

CAPACITIVE LEVEL SENSORS DLS-35

- 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 $\epsilon_r \geq 1.3$)



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.

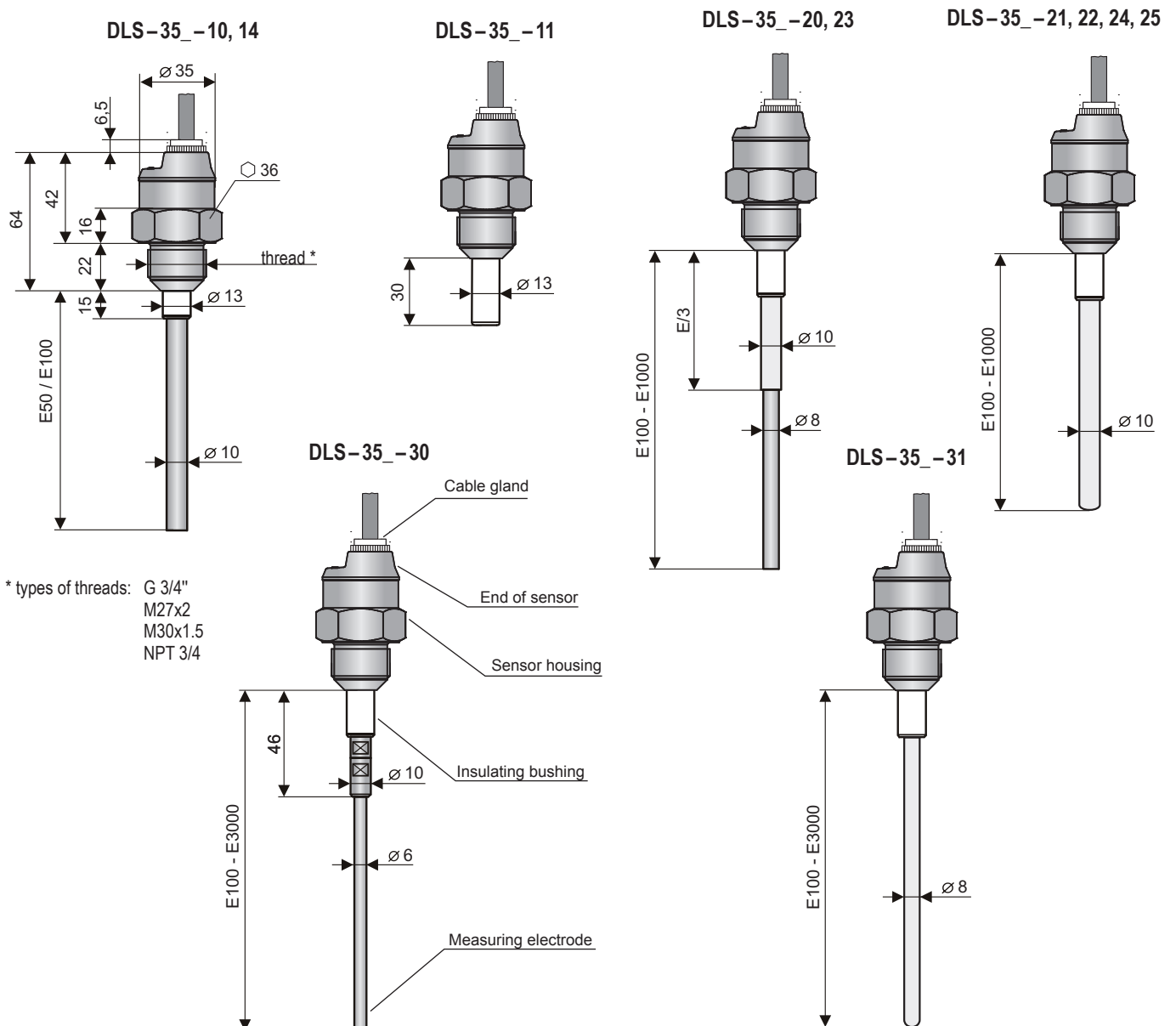
Sensors are produced in the following designs: **N** – for non-explosive areas - **NT** – high-temperature design for non-explosive areas. DLS are offered in variants with various types of process connection (metric and pipe thread, pressure thread NPT).

