



fill level



water level



pressure



temperature



flow



visualization



signal converter



sensoric



Capcont L

Fill level limit switch

*Capacitive filling level supervision
in liquids and solids*

Technical manual
01.14

Main features

Finely graded pressure measuring

- for filling level resp. limit value detection in container
- for dry run protection of pumps
- in liquids, viscous substances, granular substances or powders
- as elastomer-free measuring system for hygienic applications
- for electrically conductive and non-conductive materials
- for materials with a relative permittivity $\epsilon_r \geq 1,5$

Suitable for wide process temperature range from -40 °C to $+140\text{ °C}$

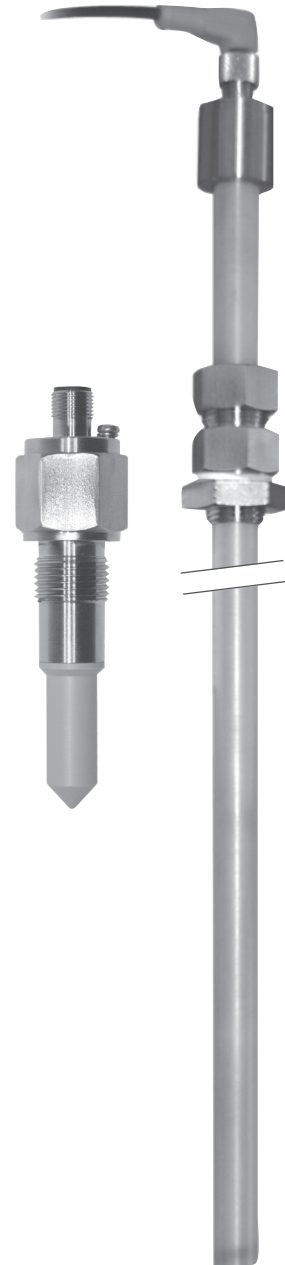
Useable at process pressures from -1 to 10 bar

Fully isolated electrode rod with isolation 1mm in PTFE resp. PEEK

Integrated evaluation electronic with PNP switching output

ATEX II 3G Ex ic IIC T6...T1 Gc resp. ATEX II 3D Ex ic IIIC T98°C Dc IP68

Certification for the use in explosion hazardous areas



ACS-CONTROL-SYSTEM
knowledge and systems

Your partner for measuring technology and automation



You have purchased a high-grade and modern measuring device of ACS-CONTROL-SYSTEM GmbH.

We want to give thanks for your purchase and for your confidence to us.

The actual technical manual includes instructions for installation, electrical connection and inauguration, as well as the technical data of the device.

Modifications, that answer the purpose of the technical progress, are reserved by ACS-CONTROL-SYSTEM GmbH without prior notice.

If a question occurs, that can't be answered by the listed informations, please call on our technicians team in Eggenfelden Tel: +49 8721/ 9668-0 or info@acs-controlsystem.de

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Index

Application	4
Function	4
Safety notes	5
Special safety notes	6
Installation	7
Installation place	7
Process and environmental temperature	9
Installation notes	9
Electrical connection	10
Potential equalization – earthing	10
Connection cable	10
Supply voltage	10
Switch output	10
Connection scheme	11
Operation	12
Operation and display parts	12
Adjustment	12
Maintenance	13
Repair	13
Technical Data	14
Auxiliary power supply	14
Input	14
Output Switch output	14
Process conditions	14
Environmental conditions	15
Materials - process wetted	15
Materials - not process wetted	15
Dimension drawings	16
Order Code	19
Type LS	19
Type LL2	19

Application

The device is a compact filling level limit switch with integrated evaluation electronic for supervision of filling levels in liquids and solids within container or pipes.

The device is suitable for limit value detection of also as dry run protection in liquids and viscous substances and also in powdery and fine granular substances, like e.g. grain, flour, powdered milk, mixing food, cement, chalk or gypsum.

It can be used in electrically conductive as well as in non-conductive materials.

The type LL2 with elastomer-free sealing and rod isolation in PEEK is especially suitable for the use in hygienic applications.

Function

The device is mounted from the top side or into the side wall of the pressure container or of the pipe. At the mounting from the top side the adjustment of the detection level is possible by using a sliding sleeve.

The device is a capacitive operating sensor for limit value detection.

Electrode rod, filling material and container wall creates an electrical capacitor.

The contact of the electrode rod with the filling material produces a variation in capacity, that is evaluated by the electronic and converted in a correspondent switching action.

The detection of a filling level signal is indicated at the plug side of the device by a yellow LED and converted into a switching command and output at the PNP switching output.

This allows the drive of relays, contactors, magnetic vents, optical indicators, horns as well as of SPS inputs.

At a switching reaction, the voltage of the connection terminal 1 (+L) is output alternating by two contrary operated semiconductor switches at two connection terminals.

The adjustment of the response sensitivity of the device to the respective filling material is done by a potentiometer.

Safety notes

Each person that is engaged with inauguration and operation of this device, must have read and understood this technical manual and especially the safety notes.

Installation, electrical connection, inauguration and operation of the device must be made by a qualified employee according to the informations in this technical manual and the relevant standards and rules.

The device may only be used within the permitted operation limits that are listed in this technical manual.

Every use besides these limits as agreed can lead to serious dangers.

