

General description

Capacitive level sensors (switches) DLS-27 are designed for limit level sensing of liquids and bulky solid materials in vessels, containers, silos, tanks, reservoirs, etc.

Sensors are made in several modifications of sensing electrodes - short and long rods or rope. The electrodes can be coated what has important sense in case of adhesive, aggressive or electrically conductive media sensing.

The process coupling at the housing can be with thread M27x2, G3/4" or with Triclamp coupling.

Electric connection is provided by means of permanent cable lead (variant B) or by means of connector (variant C).

Output performances - transistor outputs with open collector (NPN, PNP) - or NAMUR output.

There is available the performance for normal atmospheres **N**, the variant **Xc** for use in flammable dust atmosphere, explosion proof performance **Xi** and **XiM** variant for use in mines where is methane or flammable dust presence danger - see technical specifications.

On the rear side of the sensor there are (under the cover screws) trimmers for sensitivity and hysteresis adjustment. The hysteresis adjustment allows to increase the electromagnetic immunity, the resistance to level flutter or enables simple 2-state level regulation by means of only one vertically installed level sensor.

Besides the trimmers there is red colour LED for state indication.

Function principal

The level sensor DLS-27 has no moving parts, it works on capacitive principle. Its electrode (rod, rope, etc.) makes the capacitor together with the metallic housing (and consequently the metallic walls of a vessel or other near objects). The capacity of the capacitor is done by the dimensions of the electrode and the dielectric properties of the surrounding medium (its permittivity). When the change of the permittivity occurs - by fully or partly immersion into the matter - the capacity changes its value. This change is detected by electronics inside the DLS and makes the state change on its output.

Technical specifications

Performances and working areas (EN 60079-14, EN 50281-1-2)

DLS-27N(T)				for non-explosive areas
DLS-27Xc	Ex II1/2D T77°C		electrode part	zone 20
			housing	zone 21
DLS-27Xi	Ex II1GDT76°CExia IIBT6	with Namur supply unit (NSSU, NDSU, NLCU)	complete sensor	zone 0, zone 20
DLS-27XiT	Ex II1/2GDT76°CExia IIBT6	with Namur supply unit (NSSU, NDSU, NLCU)	electrode part	zone 0, zone 20
			housing	zone 1, zone 21
DLS-27XiM	Ex I M2 Ex ia I	with Namur supply unit with galvanical separation (NSSU, NDSU, NLCU)		

Supply voltage		DLS-27N / Xc	7 ÷ 36 VDC
		DLS-27Xi / XiM	8 ÷ 9V DC (max. 12V)
Supply current	LED	DLS-27N / Xc	3/7 mA
	off / on	DLS-27Xi / XiM	≤1mA / ≥ 2,2 mA
Output switching current (output NPN, PNP)			max. 200 mA
Maximum inner parameters - Xi, XiM version		Ui=12VDC, Ii=15mA, Pi=45mW, Ci=15nF, Li=10uH	
Output time delay			0,2 s
Input resistance / electric strength	(electrode - housing)		1 MΩ / 1 kV AC
Coupling capacity / electric strength	(housing - supply leads)	DLS-27N / Xc	47 nF / 200 VAC
		DLS-27Xi / XiM	2,7 nF / 500 VAC

Ambient temperature / medium operating temperature	DLS-27N	-20 to +80 °C / -20 to +85 °C
	DLS-27Xi / XiM	-20 to +75 °C / -20 to +85 °C
	DLS-27Xc	-20 to +70 °C / -20 to +70 °C
	DLS-27□T-10, 11, 20, 30	-20 to +75 °C / -30 to +200°C
	DLS-27□T-21, 31, 40	-20 to +75 °C / -30 to +120°C
Allowed ambient temperature in zone 0		-20 to +60 °C

Protection classification		IP 67
Max. operating pressure	DLS-27N / Xi / XiM / Xc	3 MPa
	DLS-27□T in +100 °C	0,6 MPa
	in +180 °C	0,1 MPa
Cable	DLS-27N	PVC 3 x 0,5 mm²
	DLS-27Xi	PVC 2 x 0,75 mm²
Cable length	(var. B) standard 2 m	(on request up to 30 m)
Weight without the electrode	(incl. 2 m cable)	DLS-27N / Xi / XiM / Xc c. 0,4 kg
		DLS-27□T c. 0,7 kg

