Technical Information
Oil Leak Detector
NAR300 System
Equipped with Two Detection Principles: Conductivity and Vibration Sensor

Application
This system is designed to be installed in a pit within an oil retaining dike, a plant, or a sump pit near a pump yard, where it can provide the ultimate in leak detection function for oil, petrochemicals or vegetable oils. The oil leak detector NAR300 system utilizes two separate detection functions, a conduction sensor and a tuning fork sensor, to monitor conditions. Highly accurate alarm recognition is attained through a 2-stage logic process, which ensures safe tank yard operation, with minimal equipment configuration.

Flame proof system
Alarm output can be transmitted by the host controller using the external transmitter NRR261 connected to the existing level transmitter via a switching input.

Intrinsically safe system
The alarm system can be configured independently of the tank gauge by combining the internal transmitter NRR262 with the external transmitter.

Features and benefits
• SIL2 certified
• A unique all-new twin detection function for reliable detection:
  • Conduction sensor: detects presence of conductive liquids
  • Tuning fork sensor: determines presence of air or liquid (oil or water)
• No special attachment required, even with an empty pit
• No moving parts, low maintenance, long life
• Reliable failsafe function outputs an alarm in the event of power failures, freezing pit-water, etc.
• Detection is possible regardless of relative dielectric constant, as long as the oil is water insoluble.
• Improved performance against the influence of adhered material
• Intrinsically safe, anti-combustion design
• EMC-compliant (EN61326)
# Table of contents

**Important document information** .................................. 3
  Notes on safety conventions and symbols ......................... 3

**Function and system design** ................................. 4
  Ex d [ia] IIB T4 ...................................................... 4
  Ex ia IIB T4 (Separate type) ..................................... 5
  Ex d [ia] IIB T4 (Separate type) .................................. 6

**Operation principal** .................................................. 7
  Detecting principal .................................................. 7
  System configuration .................................................. 9

**Operating conditions** .................................................. 11
  Detection sensitivity ................................................ 11
  Pits containing water ............................................... 11
  Gasoline applications ............................................... 11

**Installation** .......................................................... 12

**Dimensions** .......................................................... 14
  Float sensor NAR300 ............................................... 14
  Float guide ......................................................... 15
  Ex d [ia] transmitter NRR261 ..................................... 16
  Ex ia transmitter NRR262 ......................................... 17
  Ex I/F box .......................................................... 18

**Electrical connection** ................................................ 19
  Grounding cable ..................................................... 19
  Ex ia transmitter NRR261-2xx ................................... 20
  Ex d transmitter NRR262-2x ....................................... 22
  Ex d transmitter NRR261-3xx ....................................... 24

**Order information** .................................................... 26
  Float sensor NAR300 ............................................... 26
  Transmitter NRR261 ............................................... 27
  Transmitter NRR262 ............................................... 27

**Specifications** .......................................................... 28
  Float sensor NAR300 ............................................... 28
  Ex I/F box .......................................................... 28
  Transmitter NRR261 ............................................... 28
  Transmitter NRR262 ............................................... 29

**Process condition** ..................................................... 30
  Float sensor NAR300 ............................................... 30
  Ex I/F box and transmitter NRR261/NRR262 ...................... 30

**Accessory** .......................................................... 31
  Float guide .......................................................... 31
  U bolt and cable gland (Waterproof) ................................ 32

**Certificates and approvals** ........................................ 33
  Ex approval .......................................................... 33
  Safety function approval .......................................... 34

**Documentations** ....................................................... 35
  Operating instructions ............................................... 35
  Safety instruction ................................................... 35
  Functional safety manual ............................................ 35
## Important document information

### Notes on safety conventions and symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="A0011189-EN" alt="DANGER" /></td>
<td>DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.</td>
</tr>
<tr>
<td><img src="A0011190-EN" alt="WARNING" /></td>
<td>WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.</td>
</tr>
<tr>
<td><img src="A0011191-EN" alt="CAUTION" /></td>
<td>CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.</td>
</tr>
<tr>
<td><img src="A0011192-EN" alt="NOTICE" /></td>
<td>NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.</td>
</tr>
</tbody>
</table>

### Symbols for certain types of information

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="A0011182" alt="Allowed" /></td>
<td>Allowed Indicates procedures, processes or actions that are allowed.</td>
</tr>
<tr>
<td><img src="A0011183" alt="Recommendation" /></td>
<td>Recommendation Indicates procedures, processes or actions that are recommended.</td>
</tr>
<tr>
<td><img src="A0011184" alt="Forbidden" /></td>
<td>Forbidden Indicates procedures, processes or actions that are forbidden.</td>
</tr>
<tr>
<td><img src="A0011185" alt="Tip" /></td>
<td>Tip Indicates additional information.</td>
</tr>
</tbody>
</table>
Function and system design

Oil leak detector NAR300 system is available in three configurations to meet a variety of applications.

