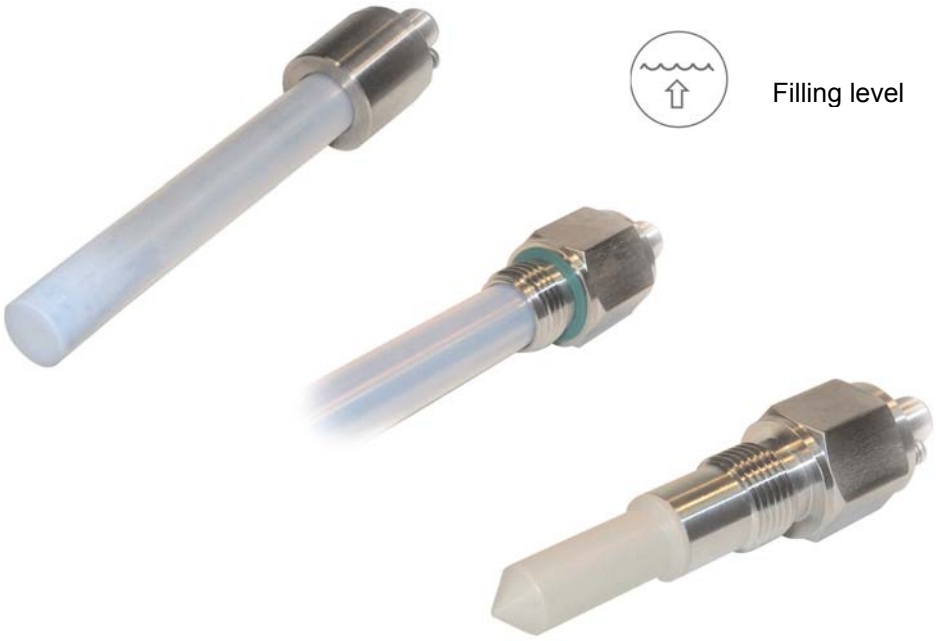
Technical manual BA 1109



Filling level

Capcont L

Fill level limit switch

for capacitive filling level supervision
in liquids and solids with a relative permittivity $\varepsilon_r \geq 1,5$

Useable

- for filling level resp. limit value detection in container
- for dry run protection of pumps
- in liquids, viscous substances, granular substances or powders
- as gasket-free measuring system for hygienic applications
- for electrically conductive and non-conductive materials

Suitable for wide process temperature range from – 40°C to +140 °C

Useable at process pressures from –1 to 10 bar

ATEX II 1 G Ex ia IIC T4 resp. ATEX II 1 D Ex iaD 20 T60°C
Certification for the use in explosion hazardous areas

Useable as overflow protection acc. to WHG

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

Integrated evaluation electronic with PNP switching output

ACS-CONTROL-SYSTEM
know how mit system

Lauterbachstr. 57 – 84307 Eggenfelden – Germany
Tel: +49 8721/9668-0 – Fax: +49 8721/9668-30
info@acs-controlsystem.de – www.acs-controlsystem.de

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Lauterbachstr.57 - 84307 Eggenfelden - Germany
Tel: +49 8721/ 9668-0 - Fax: +49 8721/ 9668-30
info@acs-controlsystem.de - www.acs-controlsystem.de

1. Application

The device **Capcont L** with integrated evaluation electronic is a compact filling level limit switch for supervision of filling levels in liquids and solids within container or pipes, also in explosive hazardous areas, at process temperatures from – 40°C to +140°C and process pressures from –1 up to 10 bar.

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 device in Variant **Capcont LL** with metallic gasket and rod isolation in PEEK is especially suitable for the use in hygienic applications.

The device is certificated for the use as overflow protection acc. to WHG.

2. Function

The device in Variant **Capcont LS** is mounted from the top side of the pressure container or of the pipe.
An adjustment of the detection level is possible. The device in Variant **Capcont LL** is mounted from the top side or into the side wall of the pressure container or of the pipe.