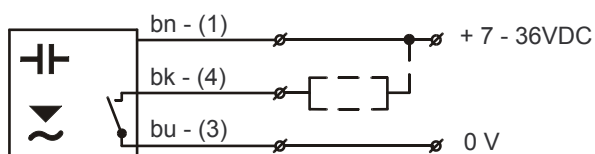
Used materials:	housing	stainless steel W.Nr. 1.4301 (AISI 304)	(on request 1.4571)
	insulating bushings, rod electrode coating (type 20, 21, 31)		PTFE
	rope electrode coating (variant 40)		polyolefin
	cable outlet - var. B		HDPE

Sensitivity characteristics

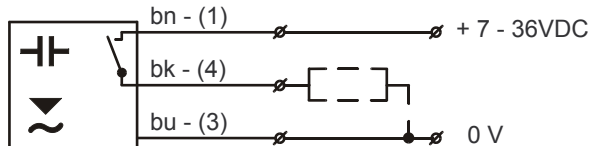
type of sensor	tresh. sensitivity	hysteresis	sesnitivity adjusting range	temp. stability	min. rel. permittivity
DLS-27__-10	0,1 pF	0,1 ÷ 2 pF	min 8 pF (1 rot. = 1pF)	± 0,004 pF.K-1	1,4 ÷ 1,5
DLS-27__-11	0,2 pF	0,2 ÷ 4 pF	min 20 pF (1 rot. = 2 pF)	± 0,007 pF.K-1	5
DLS-27__-20	0,1 pF	0,2 ÷ 3 pF	min 15 pF (1 rot. = 1,5 pF)	± 0,006 pF.K-1	1,3
DLS-27__-21	0,3 pF	0,3 ÷ 6 pF	min 30 pF (1 rot. = 3 pF)	± 0,01 pF.K-1	4
DLS-27__-30	0,2 pF	0,2 ÷ 4 pF	min 20 pF (1 rot. = 2 pF)	± 0,01 pF.K-1	1,6
DLS-27__-31	0,3 pF	0,2 ÷ 5 pF	min 25 pF (1 rot. = 2,5 pF)	± 0,01 pF.K-1	5
DLS-27__-40	0,3 pF	0,2 ÷ 6 pF	min 20 pF (1 rot. = 2 pF)	± 0,01 pF.K-1	2

Sensors connection

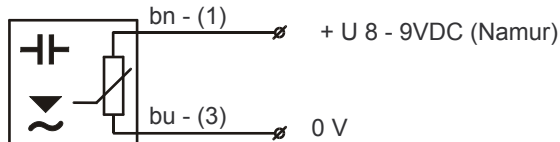
DLS-27N□-□□-□-N□-□
DLS-27Xc-□□-B-N□-□



DLS-27N□-□□-□-P□-□
DLS-27Xc-□□-B-P□-□



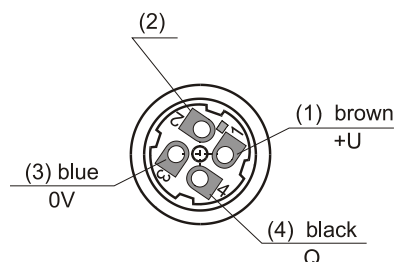
DLS-27Xi□-□□-□-R□-□



Notes for connection:

- 1) Sensor with NPN or PNP output is allowed to lead only by resistive or inductive lead. The output is equipped with pulse short circuit protection. So the capacitive leads (> ca. 100nF) and leads with low zero-time resistance (bulb lamps) are taken as a short circuit.
- 2) It is recommended to lead the cable separately from power distribution leads and strong sources of EMI (pulse converters, electric motors).

The inside of the connector socket
ELWIK 4012 K PG7



Adjustment

The sensor is factory adjusted for basic sensitivity.

The sensitivity is set by trimmer located under the left cover screw on the rear side. Clockwise turning makes the sensitivity lower, reverse direction turning makes the sensitivity higher.

