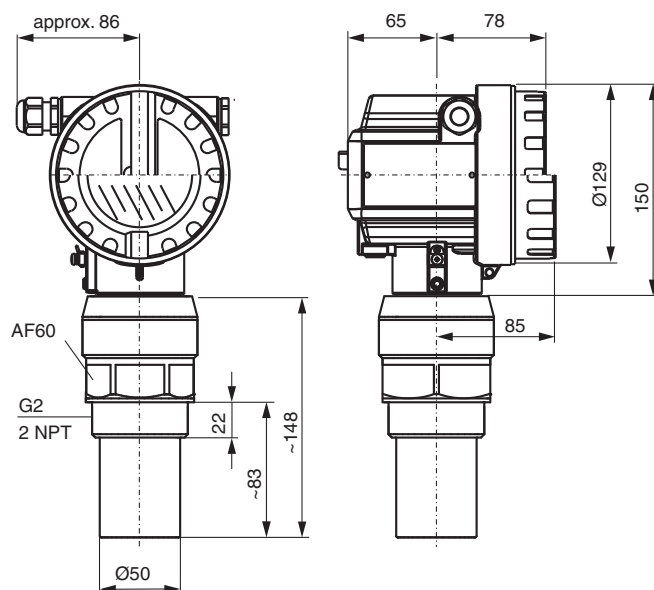
Connection IH, 4 mA ... 20 mA with HART, 2-wire (example)



Other connection types see section electrical connection.

Dimensions

LUC-M20 with F12 housing
and process connection 2"



Additional dimensions
see section dimensions.

Technical Data

Function and system design

Measuring principle

The sensor of the device transmits ultrasonic pulses in the direction of the product surface. There, the ultrasonic pulses are reflected back and received by the sensor. The device measures the time between pulse transmission and reception. The instrument uses the time (and the velocity of sound) to calculate the distance between the sensor membrane and the product surface. As the device knows the empty distance from a user entry, the device calculate the level.

Equipment architecture

4 ... 20 mA output with HART protocol
system integration via PROFIBUS PA

Input characteristics

Measured variable

distance between the sensor membrane and the product surface
using the linearization function, the device calculate

- level in any units
- volume in any units
- flow across measuring weirs or open channels in any units

Measurement range

LUC-M10: max. 5 m (16.4 ft) in fluids and 2 m (6.6 ft) in bulk materials
LUC-M20: max. 8 m (26.2 ft) in fluids and 3.5 m (11.5 ft) in bulk materials
LUC-M30: max. 15 m (49.2 ft) in fluids and 7 m (23 ft) in bulk materials
LUC-M40: max. 10 m (32.8 ft) in fluids and 5 m (16.4 ft) in bulk materials

Blocking distance

LUC-M10: 0.25 m (0.8 ft)
LUC-M20: 0.35 m (1 ft)
LUC-M30: 0.6 m (2 ft)
LUC-M40: 0.4 m (1.3 ft)

Operating frequency

LUC-M10: approx. 70 kHz
LUC-M20: approx. 50 kHz
LUC-M30: approx. 35 kHz
LUC-M40: approx. 42 kHz

Output characteristics

Output signal

according to the instrument version:
- 4 ... 20 mA with HART protocol
- PROFIBUS PA

Signal on alarm

error information can be accessed via the following interfaces:
- on-site display (error symbol, error code and plain text description)
- current output (configurable)
- digital interface

Output damping

0 ... 255 s, freely selectable

Load

minimum load for HART communication: 250 Ω

Linearization

The linearization function of the device allows conversion of the measured value into any unit of length or volume. In open channels or measuring weirs, also a flow linearization is possible (calculation of the flow from the measured level).

