

# Capacitive Limit Switch Food NCS

## Application / Specified Usage

- Limit detection of media with low or no water content like syrup, fruit concentrates, alcohols und oils with a dielectric constant  $\epsilon_r$  (Dk)  $\geq 2$

## Application Examples

- Limit detection in vessels (build-in position sidewise) or pipes
- High alarm in vessels and tanks with build-in position from top (type NCS-L)
- Empty alarm in vessels and tanks with build-in position from bottom (type NCS-L)
- Product monitoring in pipes
- Pump / dry running protection

## Hygienic Design / Process Connection

- Flow optimized, hygienic and easy sterilizable installation by sleeve EMZ-132 or build-in system EHG-.../1/2" and EHG-.../M12
- 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
- Process connections see product information CLEANadapt, e.g: Tri-Clamp, dairy flange (DIN 11851), Varivent ...

## Features

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

## Options / Accessories

- LED state indicator with inspection window lid
- Version with spacer (option H) for isolated vessels or permanent process temperatures up to 143 °C (available for NCS-x1 and NCS-x2)
- 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. 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-01



NCS-12



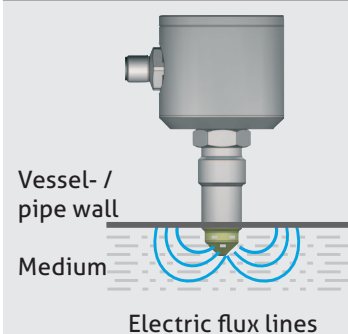
NCS-L-11/50



NCS-L-11/150

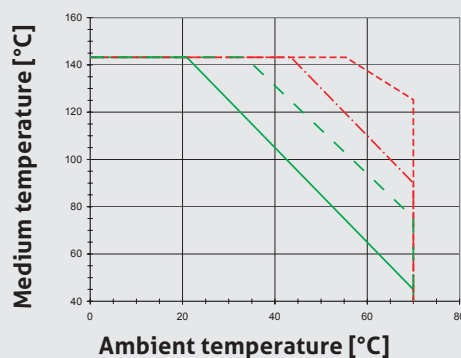


## Measuring principle



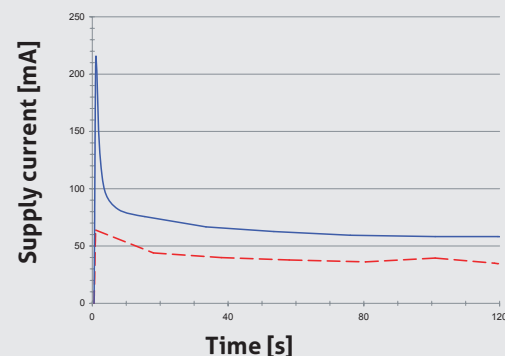
| Specification         |                                  |                                                                                                      |
|-----------------------|----------------------------------|------------------------------------------------------------------------------------------------------|
| Process Connection    | thread                           | M12 x 1,5, G1/2" CLEANadapt, combined with Negele weld-in sleeves, build-in systems, adapter sleeves |
|                       | tightening torque                | max. 5...10 Nm                                                                                       |
| Materials             | connection head                  | stainless steel 1.4305 (303)                                                                         |
|                       | connection piece                 | stainless steel 1.4305 (303)                                                                         |
|                       | spacer                           | stainless steel 1.4305 (303)                                                                         |
|                       | sensor tip NCS-1x                | PEEK (FDA approval number 21 CFR 177.2414)                                                           |
|                       | sensor tip NCS-0x, NCS-L         | stainless steel 1.4404 (316L)                                                                        |
| Surface Quality       |                                  | R <sub>a</sub> ≤ 0,8 µm                                                                              |
| Weight                |                                  | ca. 500 g                                                                                            |
| Operating Pressure    |                                  | max. 10 bar                                                                                          |
| Electrical Connection | cable gland                      | M16 x 1,5 (PG)                                                                                       |
|                       | cable connection                 | M12-plug, stainless steel 1.4305 (303)                                                               |
| Protection Class      |                                  | IP 69 K (with cable connection)<br>IP 67 (with cable gland)                                          |
| Supply                |                                  | 16...32 V DC (see graphic)                                                                           |
| Output                |                                  | PNP (active 50 mA, short-circuit-proof)                                                              |
|                       | optional                         | NPN (active 50 mA, short-circuit-proof)                                                              |
| Switching Function    | adjustable by polarity of supply | high active (sensor wetted: 'high')                                                                  |
|                       |                                  | low active (sensor free: 'high')                                                                     |
| Status Display        |                                  | LED                                                                                                  |
| Measuring Range       | NCS-x1, NCS-L-11                 | Dk ≥ 20                                                                                              |
|                       | NCS-02                           | Dk ≥ 5                                                                                               |
|                       | NCS-12, NCS-L-12                 | Dk ≥ 2                                                                                               |
| Switching Threshold   | NCS-x1, NCS-L-11                 | threshold stepwise adjustable Dk = 20 ... Dk = 70                                                    |
|                       | NCS-02                           | threshold stepwise adjustable Dk = 5 ... Dk = 20                                                     |
|                       | NCS-12, NCS-L-12                 | threshold stepwise adjustable Dk = 2 ... Dk = 20                                                     |
|                       | NCS-02, NCS-12, NCS-L-12         | threshold external switchable to Dk = 50 fixed                                                       |