If the sensed medium is at your disposal before setting into service it is useful to provide individual setting as follows:

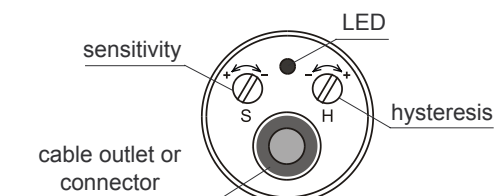
- 1, activate the sensor by inundation (immersion) the electrode into the medium.
- 2, lower the sensitivity (by clockwise turning).
- 3, turn 0,5 ÷ 1 rotation left from the threshold point (when the sensor just stops its reaction to immersion).
- 4, check the setting.

By above mentioned steps is achievable the best resistance to adhered sediment.

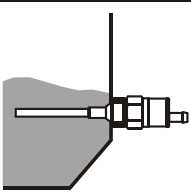

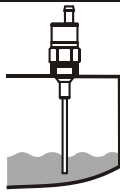

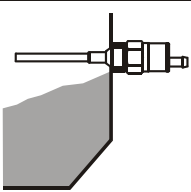

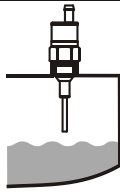

If the sensed medium is not at your disposal, let the factory sensitivity set and after some time after setting into service (after some sedimentation) make the correction of the sensitivity.

The hysteresis is set by trimmer located under the right cover screw. Clockwise turning makes the hysteresis higher, reverse direction turning makes it lower. The lower the hysteresis is, the higher sensitivity is possible to obtain, but the resistance against various disturbances get worse. For usual applications is optimal hysteresis from 1/4 to 3/4 rotation of sensitivity trimmer.

Rear side of the sensor



Function of sensors

function	level state	output state	LED
minimum level sensing		DLS-27N□-□□-□-□O-□ DLS-27Xc-□□-B-□O-□ closed	
		DLS-27Xi□-□□-□-RO-□ higher current	
		DLS-27N□-□□-□-□O-□ DLS-27Xc-□□-B-□O-□ open	
		DLS-27Xi□-□□-□-RO-□ lower current	
maximum level sensing		DLS-27N□-□□-□-□C-□ DLS-27Xc-□□-B-□C-□ closed	
		DLS-27Xi□-□□-□-RC-□ higher current	
		DLS-27N□-□□-□-□C-□ DLS-27Xc-□□-B-□C-□ open	
		DLS-27Xi□-□□-□-RC-□ lower current	

Notes for picture: for minimum level sensing we recommend sensor with normally open output - NO, PO, RO. It is for failure safety reasons - eventual failure of sensor behaves similarly as an exceeding of the limit state. Analogically for maximum level sensing we recommend normally closed outputs - NC, PC, RC.

Accessories

standard - (no extra charges)

to each pc of DLS - 1 pc of seal (asbestos free), other seals are on request (PTFE, Al, etc.)

to each delivery (each 5 pcs)

- 1 pc screwdriver for adjustment

optional - (see datasheet "accessories")

- extra cables (over the standard length 2m)
- connector plug M12 - type ELWIK ...
- normal steel welding flange ON-27x2
- stainless steel welding flange NN-27x2
- stainless steel fixing nut UM-27x2

Safety, protections, compatibility and explosion proof

Level sensor DLS-27 is equipped with protection against electric shock on electrode, reverse polarity, output current overload, short circuit and short time overvoltages.

Electromagnetic compatibility is provided by conformity with standards: EN 55022/B, EN 61326-1, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6.

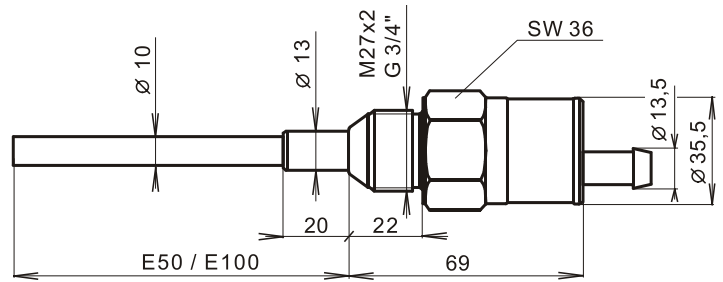
Explosion proof of DLS-27Xi is examined by FTZU-AO 210 Ostrava - Radvanice certificate No.: FTZU 02 ATEX 0234X.

Explosion proof of DLS-27Xc is examined by FTZU-AO 210 Ostrava - Radvanice certificate No.: FTZU 04 ATEX 0238X.