VARIANTS OF SENSORS

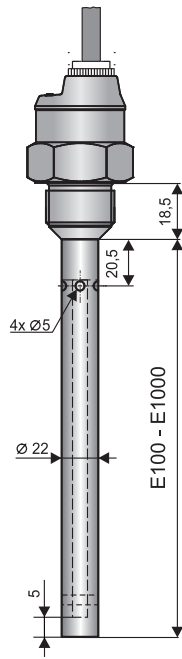
- | | |
|-------------------|---|
| DLS-35_-10 | Uncoated short bar electrode for sensing non-adhesive bulk solids (sand, sugar) and non-conductive liquids (petroleum products, oils), horizontal mounting. Electrode length 50 mm or 100 mm. |
| DLS-35_-11 | Fully coated short bar electrode , for sensing conductive liquids (water). Horizontal mounting into tanks and tubes. Electrode length 30 mm |
| DLS-35_-14 | like DLS-35_-10, but higher pressure resistance |
| 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. Electrode length from 0.1 m to 1 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. Electrode length from 0.1 m to 1 m. |
| DLS-35_-22 | 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 food, pharmaceutical and chemical industries. Suitable for high-temperature applications (hot steam), volatile aggressive liquids, etc. Horizontal or vertical mounting. Electrode length 0.1 m ... 1 m. |
| DLS-35_-23 | like DLS-35_-20, but higher pressure resistance |
| DLS-35_-24 | like DLS-35_-21, but higher pressure resistance |
| DLS-35_-25 | like DLS-35_-22, but higher pressure resistance |

- DLS-35_-30** **Dismountable rod uncoated electrode**, for sensing bulk solids and conductive or non-conductive liquids. Vertical or horizontal slant mounting. Electrode length from 0.1 m to 3 m.
- DLS-35_-31** **Fully coated rod electrode (FEP insulation)**, for sensing aggressive conductive liquids (water, various chemicals). Vertical mounting. Electrode length from 0.1 m to 3 m.
- DLS-35_-40** **Uncoated stainless steel rod electrode with reference tube (coaxial electrode)**, for sensing non-conductive liquids (petroleum products, oil) in non-conductive tanks. Vertical mounting. Maximum electrode length 1 m.
- DLS-35_-41** **Uncoated stainless steel rod electrode (FEP insulation) with reference tube (coaxial electrode)**, for sensing conductive liquids in non-conductive tanks. Vertical mounting. Maximum electrode length 1 m.
- DLS-35_-43** like DLS-35_-40, but higher pressure resistance
- DLS-35_-44** like DLS-35_-41, but higher pressure resistance
- 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.