### Temperature Range



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

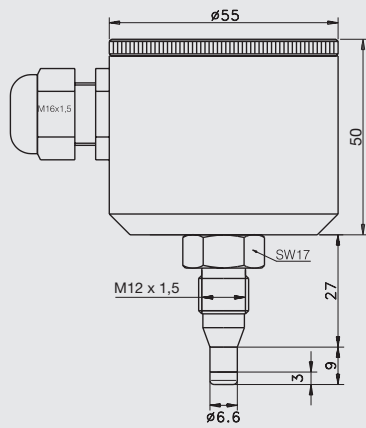
### Supply / Power Input



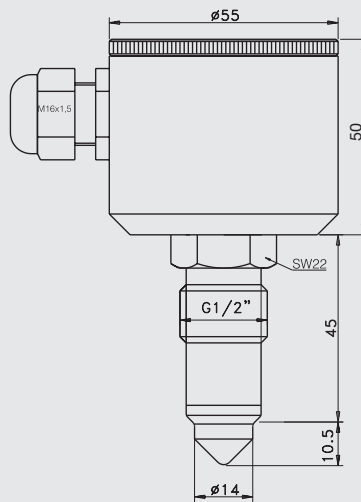
- - -  $U_b = 24 \text{ V}, T_u = 20 \text{ °C}$
- $U_b = 33 \text{ V}, T_u = -15 \text{ °C}$