Technical Data

Auxiliary energy

Electrical connection	terminal compartment: In the F12 housing, the terminals are located underneath the housing cover, in the T12 housing, they are under the cover of the separate terminal compartment. cable gland: M20x1.5 (recommended cable diameter 6 ... 10 mm (0.24 ... 0.4 inch)) cable entry G1/2 or NPT1/2 PROFIBUS PA: M12 plug connector
Supply voltage	2-wire HART (standard): - current consumption 4 ... 20 mA - min. terminal voltage 14 V (at 4 mA), 8 V (at 20 mA) - max. terminal voltage 36 V 4-wire HART: - DC version: voltage 10.5 ... 32 V, max. load 600 Ω - AC version: 90 ... 253 V, max. load 600 Ω PROFIBUS PA: 9 ... 32 V DC for additional information see technical information
Power consumption	2-wire: 51 ... 800 mW 4-wire AC: max. 4 VA 4-wire DC: 0.6 ... 1 W
Current consumption	2-wire devices: - HART: 3.6 ... 22 mA - PROFIBUS PA: max. 13 mA
Ripple	HART: 47 ... 125 Hz, $U_{pp} = 200$ mV (measured at 500 Ω)
Noise	HART: 0.5 ... 10 kHz, $U_{rms} = 2.2$ mV (measured at 500 Ω)
Galvanic isolation	at 4-wire devices with evaluation electronics and mains voltage
Terminal assignment	see section electrical connection

Measurement accuracy

Reaction time	depends on the parameter settings: - min. 0.5 s for 4-wire devices - min. 2 s for 2-wire devices
Reference operating conditions	temperature = 20 °C (68 °F) pressure = 1013 mbar _{abs} humidity = 50 % ideal reflective surface (e. g. calm, smooth fluid surface) no interference reflections within signal beam set application parameters: - tank shape = flat ceiling - medium property = liquid - process conditions = calm surface
Measured value resolution	LUC-M10, LUC-M20: 1 mm (0.04 inch) LUC-M30, LUC-M40: 2 mm (0.08 inch)
Measuring frequency	2-wire devices: max. 0.5 Hz 4-wire devices: max. 2 Hz dependent on the type of device and the parameter settings
Maximum measured error	typical specifications for reference operating conditions (include linearity, repeatability, and hysteresis): ± 2 mm (0.08 inch) or 0.2% of set measuring range (empty calibration) ¹⁾ whichever is greater

Operating conditions

Installation conditions	see technical information (TI)
Ambient conditions	
Ambient temperature	-40 ... 80 °C (-40 ... 176 °F) , For further information see technical information.
Storage temperature	-40 ... 80 °C (-40 ... 176 °F)
Resistance to alternating temperature cycles	Nb test: +80 °C/- 40 °C (353 K/233 K), 1 K/min, 100 cycles
Vibration resistance	20 ... 2000 Hz, 1 (m/s ²)/Hz; 3 x 100 min
Process conditions	
Process temperature	-40 ... 80 °C (-40 ... 176 °F) (233 ... 353 K), a temperature sensor is integrated in the sensor for correction of the temperature-dependent time-of-flight
Process pressure (static pressure)	LUC-M10, LUC-M20: 0.7 ... 3 bar _{abs} LUC-M30, LUC-M40: 0.7 ... 2.5 bar _{abs}

Mechanical specifications

Degree of protection	with closed housing, tested according to - IP68, NEMA 6P (24 h at 1.83 m under water surface) - IP66, NEMA 4X with open housing: IP20, NEMA 1 (also ingress protection of the display)
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Mechanical construction