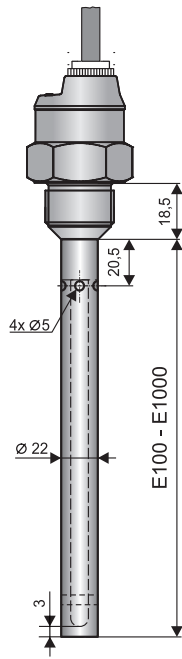
DIMENSIONAL DRAWINGS



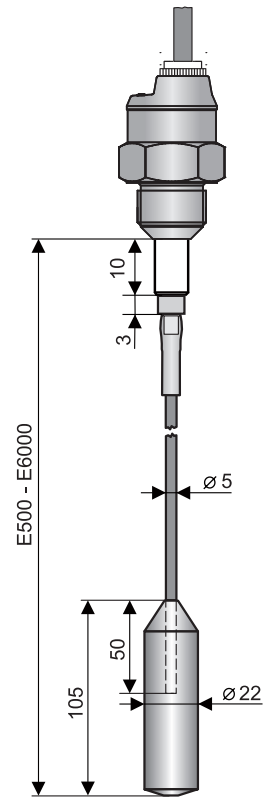
DLS-35_-40, 43



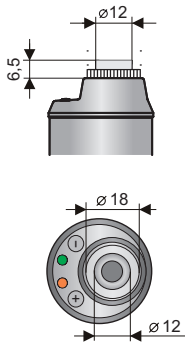
DLS-35_-41, 44



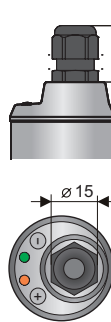
DLS-35_-50



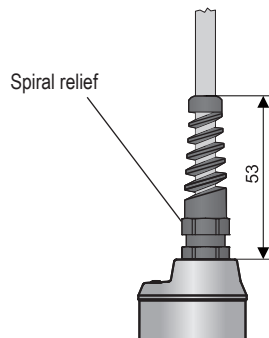
Design "A" with short stainless steel gland



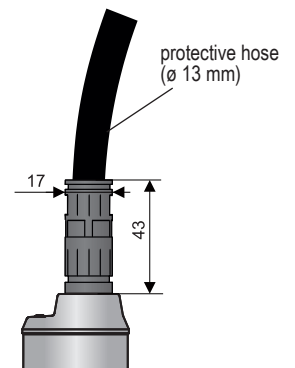
Design "B" with plastic threaded cable gland



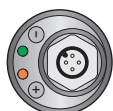
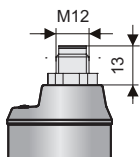
Design "V" with plastic cable gland with spiral relief – in case of increased mechanical wear on the cable.



Design "H" with cable gland for protected hoses – for using in an outdoor environment or in an area with increased moisture.



Design "C" with connector M12



BASIC TECHNICAL DATA

Supply voltage		7 ... 34 V DC
Power consumption		max. 5 mA
Max. switching current (PNP, NPN output)		300 mA
Residual voltage – ON state		max. 1.5 V
Leakage resistance (electrode - housing) / dielectric strength		1 MΩ / 200 V DC
Coupling capacity (housing - power) / dielectric strength		50 nF / 500 V AC
Coupling capacity (electrode - power) / dielectric strength		47 nF / 500 V AC
Protection	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
Ambient temperature range:		- 40 ... + 85 °C
Weight	design N	approx. 0.3 kg
(excluding electrode and cable)	design NT	approx. 0.6 kg

MATERIAL DESIGN

Part of sensor	Type	Standard material	Optional (on request)
Housing	all types	stainless steel W.Nr. 1.4301 (AISI 304)	stainless steel W.Nr. 1.4571 (AISI 316 Ti)
Rod electrode	all besides DLS-35_-50	stainless steel W.Nr. 1.4301 (AISI 304)	stainless steel W.Nr. 1.4571 (AISI 316 Ti)
Rope electrode	DLS-35_-50	stainless steel W.Nr. 1.4404 (AISI 316 L)	–
Reference tube	DLS-35_-40, 41	stainless steel W.Nr. 1.4301 (AISI 304)	stainless steel W.Nr. 1.4571 (AISI 316 Ti)
Insulating bushing	DLS-35_-20,21,22,30,31,40,41 DLS-35_-23,24,25,43,44,50	PTFE PPS + GF40	– –
Electrode coating	DLS-35_-21, 24, 31, 41	FEP	–
Electrode coating	DLS-35_-22, 25	PFA	–
Cable outlet	DLS-35-__-A DLS-35-__-B DLS-35-__-V DLS-35-__-H	stainless steel W.Nr. 1.4301 (AISI 304) plastic PA plastic PA plastic PA	–
Connector M12	DLS-35-__-C	nickel-plated brass	–
Weight	DLS-35_-50	stainless steel W.Nr. 1.4301 (AISI 304)	–

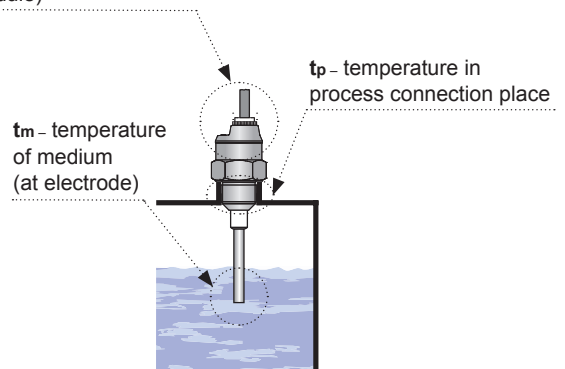
TEMPERATURE AND PRESSURE DURABILITY – DESIGN N, NT