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

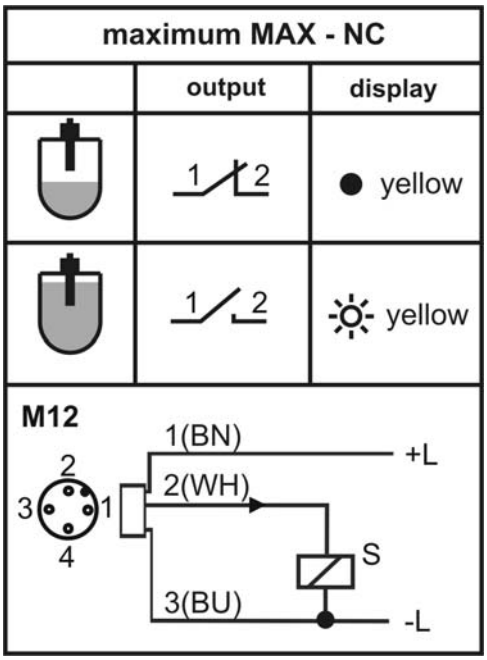
Electrode rod, filling material and container wall creates an electrical capacitor.
The contact of the electrode rod with the filling material produces a variation in capacity, that is evaluated by the electronic and converted in a correspondent switching action.
The detection of a filling level signal 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.

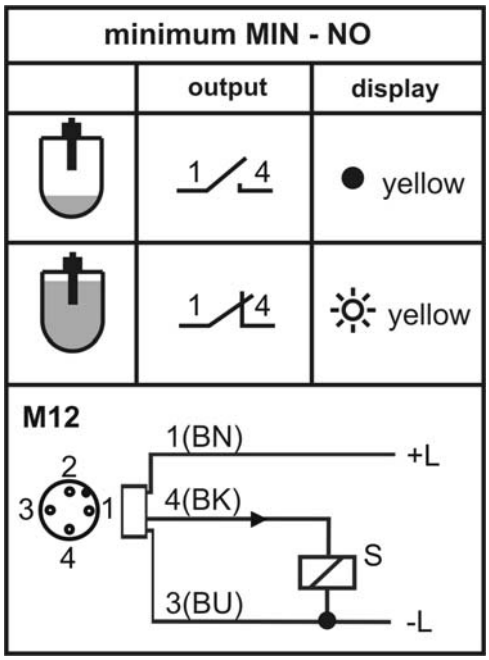
The adjustment of the responsitivity of the device to the respective filling material is done by a potentiometer.

Safety function

The safety function defines the operation principle of the output.

- Maximum safety: The output switches off, if the switching level is exceeded (liquid detected at measuring probe) or the power supply fails.
- Minimum safety: The output switches off, if the switching level is underrun (no liquid detected at measuring probe) or the power supply fails.





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

This device is conform to 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. CE **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 (EN60079-14, EN61241-14, VDE0165), this 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	$T_{a\ process}$	$T_{a\ housing}$
II 1 D Ex iaD 20 T60°C	**-20... +60 °C**	**-20…+60 °C**
II 1/2 D Ex iaD 20/21 T60°C / T100°C	**-20... +60 °C**	**-40…+85 °C**
II 2 D Ex ibD 21 T100°C	**-40…+85 °C**	**-40…+85 °C**
II 1 G Ex ia IIC T4	**-20... +60 °C**	**-20…+60 °C**
II 1/2 G Ex ia IIC T4	**-20... +60 °C**	**-40…+85 °C**
II 2 G Ex ib IIC T4	**-40…+85 °C**	**-40…+85 °C**

The devices are conceived for measuring of limit levels in explosive hazardous areas.
The measured medium may also be combustible liquids and dusts.

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 1/2 or category 1, the process pressure and temperature range of the liquid has to be between 0,8 bar and 1,1 bar and between -20 °C and 60 °C.

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

The PA terminal at the connection housing resp. the process connection must be connected to the potential compensation of the explosive hazardous area.

At variants of the devices with chargeable plastic parts (e.g. rod 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

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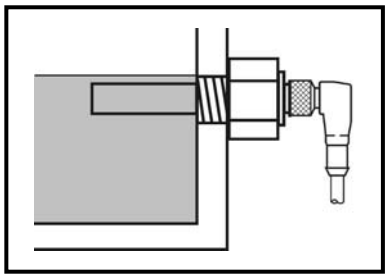
4. Installation

Prior to installation resp. deinstallation of the device the system must be pressure free.
High temperatures should be avoided to protect from injury

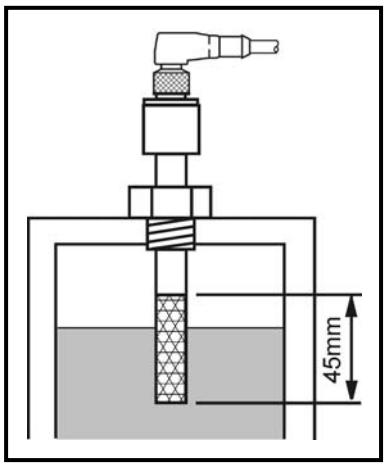
The device can be installed horizontal, that is at the side, or also vertical, that is from the top into the container resp. pipe wall.



