DLS-35

Dinel®

CAPACITIVE LEVEL SENSOR

Universal sensors for limit level detection of liquids, bulk materials, and powders.

MIN -40°C

adjustment with magnetic pen

- **Universal use for limit level sensing of liquids and bulk solids**
- **Direct mounting into tanks, vessels, sumps and tubes or silos and hoppers**
- **Setting using a magnetic pen**
- **Mode for quick sensor setting without the presence of medium**
- **Optical indication by two LEDs**
- **Wide selection of connections: connector or cable glands**
- **Housing, electrodes and reference tubes made from stainless steel**
- **High stability upon high sensitivity (possible to use for materials with $\varepsilon_r \geq 1.3$)**

TECHNICAL SPECIFICATION		
Supply voltage		7 ... 34 V DC
Output type		NPN; PNP; NAMUR
Switching current		max. 300 mA (NPN, PNP)
Ambient working temperatures		-40 ... +85 °C
Working temperatures at process connection		-40 ... +200 °C
Medium temperatures		-40 ... +300 °C
Process connection		thread G1"; G¾"; M27 x 2; M30 x 1,5 ; NPT¾; Tri-Clamp (ø 34, ø 50,5)
Pressure range at process connection (at +85 °C)	DLS-35_-13 DLS-35_-10, 20, 30 DLS-35_-25, 21, 22, 31, 40, 41 DLS-35_-50 DLS-35_-52	0 ... 50 bar 0 ... 25 bar 0 ... 20 bar 0 ... 1 bar 0 ... 5 bar
Protection	DLS-35_-__-C-_-_ DLS-35_-__A(B, D, V, H)-_-	IP67 IP68

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BASIC FEATURES AND VARIANTS

Capacitive level sensors DLS® are designed for limit sensing of the level of liquid and bulk solids in tanks, sumps, tubes or, hoppers, silos, etc. The sensors are manufactured in several modifications of sensing electrodes (rod and rope). The electrodes can be given an insulating coating, a useful feature in case of adhesive, aggressive or conductive media sensing. Rod electrodes are also available in a version with reference tube for measuring fluids in tanks made from non-conductive material.

Sensors are manufactured in the following configurations: N – for non-explosive areas, Xi – Explosion proof – intrinsically safe for hazardous (explosive) areas and XiM – Explosion proof – intrinsically safe for use in mines with methane or flammable dust presence danger (see technical specifications). There are high temperature performance NT, XiT, XiMT available. DLS are offered in variants with various types of process connection (metric and pipe thread, pressure thread NPT).

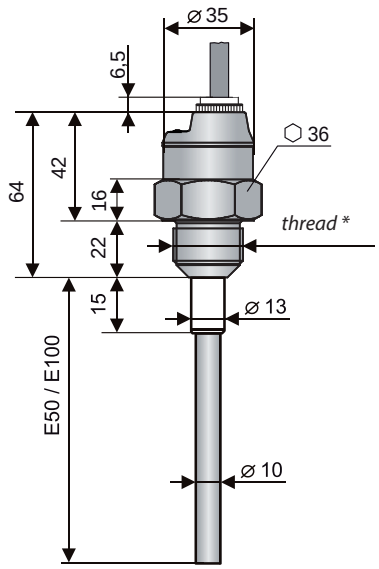
VARIANTS

code	electrode type	electrode length
DLS–35_–10	**Uncoated short bar electrode** for sensing non-adhesive bulk solids (sand, sugar) and non-conductive liquids (petroleum products, oils), horizontal mounting.	0,05 ... 1 m
DLS–35_–13	like DLS-35_-10, but higher pressure resistance	0,05 ... 1 m
DLS–35_–20	**Semi-coated rod electrode** for sensing slightly adhesive bulk solids (cement, flour) and non-conductive liquids (plant oils), horizontal, slant or vertical mounting.	0,1 ... 2 m
DLS–35_–21	**Fully coated rod electrode (FEP insulation)** for sensing conductive liquids (water solutions, water), adhesive and aggressive materials, horizontal or vertical mounting.	0,1 ... 2 m
DLS–35_–22	**Fully coated rod electrode (PFA insulation)** with enhanced resistance to permeation (diffusion) of vapours and gases. For sensing the level of water and other conductive liquids. In the short term can be used for high temperature applications (e.g. hot steam sanitation), or for volatile aggressive liquids, etc. Horizontal or vertical mounting.	0,1 ... 2 m
DLS–35_–25	like DLS-35_-22, but higher pressure and mechanical resistance at high temperature. Suitable for high temperature applications (hot steam), etc. .	0,1 ... 2 m

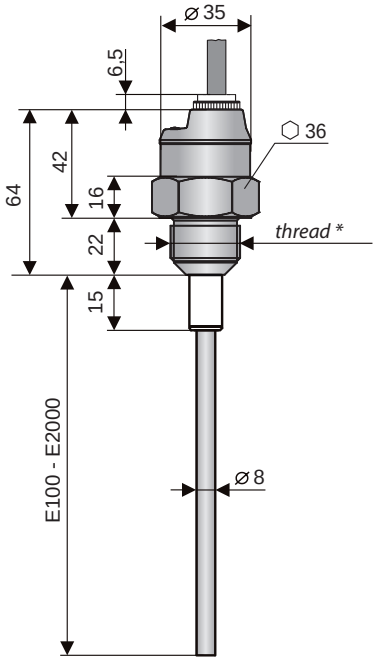
code	electrode type	electrode length
DLS–35_–30	**Dismountable uncoated rod electrode** for sensing bulk solids and conductive or non-conductive liquids. Vertical or horizontal slant mounting.	0,1 ... 3 m
DLS–35_–31	**Fully coated rod electrode (FEP insulation)**, for sensing aggressive conductive liquids (water, various chemicals). Vertical mounting.	0,1 ... 3 m
DLS–35_–40	**Uncoated rod electrode with reference tube (coaxial electrode),** for sensing non-conductive liquids (petroleum products, oil) in non-conductive tanks. Vertical mounting.	max 1 m
DLS–35_–41	**Fully coated rod electrode (FEP insulation) with reference tube (coaxial electrode)**, for sensing conductive liquids in non-conductive tanks. Vertical mounting.	max 1 m
DLS–35_–50	**Uncoated rope electrode and weight,** for general purpose use in deeper silos (bulk solids sensing – sand, gravel, cement) or sumps (sensing liquids). Vertical mounting. Electrode length from 1 m to 6 m.	1 ... 6 m
DLS–35_–52	**insulated rope electrode (FEP),** for electrically conductive and non-conductive liquids.	1 ... 10 m

