



Technical manual BA 0210



Filling level



SAT – STK – SLK – SST

Electrode probe

for conductive limit level detection
in electrical conductive liquids

Detects up to six limit values simultaneously

Useable

- for leakage or overflow protection in container
- for minimum, maximum resp. multilevel detection in container
- as pump protection, resp. dry run protection in pipelines
- for two-position-control of pumps

Wide application range

- for conductivities higher than 1 $\mu\text{S}/\text{cm}$
- for process temperatures from $-40\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$
- for process pressures from -1 bar to $+20\text{ bar}$
- materials also for aggressive filling material

ATEX II 1 G Ex ia IIC T6

Certification for the use in explosion hazardous areas


Rod or rope electrode version

ACS-CONTROL-SYSTEM
know how mit system



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Index

Application field – variant differences	3
Function	3
Safety notes	4
Safety notes 	4
Installation	5
Maintenance	5
Repair	6
Electrical connection	6
Technical data	7
Dimension drawings – SAT	8
Order code overview – SAT	9
Dimension drawings – STK	10 / 11
Order code overview – STK	12
Dimension drawings – SLK	13 / 14
Order code overview – SLK	15
Dimension drawings – SST	16
Order code overview – SST	17

Application field

The electrode probes series **SAT – STK – SLK - SST**, in combination with a suitable evaluation device, is used for conductive limit value detection in electrically conductive filling materials.

Depending on the application, the electrode rod's resp. rope's can be mounted at a metallic or plastic process connection, whereas the rod's can have a length of up to 3 m resp. the rope's can have a length of up to 15 m.

With up to seven contact electrodes multiple tasks can be fulfilled simultaneously. Among these tasks are e.g. leakage and overflow protection, minimum / maximum protection resp. multilevel detection in container, pump protection in pipelines and also the two-position-control of pumps.

The electrode probes are designed for a wide application range.

The conductivity also of aggressive filling materials, with 1 $\mu\text{S}/\text{cm}$ and higher can be detected, at process temperatures from $-40\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$, at pressures from -1 bar to $+20\text{ bar}$.

The electrode probes series SAT – STK – SLK are certificated for the use in explosion hazardous areas acc. to ATEX II 1 G in zone 0.

	SAT	STK	SLK	SST
Hygienic applications			x	
Use in explosion hazardous areas – ATEX	x	x	x	
Rod electrodes	x	x	x	
Rope electrodes				x
Metallic process connection		x	x	
Plastic process connection	x			x
Number of electrodes	7	5	4	7
maximum number of switching levels	6	5	4	6
maximum process pressure / bar	-1...+10	-1...+20	-1...+20	pressure less

Function

The electrode probe **SAT – STK – SLK - SST** is mounted directly in the wall of the container or of the pipe by using the respective process connection or installed over the filling material by using a suitable mount.

The alternating voltage, that is generated by a suitable evaluation electronic is applied either between the electrode rods resp. ropes or, at electrode probes with metallic process connection, between the electrode rods resp. ropes and the metallic wall of the container resp. pipe that is connected to the metallic process connection.

As soon as the electrically conductive filling material makes a connection between the electrodes resp. between the electrode and the metallic wall of the container resp. pipe, an measurable current flows, that causes a reaction of the connected evaluation device.

Due to the use of a alternating voltage the corrosion at the electrode and the electrolytic decomposition of the filling material is avoided.

At electrode probes an additional module (diode module LBM) for the wire supervision can be installed inside the housing.

In the case of a wire break between electrode probe and a suitable evaluation device, the evaluation device can output a corresponding warning signal.

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 suitability to the respective application requirements (contacting substances, process temperature). An unsuitable material can lead to damage, abnormal behavior or destruction of the device and to the resulting dangers.

The device meets the legal requirements of all relevant EC directives.  0158



Safety notes for 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), these safety notes and the enclosed EC conformity certificate must be observed.

The installation of explosive hazardous systems must be carried out principally by specialist staff.

The device meets the classification

II 1 G Ex ia IIC T6...T1 resp.

II 1/2 G Ex ia IIC T6...T1 resp.

II 2 G Ex ib IIC T6...T1

The devices are conceived for detection of limit values in explosive hazardous areas.

The measured medium may also be combustible liquids.

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

For applications, which require devices of category 1 or category 1/2, the process pressure and temperature range of the media has to be between 0,8 bar and 1,1 bar and between -20 °C and 60 °C.

If a device is mounted in the separation wall to the hazardous area that requires devices of category 1, the process connections have to be designed in such a way, that they are sufficiently tight according to EN/IEC 60079-14 section 4.6.

The operating device may only remain in the zone when connected to an evaluation device and connected to the potential compensation.

The metallic process connection resp. the metallic connection housing must be connected with the potential compensation of the explosion hazardous area.

The device is earthen for safe technical function. Provide sufficient potential compensation along the complete cable way. Install the intrinsically safe circuit earth free.

At variants of the devices with chargeable plastic parts (e.g. connection housing, isolation), 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
- protect the electrode rods resp. ropes against pendular movements

Installation

The isolation of the electrode rod resp. electrode rope may not be damaged resp. removed excepted at the electrode tip.

Cutting the electrode rods - variants SAT / STK / SLK:

The electrode rods can be cut arbitrarily by a tong or a saw. After cutting the electrode rod, remove 10 mm of the isolation. The electrode may not be mechanically forced at the cutting, to avoid damaging the isolation.

Cutting the electrode ropes - variant SST:

The cutting of the rope is made at the side of the connection housing. Unscrew the fixation ring of the rope inside the connection housing and pull out the rope to the needed rope length. After that, fix the rope by screwing the fixation ring. Cut the rope with a tong and remove 10 mm of the isolation.

Installation notes

Drive the system pressure free prior installation resp. deinstallation of the device and avoid high temperatures to avoid injuries.

Consider enough installation space outside the container, to insert the electrode probe into the plant without the use of force.