Only the devices **Capcont LS** of variant with length L = type A and **Capcont LL** are conceived for 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.

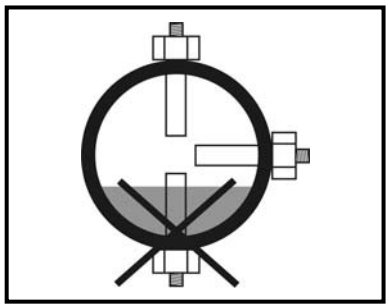
At a horizontal installation the device should be installed at an angel with the electrode rod tip below (approx. 20...30°), to allow an easier flow-off of filling material residues.



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 **Capcont LS** the filling material level can be adjusted at installation from the top by the rod length and by the position of the device in the sliding sleeve.

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



- 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.

The tightening of the process connection with screw in thread may only be done at the hexagon by a suitable tool.
The screw in of the process connection by using the connection housing is not permitted.

Lauterbachstr.57 - 84307 Eggenfelden - Germany
Tel: +49 8721/ 9668-0 - Fax: +49 8721/ 9668-30
info@acs-controlsystem.de - www.acs-controlsystem.de

5. 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 the connection use only suitable cables, that fulfills the requirements e.g. regarding temperature, chemical resistance or laying at the place of installation.
The device must be grounded.

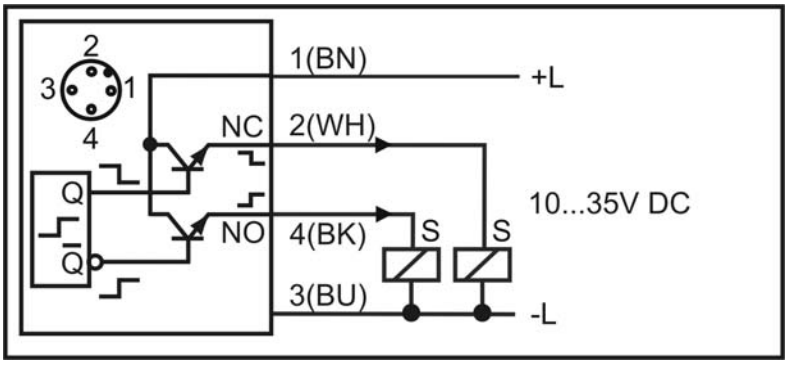
For inauguration it is suggested to switch off all connected control devices to avoid unintended control actions.

The power supply voltage may not exceed 35 V to avoid damage of the electronic.
The power supply voltage connection is polarity protected.

At an activated output, the load at the PNP switching output will be connected contactless and by this bounce-free by a semiconductor switch with the terminal 1, that is the terminal +L of the power supply voltage.
Thus, at the respective output terminal a positive signal near power supply voltage is produced.
At deactivated switching state and at failure of power supply voltage the semiconductor switch is shut off.
The PNP switching output is current limited to 0,5 A.

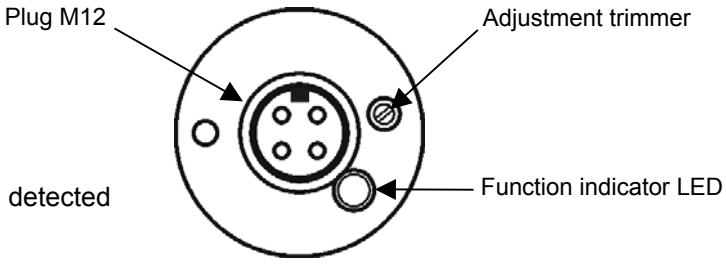
Inductive loads at the PNP switching output, e.g. relays or contactors may only be used with a free-wheeling diode or a RC protection circuit to avoid high voltage peaks.

The device is suitable for antivalent use. Using both outputs the MIN and MAX 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 filling level monitoring also a function dependent monitoring of the sensor can be realized.



Conductor color standard connection cable: BN = brown, WH = white, BK = black, BU = blue
The connection cable is not enclosed in the delivery contents.

6. Operation



Indicator

yellow light-emitting diode ➔ filling material detected

Adjustment trimmer

adjustment of the responsitivity

turn to the left ➔ filling material detection at higher DK value

procedure at adjustment:

- 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

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7. Maintenance

The device is free of maintenance.