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

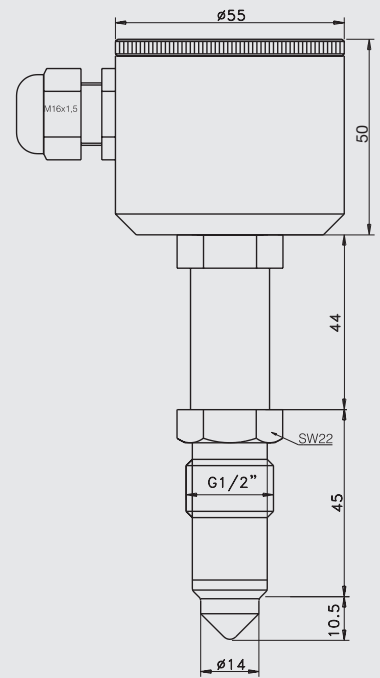
NCS-0x



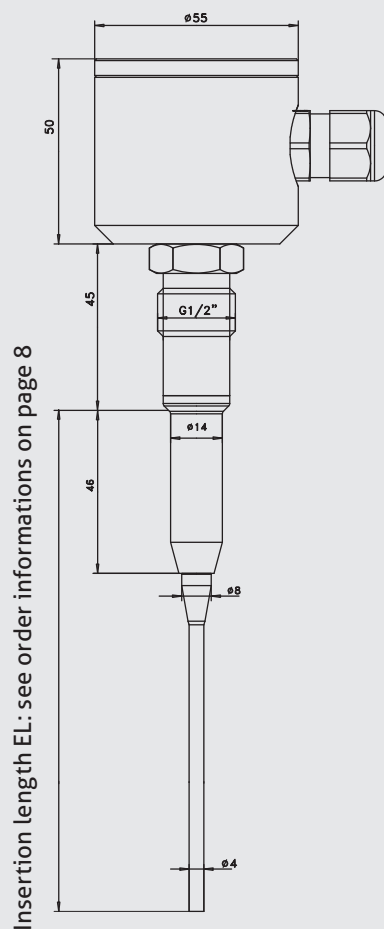
NCS-1x



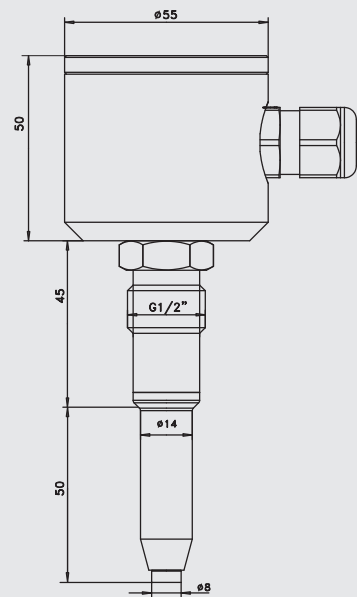
NCS-1x / H



NCS-L-11 / X



NCS-L-12 / 50



#### Belated Shortage of Sensor Rod



Sensor length can be shortened by up to 50 mm. Thereby immersion length needed for switching can vary after cut down. These is about 5 mm at watery media.

## Conventional Usage



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

Electrical Connection NCS- $\alpha$ 1, NCS-L-11

| Strip terminal | High active                                             | Low active                                              |
|----------------|---------------------------------------------------------|---------------------------------------------------------|
|                | 1: + 24 V DC<br>2: 0 V<br>3: output                     | 1: 0 V<br>2: + 24 V DC<br>3: output                     |
| M12-plug       | High active                                             | Low active                                              |
|                | 1: + 24 V DC<br>2: not connected<br>3: 0 V<br>4: output | 1: 0 V<br>2: not connected<br>3: + 24 V DC<br>4: output |

Electrical Connection NCS- $\alpha$ 2, NCS-L-12

| Strip terminal | High active                                             | Low active                                              |
|----------------|---------------------------------------------------------|---------------------------------------------------------|
|                | 1: control input<br>2: + 24 V DC<br>3: 0 V<br>4: output | 1: control input<br>2: 0 V<br>3: + 24 V DC<br>4: output |
| M12-plug       | High active                                             | Low active                                              |
|                | 1: + 24 V DC<br>2: control input<br>3: 0 V<br>4: output | 1: 0 V<br>2: control input<br>3: + 24 V DC<br>4: output |

## Mechanical Connection / Installation in Pipes



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 (see figure "Build-in Position" on page 5):

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

- Use Negele **CLEANadapt** system for all types of NCS to ensure safe operation of measuring point!
- Attention: The maximum tightening torque for mounting is 10 Nm!
- Use a welding mandril for correct installation of **CLEANadapt** weld-in fittings. Please pay attention to the weld-in and installation details in the **CLEANadapt** product information.
- 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-x1 and NCS-x2 are approved according to the 3-A-Standard.
- Only with the build-in system **CLEANadapt** (EMZ, EMK, EHG with tube  $\geq$  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, see figure "Build-in Position").
- The process connection needs a self-draining leakage hole.