DIMENSIONS

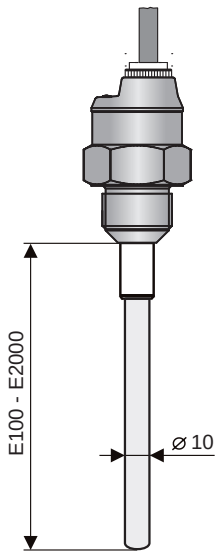
DLS-35_-10, 13



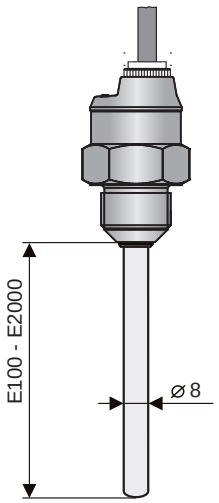
DLS-35_-20



DLS-35_-21, 22



DLS-35_-25



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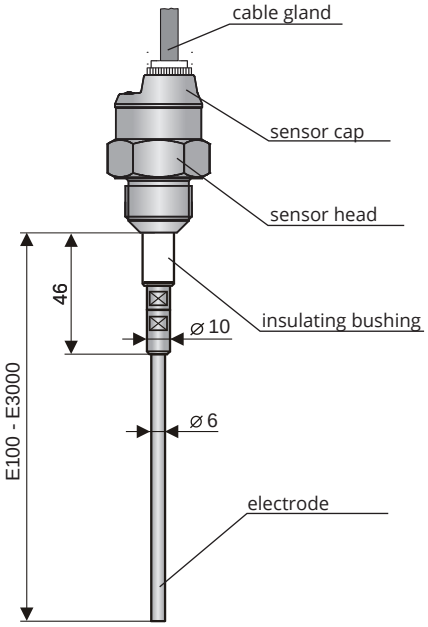
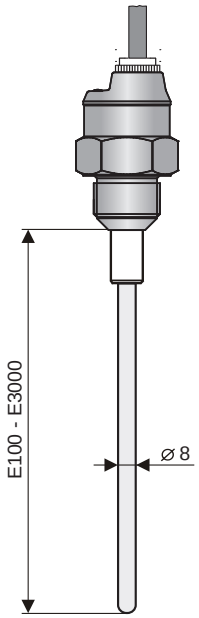
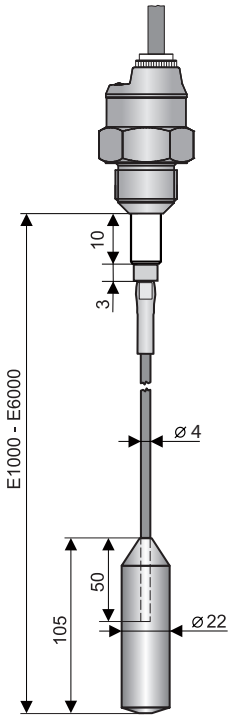
DLS-35_-30



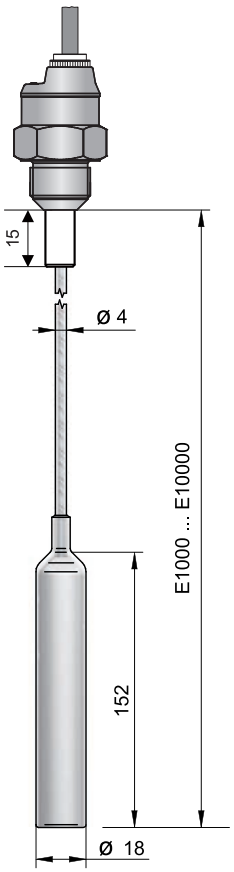
DLS-35_-31



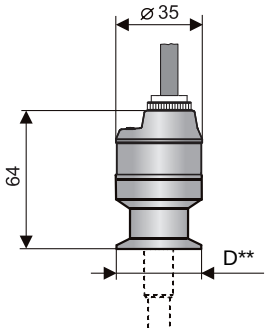
DLS-35_-50



DLS-35_-52



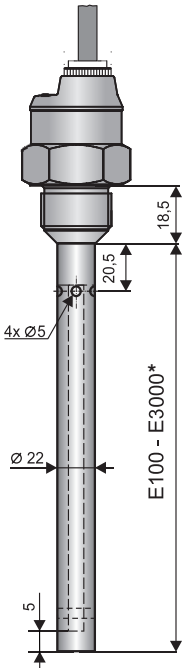
Process connection Tri-Clamp



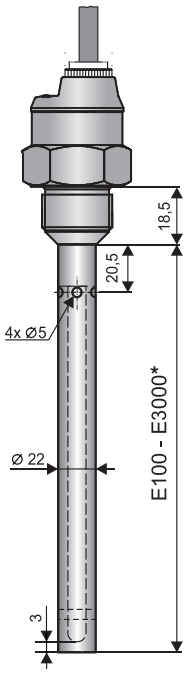
* thread type: G 1"G 3/4"; M27x2;
M30x1,5; NPT 3/4

D** Tri-Clamp CI34 (ø 34 mm)
Tri-Clamp CI50 (ø 50,5 mm)

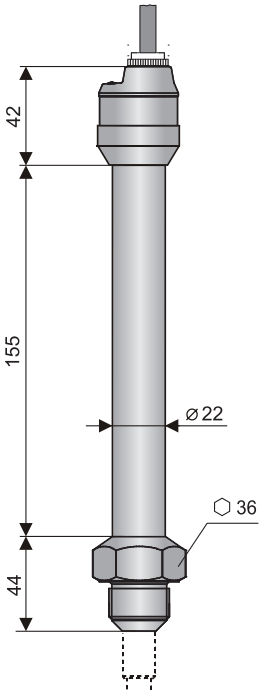
DLS-35_-40



DLS-35_-41



High-temperature variant



All dimensions are in mm
*For lengths E> 1000mm, only process connections with G1 thread can be used.
The outer diameter of the pipe in this case is 28mm. The dimension “E” is valid according to the drawing.

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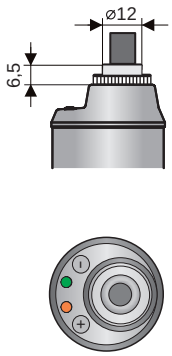
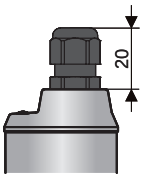
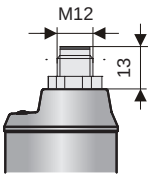
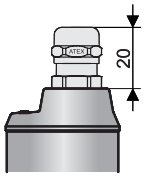
Version „A“ with short stainless steel gland	Version „B“ with plastic threaded gland	Version „C“ with M12 connector

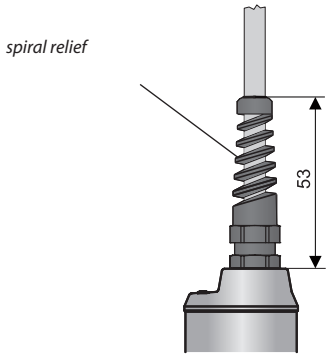


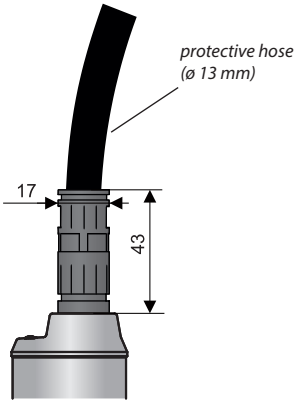




Version „D“ with metal dustproof gland	Version „V“ with plastic gland and spiral relief for increased mechanical stress on the cable.	Version „H“ with protective hose outlet for use outdoors or in places with high humidity.







TECHNICAL SPECIFICATION

BASIC TECHNICAL DATA		
Power consumption (variant DLS-35N(T))		7 ... 34 V DC
Power consumption (variant DLS-35N(T))		max. 5 mA
Max. switching current (NPN, PNP output)		300 mA
Residual voltage – ON state		max. 1,5 V
Input resistance / electric strength		1 MΩ / 200 V DC
Coupling capacity (housing - power) / dielectric strength		50 nF / 350 V AC
Coupling capacity (electrode - power) / dielectric strength		47 nF / 350 V AC
Protection class	type DLS-35_-_ _-C-_-_ type DLS-35_-_ _-A(B,V,H)-_-_	IP67 IP68
Cable (versions with cable outlets)		PVC 3 x 0,5 mm^2
Weight (excl. electrode and cable)	variant N variant NT	approx 0,3 kg approx 0,6 kg

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ELECTRICAL PARAMETERS (VARIANT XI, XIT, XIM, XIMT)	
Power supply voltage	8 ... 9 V DC
Current consumption (disconnected/ connected) – NAMUR	≤ 1 mA / ≥ 2,2 mA
Limit values	Ui = 12 V DC; Ii = 15 mA; Pi = 45 mW; Ci = 15 nF; Li = 10 µH
Reference value LC for the parameters of the used cable	typic C < 150 pF/m typic L < 0,8 µH /m

PROCESS CONNECTION		
type	**size**	**marking**
Pipe thread	G 1''	G 1
	G 3/4''	G3/4
Metric thread	M27x2	M27
	M30x1,5	M30
Taper pipe thread	NPT 3/4	NPT
Jointless connection (Tri-Clamp)	ø 34 mm	Cl34
	ø 50,5 mm	Cl50