8. 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 absolutely possible to remove unhealthily products completely, because e.g. they have been penetrated into cracks or are diffused through plastic.

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9. Technical data

Auxiliary power supply

Permissible supply voltage:	10 V to 35 V DC	polarity protected
Ripple voltage:	≤ 2 V_{PP}	within the permissible supply voltage range
Supply current:	≤ 10mA	switching outputs no load
Insulating voltage:	75V_{DC}	

Input

Measuring range:	Relative permittivity $\varepsilon_r \geq 1,5$

Output

Function:	PNP transistor output, switching to contact +L	
Output voltage:	$V_{OUT} \geq V_{+L} - 2$ V	
Output current:	≤ 500 mA	current limited, short circuit protected
Cutoff current:	≤ 100 µA	current limited, short circuit protected
Rise up time:	< 30 µs	R_L < 3 kΩ resp. I_L > 4,5 mA
Delay time:	≤ 200 ms / ≥ 5 Hz	
Switching cycles:	≥ 100.000.000	

Materials

Process connection: (medium contact)	steel 1.4404 (AISI 316L) / 1.4571 (AISI 316Ti)		
Electrode rod isolation: (medium contact)	*Capcont LS*	➔	PTFE – polytetrafluorethylene (Teflon®)
	Capcont LL	➔	PEEK
Device plug M12x1:	socket CrNi-steel, insert PUR, contacts gold-plated		
Gaskets:	medium contact (LS)	➔	FPM – fluorelastomere (Viton®) EPDM – etylene-propylene-dienmonomere
	other	➔	FPM – fluorelastomere (Viton®)

Environmental conditions

Environmental temperature: – 40°C...+100°C, limitation at Ex variants

Limitation by variant	Environmental temperature range
Variant WHG	-20...+70°C

Process temperatures: *Capcont LS* – 40°C...+100°C, limitation at Ex variants

Limitation by variant	Process temperature range
Variant WHG	-20...+70°C
Limitation by material	**Process temperature range**
Gasket FPM	-25...+100°C

Capcont LL – 40°C...+140°C, limitation at Ex variants

Limitation by variant	Process temperature range
Variant WHG	-20...+70°C

Process pressures:	*Capcont LS*	➔	– 1 bar ...1 bar
	Capcont LL	➔	– 1 bar ...10 bar
Weight:	depends on variant	e.g. 0,23 kg – Capcont LS – length type A	
Torque strength:	≤ 50 Nm	for variants with screw-in thread	
Protection classification:	IP68 / 3mH_2O for 1h	DIN EN 60529	
Climatic classification:	4K4H	DIN EN 60721-3-4	
Shock classification:	15 g / 11 ms	DIN EN 60068-2-27	
Vibration classification:	5 g / 10 – 2000 Hz	DIN EN 60068-2-6	
EM – compatibility:	emission immunity	DIN EN 61326-1 DIN EN 61326-1	operation device class B industrial range
Reference conditions:	DIN EN 60770-1 T = 25 °C, rel. humidity 45...75 %, environm. air pressure 860...1060 kPa		

Lauterbachstr.57 - 84307 Eggenfelden - Germany
Tel: +49 8721/ 9668-0 - Fax: +49 8721/ 9668-30
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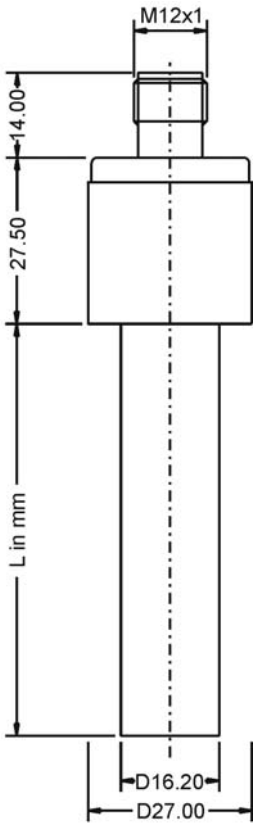
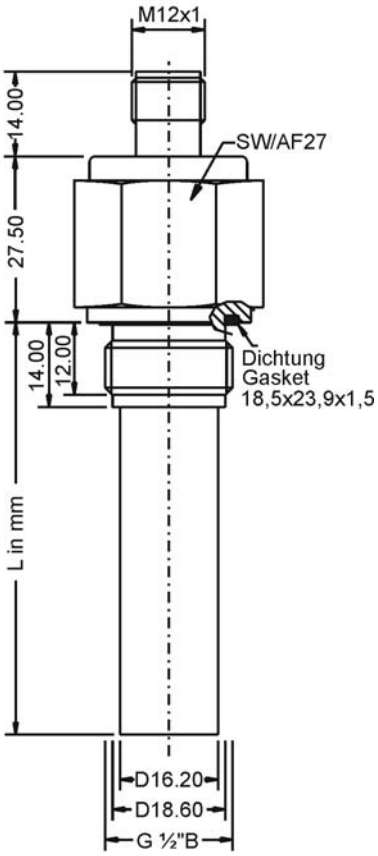
10. Dimension drawings