Overview of basic variants

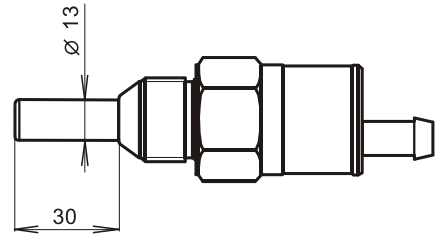
DLS-27□□-10

- for limit level sensing of non-conductive liquids, bulk solid and powder materials
- uncoated bar electrode



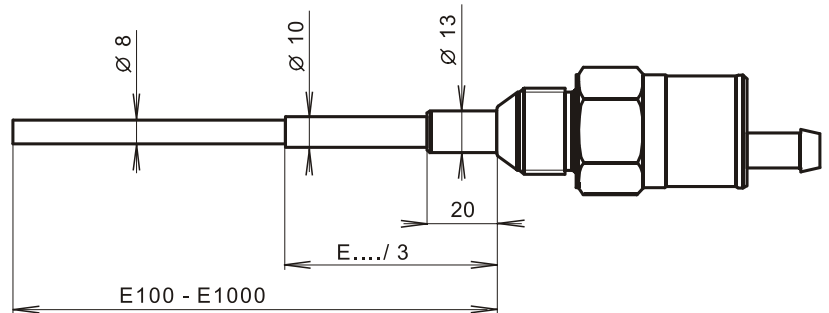
DLS-27□□-11

- for limit level sensing of electrically conductive liquids
- short fully coated (insulated) electrode



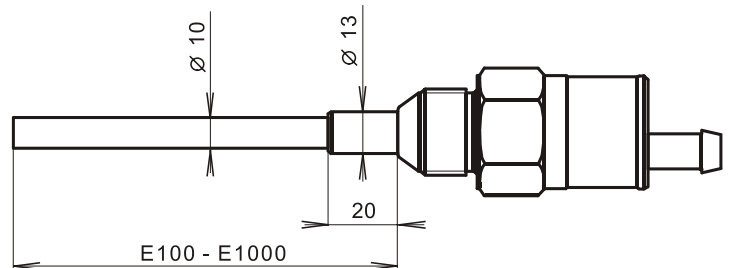
DLS-27□□-20

- for limit level sensing of light-bulk solid and powder materials
- rod electrode with extended PTFE insulation



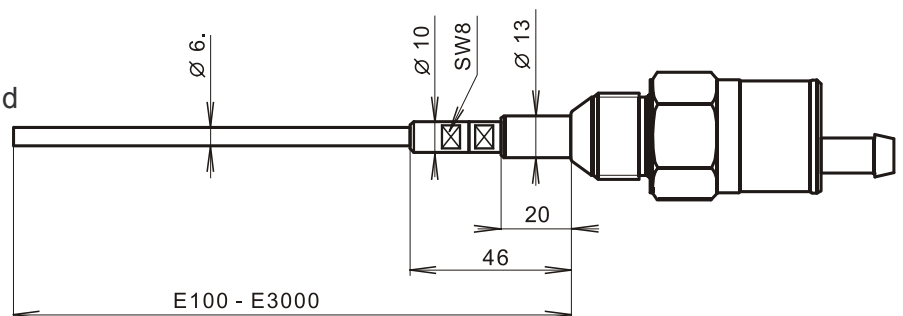
DLS-27□□-21

- for limit level sensing of conductive liquids
- PTFE fully coated rod electrode



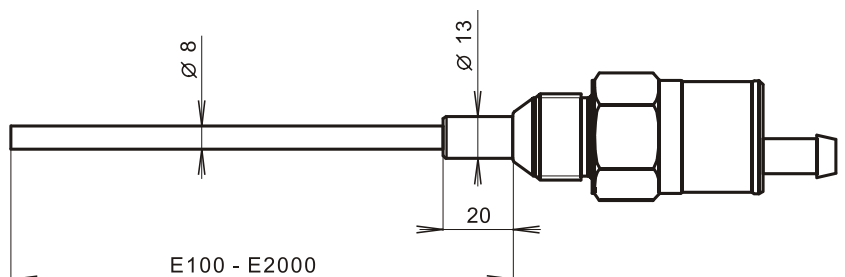
DLS-27□□-30

- for limit level sensing of liquid and solid materials
- dismountable rod uncoated electrode