**NOTICE** The combination of the TIIS certifications varies depending on that of the NAR300 system. Refer to the 'Certificates and Approvals' for details.

**Ex d [ia] IIB T4**

From oil leak detection to alarm output, the Ex d [ia] oil leak detection system can monitor the entire process in outdoor Ex areas. Circuity is intrinsically safe, from NAR300 float sensor to the input Ex d [ia] side of NRR261 Ex d [ia] transmitter, since a cable specially supplied by Endress+Hauser as part of the sensor. The NRR261 output (Ex d) side may be connected to a tank yard junction box or alternatively to level transmitter relay inputs. This configuration allows signal transmission from float sensor to transmitter over ranges up to a maximum 30 m (meters).

Figure 1: System layout 1

A  Float sensor NAR300-xxxx
B  Transmitter NRR261 (Integrated type)
1.  Alarm output: Alarm, PLC, DCS
2.  Power supply (VAC or VDC)
3.  Special cable for IS connection: 6 to 30 m

- TIIS: NAR300-1xxxx + NRR261-2xx
- ATEX: NAR300-A1xxxx + NRR261-Axx
- IECEx: NAR300-B1xxxx + NRR261-Bxx
- FM: NAR300-C1xxxx + NRR261-Cxx
**Ex ia IIB T4 (Separate type)**

The intrinsically safe system includes the intrinsically safe transmitter NRR262, which is installed indoors in non-Ex areas, and outputs a signal to an indoor alarm panel or host system. The signal from NAR300 is output to transmitter NRR262 via the Ex I/F box. The cable and its entry from the float sensor NAR300 and Ex I/F box are Endress+Hauser’s delivered dedicated ones.

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**Figure 2: System layout 2**

A. Float sensor NAR300-x5xxxx
B. Ex I/F box
C. Transmitter NRR262
1. Special cable for IS connection: 6 to 30 m
2. Cable for Ex I/F box and transmitter (refer to 'Process condition' for details).
3. Alarm output (Alarm, PLC, DCS)
4. Power supply (VAC or VDC)

- TIIS: NAR300-15xxxx + NRR262-2x
- ATEX: NAR300-A5xxxx + NRR262-Ax
- ICECx: NAR300-B5xxxx + NRR262-Bx
- FM: NAR300-C5xxxx + NRR262-Cx
Oil leak detector NAR300 system

**Ex d [ia] IIB T4 (Separate type)**

From oil leak detection to alarm output, the Exd [ia] oil leak detection system can monitor the entire process in outdoor Ex areas. Circuitry is intrinsically safe, from the NAR300 float sensor to the input Ex d [ia] side of NRR261 Ex d [ia] transmitter, since a cable specially supplied by Endress+Hauser as part of the sensor. NRR261 output (Ex d) side may be connected to a tank yard junction box or alternatively to level transmitter relay inputs.

Figure 3: System layout 3

A. Float sensor NAR300-x5xxxx
B. Ex I/F box
C. Transmitter NRR261 (Separate type)
1. Special cable for IS connection: 6 to 30 m
2. Cable for Ex I/F box and transmitter (refer to 'Process condition' for details).
3. Alarm output (Alarm, PLC, DCS)
4. Power supply (VAC or VDC)

- TIIS: NAR300-15xxxx + NRR261-3
- For ATEX, IECEx, and FM specifications, contact Endress+Hauser representatives.
Operation principal

**Detecting principal**

**Tuning fork sensor**

The tuning fork sensor determines presence of liquid (water/oil) (On) or non-presence of liquid (air) (Off). The sensor vibrates at the point of the liquid operating level or less (no liquid) and stops vibrating at the point of the liquid operating level or more (with liquid).