Technical Data

Construction type	housing design: - F12 housing with sealed terminal compartment for standard or EEx ia applications - T12 housing with separate terminal compartment and flameproof encapsulation cover: - version without on-site display - version with on-site display (transparent cover), this version cannot be supplied together with the ATEX II 1/2D certificate
Dimensions	see section dimensions
Mass	LUC-M10: approx. 2.5 kg LUC-M20: approx. 2.6 kg LUC-M30: approx. 3.5 kg LUC-M40: approx. 3 kg
Material	material in contact with process: - LUC-M10, LUC-M20: sensor PVDF, seal EPDM - LUC-M30: sensor UP and stainless steel 1.4571/316Ti, seal EPDM, flange PP or stainless steel 1.4571/316Ti - LUC-M40: sensor PVDF, seal Viton or EPDM, flange PP, PVDF or stainless steel 1.4535/316L housing: aluminum, seawater resistant, chromated, powder-coated cover: - aluminum, for version without on-site display - inspection glass for version with on-site display
Process connection	- cylindrical thread G1-1/2B, G2B to DIN/ISO 228/1 - conical thread NPT1-1/2, NPT2 to ANSI B 1.20.1 - flanges to EN 1092-1 from DN80, to ANSI B 16.5 from 3 inch, to JIS B 2238 (RF) from DN80 - mounting bracket LUC-Z17
Electrical connection	cable gland M20x1.5 cable gland NPT1/2 cable gland G1/2 PROFIBUS PA plug M12x1
Indication and operation	
Display elements	display and operating module LUC-Z15 at the device
Control elements	on-site operation: - via 3 keys of the display and operating module - via handheld terminal remote control: - operation with operating program (for communication variants HART or PROFIBUS-PA)
Certificates and approvals	
Explosion-hazardous area	KEMA 05 ATEX 1111, KEMA 05 ATEX 1112, for additional certificates see www.pepperl-fuchs.com
Type of protection	⊕ II 1/2G or II 2G EEx ia IIC T6 (KEMA 05 ATEX 1111) ⊕ II 1/2G or II 2G EEx d [ia] IIC T6 (KEMA 05 ATEX 1111) ⊕ II 1/2G or II 2G EEx em [ia] IIC T6 (KEMA 05 ATEX 1111) ⊕ II 1/2D or II 2D or II 1/3D or II 3D T115°C or T100°C or T95°C (KEMA 05 ATEX 1111) ⊕ II 1/2D or II 2D or II 1/3D or II 3D T115°C or T83°C or T84°C or T86°C (KEMA 05 ATEX 1112) ⊕ II 3G EEx nA II T6
General information	
Directive conformity	
Directive 73/23/EEC (Low Voltage Directive)	EN 61010-1
Directive 89/336/EEC (EMC)	emitted interference to EN 61326, class B equipment noise immunity to EN 61326, annex A (industrial sector) A standard installation cable is sufficient if only the analog signal is used. Use a screened cable when working with a superimposed communication signal (HART).
Directive 94/9/EC (ATEX)	EN 50014, EN 50018, EN 50019, EN 50020, EN 50028, EN 50281-1-1, EN 50284
Conformity	
Electromagnetic compatibility	NE 21
Degree of protection	EN 60529
Climate class	EN 60068-2-38 (test Z/AD) DIN/IEC 68 T2-30Db
Vibration resistance	EN 60068-2-64
Resistance to alternating temperature cycles	EN 60068-2-14