Install the device if necessary into a bypass if dense heavy foam, wild turbulences or foamed liquids can occur.

If a metallic wall of a container resp. pipeline should be used as reference electrode there must be paid attention that the metallic process connection (variant STK / SLK) of the electrode probe is safe electrically conductive connected with the container resp. the pipeline. Use conductive gaskets like e.g. copper or lead. Isolation measures like e.g. the wrap of the thread with teflon band or a paper gasket can interrupt the electric contact.

Install the electrode probe in such a position in the container, where no strong forces to the side, like e.g. by mixer or near fill-in openings, can have an effect to the electrode rods resp. ropes.

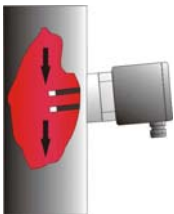
This is especially important for especially long electrode rods resp. ropes.

The non-isolated electrode tips, when mounted, may not make a contact to the wall of the container, if this is made of metal or electrically conductive plastic.

Electrode rods longer than 0,5 m must be stabilized among each other or against the wall of the container, especially if the filling material is strongly fluctuating.

Use for the stabilization suitable isolating spacers.

The distance between the spaces should be not more than 0,5 m.



At horizontal side mounting into a container or also into a pipe for stability reasons the length of the electrode rods should be not more than 200 mm.

At wider electrode rods (8 or 10 mm) the length can be longer.

At a horizontal mounting the electrode rods should be installed at an angle with the electrode rod tip below (approx. 20°), to allow an easier flow-off of filling material residues and by this to avoid the coat-forming.

Electrode ropes are not suitable for side mounting.



At horizontal pipelines the length of the electrodes is limited by that way, that in a empty pipe, also in the case of liquid residues, the electrically conductive liquid connection between electrode and wall resp. between the two electrode rods can disconnect. Otherwise and empty pipe can be detected as filled.

At process connections with a screwing thread the tightening of the process connection may only be done at the hexagon by a suitable spanner. The maximum permitted torque strength is 100 Nm.

The screw in of the process connection by using the connection housing is not permitted.

Maintenance

The devices is free of maintenance.

The isolation of the electrodes should be checked regularly and also a possible coating at the electrode tips should be removed.

A non-conductive coating at the metallic electrode tip can effect error behaviour because no current can flow although the electrically conductive filling material makes a connection.

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

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.

Use only suitable cables with max. 25 Ω per wire, that fulfills the requirements e.g. regarding temperature, resistance or laying at the place of installation.

The cable gland is suitable for cable diameters from 3,5 to 8 mm. After installation of the cable the cable gland must be fix screwed to ensure the tightness of the connection housing.

Use only shielded signal and measurement wires and install these wires separated from power leading wires. At strong electromagnetic irradiation use principally a cable with shield. Connect the cable shield only at one side to earth.

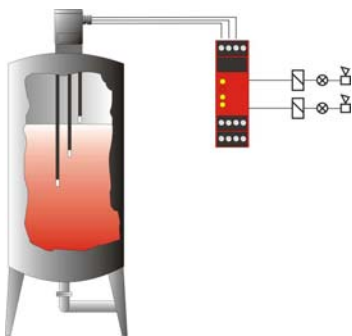
A suitable evaluation device must by connected by the connection cable with the electrode rods resp. ropes inside the connection housing.

The connection of the cable to the electrode rods resp. ropes is made by terminals for wire cross-cuts up to 2,5 mm² or by screw connections inside the connection housing. For the connection use isolated thimbles. At devices with metallic process connection the metallic process connection can be contacted by a tab.

At electrode probes an additional module (diode module LBM) for the wire supervision can be installed inside the housing. This must always be connected between the shortest rod/rope and the longest rod/rope resp. at electrode probe with metallic process connection between this and the shortest rod/rope.

A connection polarity is not relevant. When using evaluation devices resp. transmitter, that does not support a wire supervision, this module may not be installed.

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



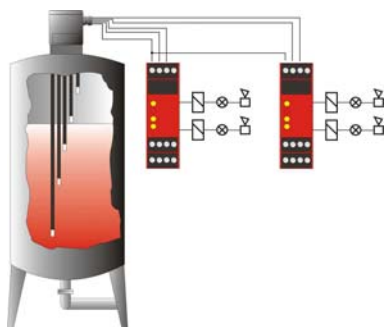
Two-position-control

For a two-position-control, a electrode probe with three rods/ropes must be used, where the longest rod/rope represents the reference electrode.

Alternatively at a container with electrically conductive wall a electrode probe with metallic process connection and only two rods/ropes can be used.

Here the container wall represents the reference electrode.

The evaluation device with a function for two-position-control keeps the filling material level between the upper and the lower limit level.



Four-level-detection

For a four-level-detection a electrode probe with five rods/ropes must be used, where the longest rod/rope represents the reference electrode.

Alternatively at a container with electrically conductive wall a electrode probe with metallic process connection and only four rods/ropes can be used.

Here the container wall represents the reference electrode.

For the evaluation two two-channel-evaluation-devices are used, whose both reference connection must be connected with the longest electrode or with the metallic process connection.

