

# Capacitive Limit Switch

## Pharma NCS



### Application / Specified Usage

- Limit detection of liquid media even with low or no water content e.g. alcohols or oils with a dielectric constant  $\epsilon_r$  (Dk)  $\geq 2$

### Application Examples

- Limit detection in vessels or pipes
- Product monitoring in pipes
- Pump / dry running protection
- Detection of WFI (water for injection)

### Hygienic Design / Process Connection

- Flow optimized, hygienic and easy sterilizable installation by sleeve EMS-032, build-in system EHG-.../M12 or the build-in system EPA
- CIP- / SIP-cleaning up to 143 °C / max. 120 minutes
- Product contacting materials compliant to FDA
- Sensor made of stainless steel, sensor tip made of PEEK
- Additional process connections with adapter or direct connection (NCS-3xP): Tri-Clamp, DRD, Varivent, APV, BioControl

### Features

- Capacitive measuring principle
- Independent of the conductivity
- Short response time (< 1 s)
- Defined position of the M12-plug
- Reversible output (full / empty active)
- Heated electronic to avoid condensation
- Insensitive to foam and adherence
- Simulation of sensor status possible

### Options / Accessories

- Version with spacer (option H) for isolated vessels or permanent process temperatures up to 143 °C
- NPN output (Open Collector)
- M12-plug and matching cable assembly
- Heating element switched off for extension of the temperature range

### Measuring Principle

The capacity of a capacitor is affected by 3 factors: **distance** and **size of the electrodes** as well as the **kind of medium** between the electrodes. Using the capacitive sensors only the kind of medium is of interest cause the others are constant. The electrode of the sensor and surface of tank can be seen as capacitor, the medium as dielectric fluid. Caused by the higher Dk-value of the medium compared to air the capacity increases if the sensor is covered with the medium. The change of capacity is evaluated by electronics and converted into a corresponding switching order. This functional principle requires that the sensor tip is completely covered with medium. That way the sensor is insensitive to foam and adherences.