The materials of the device must be chosen resp. checked for compatibility with the respective application requirements (contacting materials, process temperature). An unsuitable material can lead to damage, abnormal behavior or destruction of the device and to the resulting dangers.

The sensors may not be used as sole device for prevention of dangerous conditions in machines and plants.

This measuring device meets article 3 (3) of the EC directive 97/23/EC (pressure equipment device directive) and is designed and produced in good engineer practice.

The device meets the legal requirements of all relevant EC directives.



Using the device in a manner that does not fall within the scope of its intended use, disregarding this instruction, using under-qualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

Special safety notes

Electrical operating supplies for explosive hazardous areas

If a device is installed and operated in explosive hazardous areas, the general Ex construction standards (EN/IEC 60079-14, VDE 0165) and these safety notes be observed.
The installation of explosive hazardous systems must be carried out principally by specialist staff.

The device meets the classification:

II 3G Ex ic IIC T6/T5/T4...T1 Gc	$T_a = -40...+65^{\circ}\text{C}/+80^{\circ}\text{C}/+85^{\circ}\text{C}$
II 3D Ex ic IIIC T98°C Dc IP68	$T_a = -40...+85^{\circ}\text{C}$

The device is conceived for measuring of limit levels in explosive hazardous areas, which requires devices of category 3. The measured medium may also be combustible liquids or dusts.
The sensor may be mounted in explosion hazardous areas, which requires devices of category 3.
The permitted operating pressures are type and variant dependent and can be found in this technical manual.

The permitted operating temperatures are type and variant dependent and can be found in this technical manual.

The device is earthen for safe technical function. Provide sufficient potential compensation along the complete cable way.

The PA connection of the terminal enclosure housing must be connected with the potential compensation of the explosion hazardous area.

Supply and signal circuits in type of protection „Intrinsic safety“ Ex ic IIC resp. Ex ic IIIC, only for connection to certified intrinsically safe circuits.

Sum of the maximum values of the intrinsically safe circuits	
U_i	30 V
I_i	300 mA
P_i	0,9 W

Effective internal capacitances and inductances	
C_i	26,1 nF
L_i	negligible

The supply and signal circuits are galvanically connected with each other.

The rules for combination of intrinsically safe circuits must be applied.

At the chargeable plastic parts of the device there is a danger of ignition by electrostatic discharges.

The operator has to ascertain the suitability of this equipment for his use.

At variants of the devices with chargeable plastic parts, a warning marking points out to the safety measures, that must be applied because of the electrostatic charging in operation and especially in the case of maintenance activities:

- avoid friction
- no dry cleaning
- no assembling in pneumatic conveying stream

At possible dangers due to pendular or swinging movements, the sensor must be protected effective against these dangers.

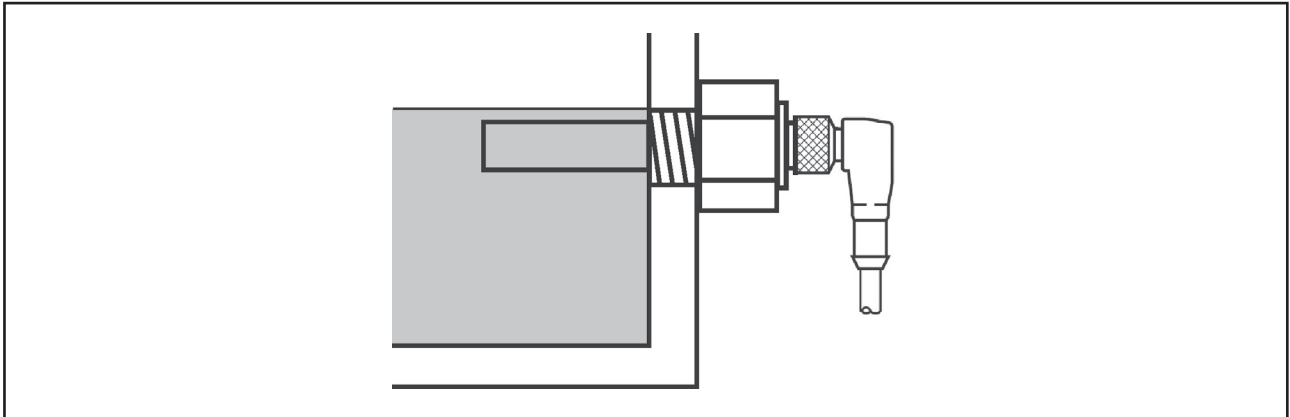
Installation

The correct function of the device within the specific technical data can only be guaranteed, if the permitted process and environmental temperatures (see chapter „Technical data“) will not be exceeded.

Installation place

The device can be installed horizontal, that is at the side, or also vertical, that is from the top into the container resp. pipe wall.