Design variant	Temperature t_p	Temperature t_m	Temperature t_a	Maximum overpressure for temperature t_p				
				Up to 30°C	Up to 85°C	Up to 120°C	Up to 150°C	Up to 200°C
DLS-35N-10,11,20,21, 22,30,31,40,41,50	-40°C ... +85°C	-40°C ... +200°C	-40°C ... +85°C	5 Mpa	2.5 Mpa	–	–	–
DLS-35N-14,23,24,25,43,44	-25°C ... +85°C	-40°C ... +200°C	-25°C ... +85°C	7.5 Mpa	5 Mpa	–	–	–
DL-35NT-10,11,20,21, 22,30,31,40,41,50	-40°C ... +200°C	-40°C ... +200°C	-40°C ... +85°C	5 Mpa	2.5 Mpa	1.5 Mpa	1 Mpa	0.5 Mpa
DLS-35NT-14,23,24,25,43,44	-25°C ... +200°C	-40°C ... +200°C	-25°C ... +85°C	7.5 Mpa	5 Mpa	4.5 Mpa	4 Mpa	3.5 Mpa

PROCESS CONNECTION

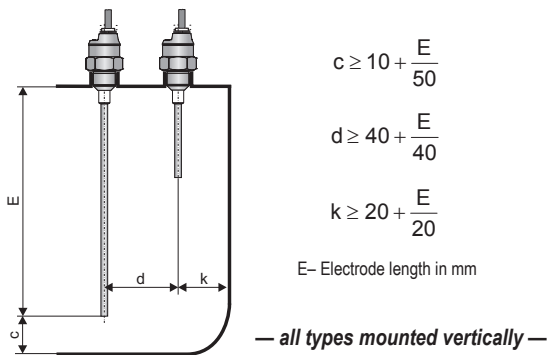
Name	Size	Marking
Pipe thread	G 3/4"	G
Metric thread	M27x2	M27
Metric thread	M30x1.5	M30
Pressure thread	NPT 3/4	NPT

t_a – ambient temperature
(housing with electronic
module)

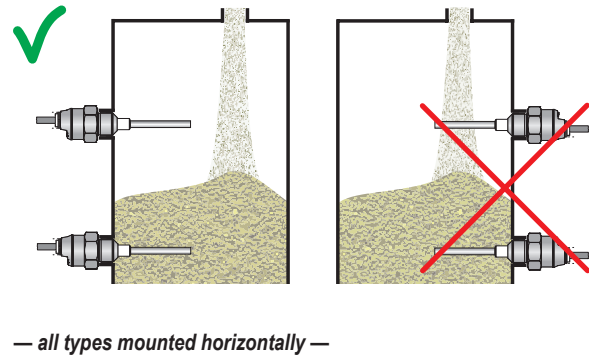


MOUNTING RECOMMENDATIONS

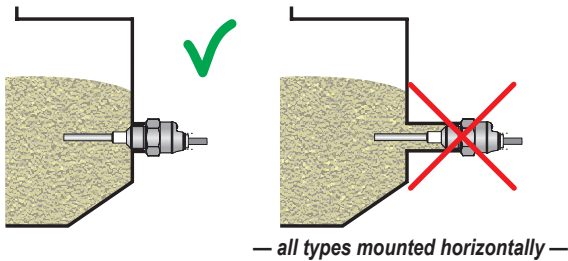
In case of vertical mounting, sensors can be mounted into open, closed and pressurized tanks. The stated distances relate to the electrode length (longer electrode).