Technical data

Materials

Electrode rod: (medium contact)	steel 1.4404 (AISI316L) resp. 1.4571 (AISI316Ti) optional with tantalum tips hastelloy B2 hastelloy C4 titan								
Electrode rope: (medium contact)	steel 1.4404 (AISI316L) resp. 1.4571 (AISI316Ti)								
Electrode rod isolation: (medium contact)	PA – polyamide (Rilsan®) E-CTFE – ethylene-chlorotrifluorethylene (Halar®)								
Electrode rope isolation: (medium contact)	PTFE – polytetrafluorethylene (Teflon®)								
Process connection: (medium contact)	steel 1.4404 (AISI316L) resp. 1.4571 (AISI316Ti) / PP – polypropylene / POM – polyoxymethylene (Delrin®) / PTFE – polytetrafluorethylene (Teflon®)								
Connection housing:	CrNi-steel / POM – polyoxymethylene (Delrin®) / PP – polypropylene / PTFE – polytetrafluorethylene (Teflon®)								
Cable gland:	housing CrNi-steel for connection housing CrNi-steel PA – polyamide for connection housing POM / PP / PTFE								
	gasket CR / NBR								
Gaskets:	medium contact								
	<table border="1"> <tr> <td>type SAT/STK – electrode isolation PA</td> <td>NBR – nitril-butadien-rubber</td> </tr> <tr> <td>type SAT/STK – electrode isolation E-CTFE</td> <td>FPM – fluorelastomere (Viton®)</td> </tr> <tr> <td>type SLK</td> <td>EPDM – etylene-propylene-dienmonomere</td> </tr> <tr> <td>type SST</td> <td>NBR – nitril-butadien-rubber</td> </tr> </table>	type SAT/STK – electrode isolation PA	NBR – nitril-butadien-rubber	type SAT/STK – electrode isolation E-CTFE	FPM – fluorelastomere (Viton®)	type SLK	EPDM – etylene-propylene-dienmonomere	type SST	NBR – nitril-butadien-rubber
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type SLK	EPDM – etylene-propylene-dienmonomere								
type SST	NBR – nitril-butadien-rubber								
	other → NBR – nitril-butadien-rubber FPM – fluorelastomere (Viton®)								

Environmental conditions

Environmental temperature: maximum – 20°C...+100°C, follow limitations

Limitation by variant	Environmental temperature range
ATEX zone 0	-20...+60°C
ATEX T6	-20...+80°C
ATEX T5...T1	-20...+95°C

Limitation by material	Environmental temperature range
Connection housing PP	+5...+100°C

Process temperature: maximum – 40°C...+150°C, follow limitations

Limitation by variant	Process temperature range
ATEX zone 0	-20...+60°C
ATEX T6	-40...+80°C
ATEX T5	-40...+ 95°C
ATEX T4	-40...+ 130°C
ATEX T3...T1	-40...+ 150°C
Variant SAT – electrode isolation PA	-10...+100°C
Variant SAT – electrode isolation E-CTFE	-15...+150°C
Variant STK – electrode isolation PA	-10...+100°C
Variant STK – electrode isolation E-CTFE	-15...+150°C
Variant SLK	-40...+130°C
Variant SST	-10...+120°C

Limitation by material	Process temperature range
Process connection POM	-40...+110°C
Process connection PP	+5...+100°C

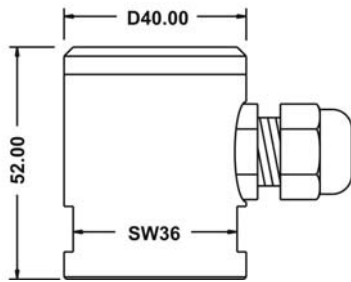
Process pressure: process connection POM / PP / PTFE -1 bar...+10 bar
 process connection steel -1 bar...+20 bar
 ATEX zone 0 +0,8 bar... +1,1 bar
 type SST (rope electrode) pressure less

Conductivity: ≤ 1 MΩ resp. ≥ 1 μS/cm, depends on connected evaluation device

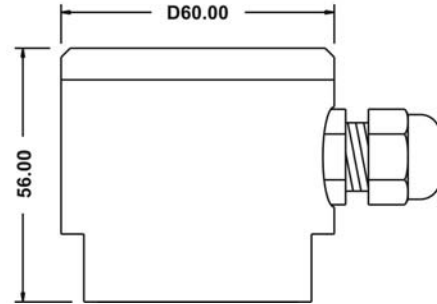
Protection classification: IP67 EN/IEC 60529

Weight: depends on material / size of connection housing resp.
 material / style of process connection resp.
 material / diameter / number / length of the electrodes

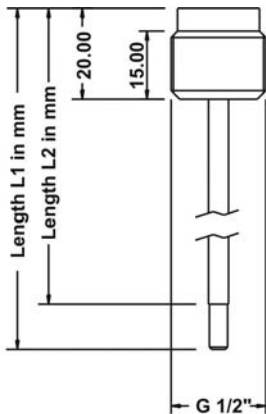
Dimension drawings – SAT



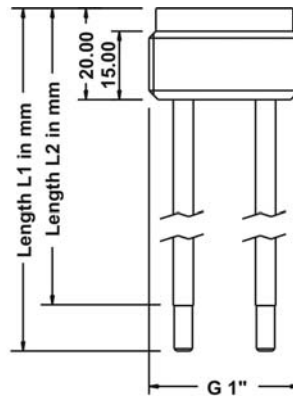
connection housing
Ø 40mm



connection housing
Ø 60mm (only material POM)

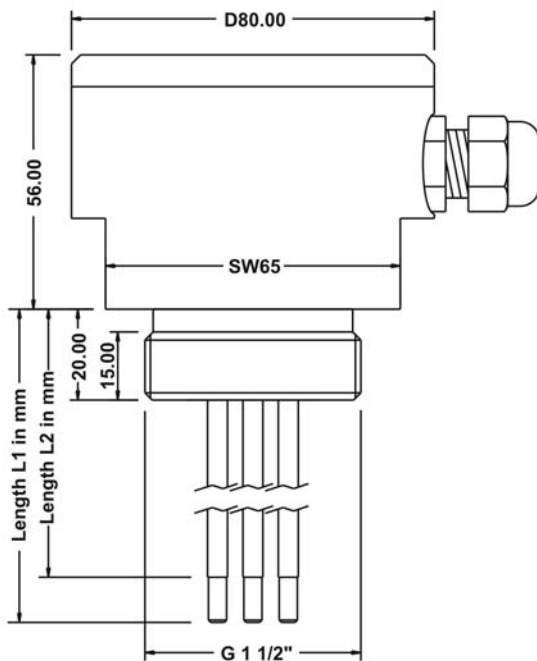


process connection
G12 – G 1/2"

