



## HIGH-FREQUENCY LIMIT LEVEL SENSOR RFLS-35

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## USED SYMBOLS

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To ensure maximum safety of control processes, we have defined the following safety instructions and information. Each instruction is labelled with the appropriate pictogram.



### **Alert, warning, danger**

This symbol informs you about particularly important instructions for installation and operation of equipment or dangerous situations that may occur during the installation and operation. Not observing these instructions may cause disturbance, damage or destruction of equipment or may cause injury.



### **Information**

This symbol indicates particularly important characteristics of the device.



### **Note**

This symbol indicates helpful additional information.

## SAFETY

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**All operations described in this instruction manual have to be carried out by trained personnel or by an accredited person only. Warranty and post warranty service must be exclusively carried out by the manufacturer.**

**Improper use, installation or adjustment of the sensor can lead to application failures (overfilling tanks or damage to system components).**

**The manufacturer is not responsible for improper use, loss of work caused by either direct or indirect damage, and for expenses incurred at the time of installation or during the period of use of the level sensors.**

## 1. BASIC DESCRIPTION

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The **high-frequency level sensor RFLS-35** is designed for industrial use for limit sensing of the level of liquid and pasty media. The high-frequency level sensor may be a direct replacement of a vibrating level sensor, or of a capacity level sensor in case of more demanding applications. The media may be electrically conductive or non-conductive with any permittivity. It can be installed in metal or plastic tanks, pipes, filling tanks, sumps, etc.

It is mainly designed for mounting into the wall of a tank or pipe, in which the actual detection of the level will take place. The sensor works in the high frequency band, enabling reliable detection of the level of media, and eliminating deposits or foam on the electrode. The sensor suppresses the influence of deposits of viscous media (ketchup, yoghurt, pastes, syrups, jams and jellies, creams, soap) as well as electrically conductive adhesive products (detergents, alkalis, chemicals).

Likewise, it is possible to utilize it to differentiate a specific media from others - the "Medium window" function. E.g. it can differentiate oil from water and air, detect only beer foam and ignore beer and air, etc.

The sensor is made from a stainless steel housing at one end terminated by a sensing electrode, and terminated at the other end by an ending with a status indicator, control elements and electrical connection.

There are next performances available: **N** – For normal atmospheres, **Xi** – Explosion proof – intrinsically safe for hazardous (explosive) areas. and **XiM** – Explosion proof – intrinsically safe for use in mines with methane or flammable dust presence danger (see technical specifications).

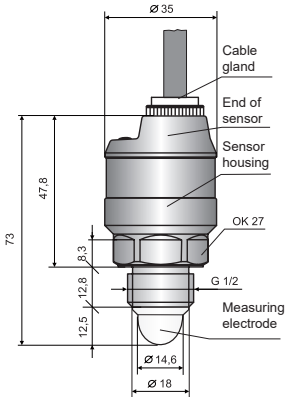
## 2. VARIANTS OF SENSORS

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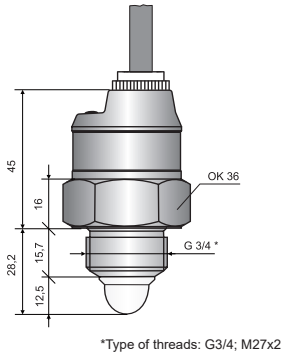
- **RFLS-35\_-1B** **Insulated electrode (PEEK) with sealing O-ring NBR**, for sensing various liquid, mashed and paste-like materials, appropriate also for fuel, oil or methanol, use from minimum temperature of -40 °C
- **RFLS-35\_-11B** **Insulated electrode (PEEK) extended version with sealing O-ring NBR**, for sensing various liquid, mashed and paste-like materials, appropriate also for fuel, oil or methanol, use from minimum temperature of -40 °C
- **RFLS-35\_-1E** **Insulated electrode (PEEK) with sealing O-ring EPDM**, for sensing various liquid, mashed and paste-like materials, appropriate also for acids, bases or alcohol, ammonia, acetone, chlorine, from minimum temperature of -40 °C
- **RFLS-35\_-11E** **Insulated electrode (PEEK) extended version with sealing O-ring EPDM**, for sensing various liquid, mashed and paste-like materials, appropriate also for acids, bases or alcohol, ammonia, acetone, chlorine, from minimum temperature of -40 °C
- **RFLS-35\_-1V** **Insulated electrode (PEEK) with sealing O-ring Viton**, for sensing various liquid, mashed and paste-like materials, appropriate also for fuel, oil, acids, bases or asphalt, tar, toluene, use from minimum temperature of -20 °C
- **RFLS-35\_-11V** **Insulated electrode (PEEK) extended version with sealing O-ring Viton**, for sensing various liquid, mashed and paste-like materials, appropriate also for fuel, oil, acids, bases or asphalt, tar, toluene, use from minimum temperature of -20 °C
- **RFLS-35\_-2** **Insulated electrode (PTFE) without O-ring**, for sensing various liquid, mashed and paste-like materials, especially suitable for aggressive liquids, use from minimum temperature of -40 °C.
- **RFLS-35\_-21** **Insulated electrode (PTFE) extended version without O-ring**, for sensing various liquid, mashed and paste-like materials, especially suitable for aggressive liquids, use from minimum temperature of -40 °C.

### 3. DIMENSIONAL DRAWING

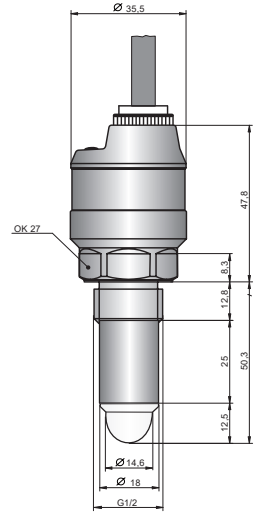
RFLS-35\_-1-G1/2



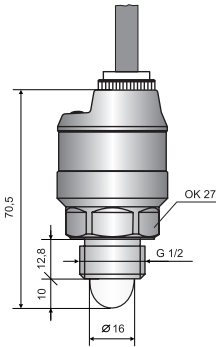
RFLS-35\_-1-G3/4



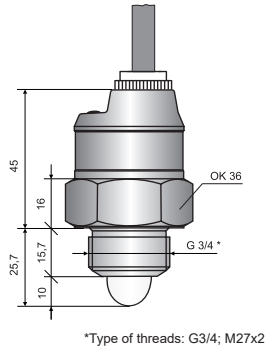
RFLS-35\_-11-G1/2



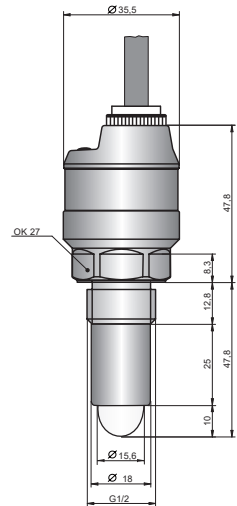
RFLS-35\_-2-G1/2



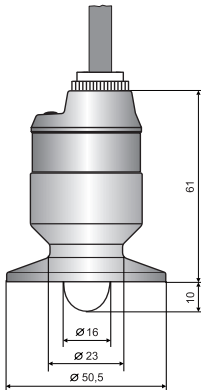
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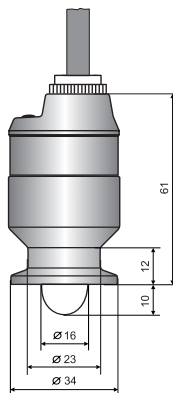
RFLS-35\_-21-G1/2