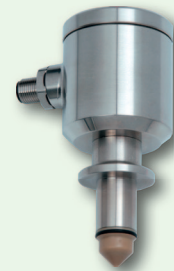
### Authorizations



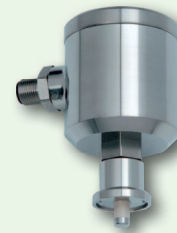
### NCS-6xP for EPA-8



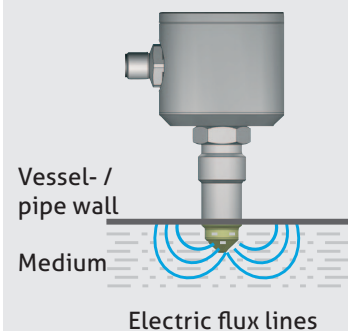
### NCS-8xP for EPA-18



### NCS-3xP with Tri-Clamp

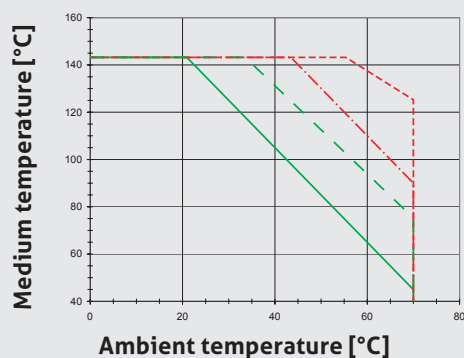


### Measuring principle



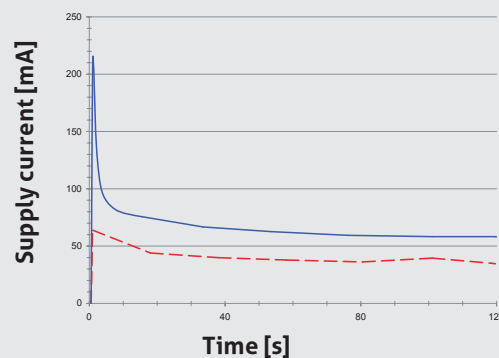
Specification		
<b>Process Connection</b>	thread NCS-0xP clamp NCS-6xP clamp NCS-8xP direct connection NCS-3xP	M12 x 1,5 CLEANadapt; tightening torque max. 5...10 Nm EPA-8 PHARMadapt EPA-18 PHARMadapt overview see order code on page 8
<b>Materials</b>	connecting head connecting piece spacer sensor tip NCS-0xP sensor tip NCS-3xP sensor tip NCS-6xP sensor tip NCS-8xP sealing	stainless steel 1.4305 (303) stainless steel 1.4305 (303) stainless steel 1.4305 (303) stainless steel 1.4435 (316L) with 3.1 cert. PEEK USP Class VI PEEK USP Class VI, stainless steel 1.4435 (316L) with 3.1 cert. PEEK USP Class VI EPDM
<b>FDA Approval</b>	PEEK EPDM	21 CFR 177.2415 21 CFR 177.2600
<b>Surface</b>	product contacting optional	$R_a \leq 0,8 \mu\text{m}$ $R_a \leq 0,6 \mu\text{m}$ (not for NCS-0xP, -6xP, -3xP...3/4)
<b>Delta Ferrite DF</b>		< 1,0 %
<b>Weight</b>		ca. 500 g
<b>Operating Pressure</b>		max. 10 bar (resp. acc. to process connection standard)
<b>Protection Type</b>		IP 69 K
<b>Electrical Connection</b>	cable connection	M12-plug, stainless steel 1.4305 (303)
<b>Supply</b>		16...32 V DC (see graphic)
<b>Output</b>	optional	PNP (active 50 mA, short-circuit-proof) NPN (max. 50 mA, short-circuit-proof)
<b>Switching Function</b>	adjustable by polarity of supply	high active (sensor wetted: 'high') low active (sensor free: 'high')
<b>Status Display</b>		LED
<b>Measurement Range</b>	NCS-01P, -31P, -61P, -81P NCS-02P, -32...TC3/4, -62P NCS-32P...TC1, -32P...TC2, -82P	$D_k \geq 20$ $D_k \geq 5$ $D_k \geq 2$
<b>Switching Threshold</b>		see page 5: "Adjustment of threshold"

### Temperature Range



- Continuous temperature limit with heater
- - - Temperature excursion (60 min) with heater
- Continuous temperature limit without heater
- - - Temperature excursion (60 min) without heater

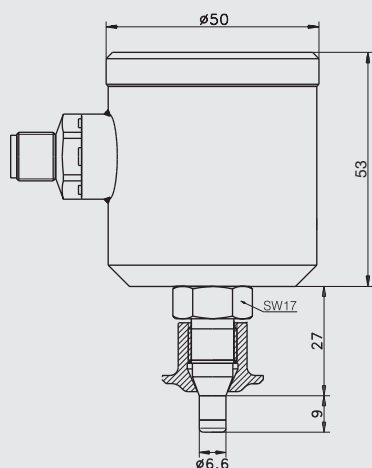
### Supply / Power Input



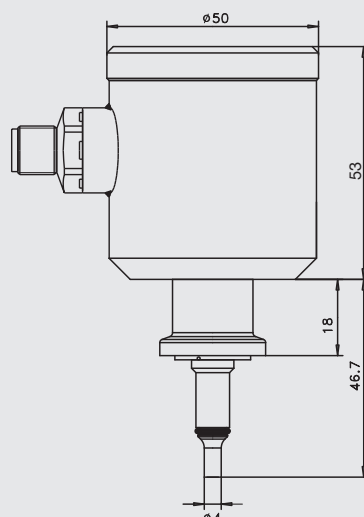
- - -  $U_b = 24 \text{ V}, T_u = 20 \text{ °C}$
- $U_b = 33 \text{ V}, T_u = -15 \text{ °C}$