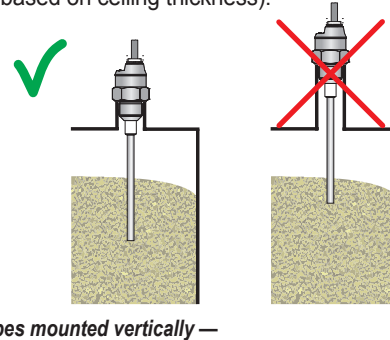
In the case of **side wall mounting** it is necessary to place the sensor away from falling bulk solids or liquids.



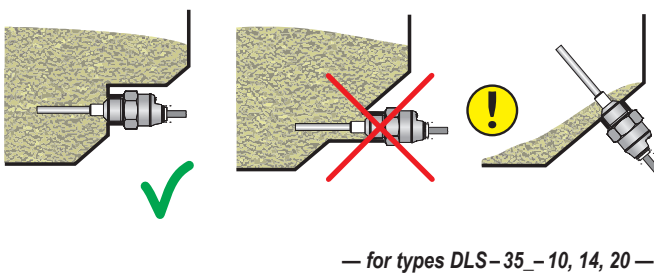
In the case of **side wall mounting** it is necessary to avoid long fitting tubes, where sensed medium could accumulate (Figure on right). We recommend mounting the sensor so that the whole sensing electrode is inside the storage tank (Figure on left)



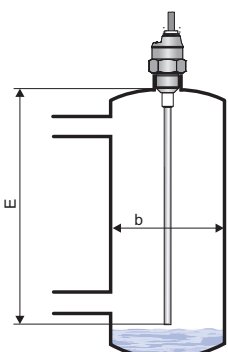
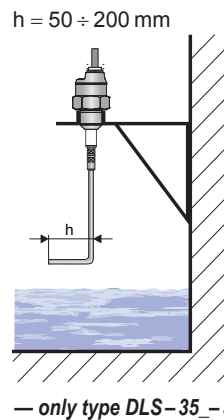
In the case of **vertical mounting** especially on existing tanks, it is necessary to select the pipe length as **short as possible** to avoid vapour condensation, or sedimentation of contaminants. A similar situation occurs when the sensing electrode goes through the concrete ceiling of the silo. The hole diameter should be at least 50 mm (based on ceiling thickness).



In the case of **slanted wall mounting** it is necessary to eliminate **long fitting tubes** thereby reducing material sedimentation. The wrong example is in the middle figure. Left figure – appropriate mounting on the auxiliary vertical plate. In some cases, the variant shown on the right figure is allowed. But this is recommended only for the DLS-35_10 type sensor measuring bulk-solid materials, which do not mechanically damage the electrode and do not form separate blocks.



In the case of **vertical installation for non-conductive fluid sensing** (concrete catch sumps), it is useful to bend the end of electrode to a right angle. This increases sensitivity at the spot of the bend. When the supposed medium is water, bending makes no sense (the sensor reacts when the end of electrode is touched). When weather conditions (wind, rain, snow) are present, we recommend using a sensor variant with an insulated electrode.

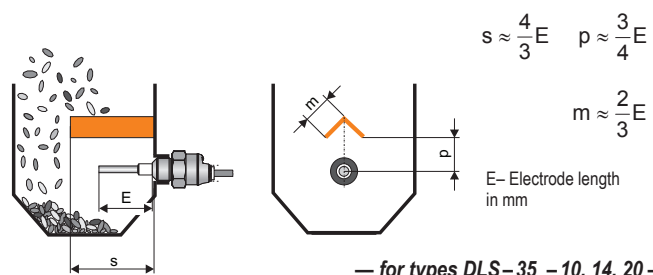


Mounting in a **bypass measuring tube**. We recommend upholding the tube diameter.