Horizontal installation



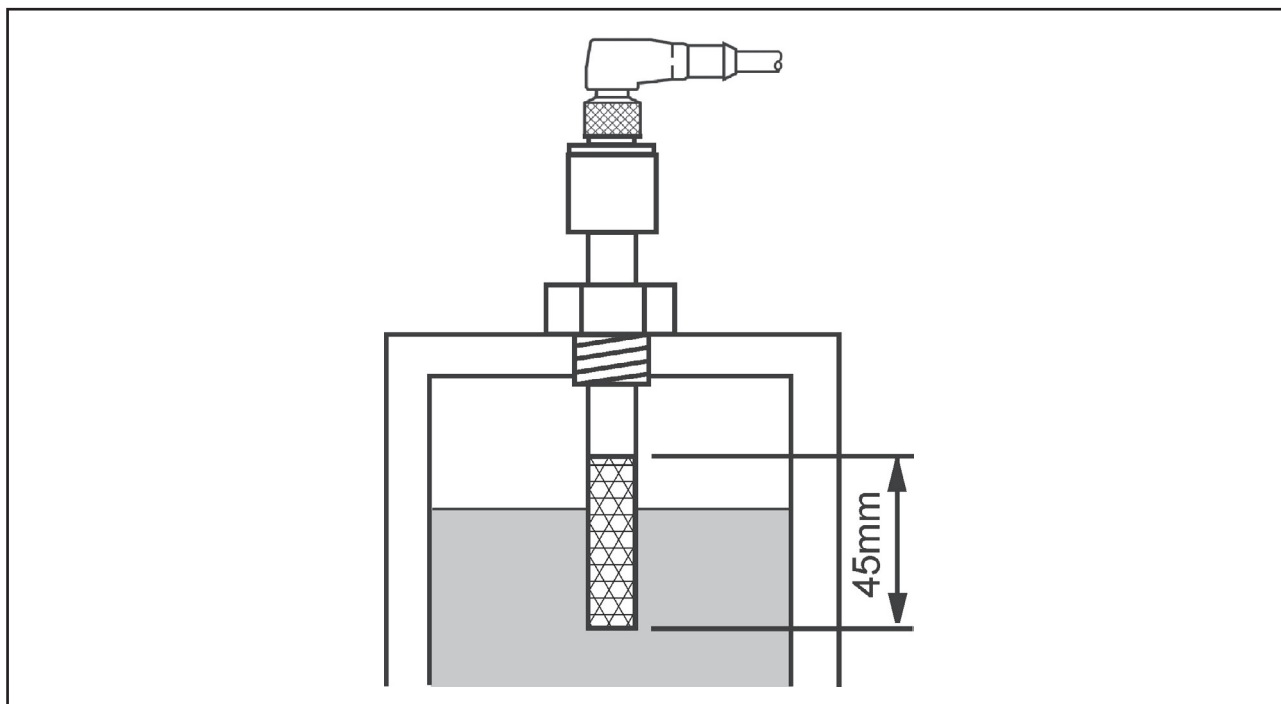
At horizontal installation the filling material will only be safe protected, if the complete rod is covered by the filling material.

However, the resulting detection level depends additionally from further factors like the characteristics of the filling material, the installation conditions and the adjustment of the device.

At a horizontal installation the device should be installed at an angle with the electrode rod tip below (approx. 20...30°), to allow an easier flow-off of filling material residues.

Only the versions LS with length A and LL2 are conceived for horizontal installation.

Vertical installation

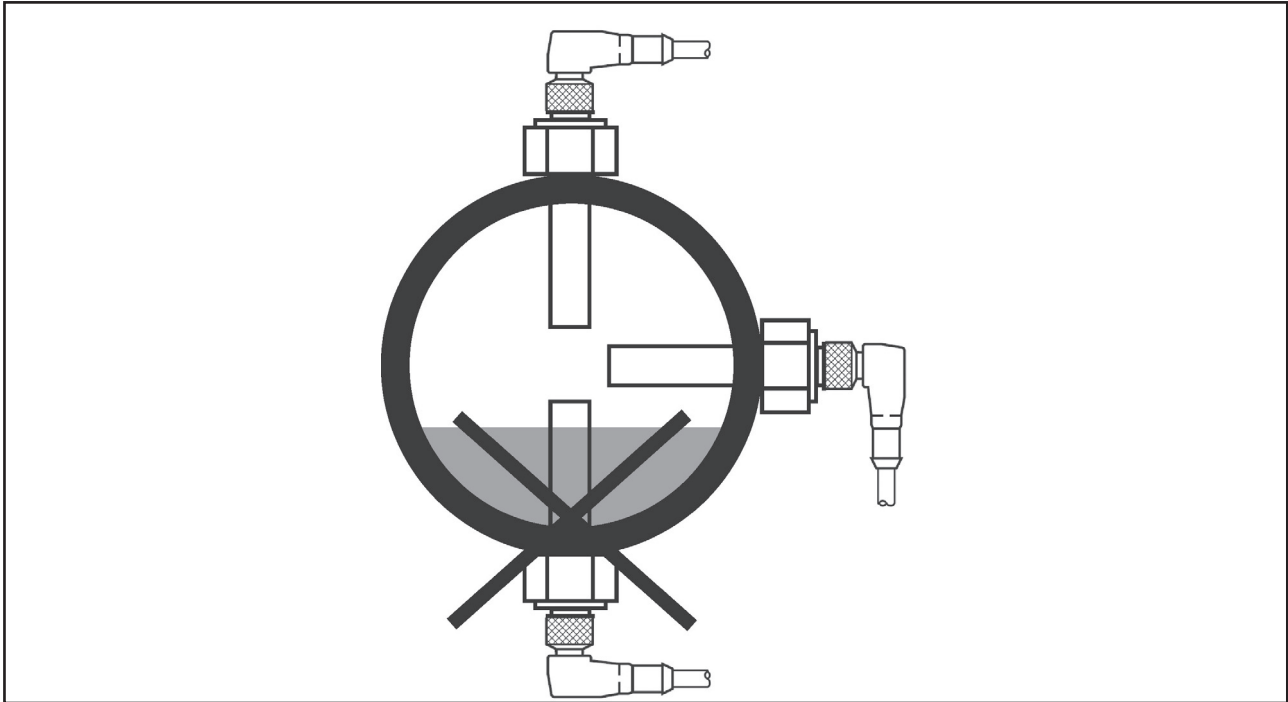


At vertical installation the filling material will only be safe protected, if the active area at the rod tip (45mm) is covered by the filling material.