TYPE OF OUTPUT	
Output	**Variants**
NPN (N)	N, NT
PNP (P)	N, NT
NAMUR (R)	Xi, XiM, XiT, XiMT

USED MATERIALS		
sensor part	**variants**	**standard material ***
Wetted parts:		
Housing	all types except Tri-clamp Tri-clamp	stainless steel W.Nr. 1.4301 (AISI 304) stainless steel W.Nr. 1.4404 (AISI 316L)
Rod electrode	all types except DLS – 35_– 50, DLS – 35_– 10 DLS – 35_– 10	stainless steel W.Nr. 1.4404 (AISI 316L) stainless steel W.Nr. 1.4301 (AISI 304)
Rope electrode	DLS – 35_– 50, 52	stainless steel W.Nr. 1.4401 (AISI 316)
Reference tube	DLS – 35_– 40, 41	stainless steel W.Nr. 1.4301 (AISI 304)
Insulating bushing	DLS – 35_– 10, 20, 21, 22, 30, 31, 40, 41 DLS – 35_– 13, 50	PTFE PPS + GF40
Electrode coating	DLS – 35_– 21, 31, 41, 52 DLS – 35_– 22, 25	FEP PFA
Sealing O-ring	DLS – 35_–13	FPM (Viton)
Weight	DLS – 35_– 50	stainless steel W.Nr. 1.4301 (AISI 304)
No wetted parts:		
Cable gland	DLS – 35_–_ _–A DLS – 35_–_ _–B DLS – 35_–_ _–D DLS – 35_–_ _–V DLS – 35_–_ _–H	stainless steel W.Nr. 1.4571 (AISI 316 Ti)/NBR plastic PA / NBR nickel-plated brass / PA / rubber CR / NBR plastic PA / NBR plastic PA / NBR
Connector M12	DLS – 35_–_ _–C	nickel-plated brass / PA

* It is always necessary to verify the chemical compatibility of the material with the measured medium. You can also choose another type of material after agreement.

WORKING AREAS AND AREA CLASSIFICATION EN IEC 60079-0, EN 60079-11, EN 60079-10-1, EN 60079-10-2	
DLS-35N	Basic design for use in non-explosive areas.
DLS-35NT	High-temperature design for use in non-explosive areas.
DLS-35Xi (10, 13, 20, 30, 40, 50)	Intrinsically safe design for use in hazardous areas (explosive gas atmospheres or explosive dust atmospheres) Ⓔx II 1G Ex ia IIB T6...T1 Ga; Ⓔx II 1D Ex ia IIIC T_{200} 80 °C...T_{200} 305 °C Da with intrinsically safe power supply unit, entire sensor zone 0 and 20.
DLS-35Xi (21, 22, 25, 31, 41, 52)	Intrinsically safe design for use in hazardous areas (explosive gas atmospheres) Ⓔx II 1G Ex ia IIB T6...T1 Ga; with intrinsically safe power supply unit, entire sensor zone 0.
DLS-35XiT (10, 13, 20, 30, 40, 50)	Intrinsically safe high-temperature version for use in hazardous areas (explosive gas atmospheres or explosive dust atmospheres) Ⓔx II 1/2G Ex ia IIB T6...T1 Ga/Gb Ⓔx II 1/2D Ex ia IIIC T_{200} 80 °C ... T_{200} 305 °C Da/Db with intrinsically safe power supply unit, electrode part zone 0 and 20, head zone 1 and 21.
DLS-35XiT (21, 22, 25, 31, 41, 52)	Intrinsically safe high-temperature version for use in hazardous areas (explosive gas atmospheres) Ⓔx II 1/2G Ex ia IIB T6...T1 Ga/Gb; with intrinsically safe power supply unit, electrode part zone 0, head zone 1.
DLS-35XiM	Intrinsically safe design for use in mines with methane or coal dust Ⓔx I M1 Ex ia I Ma with intrinsically safe power supply unit.
DLS-35XiMT	Intrinsically safe high-temperature design for use in mines with methane or coal dust Ⓔx I M1 Ex ia I Ma with intrinsically safe power supply unit.

Equipment or part thereof intended for zone 0 may also be used in zone 1 or 2.
Equipment or part thereof intended for zone 1 may also be used in zone 2.
Equipment or part thereof intended for zone 20 may also be used in zone 21 or 22.
Equipment or part thereof intended for zone 21 may also be used in zone 22.

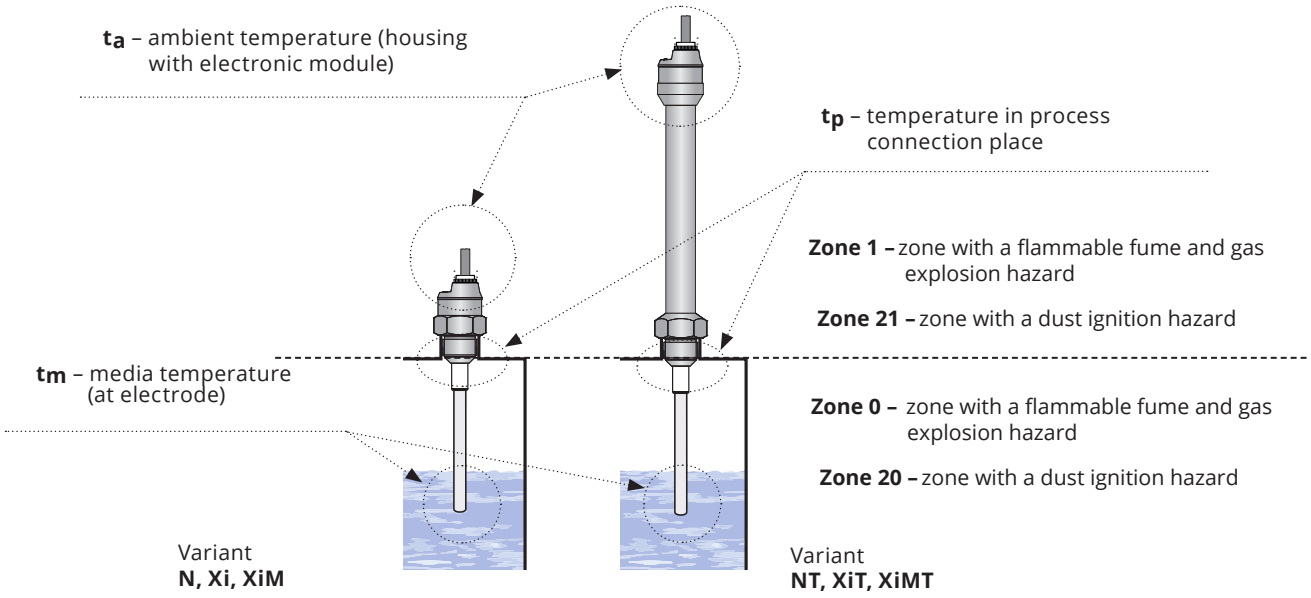

Fig. 1: Illustration of areas for temperature measurement and explosive zones

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MAXIMUM MEDIUM TEMPERATURE FOR Xi(XiT) category 1G, 1/2G version

temperature class	temperature tm
T6	+75 °C
T5	+90 °C
T4	+125 °C
T3	+190 °C
T2	+285 °C
T1	+435 °C