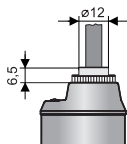
RFLS-35\_-2-CI50  
(Tri-clamp)



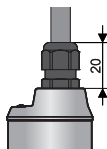
RFLS-35\_-2-CI34  
(Tri-clamp)



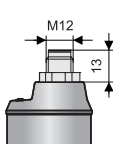
Variant "A" with short stainless steel gland



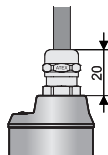
Variant "B" with plastic threaded cable gland



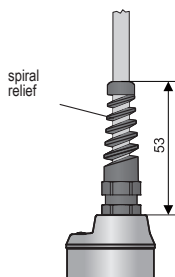
Variant "C" with connector M12



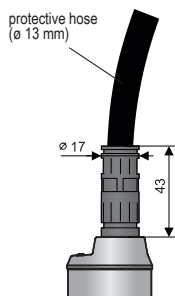
Variant "D" with dustproof cable outlet



Variant "V" with plastic cable gland with spiral relief – in case of increased mechanical wear on the cable.

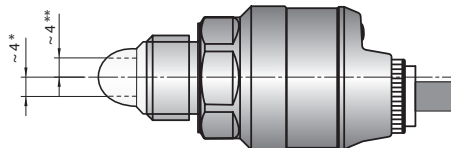


Variant "H" with cable gland for protected hoses – for using in an outdoor area or in area with increased moisture.

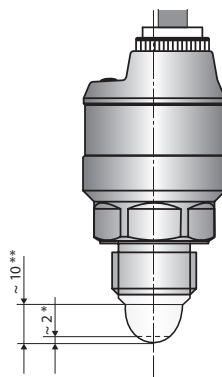


### SENSOR SWITCHING LEVEL

horizontal mounting



vertical mounting



\* Typical switching point position for water (factory setting)

\*\* Typical switching point position for oil.

## 4. INSTALLATION AND PUTTING INTO OPERATION

Please follow next 3 steps:

- **INSTALLATION INSTRUCTIONS** SEE CHAPTER 5
- **ELECTRICAL CONNECTION** SEE CHAPTER 6
- **SETTINGS** SEE CHAPTER 8

## 5. INSTALLATION INSTRUCTIONS

RFLS level sensors can be mounted in horizontal or inclined position into the shell of a container, storage tank or pipe by screwing into the welding flange, or by affixing using a nut. Basic application recommendations are mentioned below.



*During assembly into the metal tank or the storage tank, it is not necessary to separately ground the base of the level sensor*



**In the case of the use for an aggressive medium is necessary to prove the chemical compatibility of used materials of the sensor (Tab. Used materials on page 19). This guarantee ceases when the product is chemically damaged.**

Thanks to its design, the sensor is appropriate for detection of the level of viscous and simultaneously electrically conductive media (yoghurt, jams and jellies, mayonnaise, spreads, liquid soap, creams or pastes). After setting the sensitivity of the given media, it reliably reacts to the presence or absence of a medium level. On the contrary, the sensor does not react to remnants and coatings of viscous media on the measuring electrode.

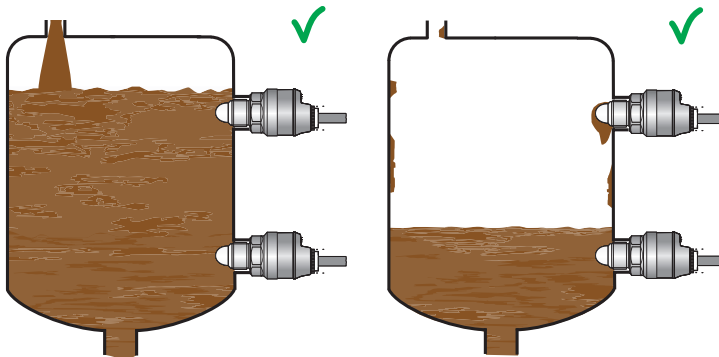


Fig. 1: Side installation of sensors into a tank with viscous medium



It is recommended to install sensors in a horizontal pipe **inclined from the side**.

Upon vertical installation of the sensor in a pipe, pay attention to potential formation of air pockets,

or adhering remnants of liquid at the bottom of the pipe.

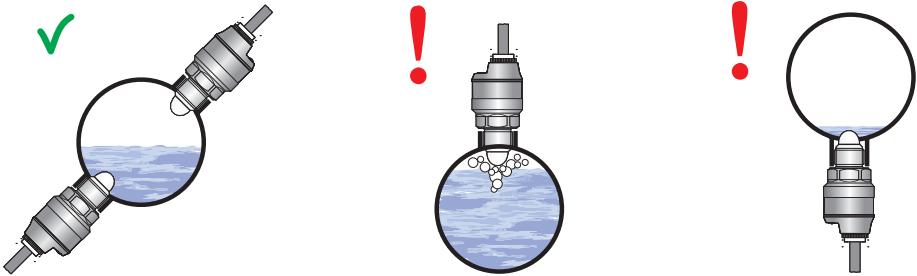


Fig. 2: Installation of the sensor in a pipe

In the case of side wall mounting, it is necessary to avoid long fitting tubes, where sensed medium could remain. We recommend mounting the sensor so that the whole measuring electrode is inside the tank.

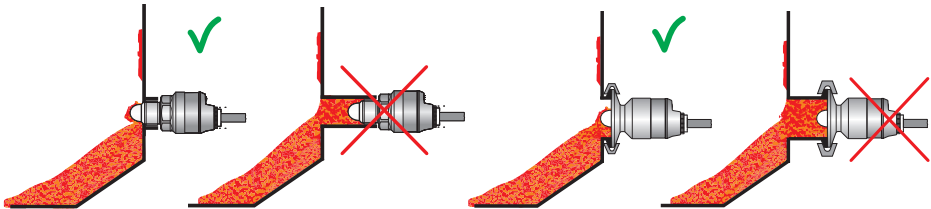


Fig. 3a: Correct and incorrect installation with a long tube

Fig. 3b: Correct and incorrect installation with a long tube for process connection with Tri-Clamp



Small Tri-clamp ( $\varnothing$  34 mm), only for liquids with low viscosity.

Installation of the sensor for reliable checking of the level of a liquid with foam on the surface. Sensitivity of the sensor can be set to detect the liquid interface with foam. After a drop in the liquid level, the sensor does not react to coatings of foam on the electrode.

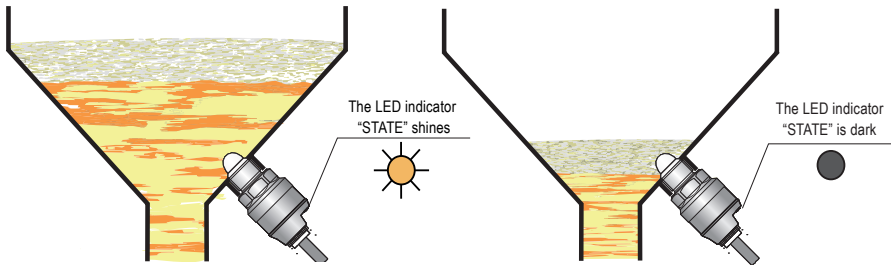


Fig. 4: Monitoring the level of foam media

The sensor can be mounted in a tank or at medium inlets. After setting to the level of the given media the sensor does not react to the current of flowing medium.