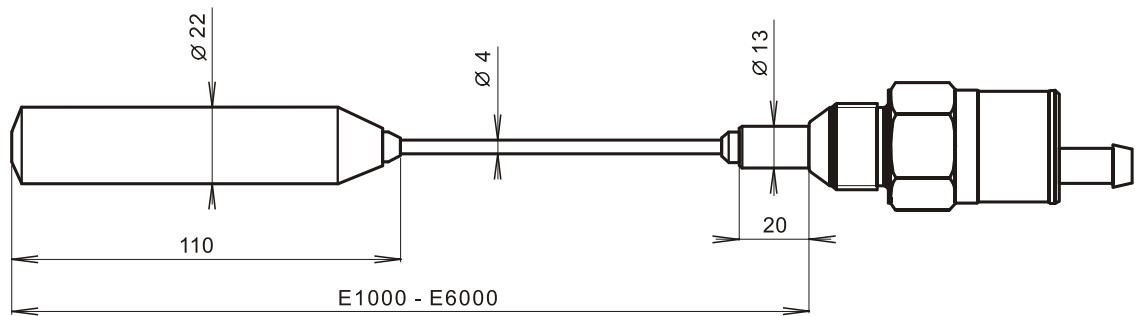
DLS-27□□-31

- for limit level sensing of conductive liquids
- PTFE fully coated rod electrode



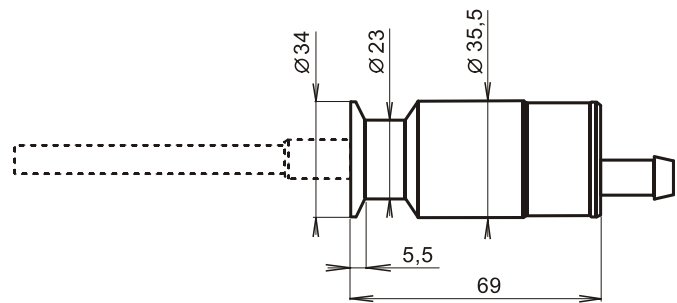
DLS-27□□-40

- for limit level sensing of liquid and solid materials
- rope polyolefin coated electrode and uncoated weight



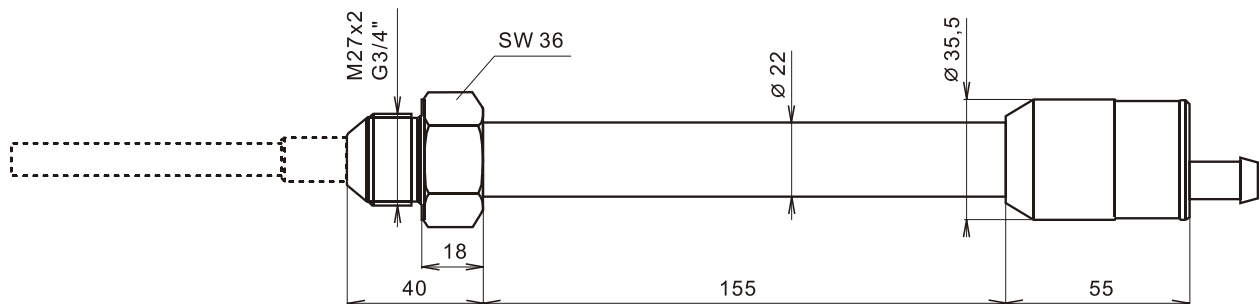
DLS-27□□-□□-□-□□-Cl

- variant equipped with Triclamp process coupling
- for food processing and pharmaceutical use
- main use due to basic variants of sensor



DLS-27□T

- variant for high temperatures
- for hot media up to 200°C
- main use, electric parameters and connection are equal to basic variants
- stainless steel tube element provides thermal separation between the housing with electronics and mounting head



Use and installation of main variants

DLS-27□□-10

Is produced in two versions - with 50mm or 100 mm length electrode. Short version (E50) is suitable for clean nonconductive liquids level sensing (oils, diesel, petrol, etc.). Longer version (E100) is designed for non-adhesive bulk-solid or non-adhesive powder materials (plastic granulates, sand, sugar, grains, etc.) and other non-conductive liquids (lubricants, plant oils).