MAXIMUM MEDIUM TEMPERATURE FOR XiM(XiMT) version category M1

maximum medium temperature	+ 145 °C

MAXIMUM SURFACE TEMPERATURE OF Xi(XiT) category 1D, 1/2D device

entire device	T_{200}=Tm + 5 °C

TEMPERATURE RESISTIVITY (variant N, NT, Xi, XiM, XiT, XiMT)

variant	temperature tm	temperature tp	temperature ta
DLS-35N–10	-40°C ... +100°C	-40°C ... +85°C	-40°C ... +85°C
DLS-35N–13	-40°C ... +200°C	-25°C ... +85°C	-40°C ... +85°C
DLS-35N–20, 30	-40°C ... +300°C	-40°C ... +85°C	-40°C ... +85°C
DLS-35N–21, 22, 31, 40, 41	-40°C ... +200°C	-40°C ... +85°C	-40°C ... +85°C
DLS-35N–25	-40°C ... +200°C	-40°C ... +85°C	-40°C ... +85°C
DLS-35N–50	-40°C ... +250°C	-40°C ... +85°C	-40°C ... +85°C
DLS-35NT–10, 20, 30	-40°C ... +300°C	-40°C ... +200°C	-40°C ... +85°C
DLS-35NT–13	-40°C ... +200°C	-25°C ... +200°C	-40°C ... +85°C
DLS-35NT–21, 22, 31, 40, 41	-40°C ... +200°C	-40°C ... +200°C	-40°C ... +85°C
DLS-35NT–25	-40°C ... +200°C	-40°C ... +200°C	-40°C ... +85°C
DLS-35NT–50	-40°C ... +250°C	-40°C ... +200°C	-40°C ... +85°C
DLS-35NT–52	-40°C ... +200°C	-40°C ... +200°C	-40°C ... +85°C
DLS-35Xi,XiM–10	-40°C ... +100°C	-40°C ... +75°C	-40°C ... +75°C
DLS-35Xi,XiM–13	-40°C ... +200°C	-25°C ... +75°C	-40°C ... +75°C
DLS-35Xi,XiM– 20, 30	-40°C ... +300°C	-40°C ... +75°C	-40°C ... +75°C
DLS-35Xi,XiM– 21, 22, 31, 40, 41	-40°C ... +200°C	-40°C ... +75°C	-40°C ... +75°C
DLS-35Xi,XiM–25	-40°C ... +200°C	-40°C ... +75°C	-40°C ... +75°C
DLS-35Xi,XiM–50	-40°C ... +250°C	-40°C ... +75°C	-40°C ... +75°C
DLS-35XiT,XiMT–10, 20, 30	-40°C ... +300°C	-40°C ... +200°C	-40°C ... +75°C
DLS-35XiT,XiMT–13	-40°C ... +200°C	-25°C ... +200°C	-40°C ... +75°C
DLS-35XiT,XiMT–21, 22, 31, 40, 41	-40°C ... +200°C	-40°C ... +200°C	-40°C ... +75°C
DLS-35XiT,XiMT–25	-40°C ... +200°C	-40°C ... +200°C	-40°C ... +75°C
DLS-35XiT,XiMT–50	-40°C ... +250°C	-40°C ... +200°C	-40°C ... +75°C
DLS-35XiT,XiMT–52	-40°C ... +200°C	-40°C ... +200°C	-40°C ... +75°C
DLS-35XiM (XiMT) - mine application	Max. 150°C on any surface where the coal-dust can form layers		

Note: For the correct operation of the level sensor, none of the here provided temperature ranges may be exceeded (tp, tm or ta).
The here-mentioned temperatures are visually explain in Fig. 1

PRESSURE RESISTIVITY (variant N, NT, Xi, XiM, XiT, XiMT)					
variant	**max. operating pressure for temperature tp**				
	up to 30°C	**up to 85°C**	**up to 120°C**	**up to 150°C**	**up to 200°C**
DLS-35N–10	5 MPa (50 bar)	2,5 MPa (25 bar)	–	–	–
DLS-35N–13	7,5 MPa (75 bar)	5 MPa (50 bar)	–	–	–
DLS-35N–20, 30	5 MPa (50 bar)	2,5 MPa (25 bar)	–	–	–
DLS-35N–21, 22, 31, 40, 41	5 MPa (50 bar)	2,0 MPa (20 bar)	–	–	–
DLS-35N–25	2,0 MPa (20 bar)	2,0 MPa (20 bar)	–	–	–
DLS-35N–50	0,1 MPa (1 bar)	0,1 MPa (1 bar)	–	–	–
DLS-35N–52	1 MPa (10 bar)	0,5 MPa (5 bar)	–	–	–
DLS-35NT–10, 20, 30	5 MPa (50 bar)	2,5 MPa (25 bar)	1,5 MPa (15 bar)	1 MPa (10 bar)	0,5 MPa (5 bar)
DLS-35NT–13	7,5 MPa (75 bar)	5 MPa (50 bar)	4,5 MPa (45 bar)	4 MPa (40 bar)	3,5 MPa (35 bar)
DLS-35NT–21, 22, 31, 40, 41	5 MPa (50 bar)	2,0 MPa (20 bar)	1,5 MPa (15 bar)	1 MPa (10 bar)	0,1 MPa (1 bar)
DLS-35NT–25	2,0 MPa (20 bar)	2,0 MPa (20 bar)	2,0 MPa (20 bar)	2,0 MPa (20 bar)	2,0 MPa (20 bar)
DLS-35NT–50	0,1 MPa (1 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)
DLS-35NT–52	1 MPa (10 bar)	0,5 MPa (5 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)
DLS-35Xi,XiM–10	5 MPa (50 bar)	2,5 MPa (25 bar)	–	–	–
DLS-35Xi,XiM–13	7,5 MPa (75 bar)	5 MPa (50 bar)	–	–	–
DLS-35Xi,XiM– 20, 30	5 MPa (50 bar)	2,5 MPa (25 bar)	–	–	–
DLS-35Xi,XiM– 21, 22, 31, 40, 41	5 MPa (50 bar)	2,0 MPa (20 bar)	–	–	–
DLS-35Xi,XiM–25	2,0 MPa (20 bar)	2,0 MPa (20 bar)	–	–	–
DLS-35Xi,XiM–50	0,1 MPa (1 bar)	0,1 MPa (1 bar)	–	–	–
DLS-35Xi,XiM–52	1 MPa (10 bar)	0,5 MPa (5 bar)	–	–	–
DLS-35XiT,XiMT–10, 20, 30	5 MPa (50 bar)	2,5 MPa (25 bar)	1,5 MPa (15 bar)	1 MPa (10 bar)	0,5 MPa (5 bar)
DLS-35XiT,XiMT–13	7,5 MPa (75 bar)	5 MPa (50 bar)	4,5 MPa (45 bar)	4 MPa (40 bar)	3,5 MPa (35 bar)
DLS-35XiT,XiMT–21, 22, 31, 40, 41	5 MPa (50 bar)	2,0 MPa (20 bar)	1,5 MPa (15 bar)	1 MPa (10 bar)	0,1 MPa (1 bar)
DLS-35XiT,XiMT–25	2,0 MPa (20 bar)	2,0 MPa (20 bar)	2,0 MPa (20 bar)	2,0 MPa (20 bar)	2,0 MPa (20 bar)
DLS-35XiT,XiMT–50	0,1 MPa (1 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)
DLS-35XiT,XiMT–52	1 MPa (10 bar)	0,5 MPa (5 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)	0,1 MPa (1 bar)

INSTALLATION INSTRUCTIONS

DLS® level sensors can be fixed in a vertical, horizontal or slanted position into the wall of a vessel, storage tank or on a fixation console in a sump by screwing into the welding flange, using a fixing nut or TriClamp® process connection.

In case of vertical mounting, sensors can be mounted into open, closed and pressurized tanks. The stated distances relate to the electrode length (longer electrode).

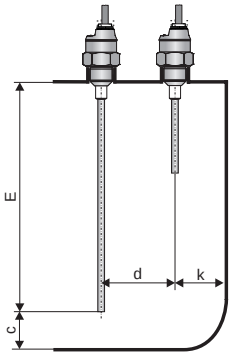

Fig. 2:Vertical mounting

All vertically mounted sensors

$$c \geq 10 + \frac{E}{50}$$

$$d \geq 40 + \frac{E}{40}$$

$$k \geq 20 + \frac{E}{20}$$

E– Electrode length in mm

In the case of **side wall mounting**. it is necessary to avoid long fitting tubes, where sensed medium could accumulate (fig. on right). We recommend mounting the sensor so that the whole sensing electrode and insulation is inside the storage tank (Fig. on left).