$U_b$ : Supply voltage  
 $T_u$ : Ambient temperature

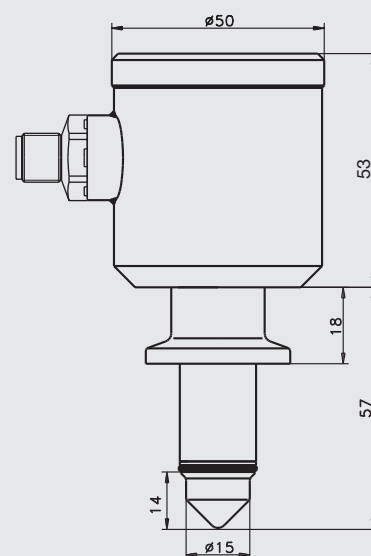
NCS-0xP with EMK-032



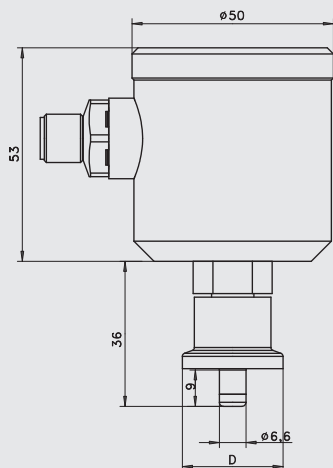
NCS-6xP (EPA-8)



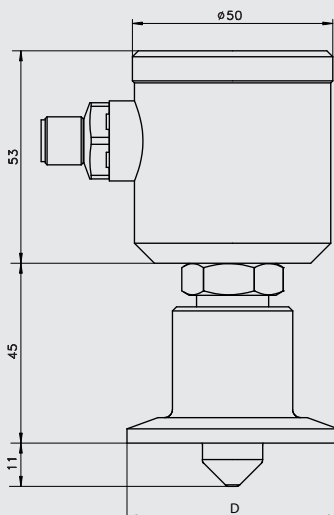
NCS-8xP (EPA-18)