Fig.: Build-in Position in Pipes

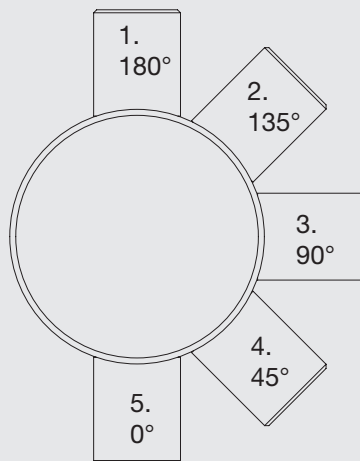
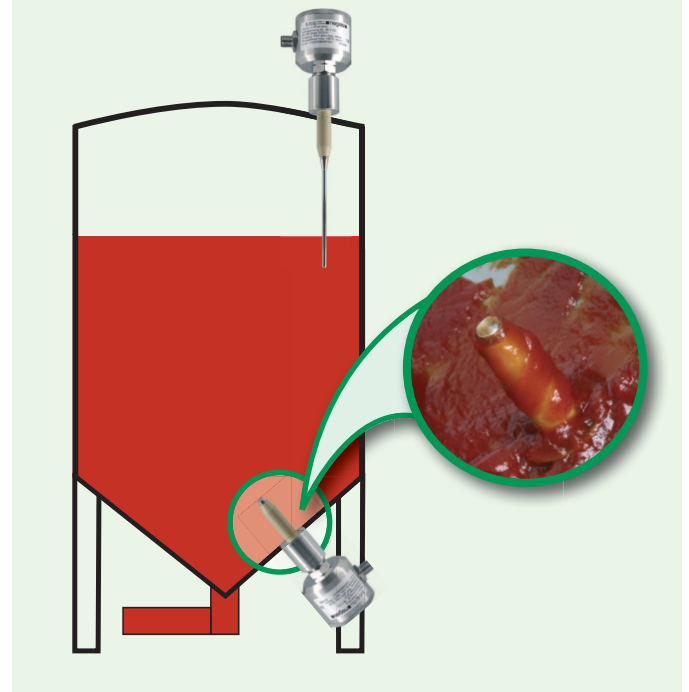


Fig.: Build-in Schema for NCS-L ...



## Handling / Operation



With the control input, the threshold of the limit switches with enhanced measurement range can be switched to threshold of  $Dk = 50$  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            | $Dk = 50$ fix                   |

## LED status display

| Sensor Tip  | NCS-x1<br>NCS-L-11                                                                                                                                                  | NCS-x2<br>NCS-L-12<br>control input<br>0 V                                                                                                                          | NCS-x2<br>NCS-L-12<br>control input<br>24 V                                                                                                                         |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| covered     |   |   |   |
| not covered |   |   |   |

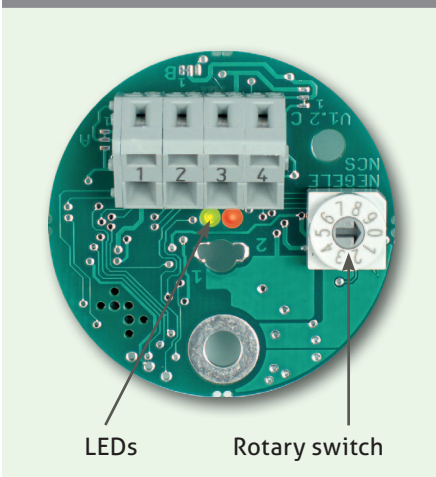
## Adjustment of threshold with rotary switch

| Switch setting | $Dk\text{-value} \geq 20$<br>NCS-x1<br>NCS-L-11 | $Dk\text{-value} \geq 5$<br>NCS-02 | $Dk\text{-value} \geq 2$<br>NCS-12<br>NCS-L-12 |
|----------------|-------------------------------------------------|------------------------------------|------------------------------------------------|
| 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                                             |

## Example

At switch setting 5 ( $Dk = 35$ ) the NCS-x1 will detect media with a dielectric constant of  $Dk \geq 35$ .