All from side mounted sensors

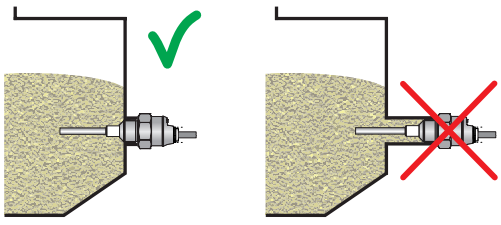

Fig. 3: Correct and incorrect installation with a long tube

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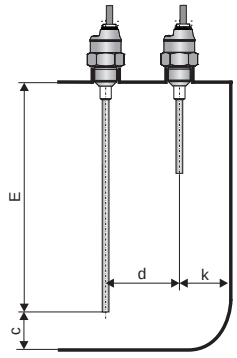
Applies to all types mounted vertically

When mounted vertically, the sensors can be mounted in open, closed and pressure tanks. The distances listed are based on the length of the electrode (the longer of the electrodes).



$$c \geq 10 + \frac{E}{50}$$

$$d \geq 40 + \frac{E}{40}$$

$$k \geq 20 + \frac{E}{20}$$

E– Electrode length in mm

Fig. 4: Vertical installation of sensors

Applies to all types mounted from the side

When mounting in the side wall, it is necessary to avoid long nozzles where material could accumulate (Fig. 5. - right). We recommend mounting the sensor so that the entire electrode and insulation are inside the tank (Fig. 4. - left).

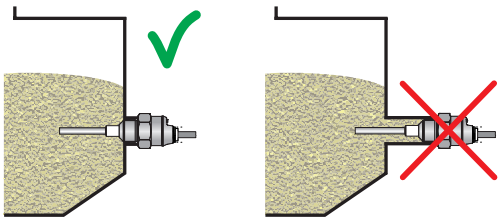


Fig. 5: Correct and incorrect installation with a long nozzle

Applies to all types mounted from the side

When mounting in the side wall (Fig. 6), place the sensor out of the direct flow of bulk solids or liquids.

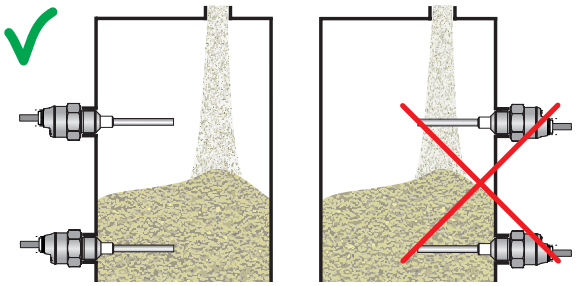
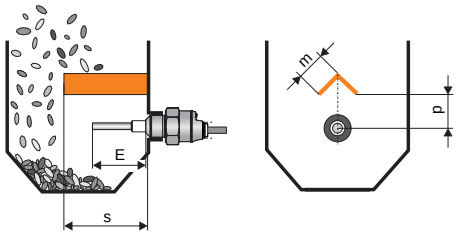


Fig. 6: Correct and incorrect installation into the side wall of the tank

Applies to types: DLS-35_-10, 13, 20

In cases of vertical material movement (abrasive materials, bulk materials forming blocks, piece materials), we recommend installing a protective canopy to prevent mechanical damage to the sensor electrode.



$$s \approx \frac{4}{3}E$$

$$p \approx \frac{3}{4}E$$

$$m \approx \frac{2}{3}E$$

Fig. 7: Mounting the protective canopy

Applies to types: DLS-35_-10, 13, 20

When mounting in an inclined wall of the tank, it is also necessary to eliminate long nozzles and thus limit the settling of the material. An example of inappropriate mounting is shown in Fig. 5 on the left. In the middle, a suitable mounting on an auxiliary perpendicular surface is shown. In some cases, the variant in Fig. 5 on the right is also permissible. However, this is recommended only for measuring bulk materials with a sensor of the DLS-35_-10 type, which do not mechanically damage the electrode and do not create separate blocks.

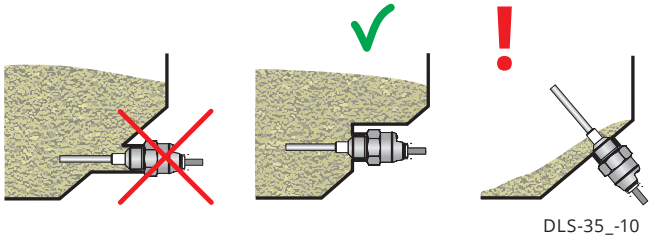


Fig. 8: Installation in an inclined tank wall

Applies to type: DLS-35_-30

In the case of vertical mounting when sensing the level of unknown (conductive and non-conductive) liquids in tanks or sumps, it is advisable to bend the end of the electrode at a right angle. This will increase the local sensitivity and accuracy of level sensing at the bend point. If the influence of weather conditions (open sumps) on the electrode (wind, rain, snow) is obvious, we recommend using the sensor variant with an insulated electrode (DLS-35_-21,22,25,31).

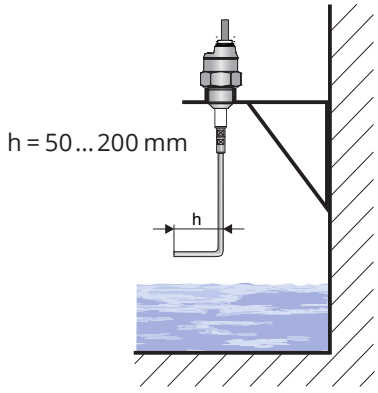
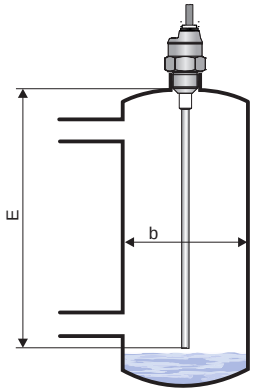


Fig. 9: Bending of the electrode tip when sensing unknown liquids

Applies to types: DLS-35_-20,21,22,25,30, 31

Installation in an auxiliary measuring container. We recommend maintaining the container diameter.



$$b \geq 40 + \frac{E}{20}$$

E– Electrode length in mm

Fig. 8: Auxiliary measuring vessel

Applies to types: DLS-35_-10,13,21,22,25

When mounting in a pipe, it is necessary to choose the inner diameter of the pipe so that the distance between the inner walls and the electrode is at least 5 mm. In some cases (adhesive liquids, liquids with low permittivity), it is appropriate to mount the sensor in a pipe elbow.

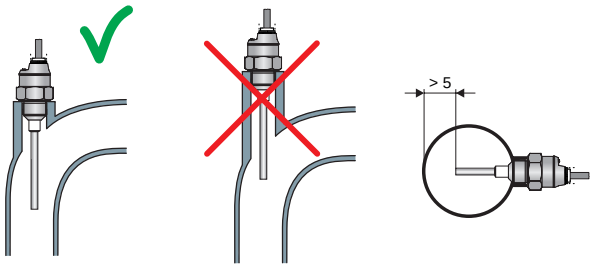


Fig. 9: Mounting the sensor in the pipe

Applies to types: DLS-35_-20,21,22,25,30,31

When installed from above, the sensor can be used for simple two-state level control between min. and max. values. The minimum and maximum level positions can be changed by adjusting the sensor. When changing the measured medium, it is necessary to make new limit settings.