However, the resulting detection level depends additionally from further factors like the characteristics of the filling material, the installation conditions and the adjustment of the device.

At a device of variant LS the filling material level can be adjusted at installation from the top by the rod length and especially at the variant LS0 by the position of the device in the sliding sleeve.

Horizontal pipes



At horizontal pipes the installation position decides about the switching behavior:

- If the device is mounted at the top side of the horizontal pipe, a switching action is generated already at a minimum of filling material deficiency.
Remains of the filling material can flow off easily from the electrode tip.
- At sided installation in a horizontal pipe, the switching action is generated at partially filled resp. partially empty pipe.
Remains of the filling material can flow off easily from the electrode tip.
- The installation at the bottom of a horizontal pipe is not recommended.
If filling material remains stays in the pipe, this can possibly not be detected.

Forces to the side of the sensor rod, produced e.g. by mixer or near fill-in openings should be avoided. For the use as pump protection, the installation at the suction side of the pump is recommended.

Process and environmental temperature

At high process temperatures a heat transfer to the terminal housing can be reduced by isolation of the medium carrying part of the plant.

Installation notes

- Drive the system pressure free prior installation resp. deinstallation of the sensor.
- The screw-in of the thread process connection by using the terminal housing, the connection plug resp. the connection cable is not permitted.
- The tightening of the thread process connection may only be done at the hexagon by a suitable spanner and with the maximum permitted torque strength.
- The maximum permitted torque strength is 50Nm.
- At the type LL2 the absence of an elastomer can only be realized, when using a suitable sleeve (SEM-22 / SEM-42)

Electrical connection

The electrical connection of the device must be carried out according to the respective country specific standards.

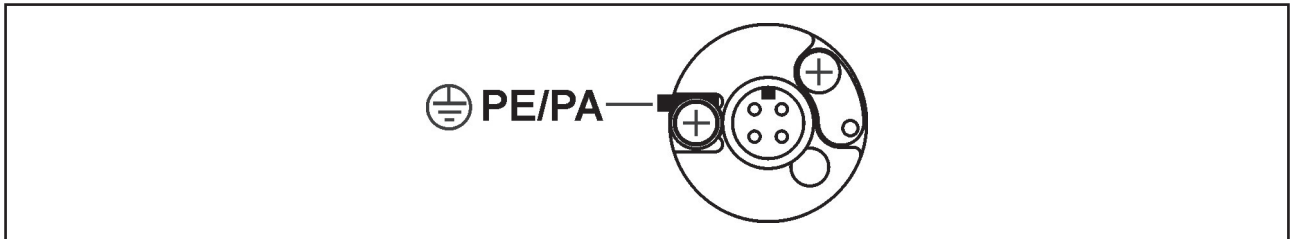
Incorrect installation or adjustment could cause applicationally conditioned risks.

For inauguration it is suggested to switch off all connected control devices to avoid unintended control actions.

Potential equalization – earthing

The device must be grounded.

The earthing can be carried out by the PE/PA terminal screw or by the metallic process connection.



Connection cable

For the connection use only suitable cables, that fulfills the requirements e.g. regarding temperature, chemical resistance or laying at the place of installation.

Supply voltage

The voltage applied to the terminal contacts may not exceed the maximum permitted supply voltage to avoid damage of the electronic.

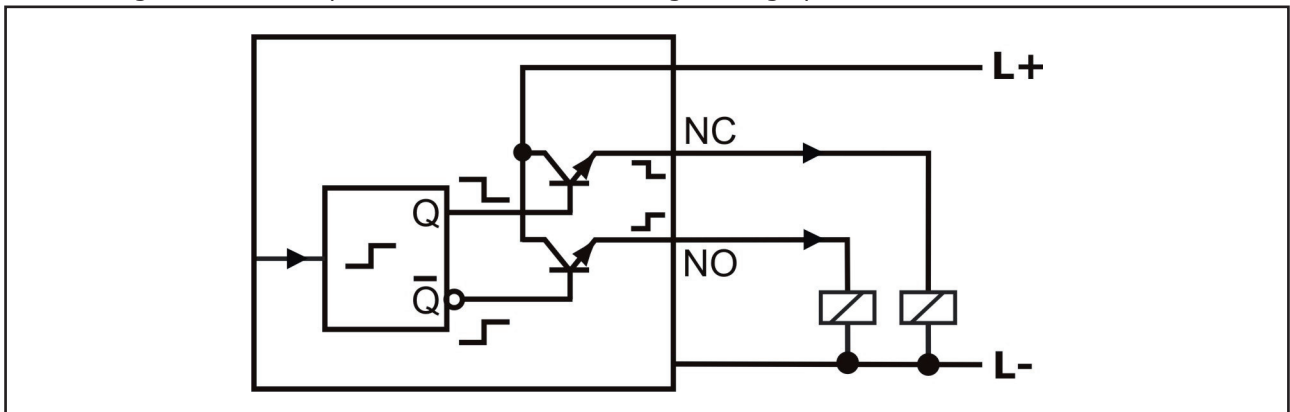
The maximum permitted supply voltage range at the respective version is:

Type L – Standard	10...35V _{DC}
Type X2L – ATEX	12...30V _{DC}

All connections are reverse polarity protected.