## Electronics NCS-x2



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

| Medium                         | $Dk$ -value |
|--------------------------------|-------------|
| water                          | 81          |
| methanol                       | 33          |
| water (demineralized)          | 29          |
| ethanol                        | 25          |
| honey, ketchup, mustard        | 24          |
| acetone                        | 21          |
| skin cream                     | 19          |
| toothpaste                     | 18          |
| draff (residual moisture 20 %) | 7           |
| butter                         | 6           |
| milkfat                        | 4           |
| chocolate                      | 3           |
| vegetable oil                  | 2           |



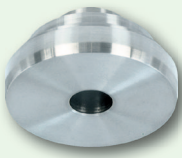
### Information Process Connection

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

|                    |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
|--------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| NCS-1x<br>NCS-L-1x |  |  |  |  |  |
| Process connection | Build-in system EHG (DIN 11850 series 2)                                          | Weld-in sleeve                                                                    | Weld-in sleeve                                                                     | Weld-in sleeve                                                                      | Collar sleeve                                                                       |

### Samples of possible process connections

|                    |                                                                                    |                                                                                    |                                                                                     |                                                                                      |                                                                                      |
|--------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| NCS-1x<br>NCS-L-1x |  |  |  |  |  |
| Process connection | Weld-in ball                                                                       | Tri-Clamp                                                                          | Dairy flange (DIN 11851)                                                            | Varivent-Inline                                                                      | Adapter                                                                              |

### 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-01</b>   | (measurement range for watery media with $D_k \geq 20$ ; CLEANadapt M12)                        |
| <b>NCS-11</b>   | (measurement range for watery media with $D_k \geq 20$ ; CLEANadapt G1/2")                      |
| <b>NCS-L-11</b> | (measurement range for watery media with $D_k \geq 20$ ; CLEANadapt G1/2")                      |
| <b>NCS-02</b>   | (measurement range for critical media with $D_k \geq 5$ ; CLEANadapt M12)                       |
| <b>NCS-12</b>   | (measurement range for critical media with $D_k \geq 2$ (e.g. Oil, Fat, ...); CLEANadapt G1/2") |
| <b>NCS-L-12</b> | (measurement range for critical media with $D_k \geq 2$ (e.g. Oil, Fat, ...); CLEANadapt G1/2") |

**Note: Only with insertion length 50 mm available!**

**Insertion Length EL (only selectable for NCS-L-11)**

|            |                                                       |
|------------|-------------------------------------------------------|
| <b>50</b>  | (insertion length 50 mm)                              |
| <b>100</b> | (insertion length 100 mm)                             |
| <b>150</b> | (insertion length 150 mm)                             |
| <b>200</b> | (insertion length 200 mm)                             |
| <b>250</b> | (insertion length 250 mm)                             |
| <b>xxx</b> | special length (only between 60...250 mm selectable!) |

**Pay attention for the information to belated shortage of sensor rod on page 3!**

**Output**

|            |                            |
|------------|----------------------------|
| <b>PNP</b> | (standard, active 24 V DC) |
| <b>NPN</b> | (NPN)                      |

**Temperature Version (see diagram on page 2)**

|           |                                                                                                                                         |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <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; not for NCS-L11 and NCS-L-12)                             |
| <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; not for NCS-L11 and NCS-L-12) |

**Status-LED**

|           |                                               |
|-----------|-----------------------------------------------|
| <b>X</b>  | (without)                                     |
| <b>KF</b> | (window in the lid, LED visible from outside) |

**Electrical Connection**

|            |                       |
|------------|-----------------------|
| <b>X</b>   | (cable gland M16x1,5) |
| <b>M12</b> | (M12-plug 1.4305)     |

NCS-01 / / PNP / H / KF / M12