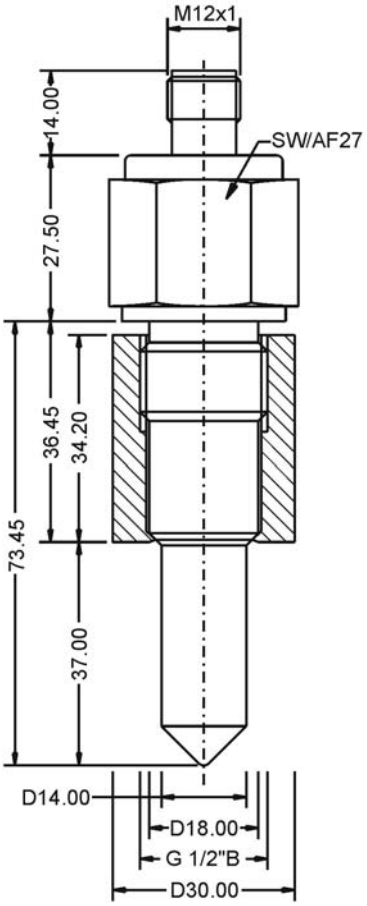
Capcont LS0



Capcont LS1



Capcont LL2



Lauterbachstr.57 - 84307 Eggenfelden - Germany
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info@acs-controlsystem.de - www.acs-controlsystem.de

11. Order code overview Capcont LS

Type:
L Standard
ExL ATEX II 1 G Ex ia IIC T4 resp. ATEX II 1 D Ex iaD 20 T60°C
WHL WHG overflow protection
XWL ATEX II 1 G Ex ia IIC T4 resp. ATEX II 1 D Ex iaD 20 T60°C and WHG overflow protection

Material electrode rod isolation (medium contact):
S PTFE polytetrafluorethylene (Teflon®)

Process connection:
0 without — installation in slide sleeve SAMV-63 resp. SAME-63
1 G ½“ B DIN EN ISO228-1 — DIN 3852-11-E
Y Other process connection — separate specification necessary

Gasket (medium contact):
1 FPM fluorelastomere (Viton®)
3 EPDM etylene-propylene-dienmonomere for food applications

Material process connection (medium contact):
V Steel 1.4404 (AISI 316L) / 1.4571 (AISI 316 Ti)

Material connection housing:
C CrNi-steel

Electronic - output:
A Direct voltage 10...35 V DC PNP switching output 3-wire-technologie

Process temperature:
0 -40°C ... +100°C

Electrical connection:
S Plug M12x1

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 _

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

Lauterbachstr.57 - 84307 Eggenfelden - Germany
Tel: +49 8721/ 9668-0 - Fax: +49 8721/ 9668-30
info@acs-controlsystem.de - www.acs-controlsystem.de

12. Order code overview Capcont LL

Type:
L Standard
ExL ATEX II 1 G Ex ia IIC T4 resp. ATEX II 1 D Ex iaD 20 T60°C
WHL WHG overflow protection
XWL ATEX II 1 G Ex ia IIC T4 resp. ATEX II 1 D Ex iaD 20 T60°C and WHG overflow protection

Material electrode rod isolation (medium contact):
L PEEK

Process connection:
1 G ½“ B DIN EN ISO228-1 DIN 3852-11-E

Gasket:
0 without

Material process connection (medium contact):
V Steel 1.4404 (AISI 316L) / 1.4571 (AISI 316 Ti)

Material connection housing:
C CrNi-steel

Electronic - output:
A Direct voltage 10...35 V DC PNP switching output 3-wire-technologie

Process temperature:
1 -40°C ... +140°C

Electrical connection:
S Plug M12x1

Length L:
0

Capcont _	L	2	0	V	C	A	1	S	0

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

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