**Conductive sensor**

The conductive sensor detects conductive liquid (water/Off) and non-conductive liquid (Air/On) between electrode and float body sensor.

<table>
<thead>
<tr>
<th>Name</th>
<th>Water</th>
<th>Air</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuning fork sensor</td>
<td>On</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>Conductive sensor</td>
<td>Off</td>
<td>On</td>
<td>On</td>
</tr>
</tbody>
</table>

The alarm is output when the both tuning fork sensor and conductivity sensor turn to On.

**Detection in pit containing water**

1. Conductive sensor continuously monitors conductivity between probe and float body.
2. When conductive sensor detects water, condition is determined to be normal and conductive probe alarm status is OFF, regardless of vibration sensor status.
3. When an oil layer forms on the water conductivity between probe and float body decreases, and conductive probe alarm status turns to ON.
4. Vibration sensor remains submersed in liquid and alarm status is ON, thus an ON/ON logic is attained.
5. In ON/ON status an alarm is output.
Detection in empty pits

1. Unlike pits containing water, the conductive probe detects air, and alarm status is ON.
2. When no liquid is present, vibration sensor alarm status is OFF, and an alarm condition is not recognized.
3. If rainwater accumulates in the pit, causing the float sensor to float, conditions outlined above (Detection in pits containing water, 2) apply.
4. Vibration sensor remains submersed in liquid and alarm status is ON. Thus an ON/ON logic is attained.
5. In ON/ON status an alarm is output.
System configuration

Figure 5: System configuration

A  Ex d type transmitter system
B  Ex [ia] type transmitter system
C  Ex d [ia] type transmitter system
PE  Protection earthing (grounding)
A-GND  Class A ground
1.  Float sensor NAR300
2.  Tuning fork drive
3.  Tuning fork
4.  Conductive sensor electrode (sensor)
5.  Special cable
6.  Conductive sensor electrode (float)
7.  Transmitter NRR261 (integrated type)
8.  Liquid sensor circuit
9.  Conductive sensor circuit
10.  Current output circuit
11.  Safety barrier
12.  Power circuit
13.  Relay
14.  Delay circuit
15.  Ex [ia] circuit
16.  Ex d circuit
17.  Current detection
18.  Delay trimmer
19.  Alarm
20.  Ex I/F box
21.  Current signal
22.  Transmitter NRR262
23.  Transmitter NRR261 (separate type)

Class A ground may be shared with the other safety barrier ground, but it must not be shared with the arrestor ground.
**Principle of alarm operation**

The oil leak detection signal output by the NAR300 float sensor is converted at the output circuit in the transmitter or Ex I/F box. Then the signal is connected to the current detection circuit via the IS safety barrier. In the current detection circuit, the presence or absence of an oil leak alarm signal is determined by the electrical current value and the alarm output relay is turned on or off by the operation delay circuit. The operation delay circuit features a delay time setting trimmer. A fail-safe function is available in the relay contacts output. The operation is shown in the following table.

**Alarm output operating table**

<table>
<thead>
<tr>
<th>Condition</th>
<th>NRR262 N.C. to COM Terminal 11, 13</th>
<th>NRR262 N.O. to COM Terminal 13, 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil leak alarm</td>
<td>Contact open</td>
<td>Contact close</td>
</tr>
<tr>
<td>Power OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid freezing</td>
<td>Contact close</td>
<td>Contact open</td>
</tr>
<tr>
<td>Non-alarm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The delay time (ON delay) is set using the delay time setting trimmer. After turning off power to transmitter NRR261, remove the electronics compartment cover to reveal the delay trimmer. On NRR262, it is located on the surface of the case. In the delay process, continuous alarm status is detected over a certain period of time, and is interpreted as an alarm. When a movement that occurs within the set time is not interpreted as an alarm. This function is to prevent false alarms. For TIIS specifications, delay time setting can be set within 30 seconds and then for the other specifications, it can be set within 15 seconds.