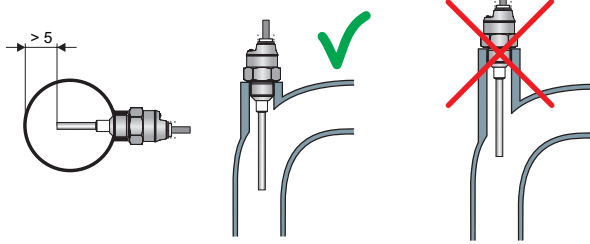
$b \geq 40 + \frac{E}{20}$
 E – Electrode length in mm

— for types DLS-35_20, 21, 22, 23, 24, 25, 30, 31 —

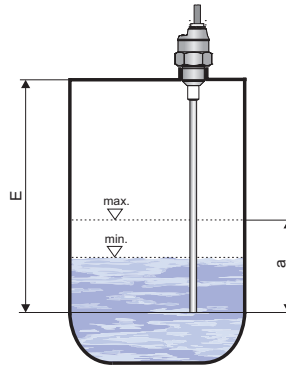
Protective roof mounting is recommended to prevent mechanical damage of the sensor electrode when **vertical movement of material** could damage the sensing electrode (abrasive materials, bulk solids forming blocks, piece goods).



In the case of **mounting in a tube**, it is necessary to select the inner diameter of the tube in order to secure distance of the internal walls from the electrode at a minimum of 5 mm. In some cases (sticky liquids, low permittivity liquids) it is better to mount the sensor into a pipe bend.



— for types DLS-35-10, 11, 14, 21, 22, 24, 25 —



In the case of **vertical mounting** it is possible to use the hysteresis setting for simple **two-state level height regulation** between the min. and max. value. The height of the controlled level is done by sensitivity setting. The difference between the min. and max. level is set by changing the hysteresis.

$$a \approx \frac{1}{10} E \div \frac{1}{3} E$$

E – Electrode length in mm

— for types DLS-35-20, 21, 22, 23, 24, 25, 31 —

ELECTRICAL CONNECTION

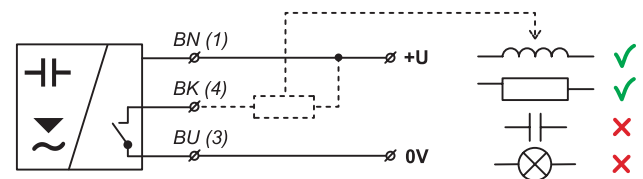
A sensor with NPN or PNP output can be loaded only by resistive or inductive load. The positive pole of the supply voltage (+U) is connected to the brown wire *BN* or pin connector no. 1, the negative pole (0V) is connected to the blue wire *BU* or pin connector no. 3 and load on the black wire *BK* or pin connector no. 4. The sensor assesses capacitive loads and low resistance loads (lamp) to be a short circuit.

Wiring diagrams are provided in the figures on the right.

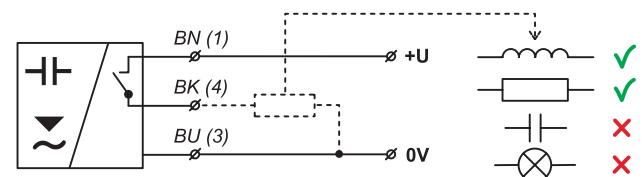
Note: In case of strong ambient electromagnetic interference, paralleling of conductors with power distribution, or for distribution to a distance over 30 m, we recommend using shielded cable.

Sensors DLS-35 with type of cable outlet A, B, V or H are connected to assessing units permanently connected by PVC cable. Design diagrams are provided on page 3.

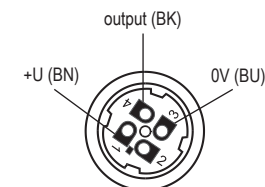
The sensors DLS-35 with connection method type C (see page 3) are connected to assessing units by means of a connector socket with compression cable (length 2 or 5 m), or by means of a connector socket without cable (see accessories). In this case the cable is connected to the inside pins of the socket 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 mm²).



NPN output type sensor connection



PNP output type sensor connection



Inside view of the connector (Variant "C")

Legend:

- (1...) – terminal numbers
- connector sockets
- BN – brown
- BU – blue
- BK – black

RANGE OF APPLICATION AND INSTALLATION OF INDIVIDUAL VARIANTS

DLS-35-10, 14

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 "14" has higher pressure resistance.

DLS-35-11

Specified for level sensing of conductive liquids (water and water solutions). It can be used to identify the boundary between fluids with differing permittivity (e.g. water – oil). The sensor is mounted directly into the side wall of the vessel or in a pipe (horizontal position) by means of a standard steel or stainless steel welding flange.