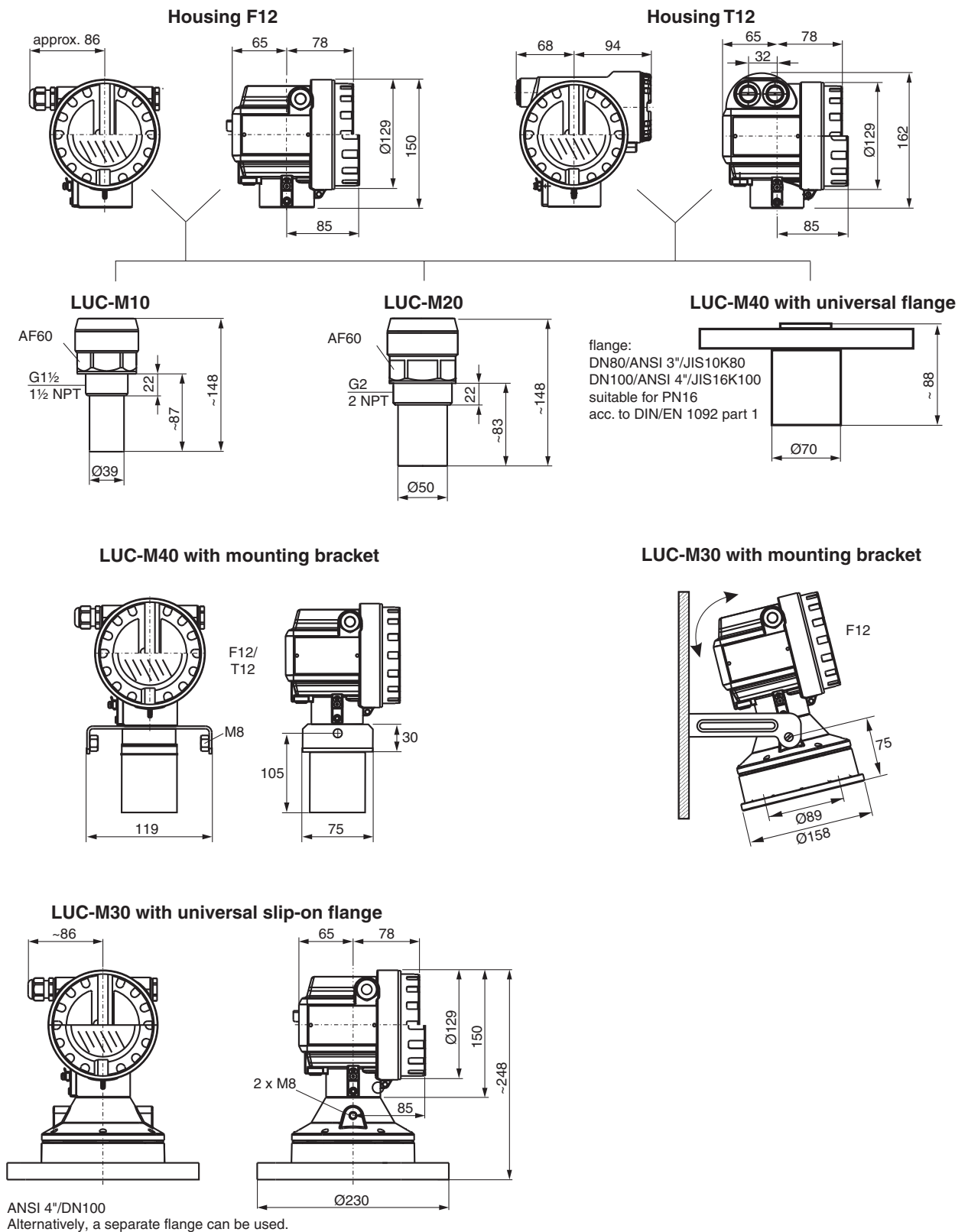
Technical Data

Supplementary documentation	technical information TI3650 short instructions KA1830 (can be found under the device housing cover) operating instructions KA1910 (connection LUC-M**) operating instructions BA2370 (4 ... 20 mA, HART devices) operating instructions BA2380 (PROFIBUS PA devices) operating instructions BA2400 (description of device functions) safety information SI1740 (KEMA 05 ATEX 1111), HART devices safety information SI1750 (KEMA 05 ATEX 1111), PROFIBUS PA devices safety information SI1760 (KEMA 05 ATEX 1111) safety information SI1770 (KEMA 05 ATEX 1112), HART devices safety information SI1780 (KEMA 05 ATEX 1112), PROFIBUS PA devices safety information SI1790 (II 3G EEX nA II T6) safety information SI1800 (KEMA 05 ATEX 1111) safety information SI2240 (KEMA 05 ATEX 1111), HART devices safety information SI2250 (KEMA 05 ATEX 1111), PROFIBUS PA devices safety information SI2590 (KEMA 05 ATEX 1111), HART devices FM control drawing ZD0960 (HART devices, F12 housing) FM control drawing ZD0970 (PROFIBUS PA devices) FM control drawing ZD0980 (T12 housing) FM control drawing ZD1390 (HART devices, T12-OVP housing) FM control drawing ZD1400 (PROFIBUS PA devices, T12-OVP housing) CSA control drawing ZD0880 (HART devices, F12 housing) CSA control drawing ZD0990 (PROFIBUS PA devices) CSA control drawing ZD1000 (T12 housing) CSA control drawing ZD1010 (HART devices, T12 housing) CSA control drawing ZD1020 (PROFIBUS PA devices)
Supplementary information	Observe the certificates, declarations of conformity, instruction manuals, and manuals where applicable. For information see www.pepperl-fuchs.com .