- **Delay time added via the delay trimmer is always in addition to the default delay time of approximately 6 seconds.**

![Figure 6: Transmitter NRR261 (left)/transmitter NRR262 (right)](image)

1. **Delay trimmer**
2. **Cover**
3. **LED power (green)/Alarm (red)**
Operating conditions

Detection sensitivity

Depending on conditions, water may sometimes adhere to the electrode, regardless of whether sensor is floating on oil above the water level. Oil detection sensitivity, in such cases, may be affected by 1 to 2 mm. When absolute precision is required, coating the electrode with a mild detergent to keep water from adhering is recommended.

Pits containing water

Not for use in salt-water pits
Float sensor NAR300 is not designed for use in salt-water. Doing so may cause the following malfunctions to occur:
- Alarm output failure when capsized
- Salt content may cause a short circuit between float sensor and probe, resulting alarm delay
- Failure due to salt-water corrosion

Pits containing liquids other than water
When using float sensor in liquids such as a solvent blend, it may become corroded or damaged.

Pits containing water high in electrical resistance
When using float sensor in water with a high electrical resistance, such as in a steam drain or in pure water, an alarm may sound. Electrical conductivity should be $\geq 10 \mu S/cm$ or $\leq 100 \, k\Omega \cdot cm$.
Example: Pure water - 1 to 0.1 $\mu S/cm$ (1 to 10 M$\Omega \cdot cm$)

Freezing water in pit
When water in the pit freezes, the alarm may sound (fail safe function). Implement countermeasures to prevent freezing.

Gasoline applications

For gasoline applications, select NAR300 product with appropriate technically specifications through Endress+Hauser representatives.
Installation

Figure 7: NAR300 + NRR26x

A   Class A ground
a   Alarm output
1.  Tank
2.  Junction box
3.  Ground wire
4.  Fence
5.  U-shaped drainage way
6.  Screen
7.  Pit
8.  Pit cover
9.  Float guide
10. Chain
11. Weight
12. Float sensor NAR300
13. Nozzle (At least 100 mm of the nozzle end should point downwards.)
14. Special cable (supplied with NAR300)
15. Cable
16. Valve
17. Drain
18. Ex I/F box
19. Transmitter NRR261 Ex d [ia]
20. U bolts
21. Transmitter NRR261 Ex d [ia]
22. Transmitter NRR262 Ex ia

To ground the barrier, connect to tank or use shielded wire for remote cable. For more on shielded wire use, refer to “Electrical connection”.

Endress+Hauser
Cautionary points regarding NAR300 system installation and setup

1. To prevent snow and debris from entering the pit, installing a rubbish guard, roof, or other covering is recommended. If snow is allowed to accumulate on the float sensor, the draft line will rise 1 mm for every 50 g of snow accumulation, which reduces oil detection sensitivity. When there is a risk that external temperatures may exceed 50 degrees (°C), install a sunshade to block direct sunlight from the float sensor. Mount a covering above the top of the pit inlet to avoid submerging NAR300 during heavy rain fall. If water enters the float sensor, it may cause malfunction or failure of the unit.

2. NAR300 may fail to operate properly if it goes off balance (tips more than 3 degrees). Use float guides as directed to keep the system horizontally balanced and be sure that chains and cables do not become tangled in the float or in the guides.

3. Install a screen at the water inlet to prevent debris from entering the pit. Inspect and clean the pit periodically to maintain optimal performance, as accumulation of debris or foreign matter in the sensor or pit can cause malfunction.

4. A lifting chain may be attached to the ring on the side of the float sensor head for added inspection convenience. The float draft will rise by 1 mm for every 50 g of excess weight, reducing the sensitivity of the device. Exceeding this weight may affect the float sensor balance. When using a chain to secure the float sensor, do not forcibly pull on the chain during inspection.

5. If the pit completely fills with water, an oil layer cannot form even if the oil is flowing. Drain the water as needed from time to time to allow an oil layer to form.

6. Do not forcibly pull or grab the sensor signal cable. Doing so may cause the sensor to malfunction or cause a fault in the waterproofing.

7. Bend the top of the discharge nozzle downward 100 mm or more so that the oil layer will form when the drain valve is kept open. Failure to do so may cause oil to discharge from the pit before it can form a detectable layer on the water surface, resulting in a delayed alarm or detection failure. For pits without a discharge nozzle, as mentioned above, install a water fence or other such device so that oil will form a layer on the water surface.

8. Install a divider to prevent large waves, crosscurrents, or water from splashing onto the float sensor.

9. Divide the pit by using an oil partition if the pit is too wide. If the volume of oil outflow in proportion to the surface area is too small, NAR300 will be unable to detect any oil leakage.