Sensor is specified to be mounted directly into a vessel or container wall (horizontal position) by means of welding flange or stainless steel fixing nut. In case of level sensing of low-permittivity media in nonconductive containers it is recommended to mount the sensor on auxiliary metal-plate electrode with min. 200 cm² area.

DLS-27□□-11

Is specified for limit level sensing of electrically non adhesive conductive liquids (water and water solutions). It is possible to use it for detection of boundary between different permittivity liquids (e.g. water - oil).

Sensor is mounted directly into the side wall of the vessel or in a pipe (horizontal position) by means of normal or stainless steel welding flange.

DLS-27□□-20

Is designed for limit level detection of light-bulk solid materials (plastic granulates) or powder materials (flour, cement, limestone powder, detergents, etc.) and for materials with variable humidity (feeding mixtures, wood sawdust, etc.). It is possible to use it for nonconductive fluids with up to 2% of water (plant oils, liquid propane, etc.)

The sensor with electrode longer than 300 mm is recommended to mount in vertical position only.

Sensor is mounted directly into a vessel or container wall in horizontal (up to E300), slant or vertical position by means of welding flange or stainless steel fixing nut. We should minimize the hollow spaces between the electrode and the wall where the material can sediment (see application notes).

In case of level sensing in nonconductive containers it is recommended to mount the sensor on auxiliary metal plate electrode with min. 400 cm² area.

DLS-27□□-21

Is specified for conductive liquids level sensing (water, water solutions, mud, etc.). It is designed for horizontal (up to E300) or vertical installation directly in the wall of a vessel. It reacts on partial or full immersion of the electrode (dependent on adjusted sensitivity). The less is the sensitivity the better is resistance to an adhered rests of media.

Sensor is mountable directly into wall of a vessel in horizontal or vertical position by means of welding flange.

DLS-27□□-30

Is designed for universal use in vertical position for limit level detection of liquids (conductive and nonconductive) and bulk-solid and powder materials. It is not recommended to install the sensor into closed vessels where intensive condensation occurs. Electrically conductive liquids are sensed just by touch of the end of electrode. To react to nonconductive liquid or solid material it is necessary 5-20% dip into a medium dependently on the permittivity of sensed medium and set sensitivity.

Sensor is mounted directly into a tank, vessel, container or basin in slant or vertical position by means of welding flange or stainless steel fixing nut.

In case of level sensing of low-permittivity media in nonconductive containers it is recommended to mount the sensor on auxiliary metal-plate electrode with min. 500 cm² area.

DLS-27□□-31

Is designed for limit level detection of conductive liquids - water and solutions of chemicals. It is possible to install the sensor into closed vessels, tanks, basins, etc. The sensor reacts to liquid level after 2-20% dip into a liquid dependently on the permittivity of sensed medium and set sensitivity.

Sensor is mounted directly into a vessel, tank or open basins in vertical position by means of welding flange or fixing nut. When installed into an open basin it is necessary to ground the housing of sensor or to connect it with sensed liquid. For this purpose it is possible to use any metallic ever immersed object (pipe, etc.).

DLS-27□□-40

Is specified for versatile use for limit level detection of liquids (conductive and nonconductive) and bulk-solid and powder materials in depths down to 6m. It is not recommended to install the sensor into closed vessels where intensive condensation occurs. Electrically conductive liquids are sensed just by touch of the end of electrode. To react to nonconductive liquid or solid material it is necessary 5-20% immersion into a material.

Sensor is mounted directly into a vessel, tank or open basins in vertical position by means of welding flange or fixing nut. When installed into an open basin it is necessary to ground the housing of sensor or to connect it with sensed liquid. For this purpose it is possible to use any metallic ever immersed object (pipe, etc.).