DLS-35_-20, 23

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 cm². Variant "23" has higher pressure resistance.

DLS-35_-21, 22, 24, 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", the material PFA is used to insulate the electrode. This variant is more resistant to aggressive fluids. Variants "24" and "25" have higher pressure resistance.

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 cm².

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, 43

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. Variant "43" has higher pressure resistance.

DLS-35_-41, 44

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. Variant "44" has higher pressure resistance.

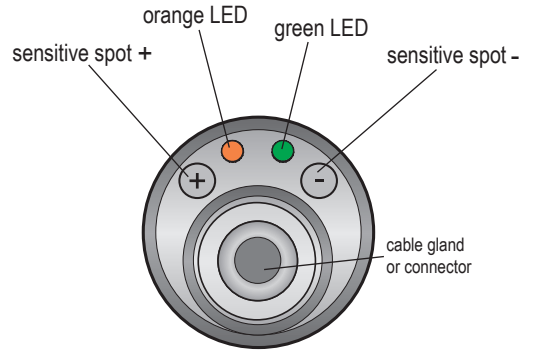
DLS-35_-50

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.

SETTINGS

Settings are performed by touching a magnetic pen on sensitive spot indicated as "+" or "-" located beside the connector or cable gland. This method is used to set the sensitivity to the measured medium, switching (O, C), with or without the presence of medium. The third function is designed for fine-tuning the sensor sensitivity. The fourth function is designed for hysteresis setting. Upon a change in the measured medium, it is necessary to perform new limit settings.

For detailed information please read at the instructions manual.