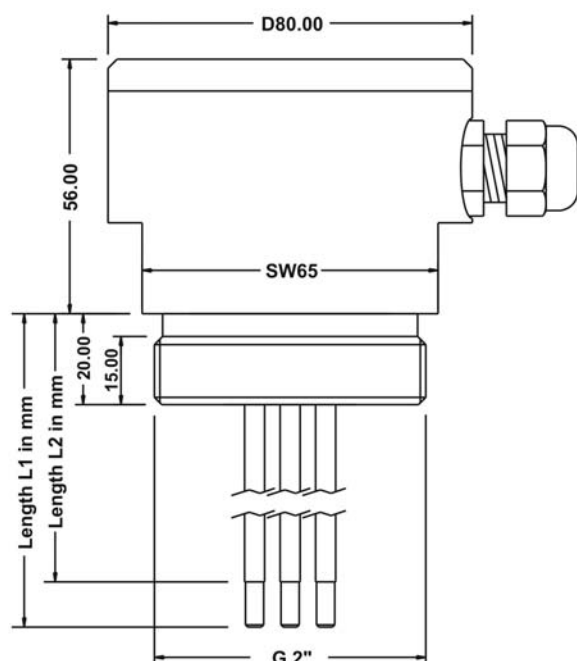


process connection
G10 – G 1"

with connection housing Ø 40mm or Ø 60mm (only material POM)



process connection
G15 – G 1 1/2"



process connection
G20 – G 2"

Order code overview – SAT

Electrode probe for conductive limit level detection in electrically conductive filling materials with up to seven electrode rods – plastic screwing thread

Type:

- Standard
Ex ATEX 1 G Ex ia IIC T6...T1

Electrode number:

- 1 1 electrode rod
- 2 2 electrode rods
- 3 3 electrode rods
- 4 4 electrode rods
- 5 5 electrode rods
- 7 7 electrode rods

Process connection

G12	G ½"	ISO 228-1	only possible with one electrode rod
G10	G 1"	ISO 228-1	up to three electrode rods possible
G15	G 1 ½"	ISO 228-1	up to five electrode rods possible
G20	G 2"	ISO 228-1	

Material electrode rod (medium contact):

- A Steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)
- D Hastelloy C only for electrode rod diameter 4mm
- Y others on request

Material process connection / connection housing (medium contact):

- D POM – polyoxymethylene (Delrin®) Ø 40 mm for G ½" / G 1" resp. Ø 80 mm for G 1 ½" / G 2"
- E POM – polyoxymethylene (Delrin®) Ø 60 mm for G ½" / G 1"
- P PP – polypropylene Ø 40 mm for process connection G ½" / G 1"
- M PP – polypropylene Ø 80 mm for process connection G 1 ½" / G 2"
- T PTFE – polytetrafluorethylene (Teflon®) Ø 40 mm for process connection G ½" / G 1"
- L PTFE – polytetrafluorethylene (Teflon®) Ø 80 mm for process connection G 1 ½" / G 2"

Material electrode isolation (medium contact):

- R PA – polyamide (Rilsan®) not for material process connection T / L – PFTE
- H E-CTFE – ethylene-chlorotrifluorethylene (Halar®)

Diameter electrode rod:

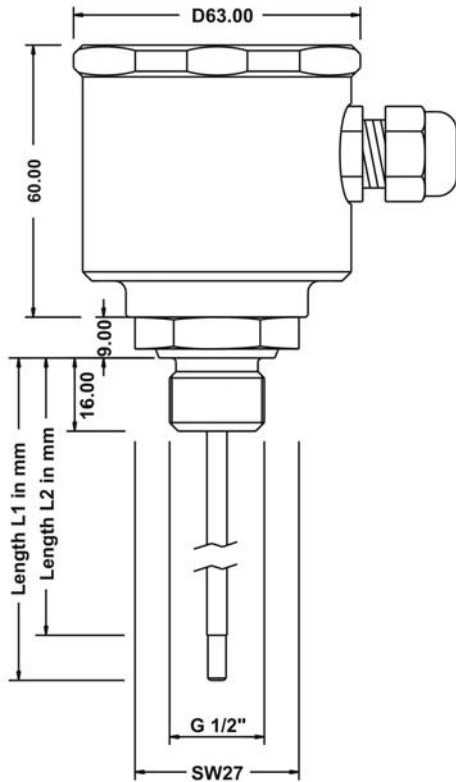
- 4 mm
- W 8 mm
- Z 10 mm

Length L1 electrode rod in mm, max. 3000 mm

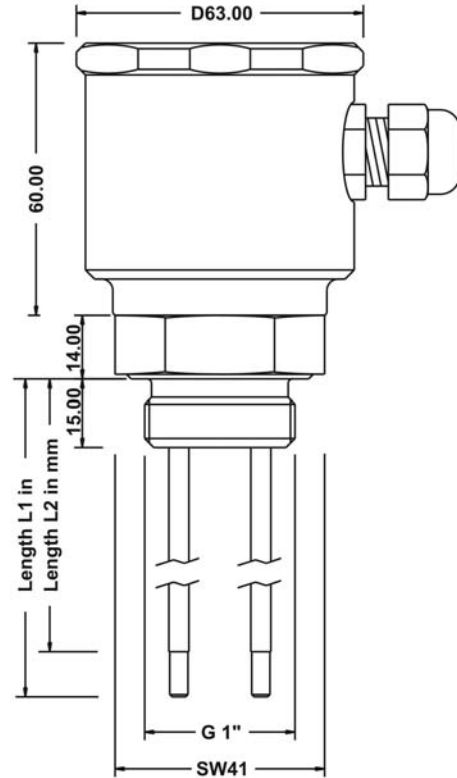
Length L2 electrode isolation in mm, max. 3000 mm