Accessories

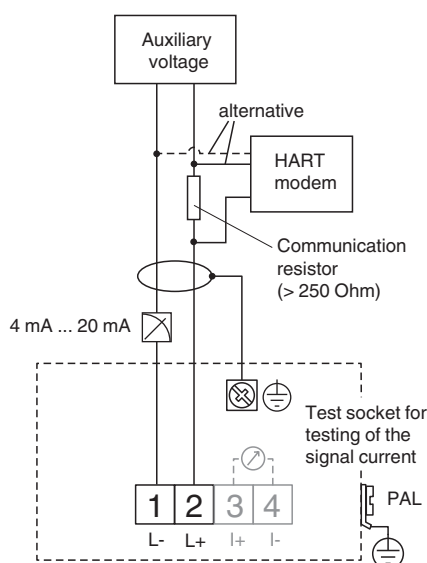
	PACTware 5.X	FDT Framework
	DTM Level Control	

Dimensions

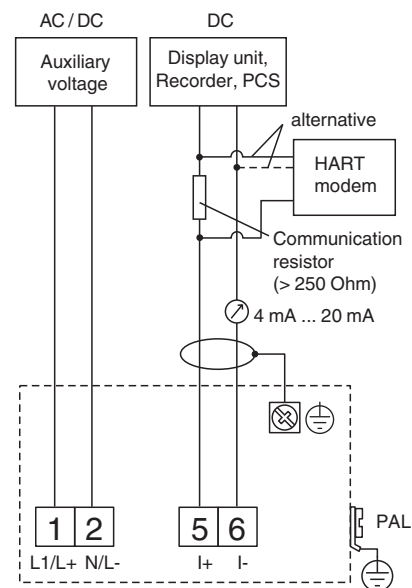


Connection

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

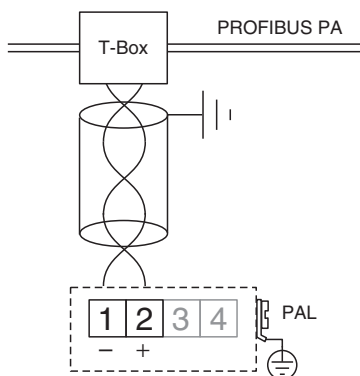


Connection AH, DH
4 mA ... 20 mA with HART, active, 4-wire



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

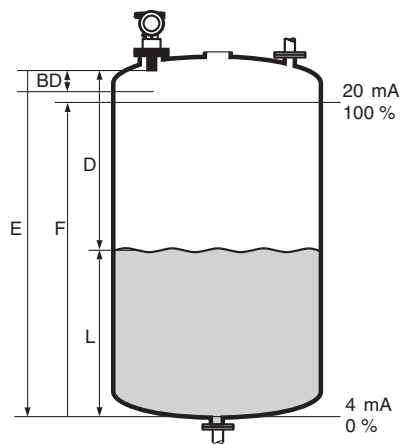
Connection PA
PROFIBUS PA



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

Technical Features

Blocking distance



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

E: empty distance

F: span (full distance)