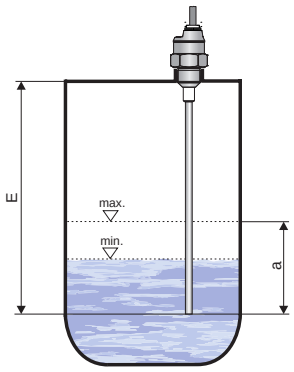


Fig. 10: Level control using hysteresis

Applies to all types mounted vertically

When installing vertically, especially on existing tanks, it is necessary to choose the shortest possible length of the nozzle to avoid condensation of vapors or the settling of dirt. A similar situation occurs when installing vertically in concrete silo ceilings. The hole through which the electrode passes should have a diameter of at least 50 mm (depending on the thickness of the ceiling).

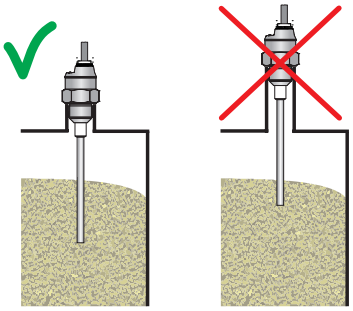


Fig. 11: Installing the sensor into the nozzle

ELECTRICAL CONNECTION

The positive pole of the supply voltage (+U) is connected to the brown wire BN or pin connector no.1, the negative pole (0 V) is connected to the blue wire BU or pin connector no. 3 and load on the black wire BK or pin connector no. 4. The sensor assesses capacitative loads and low resistance loads (lamp) to be a short circuit.

Connection diagrams are listed in Figures.

Note: In case of strong ambient electromagnetic interference, paralleling of conductors with power distribution, or for the distribution to distance over 30 m, we recommend using shielded cable.

Sensors DLS-35 with type of cable outlet A, B, D, V or H are connected to assessing units permanently connected by PVC cable.

The sensors DLS-35 with connection method type C are connected to assessing units by means of a connector socket with compression cable (length 2 or 5 m), or by means of a connector socket without cable (see accessories), the connector is not part of the sensor. In this case the cable is connected to the inside pins of the socket according to the figure on the right. The recommended diameter of this cable is 4 to 6 mm (the recommended cross-sectional area is 0.5 to 0.75 mm^2).

The connection of the sensor to the connecting device is performed using a suitable three wire (variant N) or two wire (variant Xi, XiT, XiM, XiMT) cable. With models Xi, XiT, XiM, XiMT, the length of the cable needs to be selected respecting the maximum permissible parameters (namely induction and capacity) of the outer spark-safe circuit of the power supplies (NSSU, NDSU, NLCU).

In the event that connector sockets that can be disassembled are used, the outer diameter of the cable is max. 6 mm.

A sensor with NPN or PNP output can be loaded only by resistive or inductive load.

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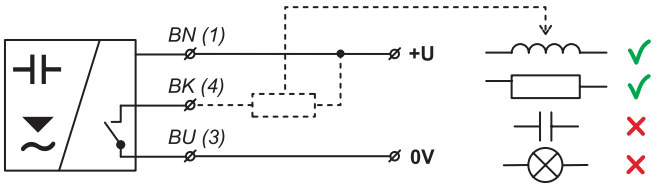

Fig. 12: Connection of a sensor with NPN output (version N, NT)

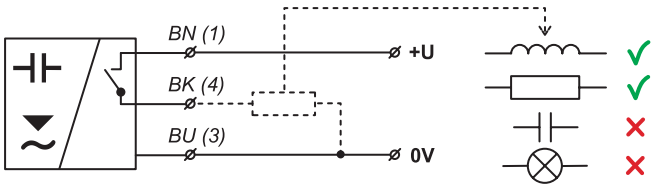

Fig. 13: Connection of a sensor with PNP output (version N, NT)

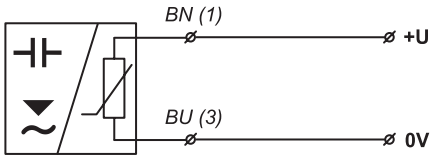

Fig. 14: Connection of a sensor with NAMUR output (version Xi, XiM, XiT, XiMT)

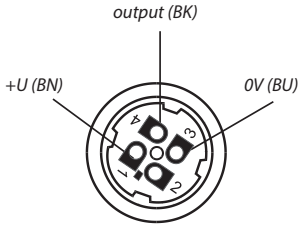

Fig. 15: Internal view of the connector socket

Legend:
(1,...) - terminal numbers connector sockets
BK - black
BN - brown
BU - blue

Electrical connection can only be made in a voltage-free state!
The power supply must be designed as a stabilized low-voltage safe voltage source with galvanic isolation. In the case of using a switched-mode power supply, its design must effectively suppress common mode interference on the secondary side. If the switched-mode power supply is equipped with a PE protective terminal, it must be grounded! Intrinsically safe devices (type DLS-35Xi(XiT, XiM, XiMT)) must be powered from an intrinsically safe power source that meets the above requirements.

Due to the possible occurrence of electrostatic charge on non-conductive parts of the sensor, all sensors intended for use in areas with a risk of explosion (type DLS-35Xi(XiT, XiM, XiMT)) must be grounded. This can be done by grounding the electrically conductive tank or the electrically conductive tank lid, and in the case of an electrically non-conductive tank, by using and grounding the auxiliary plate electrode PDE-27. If the level meter (sensor) is located outdoors at a distance greater than 20 m from an outdoor switchboard or from a closed building, the electrical supply to the level meter (sensor) must be supplemented with appropriate surge protection. In the case of strong ambient electromagnetic interference, the supply cable running parallel to a power line, or its length exceeding 30 m, we recommend using a shielded cable and grounding its shielding on the source side.

SETTINGS

The setting is done by placing a magnetic pen on the sensitive surfaces marked ⊕ or ⊖ located at the end of the sensor in four possible modes:

1. Quick setting - the user does not know exactly what medium the sensor should be set to, he only wants to put the sensor into operation (usually immediately after delivery) and roughly check whether the sensor is functional
2. Basic setting - the user has the medium available and can perform its flooding and draining on the sensor (filling and emptying)
3. Fine sensitivity setting - for additional corrections of the set limits - e.g. very high sensitivity can be set
4. Hysteresis setting - if we want to use the delay of the switching and unsetting point - e.g. for two-state level control using one vertically placed sensor

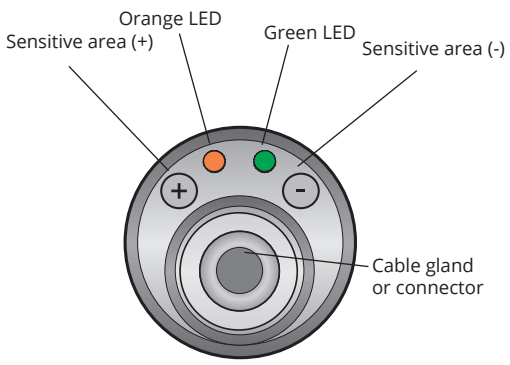

Fig. 16: Top view of the sensor

RANGE OF APPLICATION AND INSTALLATION OF INDIVIDUAL VARIANTS

DLS-35_-10, 13

Produced in two versions – with 50 mm or 100 mm electrode. The shorter version (E50) is suitable for clean non-conductive liquids level sensing (oils, diesel, petrol, etc.). The longer version (E100) is designed for non-adhesive bulk solids or non-adhesive powder materials (plastic granulates, sand, sugar, grains, detergents, etc.) and other slightly impure, non-conductive liquids (lubricants, plant oils). The sensor is specified to be mounted directly into a vessel or storage tank wall (best by horizontal position) by means of welding flanges or stainless steel fixing nuts. In case of level sensing of low-permittivity media in non-metal storage tanks, we recommend mounting the sensor on an auxiliary metal-plate electrode with min. area of 200 cm2. Variant "13" has higher pressure and mechanical resistance.