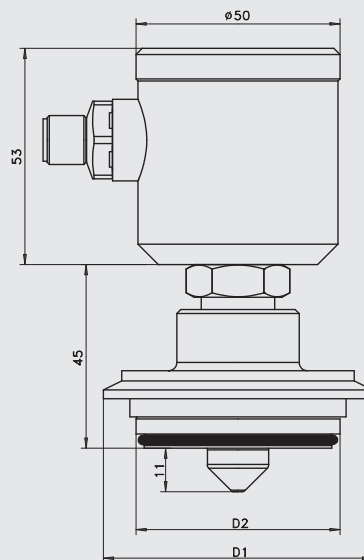
NCS-3xP Tri-Clamp TC3/4



NCS-3xP Tri-Clamp TC1 / TC2



NCS-3xP Varivent®



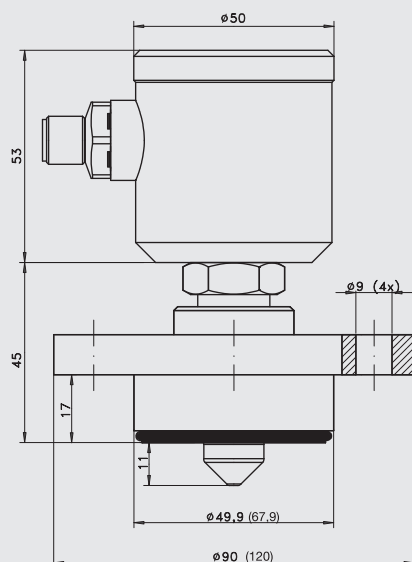
Dimension table Tri-Clamp

Type	D [mm]
TC3/4	25
TC1	50
TC2	64

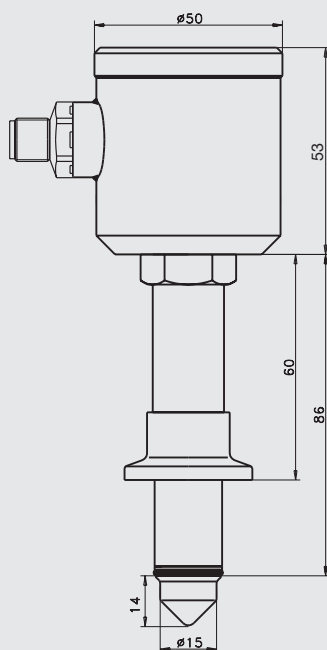
Dimension table Varivent®

Type	Varivent® Type	D1 [mm]	D2 [mm]
V10	B	53	31
V25	F	66	50
V40	N	84	62

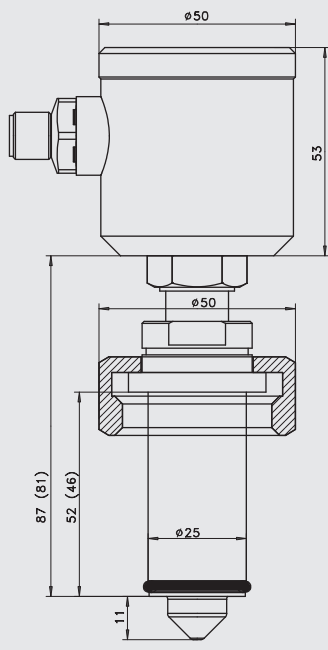
NCS-3xP BioControl



## NCS-8xP / H



## NCS-3xP Ingold® / Fermenter

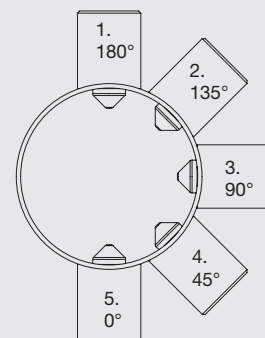


## Conventional Usage



- Not suitable for applications in explosive areas.
- Not suitable for applications in security-relevant equipments (SIL).

Fig. 1: Build-in positions



## Mechanical Connection / Installation



To guarantee a definite function, the sensor tip must be completely covered by the medium! A minimum filling level in the pipe is necessary to ensure that the sensor operates. This varies according to the mounting position:


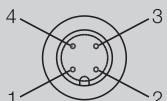
- for position 1: 100 %
  - for position 2: ca. 92 %
  - for position 3: ca. 60 %
  - for position 4: ca. 30 %
  - for position 5: min. 11 mm
- Position 2: Ideal installation as high alarm in horizontal lines; ensures that isolation of sensor tip by air bubble is prevented.
- Position 4: Ideal installation as low alarm in horizontal lines; ensures that sensor tip is not covered with residues of medium.


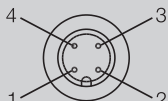
- Do not use non-conducting sealants such as PTFE (Teflon) or similar.

## Conditions for a measuring point according to 3-A-Standard 74-03



- The sensors NCS-0xP and NCS-8xP are approved according to the 3-A-Standard.
- Only with the build-in system **CLEANadapt** and **PHARMadapt** (EMZ, EMK, EHG, EPA with tube > DN25, ISO 20 and 1", Adapter AMC, AMV, AMA and AMB) allowed.
- The welding seam by using of EMZ and EMK has to correspond with 3-A-Standard 74-03, D6.1.4:  
"The minimum radii for fillets of welds in product contact surfaces shall be not less than 1/4 in. (6.35 mm) except that the minimum radii for such welds may be 1/8 in. (3.18 mm) when the thickness of one or both parts joined is less than 3/16 in. (4.76 mm)."
- Self draining has to be warranted by the build-in position (pos. 1, 2 or 3).
- The process connection needs a self-draining leakage hole.

Electrical Connection NCS-x1P		
Strip terminal	High active	Low active
	1: + 24 V DC 2: 0 V 3: output	1: 0 V 2: + 24 V DC 3: output
M12-plug	High active	Low active
	1: + 24 V DC 2: not connected 3: 0 V 4: output	1: 0 V 2: not connected 3: + 24 V DC 4: output













Electrical Connection NCS-x2P		
Strip terminal	High active	Low active
	1: control input 2: + 24 V DC 3: 0 V 4: Output	1: control input 2: 0 V 3: + 24 V DC 4: Output
M12-plug	High active	Low active
	1: + 24 V DC 2: control input 3: 0 V 4: output	1: 0 V 2: control input 3: + 24 V DC 4: output