Switch output

Inductive loads at the pnp switch output, e.g. relays or contactors may only be used with a free-wheeling diode or a RC protection circuit to avoid high voltage peaks.

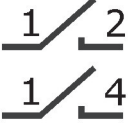

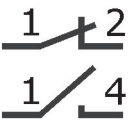


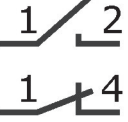


The load at the PNP switch output will be connected to the terminal +L of the supply voltage (terminal 1) by a semiconductor switch contactless and by this bounce-free.

At an activated switching state a positive signal near supply voltage is feed to the output.

At deactivated switching state and at failure of supply voltage the semiconductor switch is shut off.

The PNP switch output is current limited to 0,5 A and is overload and short circuit protected.

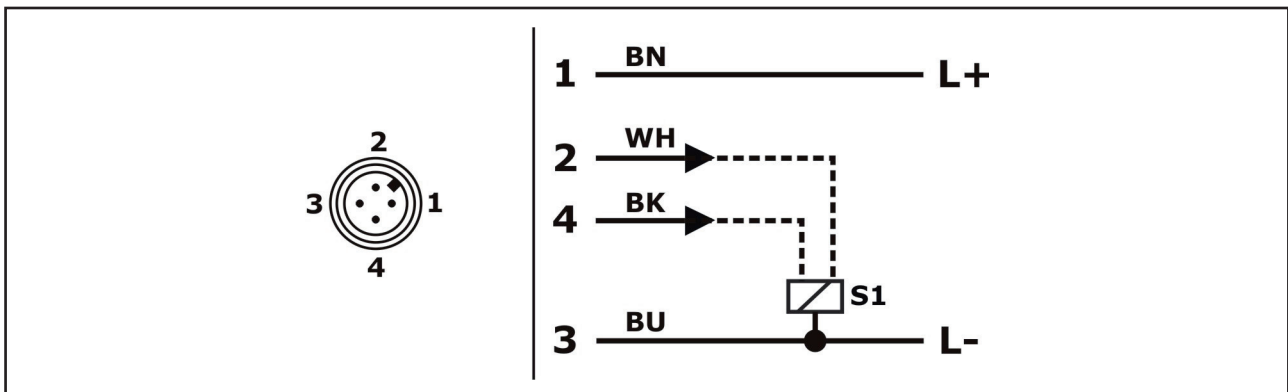
	SP-LED	S1
$U_s = 0V$	●	
	●	
	 YE	

The device is suitable for non-coincidence use. Using both outputs the NO and NC outputs leads contrary states at trouble-free operation.

In the case of failure or at wire break both electronic switches are opened.

By using a two-channel evaluation, besides the flow monitoring also a function dependent monitoring of the sensor can be realized.

Connection scheme



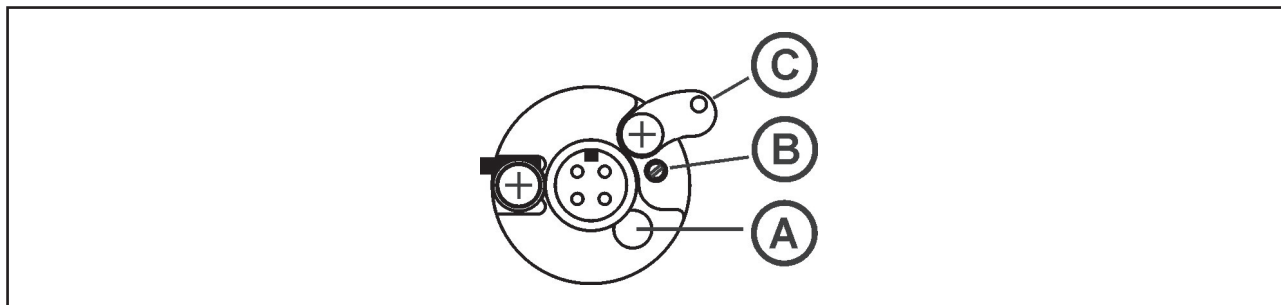
Conductor color standard connection cable M12:

BN = brown, WH = white, BU = blue, BK = black

The connection cable is not enclosed in the delivery contents.

Operation

Operation and display parts



A - LED display

- Display of switching function - yellow

B - Adjustment trimmer

- Adjustment of response sensitivity

C - Cover plate

- Protection cover for adjustment trimmer

Adjustment

The adjustment trimmer is positioned below the swiveling protection plate. To swivel the protection plate the fixing screw must be released.

Adjustment of the response sensitivity

Turn to the left → filling material detection at higher DK value
Turn to the right → filling material detection at lower DK value

Procedure at adjustment

- The filling material must have fully covered the electrode rod
- Turn adjustment trimmer left (counterclockwise), till output switches off
- Turn adjustment trimmer right (clockwise), till output switches on
- Continue turning adjustment trimmer right for a half rotation

After the adjustment the protection plate must be swiveled back and the fixing screw must be retightened. Only this ensures a safe sealing.