DLS-35_-20

Designed for limit level detection of bulk solids with low specific weight and permittivity (cement, hydrated lime, flour), and for materials expected to have changing properties (fly ash, sawdust, feed mixtures, etc.). It is possible to use it for sensing non-conductive liquids containing a small amount of water (up to 2%) or other impurities (plant oils, liquid propane, etc.). The sensor is mounted directly into the wall of a vessel or storage tank using steel welding flanges or fixing nuts horizontally, slanted from the side or vertically. It is recommended to mount a sensor with an electrode longer than 300 mm only in the vertical position. Hollow spaces should be minimized between the electrode and the wall where the sensed material can accumulate (see application notes). In non-metal storage tanks, we recommend mounting the sensor on an auxiliary metal-plate electrode with min. area of 400 cm^2.

DLS-35_-21, 22, 25

Specified for conductive liquids level sensing (water, water solutions, mud, etc.). It reacts to partial or full immersion of the electrode (depending on the adjusted sensitivity). The lower the sensitivity, the higher the sensor's resistance to contaminants and clinging remnants of material. The sensor with electrode length of up to 200 mm can be desensitized to complete water immersion, so it can be operated in the horizontal position. The sensor can be operated in the vertical position with any length up to 1 m. The sensor is mounted directly into the wall of the tank in horizontal or vertical position by applying a steel or stainless steel welding flange. For variant "22" and „25", the material PFA is used to insulate the electrode. This variants are more resistant to vapor and gas diffusion and to volatile aggressive liquids. Variants "25" have higher pressure resistance at high temperatures and is particularly suitable for hot water, aqueous solutions and steam.

DLS-35_-30

Designed for sensing conductive and non-conductive liquids and bulk solids. It is not recommended to install the sensor into closed vessels (storage tanks) where intensive water vapour condensation occurs. The sensor reacts to electrically conductive liquids just by touch of the end of electrode. To react to a non-conductive liquid (bulk solid), it is necessary to have 5 ÷ 20% immersion of the electrode according to the sensor's adjusted sensitivity and permittivity of the sensed material. The sensor is mounted directly into a tank, hopper or sump in slant or vertical position by means of welding flange or stainless steel fixing nut. In non-metal storage tanks, we recommend mounting the sensor on an auxiliary metal-plate electrode with min. area of 500 cm^2.

DLS-35_-31

Designed for limit level detection of conductive liquids (water and solutions of various chemicals). It is possible to place the sensor electrode into closed vessels (storage tanks), open canals and sumps. The sensor reacts to the conductive fluid level after 2 ÷ 20% immersion of the electrode based on the sensor's set sensitivity. The sensor is mounted vertically directly into a vessel, tank or open (concrete, plastic) sumps by means of welding flanges or fixing nuts. When installing the sensor into open sumps, it is necessary to secure conductive connection of the sensor housing with the sensed liquid. It is possible to use a metal structure, armouring or another auxiliary electrode. If you must sense an aggressive medium in a closed plastic container, contact the manufacturer.

DLS-35_-40

Designed for sensing conductive and non-conductive liquids in non-metal storage tanks. It is not recommended to install the sensor into closed vessels (storage tanks) where intensive water vapour condensation occurs. The sensor reacts to electrically conductive liquids just by touch of the end of electrode. To react to non-conductive liquid, it is necessary to have 5 ÷ 20% immersion into a medium based on the sensitivity set on the sensor and the permittivity of the sensed material. The sensor is mounted directly into a tank, hopper or sump in slant or vertical position by means of welding flange or stainless steel fixing nut.

DLS-35_-41

Designed for sensing conductive liquids (water and water solutions of various chemicals) in non-metal storage tanks. The measuring part of the sensor can be installed into closed vessels (storage tanks), open channels and sumps. The sensor reacts to the conductive liquid level after 2 ÷ 20% immersion of the electrode based on the sensor's set sensitivity. The sensor is mounted vertically directly into a vessel, tank or open (concrete, plastic) sumps by means of welding flanges or fixing nuts. If you must sense an aggressive medium in a closed plastic container, contact the manufacturer.

DLS-35_-50

For sensing conductive and non-conductive liquids and bulk solids at greater depths (sewerage sumps, shafts, wells, cement storage tanks, sand, gravel, etc.). It is not appropriate to place the sensor electrode into closed containers (storage tanks) where intensive condensation of water vapour occurs. The sensor reacts to electrically conductive liquids just by touch of the end of electrode. To react to non-conductive liquid or bulk solid, a 5 ÷ 20% immersion into the material is necessary based on the sensitivity set on the sensor and the permittivity of the sensed material. The sensor is mounted vertically directly into the wall of a storage tank or sump. For open (concrete) sumps, it can be mounted on an auxiliary metal structure conductively connected with the sensed material. For mounting, you can use supplied welding flanges or fixing nuts.

DLS-35_-52

Suitable for sensing electrically conductive liquids (water and aqueous solutions of various chemicals). The sensor's rope electrode can be placed in closed containers (tanks), open channels and sumps. The sensor will respond to the level of an electrically conductive liquid after 2 ÷ 20% flooding of the electrode according to the set sensitivity of the sensor. Mounting from above into the tank or tank shell, or into open (concrete, plastic) sumps using welds or fastening nuts. When installing the sensor in open sumps, it is necessary to ensure an electrically conductive connection of the sensor housing with the liquid being sensed. Metal structures, reinforcement, or other auxiliary electrodes can be used. If it is necessary to sense an aggressive medium in a closed plastic container, contact the manufacturer.

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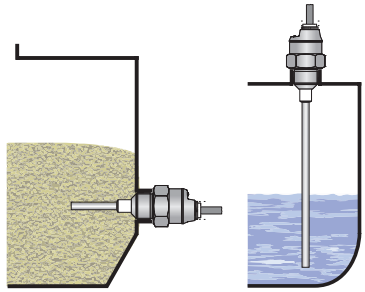
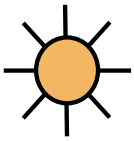
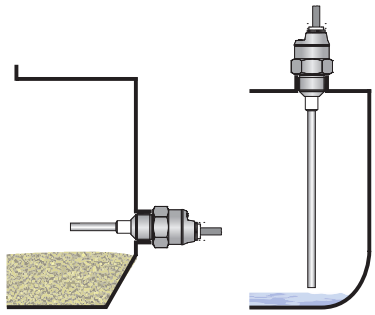
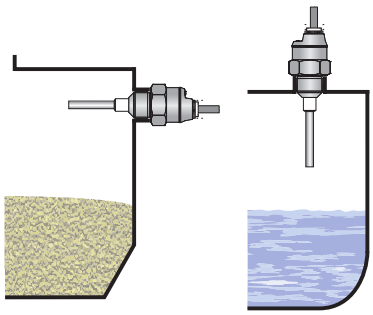
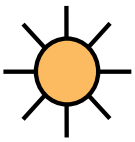
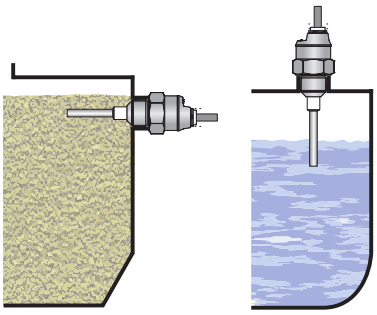
STATUS AND FUNCTION INDICATION

control	color	function
"RUN"	green	**Measurement function indication** **flashing** - (repeats according to the measurement period of approx. 0.5 s) - correct function of level detection **dark** - incorrect installation or malfunction. The LED also does not light up in limit setting mode **alternating flashing of the green and orange LED** - error during setup (sensor did not recognize open and closed states)
"STATE"	orange	**Settings indication** **illuminated** - the sensor is closed **dark** - the sensor is disconnected **3x short flashes** - confirm settings **both LEDs illuminated** - during the application of the magnetic pen, when the setting is confirmed

minimum level sensing

level state	mode	output state	LED indicator
	**O**	**CLOSED** (with type N, NT)	 (illuminated)
		HIGHER CURRENT (with type Xi,XiT,XiM and XiMT)	
	**O**	**OPEN** (with type N, NT)	(not illuminated)
		LOWER CURRENT (with type Xi,XiT, XiM and XiMT)	

maximum level sensing

level state	mode	output state	LED indicator
	**C**	**CLOSED** (with type N, NT)	 (illuminated)
		HIGHER CURRENT (with type Xi,XiT,XiM and XiMT)	
	**C**	**OPEN** (with type N, NT)	(not illuminated)
		LOWER CURRENT (with type Xi,XiT, XiM and XiMT)	