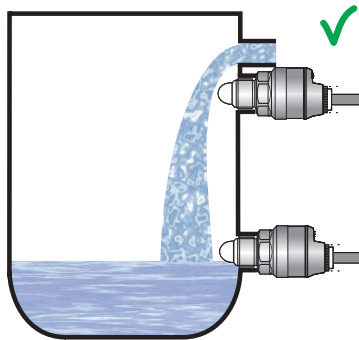


Fig. 5: Option of mounting the sensor in the medium inlet

## 6. ELECTRICAL CONNECTION

A sensor with PNP output can be loaded only by resistive or inductive load. The positive pole of the supply voltage (+U) is connected to the brown wire *BN* or pin connector no.1, the negative pole (0V) is connected to the blue wire *BU* or pin connector no. 3 and load on the black wire *BK* or pin connector no. 4. The capacitive loads and low resistance loads (bulb) are evaluated by the sensor as a short circuit.

Connection diagrams are listed in Figures 6, 7 and 8.

Connection using connector socket shows in Figure 9 and 10.

Sensors RFLS-35 with type of cable outlet A, B, V, D or H are connected to assessing units permanently connected by PVC cable. Design diagrams are provided in images 6, 7 and 8.

Sensors RFLS-35 with connection method type C are connected to control units by means of a connector socket with compression cable (length 2 or 5 m), or by means of dismantable connector socket without cable (see accessories), connector socket is not part of the sensor. In this case the cable is connected to the inside pins of the socket according to Figure 9. The recommended diameter of this cable is 4 to 6 mm (the recommended cross-sectional area is 0.5 to 0.75 mm<sup>2</sup>).

The connection of the sensor to the connecting device is performed using a suitable three wire (variant N) or two wire (variant Xi and XiM) cable. The length of the cable for the Xi and XiM variations must be selected with respect to the maximum permitted parameters (usually inductance and capacity) of the outside intrinsically safe circuit of supply units (NSSU, NDSU, NLCU).

In the event that dismantable connector sockets are used, the outer diameter of the cable is max. 6 mm.

A sensor with an NPN or PNP output can only be loaded with a resistive or inductive load.

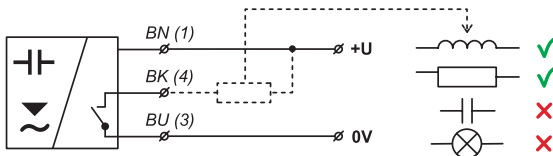


Fig. 6: Sensor connection with NPN output (N, NT version)

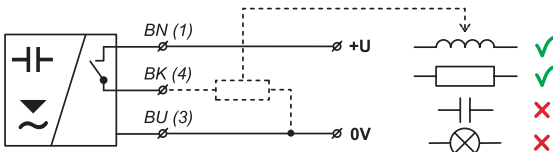


Fig. 7: Sensor wiring with PNP output (N, NT version)

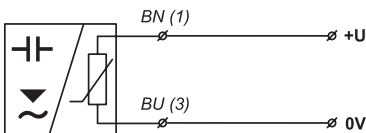


Fig. 8: Sensor connection with NAMUR output (Xi, XiM, XiT, XiMT)

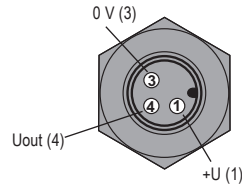


Fig. 9: Connecting the connector on the sensor

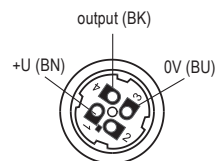


Fig. 10: Internal view of the connector socket

### Legend:

(1,...) – numbers of terminals inside the connector socket  
 BK – Black  
 BN – Brown  
 BU – Blue



Electrical connection can only be made when de-energized!

The source of the power voltage must comprise of a stabilised safe low power source with galvanic separation. In the event that a switch-mode power supply is used, it is essential that its construction effectively suppresses common mode interference on the secondary side. In the event that the switch-mode power supply is equipped with a PE safety terminal, it must be unconditionally grounded! Spark-safe devices type (RFLS-35Xi and RFLS-35XiM) must be powered from a spark-safe power source meeting the above-mentioned requirements.



In the event that the level meater (sensor) is installed in an outdoor environment at a distance greater than 20 m from the outdoor switchboard, or from an enclosed building, it is necessary to supplement the electrical cable leading to the level meater (sensor) with suitable overvoltage protection.

With regard to possible occurrence of electrostatic charge on non-conductive parts of the sensor for explosive areas (RFLS-35Xi and RFLS-35XiM, sensors must be grounded. It will be done using conductive tank, conductive lid of tank, or by the auxiliary plate electrode PDE-27.

In the event of strong ambient electromagnetic interference, paralleling of conductors with power distribution, or for distribution to distances over 30 m, we recommend grounding the level meter (see above) and using a shielded cable.

## 7. CONTROL ELEMENTS

Settings are performed by placing the magnetic pen on the sensitive spot marked “+” or “-” located at the end of the sensor in two modes:

1. Quick settings - the user does not know precisely to what medium the sensor should be set, he only wants to put the sensor into operation (usually upon receiving it) and check to see if the sensor is generally functional
2. Basic settings - the user has the medium available and can perform on the sensor its flooding and drainage
3. Medium window settings - the user has the medium available and can perform on the sensor its flooding and drainage

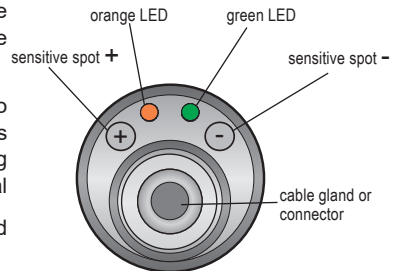


Fig. 10: Top view of sensor control elements


## 8. SETTINGS

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### 8.1. QUICK SETTINGS

This function can be used for quick setting of the sensor, or in case it is not possible (or is very complicated) to change the level of the medium for setting the sensor. Suitable also before putting into operation.

#### **A) SETTING THE MODE O (IT IS CLOSED WHEN SUBMERGED)**

1. The tank is empty or the level of measured medium in the tank is in a state where the sensor electrode is no longer submerged.
2. Place the magnetic pen for **at least 5 seconds\*** on the sensitive spot  of the sensor (first both LEDs illuminate, after approx. 3 seconds the orange LED will flash 3 times, and after another approx. 2 seconds the orange LED flashes again 3 times - now you can remove the magnetic pen). The sensor is now set to the mode O (it is closed when submerged).

#### **B) SETTING THE MODE C (IT IS OPEN WHEN SUBMERGED)**

1. The tank is empty or the level of measured medium in the tank is in a state where the sensor electrode is no longer submerged.
2. Place the magnetic pen for **at least 5 seconds\*** on the sensitive spot  of the sensor (first both LEDs illuminate, after approx. 3 seconds the orange LED will flash 3 times, and after another approx. 2 seconds the orange LED flashes again 3 times - now you can remove the magnetic pen). The sensor is now set to the mode C (it is open when submerged).