### Handling / Operation

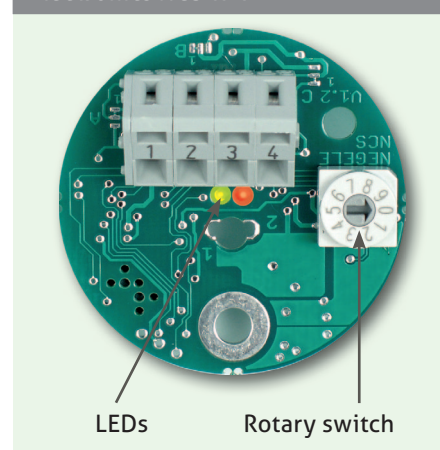


With the control input (only NCS-x2P), the threshold of the limit switches with enhanced measurement range can be switched to threshold of  $D_k = 50$  while operating. This could be useful to avoid false alarm at process steps with increasing frothing, CIP-cycles or similar.

Control input	Threshold
0 V or not connected	like setting with rotaty switch
+ 24 V DC	$D_k = 50$ fix

LED status display			
Sensor tip	NCS-x1P	NCS-x2P control input 0 V	NCS-x2P control input 24 V
covered	 	 	 
not covered	 	 	 

### Electronics NCS-x2P



### Adjustment of threshold with rotary switch

Switch setting	$D_k$ -value $\geq 20$ NCS-x1P	$D_k$ -value $\geq 5$ NCS-02P NCS-32P ... TC3/4 NCS-62P	$D_k$ -value $\geq 2$ NCS-32P ... TC1 NCS-32P ... TC2 NCS-82P
0	output off	output off	output off
1	output on	output on	output on
2	20	5	2
3	25	6	3
4	30	7	4
5	35	8	5
6	40	9	10
7	50	10	12
8	60	15	15
9	70	20	20

Showcase of media and specific  $D_k$ -value:  
(the exemplarily  $D_k$ -values can vary acc. to different outside influences like temperature, fabrication, source etc.)

Medium	$D_k$ -value
water	81
formic acid	57
methanol	33
water (demineralized)	29
ethanol	25
isopropanol	18
glycerin	13
fatty acid	2

### Example

At switch setting 5 ( $D_k = 35$ ) the NCS-x1P will detect media with a dielectric constant of  $D_k \geq 35$ .

## Information Process Connection



The complete assortment as well as the order code for build-in systems, weld-in sleeves and adapters you will find in the product information **CLEANadapt**.

## Samples of possible process connections

Type	NCS-0xP				
Process connection	Build-in system EHG (DIN 11850 series 2)	Weld-in sleeve	Weld-in ball	Collar sleeve	APV-Inline

## Information Process Connection



The complete assortment as well as the order code for build-in systems, weld-in sleeves and adapters you will find in the product information **CLEANadapt**.

## Process Connections PHARMadapt EPA

Type	NCS-6xP	NCS-8xP
Process connection	EPA-8	EPA-18

## Order Code

**SRC-05**  
**SRC-10**  
**TAG**

(for NCS-6xP, material 1.4301 bright)  
(for NCS-8xP, material 1.4301 bright)  
(labeled acc. to customer preference, material 1.4301 bright)

## Please note:

The clamp ring is not included in delivery and must be ordered separately!

## Clamp ring SRC-10 for EPA-18



## Identification with TAG-plate



## Accessories

**PVC-cable with M12-connection made of 1.4305, IP 69 K, unshielded**

<b>M12-PVC / 4-5 m</b>	PVC-cable 4-pin, length 5 m
<b>M12-PVC / 4-10 m</b>	PVC-cable 4-pin, length 10 m
<b>M12-PVC / 4-25 m</b>	PVC-cable 4-pin, length 25 m

**PVC-cable with M12-connection, brass nickel-plated, IP 67, shielded**

<b>M12-PVC / 4G-5 m</b>	PVC-cable 4-pin, length 5 m
<b>M12-PVC / 4G-10 m</b>	PVC-cable 4-pin, length 10 m
<b>M12-PVC / 4G-25 m</b>	PVC-cable 4-pin, length 25 m

## PVC-cable with M12-connection



## Cleaning / Maintenance



- In case of using pressure washers, don't point nozzle directly to electrical connections!