Top view of level sensor

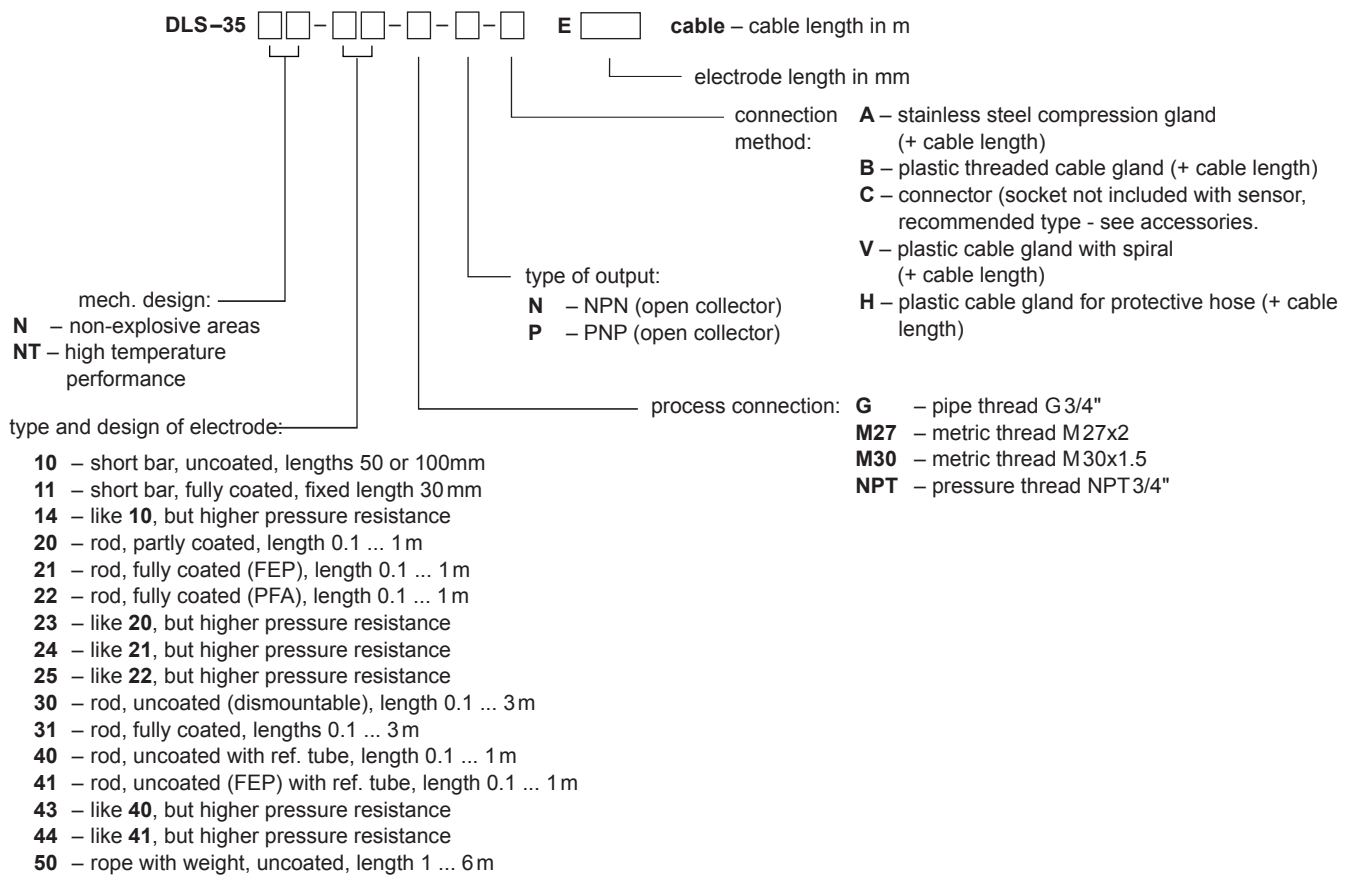
FUNCTION AND STATUS INDICATION

LED indicator	colour	function
"RUN"	green	Measuring function indication flashing – (repeats according to the period of measuring approx. 0.5 s) – correct function of level detection dark – incorrect installation or malfunction. alternating flashing of the green and orange LED – error in settings
"STATE"	orange	Settings indication permanent shine – the sensor is closed dark – the sensor is open 3 short flashes – settings confirmed simultaneous shine of green and orange LED – during touching the mag. pen, when the limit setting is confirmed

	level state	mode	output state	LED		level state	mode	output state	LED
minimum level sensing		O	CLOSED	 (illuminated)		C	CLOSED	 (illuminated)	
		O	OPEN	 (not illuminated)		C	OPEN	 (not illuminated)	

For safety reasons, we recommend using the mode "O" for min. level sensing (the sensor closes upon immersion). It is for failure safety reasons – eventual failure of sensor behaves similarly as an exceeding of the limit state. Analogically, for the max. level, we recommend setting the mode "C" (the sensor opens upon immersion).

ORDER CODE



CORRECT SPECIFICATION EXAMPLES

DLS-35N-10-M27-N-B E100 cable 5 m

(N) designed for use in normal areas; (10) uncoated short bar electrode, (M27) process connection by thread M27; (N) output type NPN; (B) plastic cable gland; (E100) electrode length 100 mm

DLS-35N-21-G-P-C E580

(N) designed for use in normal areas; (21) rod fully coated electrode; (G) process connection by thread G3/4"; (P) output type PNP; (C) connector; (E580) electrode length 580 mm.

DLS-35N-30-M30-P-C E1420

(N) designed for use in normal areas; (40) rod uncoated electrode with reference tube; (M30) process connection by thread M30, (P) output type PNP; (C) connector; (E1420) electrode length 1420 mm.

ACCESSORIES

standard – included in sensor price

- 1 pcs. magnetic pen MP-8
- 1 pcs. seal (asbestos free)

optional – for a surcharge

(see catalogue sheet of accessories)

- cable (over the standard length 2m)
- connector socket (type ELWIKa or ELKA)
- standard steel welding flange or stainless steel welding flange
- protective hose (for type of cable outlet H)
- stainless steel fixing nut
- various types of seals (PTFE, Al, etc.)

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 ČSN 33 2000-4-41. Electromagnetic compatibility is provided by conformity with standards EN 55022/B, EN 61326-1, EN 61000-4-2, -3, -4, -5 and 6.