ORDER CODE

DLS-35

MECHANICAL PERFORMANCE	
N	non-explosive areas
NT	high temperature performance
Xi	for explosive environments ⓔ
XiM	for mining environments ⓔ
XiT	high-temperature conf. for explosive environments ⓔ
XiMT	high-temperature conf. for mining environments ⓔ

TYPE AND PERFORMANCE OF ELECTRODE	
10	short bar, uncoated, lengths 50 or 100 mm
13	like 10, but higher pressure resistance
20	rod, uncoated coated, length 0.1 ... 2 m
21	rod, coated (FEP), length 0.1 ... 2 m
22	rod, coated (PFA), length 0.1 ... 2 m
25	like 22, but higher pressure and mechanical resistance at high temperatures
30	rod, uncoated coated, length 0.1 ... 3 m
31	rod, coated (FEP), length 0.1 ... 3 m
40	rod, uncoated with ref. tube, length 0.1 ... 1 m, for length >1m only process connection G1
41	rod, coated (FEP) with ref. tube, length 0.1 ... 1 m , for length >1m only process connection G1
50	rope with weight, uncoated, length 1 ... 6 m
52	insulated rope electrode and weights (FEP insulation), length 1 ... 10 m

PROCESS CONNECTION	
G1	pipe thread G 1”
G3/4	pipe thread G 3/4”
M27	metric thread M 27x2
M30	metric thread M 30x1.5
NPT	pressure thread NPT 3/4
Cl34	Tri-clamp (ø 34 mm)
Cl50	Tri-clamp (ø 50,5 mm)

TYPE OF OUTPUT	
N	NPN (open collector)
P	PNP (open collector)
R	NAMUR (change in supply current)

CONNECTION METHOD	
A	stainless steel compression gland + cable
B	plastic threaded cable gland + cable
C	connector (socket not included with sensor, recommended type - see accessories)
D	metal dust proof terminal + cable
V	plastic cable gland with spiral + cable
H	plastic cable gland for protective hose + cable

ELECTRODE	
E	electrode length in mm

CABLE	
K	cable length in m

DLS-35	N	-	20	-	G1	-	N	-	A	E50	K5	SAMPLE OF ORDER CODE

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CORRECT SPECIFICATION EXAMPLE

DLS–35N–10– M27–N– B E100 cable 5 m

(N) non-explosive areas; (10) uncoated short bar electrode; (M27) process connection by thread M27; (N) output type NPN; (B) plastic threaded cable gland; (E100) electrode length 100 mm

DLS–35NT–21–G3/4–P–C E580

(N) non-explosive areas; (21) coated bar electrode (FEP); (G3/4) process connection by thread G3/4"; (P) output type PNP; (C) connector; (E580) electrode length 580 mm.

DLS–35N–40–M30–P–V E1420

(N) non-explosive areas; (40) uncoated rod electrode with reference tube; (M30) process connection by thread M30; (P) output type PNP; (C) connector; (E1420) electrode length 1420 mm.

DLS–35Xi–10– M27–R– B E100 cable 5 m

(Xi) high-temperature conf. for explosive environments; (10) uncoated short bar electrode; (M27) process connection by thread M27; (R) output type NAMUR; (B) plastic threaded cable gland; (E100) electrode length 100 mm.

DLS–35N–22– Cl50–P–A E200 cable 5 m

(N) non-explosive areas; (22) coated bar electrode (PFA); (Cl50) process connection Tri-clamp (ø 50,5 mm); (P) output type PNP; (A) stainless steel compression gland; (E200) electrode length 200 mm.

ACCESSORIES

1x magnetic pen	included in the price	MP-8	
1x seal (asbestos free) *	included in the price		
cable (over the standard length 2m)	at extra cost	PVC 3 × 0,5 PVC 2 × 0,75 blue	
connector socket	at extra cost	ELWIKA, ELKA	
steel welding flange or stainless steel welding flange	at extra cost	ON-__ NN-__	
protective hose (for type of cable outlet H)	at extra cost	OH-10	
stainless steel fixing nut	at extra cost	UM-__	
various types of seals (PTFE, Al, etc.)	at extra cost		
auxiliary plate electrode	at extra cost	PDE-27	

* Pressure resistance see table in accessory datasheet in the seal assortment.

SAFETY, PROTECTIONS, COMPATIBILITY AND EXPLOSION PROOF

The level sensor is equipped with protection against electric shock on the electrode, reverse polarity, output current overload, short circuit and against current overload on output.

Protection against dangerous contact is provided by low safety voltage according to EN 33 2000- 4- 41. Electromagnetic compatibility is provided by conformity with standards EN 55022 / B, EN 61326-1, EN 61000-4-2 to -8.

Explosion proof DLM–35Xi (XiT, XiM, XiMT) is provided by conformity with standards EN 60079-0, EN 60079-11, EN 60079-26.

Explosion proof DLM–35Xi (XiT, XiM, XiMT) is verified FTZÚ – AO 210 Ostrava – Radvanice: FTZÚ 16 ATEX 0140X.

A declaration of conformity was issued for this device in the wording of Act No. 90/2016 Coll., as amended. Supplied electrical equipment matches the requirements of valid European directives for safety and electromagnetic compatibility.

SPECIAL CONDITIONS FOR SAFE USE OF VARIANT DLM–35XI (XiT, XiM, XiMT)

Level meters DLM-35Xi(XiT, XiM, XiMT) are intended for connection to approved spark-safe power supply unit circuits (of insulating transducers) with galvanic separation. In the event that devices without galvanic separation are used (Zener barriers), it is necessary to balance the potential between the sensor, resp. level meter and the barrier grounding location.

The limit output parameters of spark-safe units (insulating transducers) must correspond to the limit input parameters of the level meter. When assessing spark-free safety of circuits, it is necessary to also take into consideration the parameters of the connected cable (namely its induction and capacity).

The DLM-35Xi configuration may be located in zone 0 or zone 20. With the DLM-35XiT configuration it is only possible to located the electrode part in zone 0 and in zone 20, and then the head with the electronics in zone 1 or zone 21.

Ambient temperature: Tamb = -40°C to +75°C.

The temperature of the measured material according to the variant configuration, see chapter „Technical parameters“. The maximum temperature of the electrodes equals the temperature of the measured material.

Variant DLM–35XiMT it is necessary to observe that temperature of any surface of apparatus, when coal dust can from a layer, do not exceed 150°C.

Version Xi:

Temperature classes for EPL Ga:

T2 ... applies to the maximum temperature of the medium Tm = 270°C.

T3 ... applies to the maximum medium temperature Tm = 180°C.

T4 ... applies to the maximum medium temperature Tm = 115°C.

Maximum surface temperature for EPL Da:

The temperature range of the medium is -40°C to 300°C.

The maximum surface temperature must be calculated as T200 = Tm + 45 °C.

Version XiT

Temperature classes for EPL Ga/Gb:

T2 ... applies to the maximum temperature of the medium Tm = 270°C.

T3 ... applies to the maximum medium temperature Tm = 180°C.

T4 ... applies to the maximum medium temperature Tm = 115°C.

Maximum surface temperature for EPL Da/Db:

The temperature range of the medium is -40°C to 300°C.

The maximum surface temperature for the part of the EPL product must be calculated as T200 = Tm + 45°C.

Version XiM, XiMT

The maximum temperature of the medium is 145°C.

For explosive dust atmospheres, the equipment must be installed in such a way as to avoid the risk of creeping discharges on the label, cable gland or connector of the equipment.

The manufacturer reserves the right to cjange specifications and appearance of the product without prior notice.

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