Order code

DLS-27 □□ - □□ - □ - □□ - □ □

□□ - length of electrode in mm
□□ - process connection: **M** - metric thread M-27x2 **G** - thread G3/4"
□ - Triclamp coupling
□□ - output state at non activated electrode: **O** - open (R - lower current) **C** - closed (R - higher current)
□ - type of output: **N** - NPN - open collector **P** - PNP - open collector **R** - NAMUR
□ - electric connection: **B** - cable outlet (+ spec. the length of the cable) **C** - connector (+ spec. type of the socket)

performance: □

N - normal - for non-explosive areas
Xc - for use in flammable dusts areas
Xi - explosion proof - intrinsically safe - for hazardous (explosive) areas
XiM - explosion proof - intrinsically safe - for use in mines
NT, XiT - high temperature

type and electrode performance

10 - bar, uncoated, lengths 50 or 100 mm
11 - bar, short, fully insulated (length 30 mm)
20 - rod, partly coated - lengths 0,1 to 1 m
21 - rod, fully coated - lengths 0,1 to 1 m
30 - rod, uncoated (dismountable) - lengths 0,1 to 3 m
31 - rod, fully coated - lengths 0,1 to 2 m
40 - rope, with coated rope uncoated weight - lengths 1 to 6 m

Examples of correct specification

DLS-27N-10-C-NC-G E50
DLS-27NT-30-B-PO-M E1000 cable 7 m
DLS-27Xi-21-C-RO-CI E250
DLS-27Xc-20-B-PC-M E150 cable 5 m

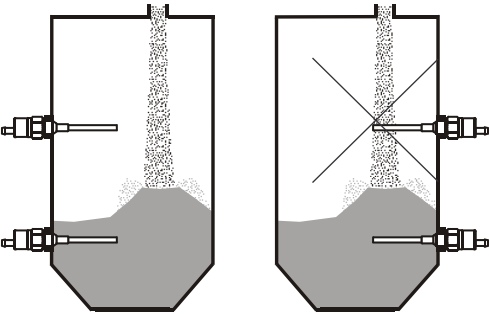
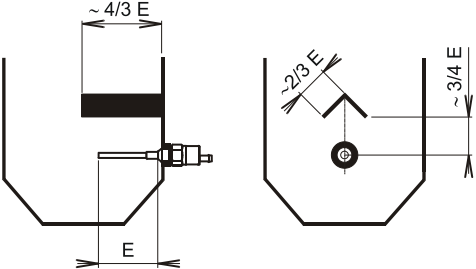
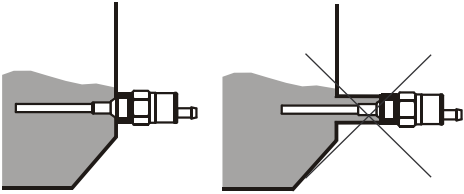
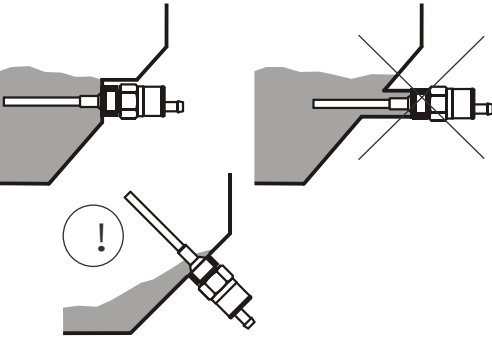
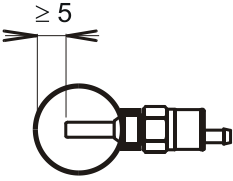
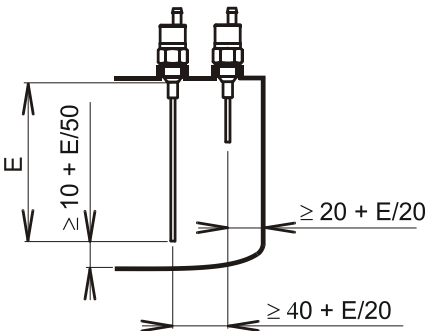
Aplication notes

FAQ: 1. Does the dust badly affect the function of DLS sensors?