*If no other agreement the mode "O" is set on all sensors straight from the factory.*



**When using the function "Quick settings", the sensor does not eliminate the presence of deposits and foam on the electrode.**



**The manufacturer recommends performing Basic Settings as soon as possible.**

*\*) Maximum 10 seconds.*



## 8.2. BASIC SETTINGS

For setting the sensitivity and switching mode, where it is possible to submerge the sensor in or remove it from the medium. When using this setting, the sensor eliminates the presence of deposits and foam on the electrode.

### A) SETTING THE MODE O (IT IS CLOSED WHEN SUBMERGED)

1. Bring the level of the measured medium in the tank to a state so that the sensor electrode would be covered.
2. Place the magnetic pen for **at least 2 seconds\*\*** on the sensitive spot  of the sensor (until both LEDs illuminate) and then remove the magnetic pen. Settings are confirmed by three flashes of the orange LED.
3. Bring the level of the measured medium in the tank to a state so that the sensor electrode would be uncovered. Leave possible deposits on the electrode.
4. Place the magnetic pen for **at least 2 seconds\*\*** on the sensitive spot  of the sensor until both LEDs illuminate and then remove the magnetic pen. Settings are confirmed by three flashes of the orange LED.
5. Check the state of indicators:
  - If the orange LED is not illuminated and the green LED is flashing, the sensor is correctly set.
  - If alternating flashing of the orange and green LED occurs, the sensor did not recognize the limits for closing and opening. In this case, find out whether the minimum and maximum levels are not set too close to one another.

### B) SETTING THE MODE C (IT IS OPEN WHEN SUBMERGED)

1. Bring the level of the measured medium in the tank to a state so that the sensor electrode would be covered.
2. Place the magnetic pen for **at least 2 seconds\*\*** on the sensitive spot  of the sensor until both LEDs illuminate and then remove the magnetic pen. Settings are confirmed by three flashes of the orange LED.
3. Bring the level of the measured medium in the tank to a state so that the sensor electrode would be uncovered.
4. Leave possible deposits on the electrode.  
Place the magnetic pen for **at least 2 seconds\*\*** on the sensitive spot  of the sensor until both LEDs illuminate and then remove the magnetic pen. Settings are confirmed by three flashes of the orange LED.
5. Check the state of indicators:
  - If the orange LED is illuminated and the green LED is flashing, the sensor is correctly set.
  - If alternating flashing of the orange and green LED occurs, the sensor did not recognize the limits for closing and opening. In this case, find out whether the minimum and maximum levels are not set too close to one another and possible repeat the settings.



*For safety reasons, we recommend setting the mode "O" for level sensing (the sensor is closed upon immersion). It is for failure safety reasons – eventual failure of sensor behaves similarly as an exceeding of the limit state. Analogically, for the maximum level it is recommended to set the mode "C" (the sensor is open upon immersion).*

\*\*) Maximum 4 seconds.

### 8.3. SETTINGS „MEDIUM WINDOW” - MEDIA DIFFERENTIATION FUNCTION

To set the sensitivity and switching mode for the required medium. With this setting, the sensor does not react to being submerged in a medium with a different permittivity.

#### A) SETTING THE MODE O (I.E. WHEN SUBMERGED IN THE REQUIRED MEDIUM, THE SENSOR IS CLOSED)

1. Bring the level of the measured medium in the tank to a state so that the sensor electrode would be covered.
2. Place the magnetic pen for **at least 10 seconds** on the sensitive spot  $\oplus$  sensor LEDs are lit, after approx. 3 seconds the orange LED will flash 3 times, and after another approx. 2 seconds the orange LED flashes again 3 times, and after another 5 s the orange LED flashes again 3 times - now the magnetic pen can be removed).  
The sensor is now set to mode O (it is unswitched when submerged in the required medium).
3. Check the state of indicators:
  - If the orange LED is not illuminated and the green LED is flashing, the sensor is correctly set.

#### B) SETTING THE MODE C (I.E. WHEN SUBMERGED IN THE REQUIRED MEDIUM, THE SENSOR IS OPEN)

1. Bring the level of the measured medium in the tank to a state so that the sensor electrode would be covered
2. Place the magnetic pen for **at least 10 seconds** on the sensitive spot  $\ominus$  sensor (first both LEDs are lit, after approx. 3 seconds the orange LED will flash 3 times, and after another approx. 2 seconds the orange LED flashes again 3 times, and after another 5 seconds the orange LED flashes again 3 times - now the magnetic pen can be removed).  
The sensor is now set to mode C (it is unswitched when submerged in the required medium).
3. Check the state of indicators:
  - If the orange LED is not illuminated and the green LED is flashing, the sensor is correctly set.

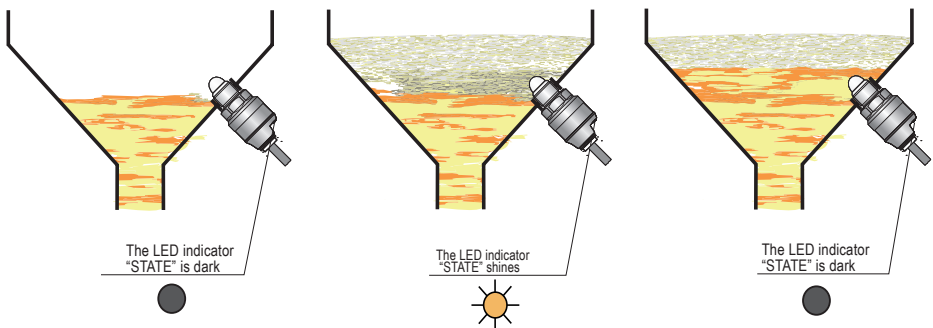
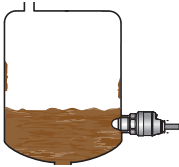

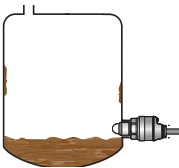

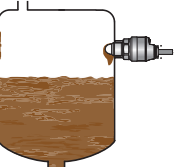

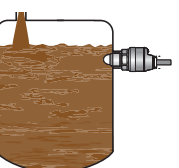



Fig 11: Mode "Medium window" - only detection of required medium (for example: only beer foam, beer and air are ignored)