10. Install NAR300, NRR261, and Ex I/F box at a minimum distance of 50 cm from each other.
Dimensions

Float sensor NAR300

Figure 8: NAR300 dimensions, Unit: mm (in)

- If the float sensor cover is broken or missing, detection sensitivity may be decreased. Replace the missing or damaged cover using genuine Endress+Hauser replacement components.
- If the float sensor can be used in pits containing liquids/substances that are corrosive to its composition material, provided that it only makes contact with the liquid during oil leaks. In case of continued use following an oil leak, conduct regular inspections.
- When performing heating for a steam drain, take precautions to prevent the float sensor from having direct contact with the steam.
- Do not attempt to disassemble or adjust float sensor electrical components. Doing so may cause sensor damage or failure.
Float guide

Figure 9: Float guide, Unit: mm (in)
1. Nuts (M10)
2. Float guide
3. Weight

Float guide produced for CFD10, CFD30, UFD10, NAR291, or NAR292 can also be installed in NAR300.
**Ex d [ia] transmitter NRR261**

Figure 10: NRR261 dimensions, Unit: mm (in)

1. **Ex d terminal**
2. **Ex [ia] terminal**
3. **U bolts with 2 nuts and 2 flat washers (JIS F3022 B50, material: iron (chromate))**
4. **Ø12**

---

**NOTICE**

1. Cable gland may only be supplied for TIIS flame-proof specification (proper cable external diameter: Ø12 to 16 mm).
2. Select the NRR261 cable entry (refer to “Order information”).
3. NRR261 is usually mounted to a pipe in the tank yard with a U bolt (JIS F3022 B50). NRR261 can be also mounted directly onto a wall (mounting holes: 4 x Ø12 mm, M10 bolts, nuts).
Ex ia transmitter NRR262

NRR262 designed to be installed indoors, such as in an instrument room and can be repaired easily using two M4 screws. NRR262 may be installed quickly and simply with DIN Rail EN50022, a convenient option (sold separately) for installing additional transmitters or for planning upgrades to multiple transmitter implementation.

Figure 11: NRR262, Unit: mm (in)

1. Screw (M4)
2. Delay trimmer
3. Screw (M3)
4. Screw (M4)
5. DIN Rail: comply with EN50022
Ex I/F box

Ex I/F box is employed in conjunction with transmitter NRR261 or NRR262 to convert float sensor signals to electric current signals. Ex box is usually mounted to a pipe in the tank yard and secured with U bolts (JIS f 3022 B50). Ex box can be also mounted directly onto a wall (mounting holes: 4 x Ø12 mm, M10 bolts and nuts).

Figure 12: Ex I/F box, Unit: mm (in)

- L1: G1/2, NPT1/2: 85 mm (3.35 in), M25: 107 mm (4.21 in)
- 1. U bolts with 2 nuts and 2 flat washers (JIS F3022 B50, Material: iron (chromate))
- 2. 4 - Ø12

Select the cable entry of Ex I/F box in NAR300 order information. When installing NAR300-15Axx, specify NAR300-15AxxB due to G1/2 cable entry.
**Electrical connection**

When float sensor NAR300 Ex [ia] is used in combination with NRR261 Ex d [ia], the safety barrier installed in NRR261 must be grounded as follows.

*CAUTION*

- The safety barrier grounding cable should be connected independent of any other devices or functions, as per class A grounding standards.
- Use a conductive grounding wire with cross-sectional dimensions of 2 mm or more. In an instrumentation room, a field device with Class A grounding may be connected in common to the communication cable shield.