SAT _ _ _ _ _ mm _ mm

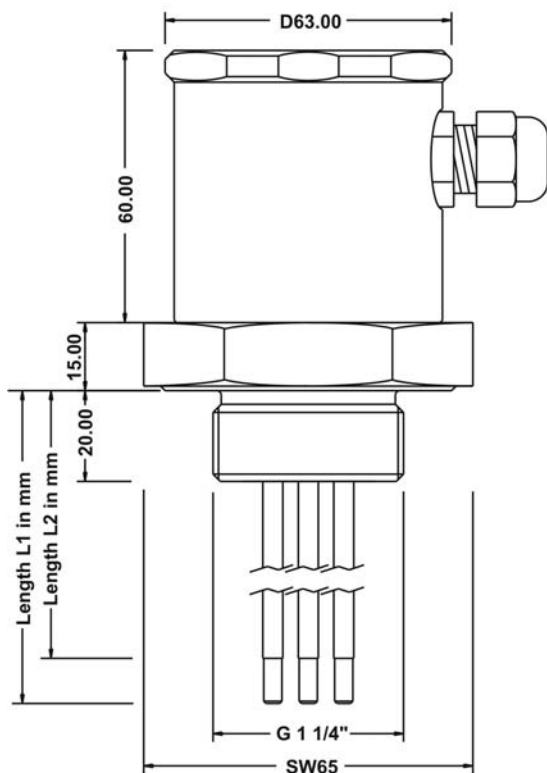
Dimension drawings – STK



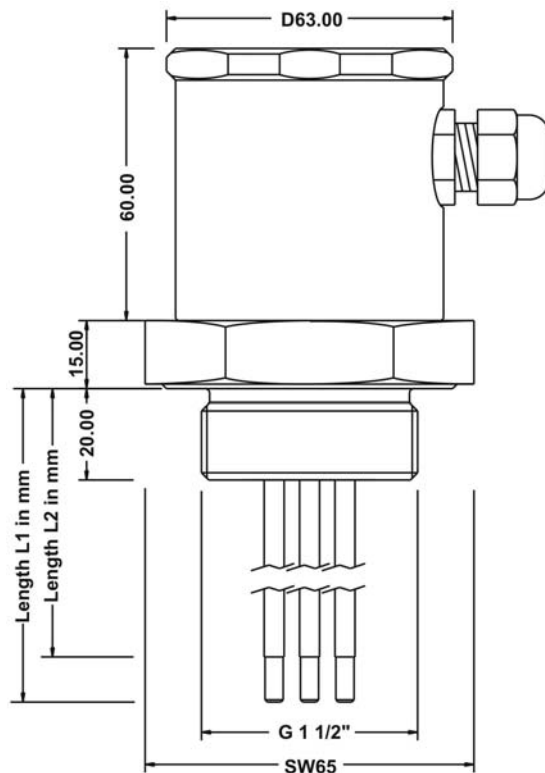
process connection
G12 – G 1/2"



process connection
G10 – G 1"

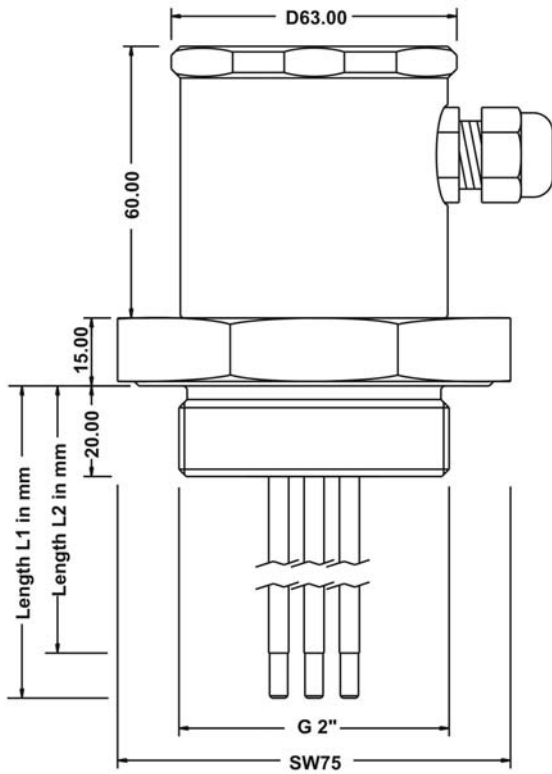


process connection
G14 – G 1 1/4 "

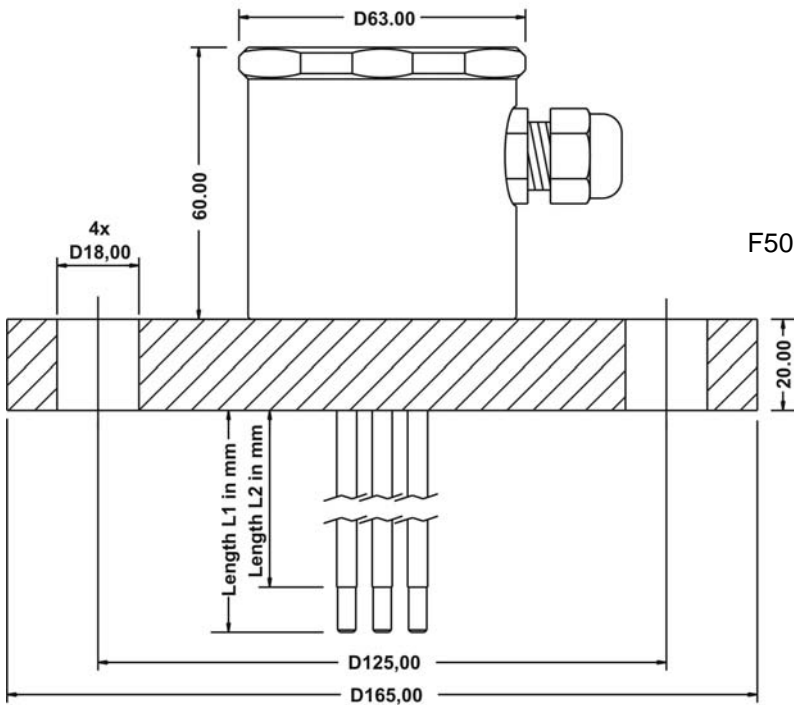


process connection
G15 – G 1 1/2 "