## 9. FUNCTION AND STATUS INDICATION

| LED indicator | colour | function   |
|---------------|--------|--|
| "RUN"         | green  | <p><b>Measuring function indication</b></p> <p><b>flashing</b> – (approx. 0.4 s) – correct function of level detection</p> <p><b>dark</b> – incorrect installation or malfunction.</p> <p><b>alternating flashing of the green and orange LED</b> – error in settings</p> <p><b>simultaneous shine of green and orange LED</b> – when applying the mag. pen, when the setting is confirmed</p> |
| "STATE"       | orange | <p><b>Settings indication</b></p> <p><b>permanent shine</b> – the sensor is closed</p> <p><b>dark</b> – the sensor is open</p> <p><b>3 short flashes</b> – settings confirmed</p> <p><b>alternating flashing of the green and orange LED</b> – error in settings</p> <p><b>simultaneous shine of green and orange LED</b> – when applying the mag. pen, when the setting is confirmed</p>      |

|                       | level state  | mode | output state                     | state indicator  |
|-----------------------|--|------|----------------------------------|--|
| minimum level sensing |   | O    | CLOSED<br>( in type N )          | <br>(illuminated)     |
|                       |  |      | HIGHER CURRENT<br>( in type Xi ) |  |
|                       |  | O    | OPEN<br>( in type N )            | <br>(not illuminated) |
|                       |  |      | LOWER CURRENT<br>( in type Xi )  |  |

|                       | level state   | mode | output state                     | state indicator  |
|-----------------------|---|------|----------------------------------|--|
| maximum level sensing |  | C    | CLOSED<br>( in type N )          | <br>(illuminated)     |
|                       |   |      | HIGHER CURRENT<br>( in type Xi ) |  |
|                       |  | C    | OPEN<br>( in type N )            | <br>(not illuminated) |
|                       |   |      | LOWER CURRENT<br>( in type Xi )  |  |

For safety reasons, we recommend using the setting of the mode "O" for min. level sensing (the sensor is closed upon immersion). It is for failure safety reasons – eventual failure of sensor behaves similarly as an exceeding of the limit state. Analogically, for the max. level it is recommended to set the mode "C" (the sensor is open upon immersion).



## 10. SENSOR VARIANT WITH OUTPUT "PD" WITH DIAGNOSTIC

---

The sensor type RFLS-35\_ \_ \_ -PD has a diagnostic built in its firmware with which it monitors its functional reliability. In order for the diagnostic to be active, i.e. the error notification to be indicated even if the control or output circuit is not functional, the microprocessor generates short pulses to the output signal, the so-called diagnostic pulses. Negative pulses are generated when the output is closed and positive pulses are generated when the output is open. This ensures faultless operation of all HW and SW components of the sensor.

### 10.1. DIAGNOSTIC MODES

The diagnostic has one mode of error-free operation and three modes indicating a malfunction or incorrect setting.

#### 10.1.1. CORRECT MEASUREMENT

INDICATION: - **green** LED flashes (approx. 0.4 s)  
- **orange** LED: when the output is closed, the LED shines  
when the output is open, the LED is dark

OUTPUT: a 300  $\mu$ s wide pulse with a period of **30 ms** is generated into the output signal

SENSOR STATUS: the diagnostic does not indicate any problem, the measuring curve and the sensor settings are correct

#### 10.1.2. INCORRECT SETTING

INDICATION: alternating flashing **green and orange** LEDs

OUTPUT: a 300  $\mu$ s wide pulse with a period of **20 ms** is generated into the output signal

SENSOR STATUS: the measuring curve is OK, but the sensor setting is incorrect (decision levels are close to each other)

#### 10.1.3. INCORRECT MEASUREMENT

INDICATION: - **green** LED is dark  
- **orange** LED: in the event of closed output the LED shines with periodic dimming (0.1 s)  
in the event of open output the LED is dark with periodic lighting up (0.1 s)

OUTPUT: a pulse with a width of 300  $\mu$ s with a period of **10 ms** is generated into the output signal

SENSOR STATUS: the sensor setting is OK, but the diagnostic indicates a problem with the measuring curve, which can be caused by a failure of any element of the sensor

#### **10.1.4. ANOTHER FAILURE OF SENSOR**

INDICATION: the state of both LEDs cannot be specified, as their function may be affected by a control circuit error

OUTPUT: **the sensor does not generate any diagnostic pulses in the output signal**

SENSOR STATUS: either it is a fault in the control circuit or a failure in the output part of the electrical circuit and these faults can be diagnosed only by a special version of the SSU-1212-D



#### **10.2. EVALUATION UNIT**

A special unit SSU-1212-D is designed for the evaluation of diagnostic modes, which can evaluate the pulses generated by the sensor. It does not matter what state the sensor output is in (closed or open). Based on the period of the generated pulse, the unit determines in which diagnostic mode the sensor is and communicates information to the user.

#### **10.3. FUNCTION AND STATUS INDICATION WITH DIAGNOSTIC**

| <i>LED indicator</i> | <i>colour</i> | <i>function</i>   |
|----------------------|---------------|---|
| "RUN"                | green         | <b><u>Measuring function indication</u></b><br><b>flashing</b> – (approx. 0.4 s) – correct function of level detection<br><b>dark</b> – incorrect installation or malfunction.<br><b>alternating flashing of the green and orange LED</b> – error in settings<br><b>simultaneous shine of green and orange LED</b> – when applying the mag. pen, when the setting is confirmed  |
| "STATE"              | orange        | <b><u>Settings indication</u></b><br><b>permanent shine</b> – the sensor is closed<br><b>dark</b> – the sensor is open<br><b>3 short flashes</b> – settings confirmed<br><b>alternating flashing of the green and orange LED</b> – error in settings<br><b>simultaneous shine of green and orange LED</b> – when applying the mag. pen, when the setting is confirmed<br><b>periodic extinction (0,1 s) in closed mode</b> - diagnosed function error<br><b>periodic lighting (0,1 s) in open mode</b> - diagnosed function error |

# 11. ORDER CODE

| PRODUCT                              |   |
|--------------------------------------|---|
| RFLS-35                              |   |
| PERFORMANCE                          |   |
| N                                    | basic performance for non-explosive area, can't be selected for the type of output R  |
| Xi                                   |  for hazardous area (explosive gas atmosphere), can't be selected for the type of output P             |
| XiM                                  |  for mine area with the occurrence of methane or coal dust, can't be selected for the type of output P |
| TYPE OF ELECTRODE                    |   |
| 1B                                   | insulated electrode (PEEK, O-ring NBR), can't be selected for process connection C134, C150   |
| 11B                                  | insulated electrode (PEEK, O-ring NBR) - extended version, can't be selected for process connection G¾, M27, C134, C150   |
| 1E                                   | insulated electrode (PEEK, O-ring EPDM), can't be selected for process connection C134, C150  |
| 11E                                  | insulated electrode (PEEK, O-ring EPDM) - extended version, can't be selected for process connection G¾, M27, C134, C150  |
| 1V                                   | insulated electrode (PEEK, O-ring Viton), can't be selected for process connection C134, C150   |
| 11V                                  | insulated electrode (PEEK, O-ring Viton) - extended version, can't be selected for process connection G¾, M27, C134, C150   |
| 2                                    | insulated electrode (PTFE, without O-ring)  |
| 21                                   | insulated electrode (PTFE, without O-ring) - extended version, can't be selected for process connection G¾, M27, C134, C150   |
| PROCESS CONNECTION                   |   |
| G1/2                                 | pipe thread G ½"  |
| G¾                                   | pipe thread G ¾", can't be selected for 11B, 11E, 11V a 21  |
| M27                                  | metric thread M27 x 2, can't be selected for 11B, 11E, 11V a 21   |
| C134                                 | Tri-clamp (ø 34 mm), can be selected only for 2   |
| C150                                 | Tri-clamp (ø 50,5 mm), can be selected only for 2   |
| TYPE OF OUTPUT                       |   |
| N                                    | NPN (open collector)  |
| P                                    | PNP (open collector), for variant N   |
| PD                                   | PNP (open collector) with diagnostic, for variant N <sup>1)</sup>   |
| R                                    | NAMUR, for variant Xi, XiM  |
| ELECTRICAL CONNECTION                |   |
| A                                    | stainless steel compression gland (+ cable length)  |
| B                                    | plastic threaded cable gland (+ cable length)   |
| C                                    | connector (socket not included with sensor, recommended type - see accessories)   |
| D                                    | nickel-plated brass threaded cable gland (+ cable length)   |
| V                                    | plastic cable gland with spiral (+ cable length)  |
| H                                    | plastic cable gland for protective hose (+ cable length)  |
| CABLE                                |   |
| K                                    | cable length in m   |
| RFLS-35 N - 2 - CL50 - P - B - K 2 M | EXAMPLE OF CODING   |

1) The SSU-1212-0 evaluation unit is used to evaluate the diagnostic signal.