## Reshipment



- Sensors shall be clean and must not be contaminated with dangerous media!
- Use suitable transport packaging only to avoid damage of the equipment!

## Advice to Conformity



- Applicable guidelines: Electromagnetic compatibility 2004/108/EC
- The accordance with applicable EC-guidelines is confirmed with CE-labeling of the device.
- You have to guarantee the compliance of all guidelines applicable for the entire equipment.

## Transport / Storage



- No outdoor storage
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration
- Storage temperature 0...40 °C
- Relative humidity max. 80 %

## Standards and Guidelines



- You have to comply with applicable regulations and directives.

## Disposal



- This instrument is not subject to the WEEE directive 2002/96/EC and the respective national laws.
- Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points.

## Order Code

<b>NCS-01P</b>	(CLEANadapt M12, measurement range Dk ≥ 20, sensor tip made of 1.4435, certificate 3.1 acc. to EN 10204)
<b>NCS-02P</b>	(CLEANadapt M12, measurement range Dk ≥ 5, sensor tip made of 1.4435, certificate 3.1 acc. to EN 10204)
<b>NCS-31P</b>	(Direct connection, measurement range Dk ≥ 20, sensor tip made of PEEK acc. to USP Class VI, certificate 3.1 acc. to EN 10204)
<b>NCS-32P</b>	(Direct connection, measurement range Dk ≥ 2 except NCS-32P...TC3/4 here Dk ≥ 5, sensor tip made of PEEK acc. to USP Class VI, certificate 3.1 acc. to EN 10204)
<b>NCS-61P</b>	(PHARMadapt EPA-8, measurement range Dk ≥ 20, sensor tip made of 1.4435, certificate 3.1 acc. to EN 10204)
<b>NCS-62P</b>	(PHARMadapt EPA-8, measurement range Dk ≥ 5, sensor tip made of 1.4435, certificate 3.1 acc. to EN 10204)
<b>NCS-81P</b>	(PHARMadapt EPA-18, measurement range Dk ≥ 20, sensor tip made of PEEK acc. to USP Class VI)
<b>NCS-82P</b>	(PHARMadapt EPA-18, measurement range Dk ≥ 2, sensor tip made of PEEK acc. to USP Class VI)
<b>Output</b>	
<b>PNP</b>	(standard, active 24 V DC)
<b>NPN</b>	(NPN)
<b>Temperature Version (see diagram on page 2)</b>	
<b>X</b>	(standard, for process temp. up to 100 °C, CIP/SIP 143 °C / 120 min)
<b>H</b>	(high temperature version with spacer, for process temperatures up to 143 °C)
<b>D</b>	(heater deactivated at higher ambient temperature)
<b>HD</b>	(for process temperatures up to 143 °C at higher ambient temperature, with spacer and heater deactivated)
<b>Process Connection (only for NCS-3xP)</b>	
<b>I46</b>	(Fermenter connection length 46 mm, not with temperature version H and HD)
<b>I52</b>	(Fermenter connection length 52 mm, not with temperature version H and HD)
<b>TC3/4</b>	(Tri-Clamp ¾")
<b>TC1</b>	(Tri-Clamp 1...1½")
<b>TC2</b>	(Tri-Clamp 2")
<b>B50</b>	(BioControl DN 40...DN 100)
<b>B65</b>	(BioControl DN 40...DN 100)
<b>V10</b>	(Varivent® DN 10...DN 15)
<b>V25</b>	(Varivent® DN 25)
<b>V40</b>	(Varivent® DN 40)
<b>NCS-31 /</b>	<b>PNP /</b>
	<b>H /</b>
	<b>TC1</b>

## Note



- All Types of NCS-...P will be delivered with window in lid and electrical connection with M12 plug.
- Varivent® is a registered trademark of GEA Tuchenhausen GmbH.
- Ingold® is a registered trademark of Mettler-Toledo GmbH.