**Class A ground general description**

<table>
<thead>
<tr>
<th>Ground resistance value</th>
<th>10Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grounding cable</td>
<td>Tensile strength: 1.04 kN or more, metallic wire or copper wire (2.6 mm or more in diameter)</td>
</tr>
</tbody>
</table>

---

**Grounding cable**

![Grounding cable diagram](image)

**Figure 13: Grounding cable**

A Non-hazardous area, Class A ground
a Power
b Alarm output
1. Tank
2. Underground
3. Grounding cable
4. Ex d terminal
5. Ex [ia] terminal
6. Cable from float sensor NAR300
Ex ia transmitter NRR261-2xx

Figure 14: NRR261-2xx

A Float sensor NAR300-x1xxxx
B Transmitter NRR261 (integrated type)
a Blue 1 (pre-wired)
b Blue 2 (pre-wired)
c Green
d Red
e Blue 3
f Yellow
g Black
h White

1. Ex d terminal
2. Ex ia] terminal
3. Special cable for IS connection: 6 to 30 m (supplied with NAR300 depending on the selected option code)
4. Alarm output: alarm, PLC, DCS
5. Power supply: VAC or VDC
6. Power arrester (supplied with NAR300)
7. Screw (M4) yellow green: FG arrester GND (class A ground) (see Information *2.)
8. Screws
9. Screw (M4) FG arrester GND (class A ground) (see Information *2.)
10. Screw (M4) internal wiring from zener barrier
**1** Connect cable if VAC cable is used with FG.

**2** If the power specification is 22 to 26 VDC, then terminal L is + (plus) and N is - (minus).

**3** To maintain IS capability, do not exceed 250 VAC 50/60 Hz and 250 VDC at both of normal and abnormal time.

**4** Perform class A grounding by using FG arrester GND for either explosion-proof side or IS side terminal.
Figure 15: NRR262-2x

A  Float sensor NAR300-x5xxxx
B  Ex I/F box
C  Transmitter NRR262
a  Green (see Information *1.)
b  Output to NRR262
c  Red
d  Blue
e  Yellow
f  Black
g  White
h  Input from Ex I/F box
i  90 to 250 VAC 50/60 Hz
j  Alarm output
k  Monitor output for check

1. Special cable for IS connection: 6 to 30 m (supplied with NAR300 depending on the selected option code)
2. Screws (M3)
3. Screw (M4) class A grounding for IS
4. Screws (M3)


*1 Connect the sealed cable only to FG on the Ex I/F box. Depending on implementation, a sealed cable can be connected to GND on NRR262-2x without connecting it to FG or it can be connected to both FG and GND.

*2 If the power specification is 22 to 26 VDC, then terminal L is + (plus) and N is - (minus).

*3 To maintain IS capability, do not exceed 250 VAC 50/60 Hz, DC250 VDC at both of normal and abnormal time.

*4 Prepare the connecting cable. For details of the cable, refer to 'Process condition'.

Ex d transmitter NRR261-3xx

Figure 16: NRR261-3xx

A  Float sensor NAR300-x5xxxx
B  Ex I/F box
C  Transmitter NRR261 (separated type)
a  Green (see Information *1)
b  Output to NRR261-3xx
c  Red
d  Blue 1
e  Yellow
f  Black
g  White
h  Blue 2 (pre-wired)
i  Blue 3 (pre-wired)
j  Blue 4 (pre-wired)
k  Class A ground
m  Input from Ex I/F box
1.  Special cable for IS connection: 6 to 30 m (supplied with NAR300 depending on the selected option code)
2. **Alarm output:** alarm, PLC, DCS
3. **Power:** VAC or VDC
4. **Ex d terminal**
5. **Ex [ia] terminal**
6. **Screws (M3)**
7. **Power arrester (attached)**
8. **Screw (M4) yellow green: FG arrester GND (class A ground) (see Information *5.*)**

---

*1 Connect the sealed cable only to FG on the Ex I/F box. Depending on implementation, a sealed cable can be connected to GND on NRR262-2x without connecting it to FG or it can be connected to both FG and GND.

*2 Connect cable if VAC cable is used with FG.

*3 If the power specification is 22 to 26 VDC, then terminal L is + (plus) and N is - (minus).

*4 To maintain IS capability, do not exceed 250 VAC 50/60 Hz, 250 VDC at both of normal and abnormal time.