Dimension drawings – STK

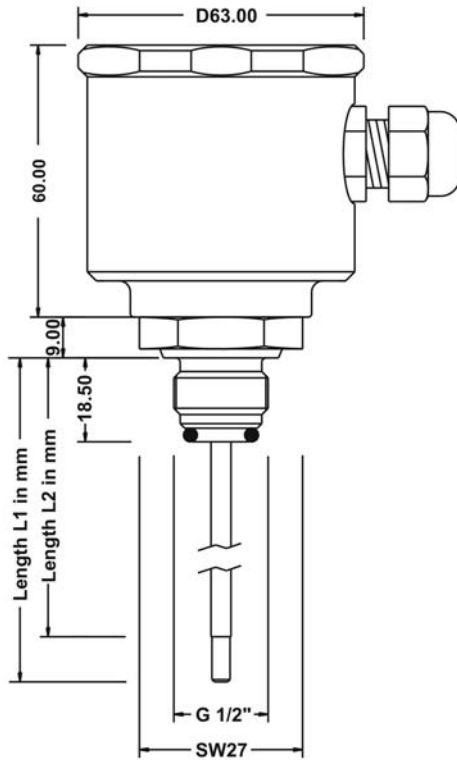


process connection
G2 – G 2"

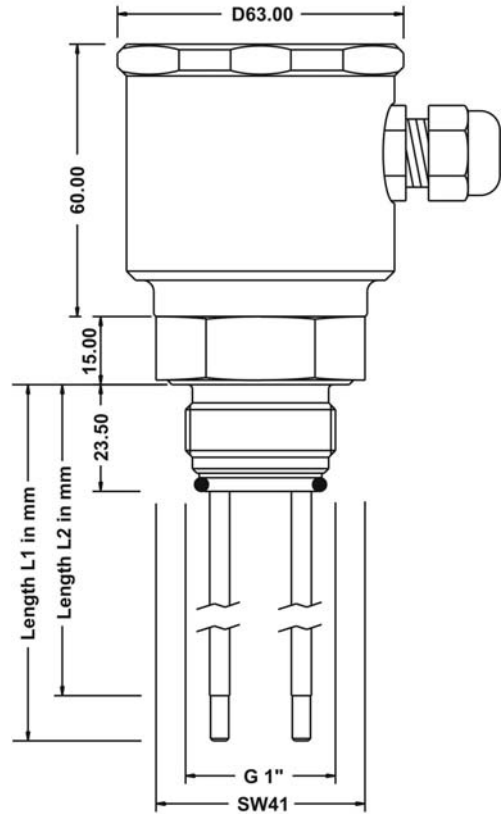


process connection
F50 – flange DN50, PN10-40

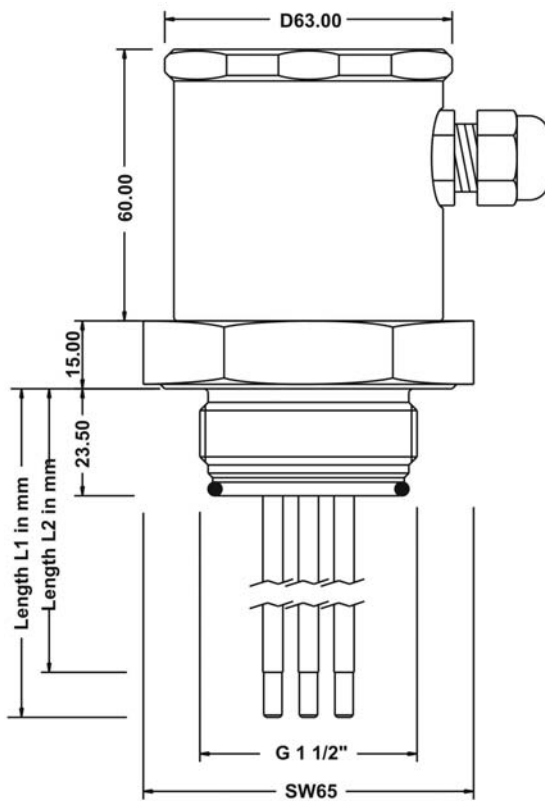
Dimension drawings – SLK



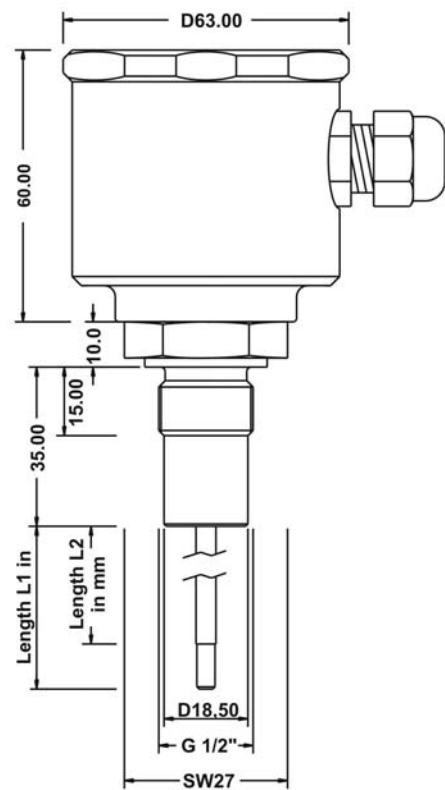
process connection
G12 – G 1/2"



process connection
G10 – G 1"