Maintenance

The device is free of maintenance.

Repair

A repair may only be carried out by the manufacturer.

If the device must be sent back for repair, the following informations must be enclosed:

- An exact description of the application.
- The chemical and physical characteristics of the product.
- A short description of the occurred error.

Before returning the device for repair, the following measures must be proceeded:

- All adhesive product residues must be removed. This is especially important, if the product is unhealthily, e.g. caustic, toxic, carcinogenic, radioactive etc.
- A returning must be refrained, if it is not possible by 100% to remove the unhealthily product completely, because e.g. it is penetrate into cracks or is diffused through plastic.

Technical Data

Auxiliary power supply

Supply voltage U_s	<u>Type L - Standard</u> 10..35V _{DC} , reverse polarity protected
	<u>Type X2L - ATEX</u> 12..30V _{DC} , reverse polarity protected
Residual ripple U_{pp}	$\leq 2V_{pp} / U_{Smin} \leq U_s \leq U_{Smax}$
Supply current I_{In}	$\leq 10mA$ Switching output no load

Input

Measurement parameter	Filling level – limit level
Measurement principle	capacitive
Measurement medium	Liquids, solids
Measurement range	Relative permittivity $\epsilon_r \geq 1,5$

Output Switch output

Start-up time t_{On}	$\leq 1s$
Function	PNP switching to +L (terminal 1)
Output voltage U_{Out}	$U_{Out} \geq U_s - 2V$
Output current I_l	0... $\leq 500mA$, current limited, short circuit protected
Cutoff current I_{l-off}	$\leq 100\mu A$
Rise time T_{90}	$< 30 \mu s$ ($R_l < 3k\Omega / I_{Out} > 4,5mA$)
Step response time t_r	$\leq 200ms$
Switch cycles	$\geq 100.000.000$

Process conditions

The permitted process temperature range results from the combination of standard range and limitation, whereby the range is defined by the narrowest limitation.

Process temperature	<u>Type LS</u> -40°C...+100°C <u>Limitation</u> Gasket FPM >> -25°C...+100°C Type X2L – ATEX >> -40°C...+85°C
	<u>Type LL2</u> -40°C...+140°C <u>Limitation</u> Type X2L – ATEX >> -40°C...+85°C Using a standard sleeve >> -25°C...+100°C
Process pressure	<u>Type LS</u> -1...+1bar
	<u>Type LL2</u> -1...+10bar <u>Limitation</u> Using a standard sleeve >> -1...+1bar

Environmental conditions

Environmental temperature	-40°C...+100°C
Protection	IP68 [≤ 3 mWs-1h] (EN/IEC 60529)
Climatic classification	4K4H [-20...+55°C / 4...100%] (EN/IEC 60721-3-4)
Shock classification	15g [11ms] (EN/IEC 60068-2-27)
Vibration classification	5g [10 - 2000Hz] (EN/IEC 60068-2-6)
EM compatibility	Operation device class B / Industrial range (EN/IEC 61326)
Weight	<u>Type LS</u> Length A - 0,23kg Length B - 0,33kg Length C - 0,48kg Length D - 0,65kg <u>Type LL2</u> 0,21kg
Reference conditions	EN/IEC 60770-1 resp. EN/IEC 61003-1
	T = 25°C, relative humidity 45...75%, environmental air pressure 860..1060kPa
Calibration position	Test medium water Mounting position vertical Supply voltage 24V _{DC}
Warm-up time	≤ 60 s