## 12. CORRECT SPECIFICATION EXAMPLES

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RFLS-35N-2-CI50-P-B K 5 m

(N) designed for normal areas; (2) insulated electrode PTFE; (CI50) process connection Tri-clamp ( $\varnothing$  50,5 mm); (P) output type PNP; (B) plastic cable gland.

RFLS-35Xi-1E-G1/2-R-C

(Xi) Explosion-proof performance; (1E) insulated electrode with O-ring EPDM; (G1/2) process connection place by thread G1/2"; (P) Output type NAMUR; (C) connector.

## 13. ACCESSORIES

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**standard** – included in the sensor price

- 1 pcs. magnetic pen MP-8
- 1 pcs. seal (asbestos free)

\* For pressure resistance see the table in the accessories datalist in the range of seals.

**optional** – for a surcharge

(see catalogue sheet of accessories)

- cable (over the standard length 2m)
- connector socket (type ELWIKa or ELKA)
- standard steel welding flange or stainless steel welding flange
- protective hose (for type of cable outlet H)
- stainless steel fixing nut
- various types of seals (PTFE, Al, etc.)

## 14. SAFETY, PROTECTIONS, COMPATIBILITY AND EXPLOSION PROOF

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The level sensor is equipped with protection against electric shock on the electrode, reverse polarity, output current overload, short circuit and against current overload on output.

Protection against dangerous contact is provided by low safety voltage according to 33 2000-4-41. Electromagnetic compatibility is provided by conformity with standards EN 55011/B, EN 61000-4-2 to -6 and -8.

Explosion proof RFLS-35Xi (XiM) is provided by conformity with standards EN 60079-0, EN 60079-11, EN 50303. Explosion proof RFLS-27Xi (XiM) is verified FTZÚ – AO 210 Ostrava – Radvanice: FTZÚ 16 ATEX 0139X.

A declaration of conformity was issued for this device in the wording of Act No. 90/2016 Coll., as amended. Supplied electrical equipment matches the requirements of valid European directives for safety and electromagnetic compatibility.

### **Special conditions for safe use of variants RFLS-35Xi and RFLS-35XiM**

Sensors RFLS-35Xi and RFLS-35XiM are intended for connection to approved intrinsically safe supply units (insulating transducers) with galvanic separation. In the event that devices without galvanic separation (Zener barriers) are used, it is necessary to balance the potential between the sensor, resp. water level meter and the grounding barrier location.

The limit output parameters of intrinsically safe supply units (insulating transducers) must correspond to the limit input parameters of the sensor, resp. level meter. When assessing intrinsically safety of circuits, it is necessary to also take into consideration the parameters of the connected cable (namely its induction and capacity).

Design RFLS-35Xi can be used in zone 0.

Design RFLS-35XiM it is necessary to observe that temperature of any surface of apparatus, when coal dust can from a layer, do not exceed 100°C.

## 15. FUNCTIONAL SAFETY

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The high-frequency level sensors RFLS-35 meet the safety integrity level requirements according to standard EN 61508. The sensors are intended for level height detection applications of liquid and pasty media with increased safety demands in modes:

- Overfill protection
- Dry run protection

In both modes, the sensors meet the requirements for functional safety at level SIL 2.

The sensor electronics have 1oo1 architecture (according to the output variant single-channel without P (R) diagnostics, or single-channel with PD diagnostics).

**It is recommended to perform a function test of the sensor's safety function 1 per year.**

## 16. USE, MANIPULATION AND MAINTENANCE

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The level meter does not require any personnel for its operation. Maintenance of this equipment consists in verification of integrity of the level meter and of the supply cable.



**It is forbidden to make any changes or interventions to the RFLS-35 sensor without the consent of the producer. Any repairs must only be carried out by the producer or authorized service organisations.**

**Assembly, installation, commissioning, service and maintenance of the RFLS-35 level sensor must be carried out in accordance with this manual and the provisions of valid standards for the installation of electrical equipment must be complied with.**

### **Activity during the operation:**

- If the sensor is connected to the automatic control system or to emergency signalling, it must not be infringed in its setting during the operation.
- If a change of the sensor settings is necessary, the whole system must be temporarily switched off and the process held in a safe condition using other means and measures.
- Signalling of failure conditions is described in chapter 9. *Function and status indication* or chapter 10.3. *Function and status indication with diagnostic*.

### **Activity in case of a failure:**

- In the event of detected faults or fault signals, the whole system must be shut down and the process held in a safe condition using other means and measures.
- If the replacement of the sensor is needed due to the fault, it is necessary to notify the manufacturer (including a description of the fault).

### **Repairs of the sensors:**

If you need to send the sensor for repair, proceed as follows:

- Remove and clean the sensor or perform its decontamination and wrap it well.
- Write a description of the fault as detailed as possible, attach also a detailed description of the application and of the installation location and everything together with the sensor send please to the address of Dinel s.r.o. company.
- Please provide maximum synergy in finding the root cause of the fault. Your satisfaction is our top priority!

## **17. PUTTING OUT OF OPERATION OR DISPOSAL**

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### **Disassembly:**

Before commencing disassembly, consider possible risks, such as for example pressure in the tank, high temperatures, corrosive properties or toxicity of products, etc.

Carefully read the product manual chapter "Installation instructions" and "Electrical connection" and perform the described steps in reverse sequence.

### **Disposal:**

The high-frequency level sensors RFLS-35 are made from materials that can be recycled by specialised companies. Mark the device as waste and dispose of it according to the respective government directive for handling electronic waste. Materials: see "Technical specifications".

## **18. GENERAL, CONDITIONS AND WARRANTY**

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Dinel, s.r.o. guarantees for the period of three (3) years that the product has the characteristics as mentioned in the technical specification.

Dinel, s.r.o. is liable for defects ascertained within the warranty period and were claimed in writing.

This guarantee does not cover the damages resulting from misuse, improper installation or incorrect maintenance.

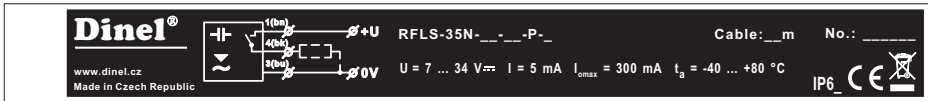
This guarantee ceases when the user or the other person makes any changes on the product or the product is mechanically or chemically damaged, or the serial number is not readable.

The warranty certificate must be presented to exercise a claim.