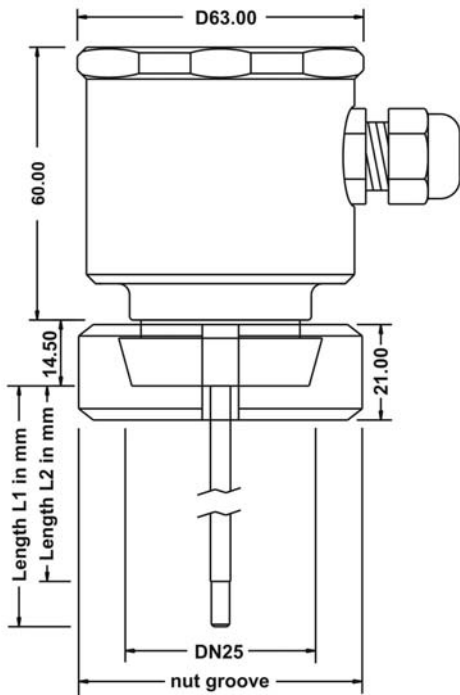


process connection
G15 – G 1 1/2"

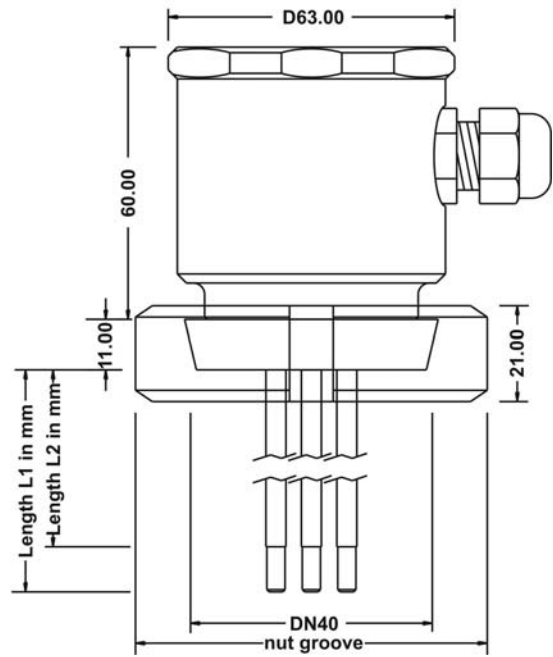


process connection
M12 – G 1/2"
metallic sealing

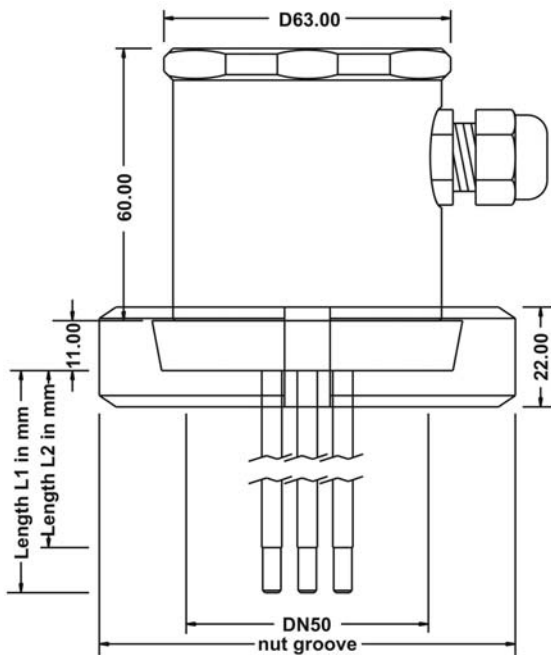
Dimension drawings – SLK



process connection
D25 – DN25



process connection
D40 – DN40



process connection
D50 – DN50

Order code overview – SLK

Electrode probe for conductive limit level detection in electrically conductive filling materials with up to five electrode rods – metallic hygienic process connection

Type:

- Standard
Ex ATEX 1 G Ex ia IIC T6...T1

Electrode number:

- 1 1 electrode rod
- 2 2 electrode rods
- 3 3 electrode rods
- 4 4 electrode rods

Process connection material steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti) (medium contact):

D25	Milk tube DN25	DIN 11851		only possible with one electrode rod
D40	Milk tube DN40	DIN 11851		up to three electrode rods possible
D50	Milk tube DN50	DIN 11851		
G12	G ½ "	ISO 228-1	O-ring front flush	only possible with one electrode rod
G10	G 1 "	ISO 228-1	O-ring front flush	up to three electrode rods possible
G15	G 1 ½ "	ISO 228-1	O-ring front flush	
M12	G ½ "	ISO 724	metallic sealing	only possible with one electrode rod

Material electrode rod (medium contact):

A	Steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)	
C	Hastelloy B	only for electrode rod diameter 4 mm
D	Hastelloy C	only for electrode rod diameter 4 mm
T	Titan	not for Ex variant
E	Steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)	tantalum tip 50mm
Y	others on request	

Material connection housing:

- D POM – polyoxymethylene (Delrin®)
- V CrNi-steel
- M PP – polypropylene
- L PTFE – polytetrafluorethylene (Teflon®)
- Y others on request

Material electrode isolation (medium contact):

- H E-CTFE – ethylene-chlorotrifluorethylene (Halar®)

Diameter electrode rod:

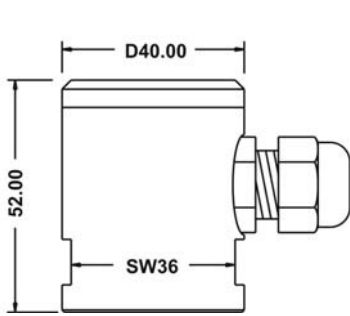
- 4 mm
- W 8 mm

Length L1 electrode rod in mm, max. 3000 mm

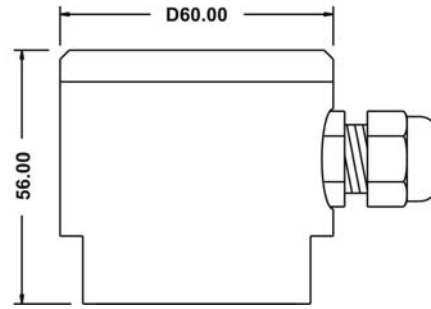
Length L2 electrode isolation in mm, max. 3000 mm