Materials - process wetted

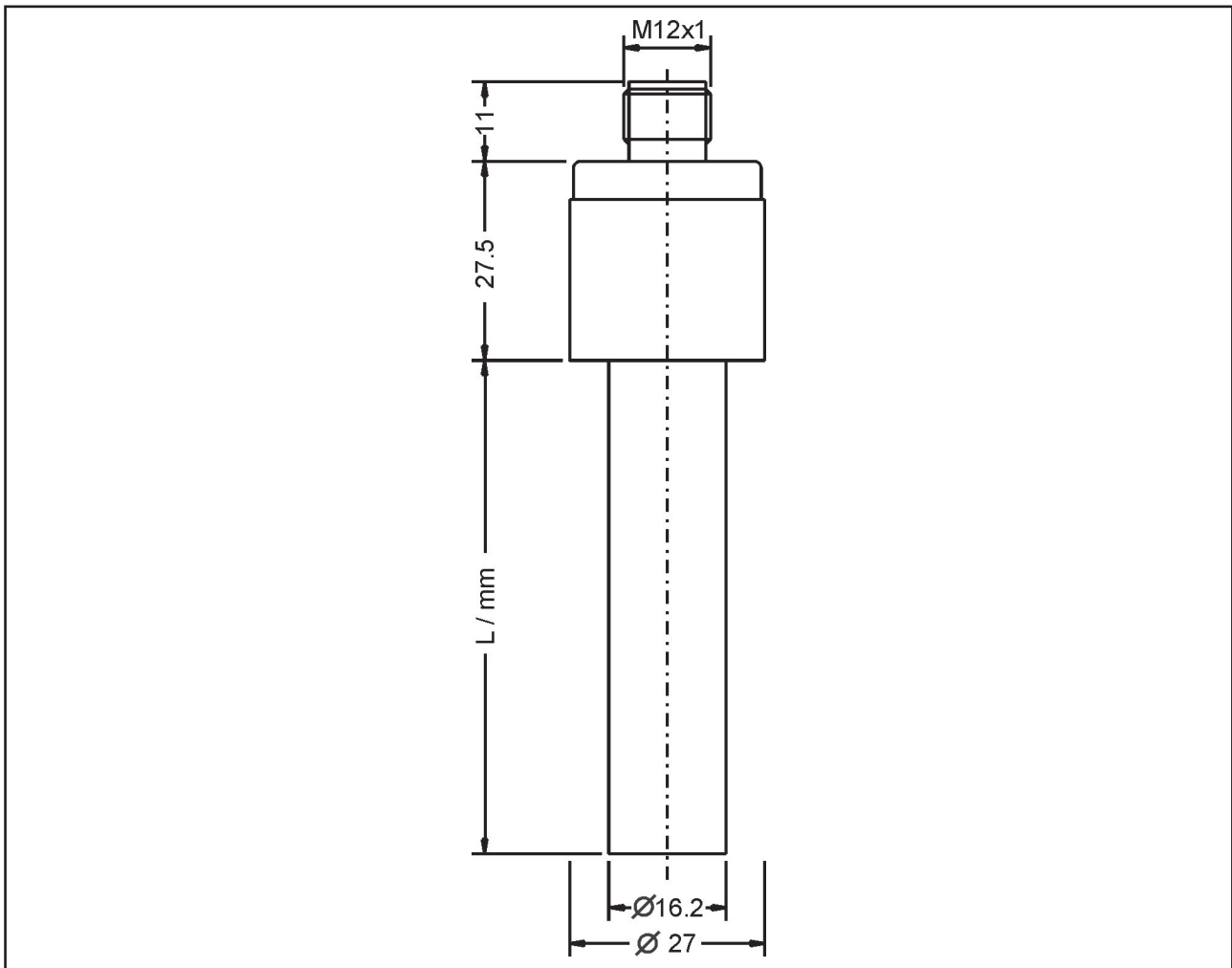
Membrane	<u>Type LS</u> PTFE – polytetrafluorethylene (Teflon®) <u>Type LL2</u> PEEK
Process connection	Steel 1.4404 (316L) / 1.4571 (316Ti)
Gaskets	<u>Type LS</u> FPM – fluorelastomere (Viton®) EPDM – ethylene-propylene-dienmonomere <u>Type LL2</u> without <u>Limitation</u> Using a standard sleeve >> FPM – fluorelastomere (Viton®)

Materials - not process wetted

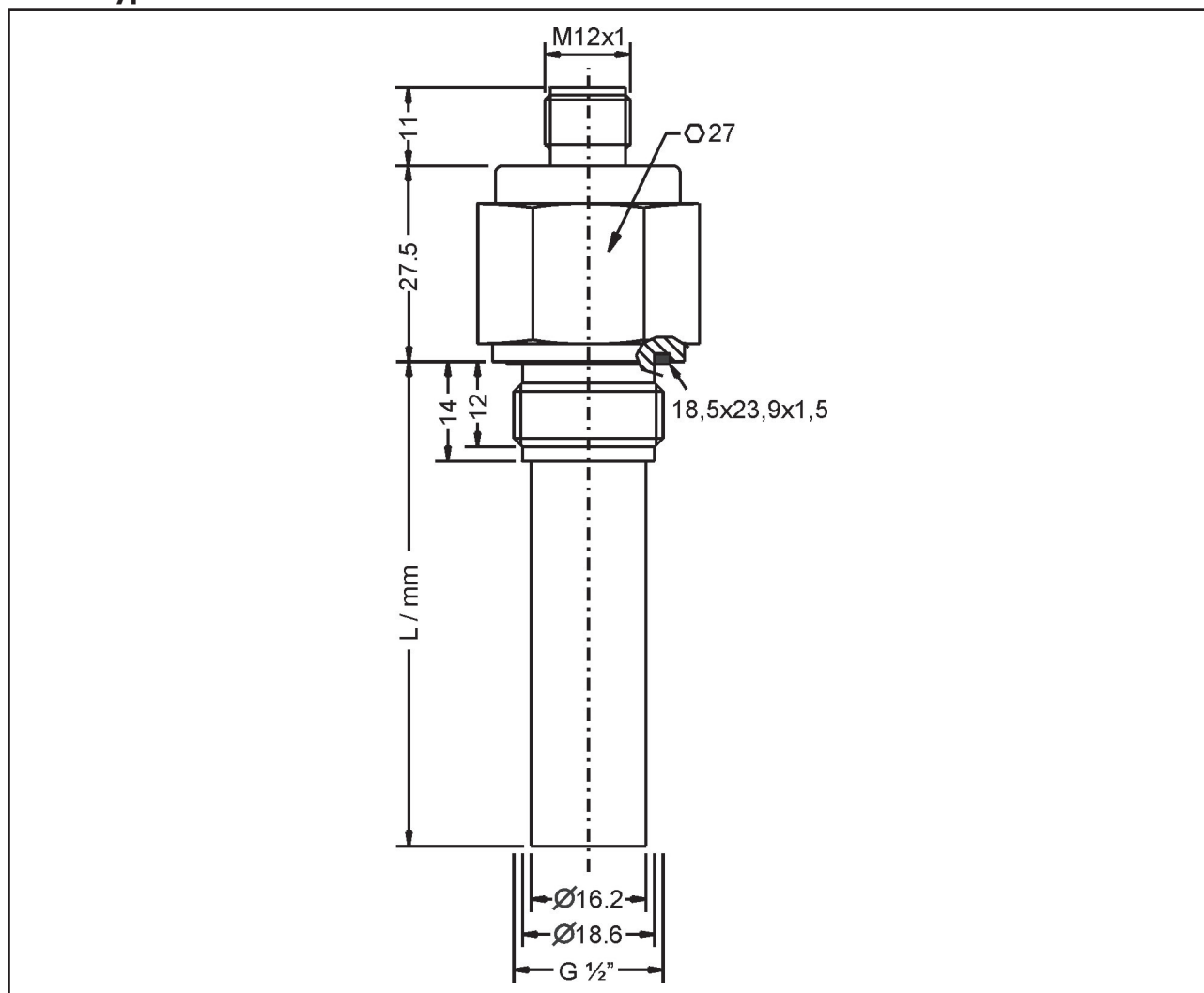
Terminal enclosure	CrNi-steel PC - polycarbonate
Electrical connection part	Device plug PUR
Gaskets	FPM – fluorelastomere (Viton®) NBR – nitril-butadien-rubber