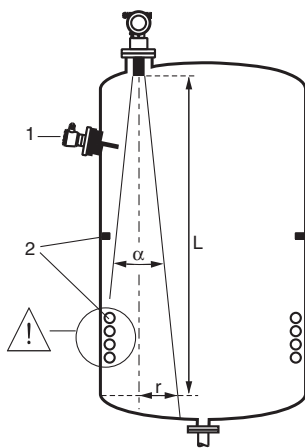
D: distance from sensor membrane - product surface

L: level

BD: blocking distance

Emitting angle

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



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

Type Code

Product structure LUC-M10

L	U	C	-	M	1	0	-						-				-		
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Certificate

NA version for non-explosion hazardous areas

EX e ll 1/2G EEx ia IIC
T6

ES e II 1/2D, aluminium cover

E2 e II 1/3D

SX e II 1/2G EEx d (ia) IIC T6

S2 e || 3G EEx nA || T6

F1 FM IS, Cl. I/II/III, Div.1 Group A-G, N.I .Cl. I, Div.2

F2 FM XP, Cl. I/II/III, Div. 1, Group A-G

CG CSA, General Purpose

C1 CSA IS, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.

C2 CSA XP, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.

Display

A * prepared for remote display, order display as accessory LUC-Z40

B without display

Product structure LUC-M20

L	U	C	-	M	2	0	-						-				-		
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Certificate

NA version for non-explosion hazardous areas

EX e II 1/2G EEx ia IIC
T6

ES e II 1/2D, aluminium cover

E2 e II 1/3D

SX e II 1/2G EEx d (ia) IIC T6

S2 e || 3G EEx nA || T6

F1 FM IS, Cl. I/II/III, Div.1 Group A-G, N.I .Cl. I, Div.2

F2 FM XP, Cl. I/II/III, Div. 1, Group A-G

CG CSA, General Purpose

C1 CSA IS, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.

C2 CSA XP, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.

Display

A * prepared for remote display, order display as accessory LUC-Z40

B without display

Product structure LUC-M30

L	U	C	-	M	3	0	-												
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Certificate

- NA** version for non-explosion hazardous areas
- ES** e II 1/2D, aluminium cover
- E2** e II 1/3D
- FM** FM DIP, Cl. II, Div.1 Group E-G, N.I .Cl. I, Div.2
- CG** CSA, General Purpose
- CS** CSA DIP, Cl. II, Div. 1, Group E-G, N.I .Cl. I, Div.2

Display

- A** * prepared for remote display, order display as accessory LUC-Z40
- B** without display
- D** with display LUC-Z15 inclusive on-site operation, envelope curve display

Electrical output

- AH** 4-wire, 90 V AC ... 250 V AC, 4 mA ... 20

Product structure LUC-M40

L	U	C	-	M	4	0	-												
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Certificate

- NA** version for non-explosion hazardous areas
- EX** e II 1/2G EEx ia IIC T6
- ES** e II 1/2D, aluminium cover
- E2** e II 1/3D
- SX** e II 1/2G EEx d (ia) IIC T6
- S2** e II 3G EEx nA II T6
- F1** FM IS, Cl. I/II/III, Div.1 Group A-G, N.I .Cl. I, Div.2
- F2** FM XP, Cl. I/II/III, Div. 1, Group A-G
- CG** CSA, General Purpose
- C1** CSA IS, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.
- C2** CSA XP, Cl. I/II/III, Div. 1, Group A-D, G + coal dust, N.I.

Additional option

- A** basic version

Sealing sensor/flange

- 2** Viton
- 3** EPDM

Display

- A** * prepared for remote display, order display as accessory LUC-Z40
- B** without display
- D** with display LUC-Z15 inclusive on-site operation, envelope curve display

Accessories

Mounting accessories

- LUC-Z17, mounting bracket for LUC-M30, LUC-M40

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

Flanges

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

Further accessories

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

for additional information see technical information