SLK	_	_	_	_	_	H	_	_	mm	_	_	mm
-----	---	---	---	---	---	---	---	---	----	---	---	----

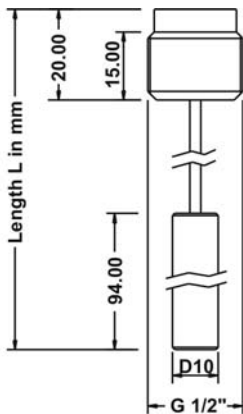
Dimension drawings – SST



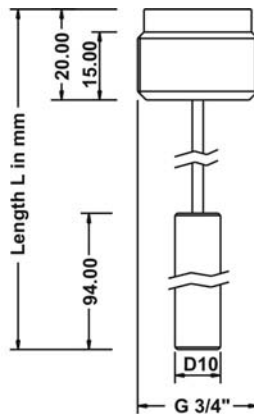
connection housing
Ø 40mm



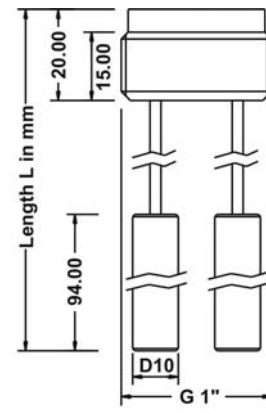
connection housing
Ø 60mm (only material POM)



process connection
G12 – G 1/2"

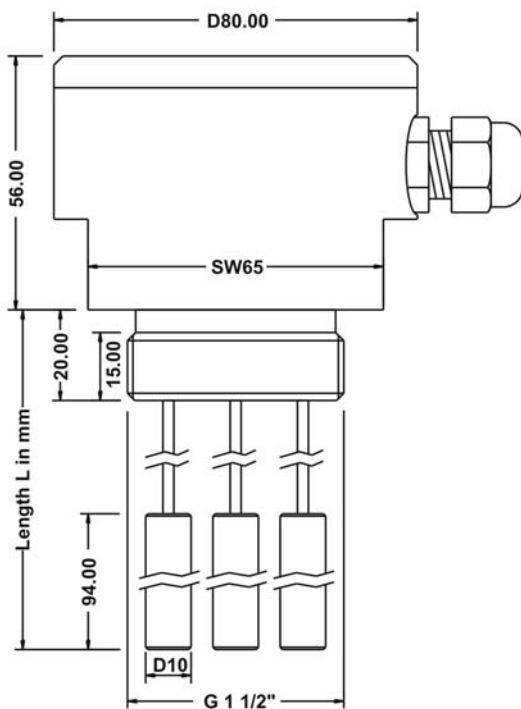


process connection
G34 – G 3/4"

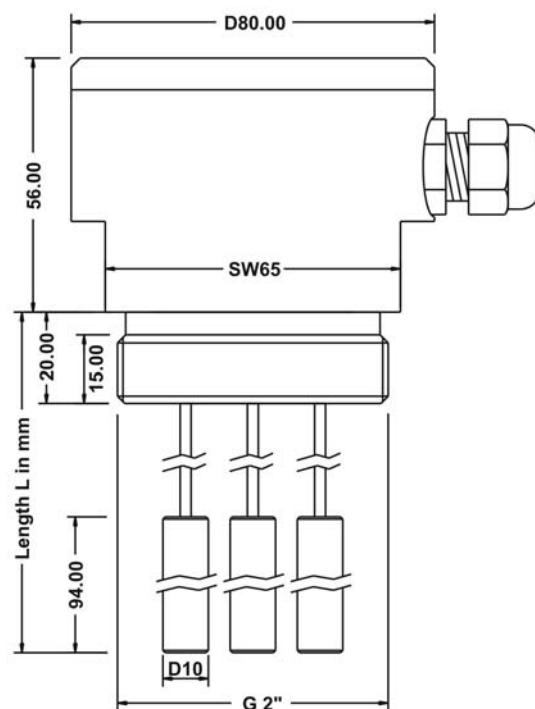


process connection
G10 – G 1"

with connection housing Ø 40mm or Ø 60mm (only material POM)



process connection
G15 – G 1 1/2"



process connection
G20 – G 2"

Order code overview – SST

Electrode probe for conductive limit level detection in electrically conductive filling materials with up to seven electrode ropes – plastic screwing thread

Type:

- Standard

Electrode number:

- 1 1 electrode rope
- 2 2 electrode ropes
- 3 3 electrode ropes
- 4 4 electrode ropes
- 5 5 electrode ropes
- 6 6 electrode ropes
- 7 7 electrode ropes

Process connection

G12	G ½"	ISO 228-1	only possible with one electrode rope
G34	G ¾"	ISO 228-1	up to two electrode ropes possible
G10	G 1"	ISO 228-1	up to three electrode ropes possible
G15	G 1 ½"	ISO 228-1	up to four electrode ropes possible
G20	G 2"	ISO 228-1	

Material electrode rope (medium contact):

- A Steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)
- Y others on request

Material connection housing / process connection (medium contact):

D	POM – polyoxymethylene (Delrin®)	∅ 40 mm for G ½" / G ¾" / G 1" resp. ∅ 80 mm for G 1 ½" / G 2"
E	POM – polyoxymethylene (Delrin®)	∅ 60 mm for G ½" / G ¾" / G 1"
P	PP – polypropylene	∅ 40 mm for process connection G ½" / G ¾" / G 1"
M	PP – polypropylene	∅ 80 mm for process connection G 1 ½" / G 2"
T	PTFE – polytetrafluorethylene (Teflon®)	∅ 40 mm for process connection G ½" / G ¾" / G 1"
L	PTFE – polytetrafluorethylene (Teflon®)	∅ 80 mm for process connection G 1 ½" / G 2"

Material electrode isolation (medium contact):

- H PTFE – polytetrafluorethylene (Teflon®)

Length L electrode rope in mm, max. 15000 mm

SST – _ _ _ _ H _ mm