Dimension drawings

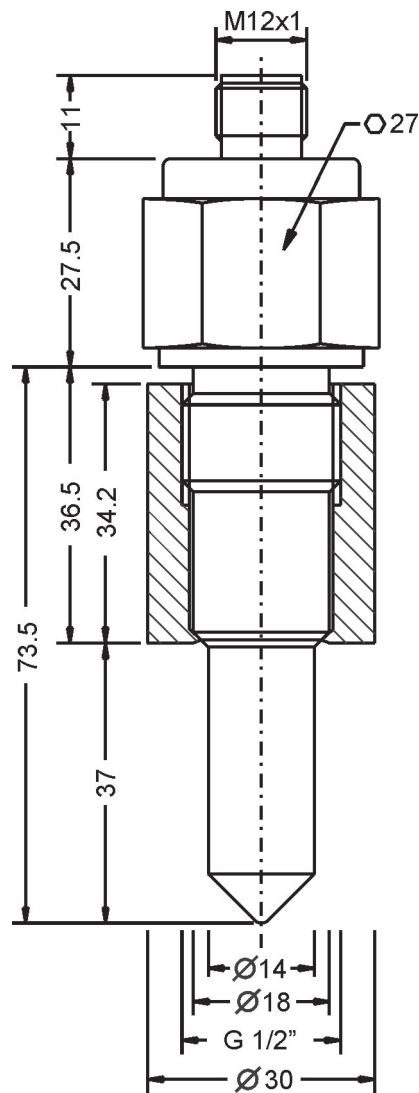
- Type LS0



- **Type LS1**



- **Type LL2**



Order Code

Type LS

L

X2L

S

V

C

A

0

S

Type
Standard
ATEX II 3G Ex ic IIC T6/T5/T4...T1 Gc / ATEX II 3D Ex ic IIIC T98°C Dc IP68

Material electrode rod insulation (process wetted)
PTFE – polytetrafluorethylene (Teflon®)

Process connection
0 without – installation in sliding sleeve SAMV-63
1 G ½" B, DIN EN ISO228-1, DIN 3852-11-E
Y others

Material gaskets (process wetted)
1 FPM – fluorelastomere (Viton®)
3 EPDM – ethylene-propylene-dienmonomere – food applications

Material process connection (process wetted)
Steel 1.4404/316L or 1.4571/316Ti

Material terminal enclosure
C CrNi-steel

Electronic - output
A Direct voltage 24V_{DC}, 1x PNP switching output

Process temperature
0 Standard, -40°C...+100°C

Electrical connection
S Plug M12

Length L
A Length L = 150mm
B Length L = 300mm
C Length L = 500mm
D Length L = 750mm

Capcont

S

V

C

A

0

S

Type LL2

L

X2L

L

2

0

V

C

A

1

S

0

Type
Standard
ATEX II 3G Ex ic IIC T6/T5/T4...T1 Gc / ATEX II 3D Ex ic IIIC T98°C Dc IP68

Material electrode rod insulation (process wetted)
PEEK

Process connection
2 G ½" B, DIN EN ISO228-1 – installation in weld-in sleeve SEM-22 / SEM-42

Material gaskets (process wetted)
0 without

Material process connection (process wetted)
Steel 1.4404/316L or 1.4571/316Ti

Material terminal enclosure
C CrNi-steel

Electronic - output
A Direct voltage 24V_{DC}, 1x PNP switching output

Process temperature
1 Extended, -40°C...+140°C

Electrical connection
S Plug M12

Capcont

L

2

0

V

C

A

1

S

0

Installation material and connection cable are not enclosed in contents of delivery.

ACS-CONTROL-SYSTEM
knowledge and systems

Your partner for measuring technology and automation



ACS-CONTROL-SYSTEM GmbH
Lauterbachstr. 57
D- 84307 Eggenfelden

Tel.: +49 (0) 8721/ 9668-0
Fax: +49 (0) 8721/ 9668-30

info@acs-controlsystem.de
www.acs-controlsystem.de