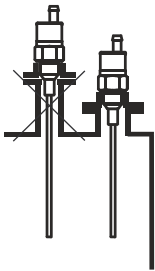
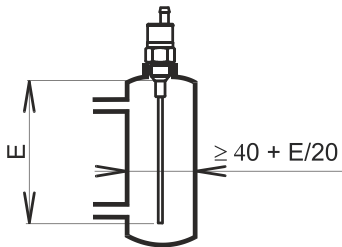
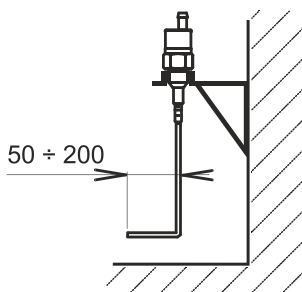
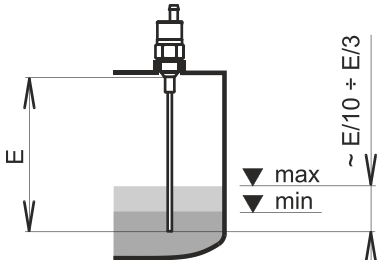
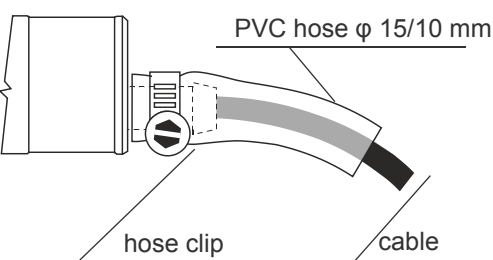
No. The dust have almost no effect to function (as similar as dry nonconductive adhered rests of material). The state of sensor changes only when the mass of material covers the electrode. The different situation is when the insulating bushing is covered by mixture of condensed water and dust. These problems can be solved by type choice of sensor and right sensitivity setting.

2. Does the DLS sensor react on foams on the level?

There exist various foams and capacitive sensors react on them differently. When the base of foam is electrically conductive solution (e.g. beer) we can DLS sensor use for foam detection, but it is possible to make them on foams insensitive (by means of type choice, sensitivity setting). The DLS sensors are generally insensitive on foams from nonconductive liquids (plant oils).

Graphic demonstration of the problem	Due to sensors	Recommendation - note
	All from side mounted sensors	<p>In the case of side wall mounting it is necessary to place the sensor aside the falling material (liquid or solid).</p> <p>left figure - O.K. right figure - wrong</p>
	DLS-27_-10, 20	<p>Protective roof mounting - is recommended when vertical movement of material could damage the sensing electrode - abrasive materials, blocks creating solid materials, etc.</p>
	All from side mounted sensors	<p>In the case of side wall mounting it is necessary to avoid long fitting tubes, where could the rests of sensed media cumulate - see the right figure. We recommend to mount the sensor so that the whole sensing electrode is inside the container (vessel)</p>
	DLS-27_-10, 20	<p>In the case of slant wall mounting it is necessary to eliminate long fittings and reduce the media sedimentation. The wrong example - right figure. Left figure - appropriate mounting on the auxiliary vertical plate.</p> <p>In some cases is allowed the variant shown on the lower figure - but only for DLS-27_-10 type, and only for not blocking materials.</p>
	DLS-27_-10, 11, 21	<p>In the case of mounting in the pipe it is necessary to provide the minimum distance of the inner walls from the electrode at 5 mm.</p>
	All vertically mounted sensors	<p>In the case of vertical mounting it is recommended to keep the mentioned distances applied to the length of the electrode (the longer one).</p>

Application notes

Graphic demonstration of the problem	Due to sensors	Recommendation - note
	All vertically mounted sensors	<p>In the case of vertical mounting it is necessary to avoid long fitting tubes, where could the vapours condense or some rests sediment.</p> <p>left figure - wrong, right figure - appropriate</p> <p>The similar situation is when the sensing electrode goes through the concrete ceiling of the silo. The hole diameter should be at least 50mm (acc. to the thickness of the ceiling)</p>
	DLS-27_-20, 21, 30,31	Mounting in a bypass measuring tube - we recommend to keep the tube diameter
	DLS-27_- 30	<p>In the case of vertical installation for non-conductive (or unknown) fluids sensing (e.g. in concrete reservoirs) is useful to bend the end of electrode to right angle. We can gain by it the good sensitivity at the end of electrode for various fluids.</p> <p>When the supposed media is water the bending has no sense (the sensor react just when the level touches the end of electrode).</p> <p>When the environmental conditions (wind, rain, snow) are present, we recommend to use types with insulated electrode (21 or 31).</p>
	DLS-27_-20, 21, 31	<p>In the case of vertical mounting it is possible to use hysteresis setting for simple two state regulation (pump control) . The height of the controlled level is done by sensitivity setting, the gap between the min. and max. is defined by hysteresis.</p>
	Variant "B" with cable outlet and fixed cable performance	In the case of vertical mounting in outer areas or in the case of high mechanical exertion we recommend to install protective hose on the cable.