In the case of a rightful complaint, we will replace the product or its defective part. In both cases, the warranty period is extended by the period of repair.

## 19. MARKING OF LABELS

Labels for device of the type **RFLS-35N-\_-\_-\_-P-\_-**



Symbol of producer: logo Dinel®

Internet address: www.dinel.cz

Country of origin: Made in Czech Republic

Connection scheme and labelling of wires: +U, 0 V

Level meter type: RFLS-35N-\_-\_-\_-P-\_-

Cable length: Cable: \_\_ m

Serial number: Ser. No.: \_\_\_\_\_ – (from the left: production year, serial production number)

Supply voltage: U = 7 ... 34 V $\overline{\text{~}}$

Supply current: I = 5 mA

Maximum output current: I<sub>omax</sub> = 300 mA

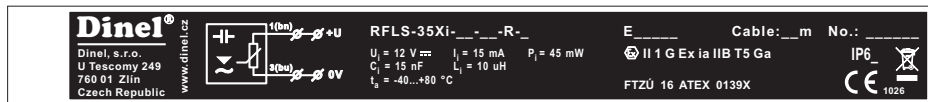
Ambient temperature range: t<sub>a</sub> = -40 ... +80 °C

Protection class: IP6\_ (Protection class according to electrical connection)

Compliance mark: **CE**

Electro-waste take-back system mark:

Labels for device of the type **RFLS-35Xi**



Symbol of producer: logo Dinel®

Contact: Dinel, s.r.o., U Tescomy 249, 76001 Zlín, Czech Republic, www.dinel.cz

Connection scheme and labelling of wires: +U, 0 V

Level meter type: RFLS-35Xi-\_-\_-\_-R-\_- E \_\_\_\_\_

Cable length: Cable: \_\_ m

Serial number: Ser. No.: \_\_\_\_\_ – (from the left: production year, serial production number)

Limit operating parameters: U<sub>i</sub> = 12 V $\overline{\text{~}}$ , I<sub>i</sub> = 15 mA; P<sub>i</sub> = 45 mW; C<sub>i</sub> = 15 nF; L<sub>i</sub> = 10 uH

Ambient temperature range: t<sub>a</sub> = -40 ... +80 °C

Label of non-explosive device:

Performance: II 1 G Ex ia IIB T5 Ga

Number of certificate of intrinsically safety: FTZÚ 16 ATEX 0139X

Protection class: IP6\_

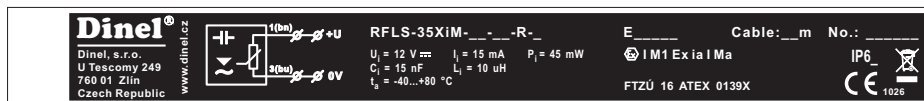
Compliance mark: **CE**, No. of authorized person examining control of system quality: 1026

Electro-waste take-back system mark:



Size of labels 70 x 20 mm, the size shown does not correspond to reality.

## Labels for device of the type RFLS-35XiM



Symbol of producer: logo Dinel®

Contact: Dinel, s.r.o., U Tescomy 249, 76001 Zlín, Czech Republic, www.dinel.cz

Connection scheme and labelling of wires: +U, 0 V

Level meter type: RFLS-35XiM-\_\_\_-R-\_\_ E\_\_\_\_\_

Cable length: Cable: \_\_ m

Serial number: Ser. No.: \_\_\_\_\_ (from the left: production year, serial production number)

Limit operating parameters:  $U_j = 12 \text{ V}$ ,  $I_i = 15 \text{ mA}$ ,  $P_i = 45 \text{ mW}$ ,  $C_i = 15 \text{ nF}$ ,  $L_i = 10 \text{ uH}$

Ambient temperature range:  $t_a = -40 \dots +80 \text{ °C}$

Label of non-explosive device:

Performance: I M1 Ex ia I Ma

Number of certificate of intrinsically safety: FTZÚ 16 ATEX 0139X

Protection class: IP6\_

Compliance mark: No. of authorized person examining control of system quality: 1026

Electro-waste take-back system mark:

## 20. TECHNICAL SPECIFICATIONS

### BASIC TECHNICAL DATA

|   |                                |                              |
|---|--------------------------------|------------------------------|
| Supply voltage (variant RFLS-35N)                         | 7 ... 34 V DC                  |                              |
| Power consumption (variant RFLS-35N)                      | max. 5 mA DC                   |                              |
| Max. switching current (PNP output)                       | 300 mA                         |                              |
| Residual voltage – ON state                               | max. 1,5 V                     |                              |
| Coupling capacity (housing - power) / dielectric strength | 5 nF / 500 V AC (50 Hz)        |                              |
| Ambient temperature range:                                | -40 ... +80 °C                 |                              |
| Protection class  | type RFLS-35-___-C-_-          | IP 67                        |
|   | type RFLS-35-___-A(B,V,H,D)-_- | IP 68                        |
| Cable (versions with cable outlets)                       | Variant (P,N)                  | PVC 3 x 0,5 mm <sup>2</sup>  |
|   | Variant (Xi, XiM)              | PVC 2 x 0,75 mm <sup>2</sup> |
| Weight (without cable)                                    | cca 0,15 kg                    |                              |

### ELECTRICAL PARAMETERS – variant Xi and XiM

|   |   |
|---|---|
| Power supply voltage                                  | 8 ... 9 V DC  |
| Current consumption (disconnected/ connected) – NAMUR | ≤ 1 mA / ≥ 2,2 mA   |
| Max. internal values                                  | $U_i = 12 \text{ VDC}$ ; $I_i = 15 \text{ mA}$ ;<br>$P_i = 45 \text{ mW}$ ; $C_i = 15 \text{ nF}$ ; $L_i = 10 \text{ uH}$ |
| Cables LC values                                      | typic C < 150 pF/m<br>typic L < 0,8 uH/m  |



## USED MATERIALS

| part of the sensor                  |  | standard material *                      |
|-------------------------------------|--|--|
| Housing                             |  | stainless steel W.Nr. 1.4404 (AISI 316L) |
| End of sensor                       |  | stainless steel W.Nr. 1.4301 (AISI 304)  |
| electrode coating                   | type el. 1, 11<br>type el. 2, 21   | PEEK<br>PTFE                             |
| Sealing O-ring                      | RFLS-35_-1B, 11B<br>RFLS-35_-1E, 11E<br>RFLS-35_-1V, 11V<br>RFLS-35_-2, 21 | NBR<br>EPDM<br>(FPM) Viton<br>-          |
| Cable gland (variant "A")           |  | stainless steel W.Nr. 1.4571 / NBR       |
| Cable gland (variant "B", "V", "H") |  | plastic PA / NBR                         |
| Cable gland (variant „D")           |  | nickel-plated brass / PA / CR / NBR      |
| Connector M12 (variant "C")         |  | nickel-plated brass / PA                 |

\* Verify chemical compatibility with the media. Upon agreement it is possible to select a different type of material.

## PARAMETERS OF FUNCTIONAL SAFETY

| variant of sensor                           | RFLS-35_-_-_-P(R)       | RFLS-35N-_-_-PD      |
|---|-------------------------|----------------------|
| according to standard                       | EN 61508 ed.2           |                      |
| Safety function                             | MIN, MAX                |                      |
| SIL   | 2                       |                      |
| Hardware architecture                       | 1oo1 without diagnostic | 1oo1 with diagnostic |
| DC  | 0 %                     | 99 %                 |
| PFH ( $T_{Proof} = 1$ rok) (for variant N)  | $2,218 * 10^{-7}$       | $2,218 * 10^{-9}$    |
| PFH ( $T_{Proof} = 1$ rok) (for variant Xi) | $2,238 * 10^{-7}$       | -                    |
| $\lambda_{DD}$ (for variant N)              | 0 FIT                   | 219,6 FIT            |
| $\lambda_{DU}$ (for variant N)              | 221,8 FIT               | 2,2 FIT              |
| $\lambda_{DD}$ (for variant Xi)             | 0 FIT                   | -                    |
| $\lambda_{DU}$ (for variant Xi)             | 223,8 FIT               | -                    |
| MTTF <sub>D</sub> (for variant N)           | 514 years               |                      |
| MTTF <sub>D</sub> (for variant Xi)          | 510 years               | -                    |
| valid version FW                            | v2                      | v3-diagnostic        |

### Explanations:

SIL ..... Safety integrity level,

DC ..... Diagnostic cover,

PFH.....Average frequency of dangerous failure per hour,



$T_{Proof}$ .....Functional control period of the device safety function

$\lambda_{DD(DU)}$ .....Detected (resp. undetected) dangerous failure rate per hour

MTTF<sub>D</sub>.....Mean Time To dangerous Failure

| PROCESS CONNECTION                 |                      |              | TYPE OF OUTPUT |          |
|------------------------------------|----------------------|--------------|----------------|----------|
| type                               | size                 | marking      | Output         | Variants |
| Pipe thread                        | G 1/2"               | G1/2         | NPN (N)        | N        |
| Pipe thread                        | G 3/4"               | G3/4         | PNP (PC; PO)   | N        |
| Metric thread                      | M27x2                | M27          | NAMUR (RC; RO) | Xi (XiM) |
| Jointless connection (Tri-Clamp) * | ø 34 mm<br>ø 50,5 mm | CI34<br>CI50 |                |          |

\* only for type electrode 2

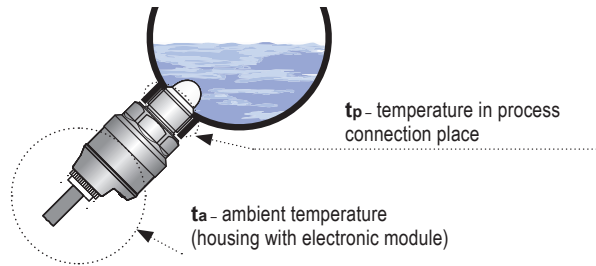
| DEVICE CLASSIFICATION |   |                          |
|-----------------------|---|--------------------------|
| Sensor performance    | Device classification and their use in atmosphere   | according to standard EN |
| RFLS-35N              | Basic performance   | -                        |
|                       | For non-explosive atmosphere  | -                        |
| RFLS-35Xi             | Equipment protection by intrinsic safety "i" for use in potentially explosion atmosphere,  II 1 G Ex ia IIB T5 Ga with intrinsically safe supply units | 60079-0,<br>60079-11     |
|                       | For use in hazardous area (explosive gas atmosphere), whole sensor zone 0   | 60079-10-1               |
| RFLS-35XiM            | Equipment protection by intrinsic safety "i" for use in potentially explosion atmosphere,  IM1 Ex ia I Ma with intrinsically safe supply units.        | 60079-0,<br>60079-11     |
|                       | For use in the mine area with the occurrence of methane or coal dust  | 60079-10-1               |

The device or its part intended for zone 0 can also be used in zone 1 or 2.

| FACTORY SETTINGS |                              |
|------------------|------------------------------|
| switching mode   | O (switches on when flooded) |
| sensitivity      | for water sensing            |

## TEMPERATURE AND PRESSURE DURABILITY – variant N, Xi and XiM

| design variant                   | temperature $t_p$                            | temperature $t_a$                           | maximum overpressure   | temperature $t_p$ at $t_a < 50^\circ\text{C}$ and $t < 1\text{h}$ |
|----------------------------------|--|---|--|---|
| RFLS-35N-1B (1E, 11B, 11E)       | $-40^\circ\text{C} \dots +105^\circ\text{C}$ | $-40^\circ\text{C} \dots +80^\circ\text{C}$ | 10 MPa   | max. $120^\circ\text{C}$  |
| RFLS-35Xi(XiM)-1B (1E, 11B, 11E) | $-40^\circ\text{C} \dots +100^\circ\text{C}$ | $-40^\circ\text{C} \dots +80^\circ\text{C}$ | 10 MPa   | max. $100^\circ\text{C}$  |
| RFLS-35N-1V (11V)                | $-20^\circ\text{C} \dots +105^\circ\text{C}$ | $-40^\circ\text{C} \dots +80^\circ\text{C}$ | 10 MPa   | max. $120^\circ\text{C}$  |
| RFLS-35Xi(XiM)-1V (11V)          | $-20^\circ\text{C} \dots +100^\circ\text{C}$ | $-40^\circ\text{C} \dots +80^\circ\text{C}$ | 10 MPa   | max. $100^\circ\text{C}$  |
| RFLS-35N-2 (21)                  | $-40^\circ\text{C} \dots +105^\circ\text{C}$ | $-40^\circ\text{C} \dots +80^\circ\text{C}$ | 5 MPa to $50^\circ\text{C}$<br>2,5 MPa over $50^\circ\text{C}$ | max. $120^\circ\text{C}$  |
| RFLS-35Xi(XiM)-2 (21)            | $-40^\circ\text{C} \dots +100^\circ\text{C}$ | $-40^\circ\text{C} \dots +80^\circ\text{C}$ | 5 MPa to $50^\circ\text{C}$<br>2,5 MPa over $50^\circ\text{C}$ | max. $100^\circ\text{C}$  |



## 21. PACKINGS, SHIPPING AND STORAGE

The device RFLS-35 is packaged in a polyethylene bag, and the entire consignment is placed into a cardboard box. A suitable filler material is used in the cardboard box to prevent mechanical damage during transport. Remove the device from the packaging only just before using, thereby protecting it from potential damage.

A forwarding company will be used to ship goods to the customer. Upon prior agreement, ordered goods can be picked up in person at company headquarters. When receiving, please check to see that the consignment is complete and matches the order, or to see if any damage has occurred to the packaging and device during transport. Do not use a device clearly damaged during transport, but rather contact the manufacturer in order to resolve the situation.

If the device is to be further shipped, it must be wrapped in its original packaging and protected against impact and weather conditions.

Store the device in its original packaging in dry areas covered from weather conditions, with humidity of up to 85 % without effects of chemically active substances. The storage temperature range is  $-10^\circ\text{C}$  to  $+50^\circ\text{C}$ .

# Dinel<sup>®</sup>

industrial electronics

**Dinel, s.r.o.**  
U Tescomy 249  
760 01 Zlín  
Czech Republic

Phone: +420 577 002 002  
Fax: +420 577 002 007  
E-mail: [sale@dinel.cz](mailto:sale@dinel.cz)

[www.dinel.cz](http://www.dinel.cz)

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