*5 Prepare the connecting cable. For details of the cable, refer to 'Process condition'.
## Order information

### Float sensor NAR300

<table>
<thead>
<tr>
<th></th>
<th>Approval:</th>
</tr>
</thead>
</table>
| 010 | 1 TIS Ex ia IIB T4  
    | A ATEX II 1/2G Ex ia IIB T5/T4  
    | B iECEx ia IIB T5/T4 Ga/Gb  
    | C FM IS Cl.1 Div.1 Gr.C,D T5/T4,zone 0,1 AEx ia IIB T5/T4  
    | 9 Special version, TSP-no. to be spec.                                   |

<table>
<thead>
<tr>
<th></th>
<th>Type:</th>
</tr>
</thead>
</table>
| 020 | 1 Float  
    | 2 Float, module set (Econounce NRR261 upgrade)  
    | 4 Float, Ex box (Econounce NRR262 upgrade)  
    | 5 Float, Ex box  
    | 6 Float, high temperature, Ex box  
    | 9 Special version, TSP-no. to be spec.                                   |

<table>
<thead>
<tr>
<th></th>
<th>Output:</th>
</tr>
</thead>
</table>
| 030 | A 2-wire current  
    | Y Special version, TSP-no. to be spec.                                   |

<table>
<thead>
<tr>
<th></th>
<th>Signal Cable:</th>
</tr>
</thead>
</table>
| 040 | A 6 m  
    | B 10 m  
    | C 15 m  
    | D 20 m  
    | E 25 m  
    | F 30 m  
    | Y Special version, TSP-no. to be spec.                                   |

<table>
<thead>
<tr>
<th></th>
<th>Float Guide:</th>
</tr>
</thead>
</table>
| 050 | 1 Not used  
    | 2 Guide 304, weight SS400  
    | 3 Guide 304, weight 304  
    | 9 Special version, TSP-no. to be spec.                                   |

<table>
<thead>
<tr>
<th></th>
<th>Cable Entry:</th>
</tr>
</thead>
</table>
| 060 | A Not needed  
    | B G1/2  
    | C NPT 1/2  
    | F M20  
    | Y Special version, TSP-no. to be spec.                                   |

NAR300- Complete product designation
### Transmitter NRR261

<table>
<thead>
<tr>
<th>010</th>
<th>Approval:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TIIS Ex d [ia] IIB T4 (NAR300 integrated type)</td>
</tr>
<tr>
<td>3</td>
<td>TIIS Ex d [ia] IIB T4 (NAR300 separate type)</td>
</tr>
<tr>
<td>A</td>
<td>ATEX II 1/2G Ex d[i]a IIB T4 (NAR300 integrated type)</td>
</tr>
<tr>
<td>B</td>
<td>IECEx d[i]a IIB T4 Ga/Gb (NAR300 integrated type)</td>
</tr>
<tr>
<td>C</td>
<td>FM XP-AIS CLI Div 1 Gr.C,D, T4, zone 0, 1 AEx d[i]a IIB T4 (NAR300 integrated type)</td>
</tr>
<tr>
<td>9</td>
<td>Special version, TSP-no. to be spec.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>020</th>
<th>Power Supply:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90-250VAC 50/60Hz</td>
</tr>
<tr>
<td>B</td>
<td>22-26VDC</td>
</tr>
<tr>
<td>Y</td>
<td>Special version, TSP-no. to be spec.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>030</th>
<th>Cable Entry:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>G3/4 x2 (Ex d), G1/2 x1 (Ex ia)</td>
</tr>
<tr>
<td>K</td>
<td>G1/2 x2 (Ex d), G1/2 x1 (Ex ia)</td>
</tr>
<tr>
<td>Q</td>
<td>NPT3/4 x2 (Ex d), NPT1/2 x1 (Ex ia)</td>
</tr>
<tr>
<td>R</td>
<td>NPT1/2 x2 (Ex d), NPT1/2 x1 (Ex ia)</td>
</tr>
<tr>
<td>U</td>
<td>M25 x2 (Ex d), M20 x1 (Ex ia)</td>
</tr>
<tr>
<td>W</td>
<td>M20 (Ex d), M20 x1 (Ex ia)</td>
</tr>
<tr>
<td>Y</td>
<td>Special version, TSP-no. to be spec.</td>
</tr>
</tbody>
</table>

**NRR261-** | Complete product designation

### Transmitter NRR262

<table>
<thead>
<tr>
<th>010</th>
<th>Approval:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TIIS Ex ia IIB, (NAR300), see additional spec.</td>
</tr>
<tr>
<td>A</td>
<td>ATEX [Ex ia] IIB</td>
</tr>
<tr>
<td>B</td>
<td>IEC [Ex ia] IIB</td>
</tr>
<tr>
<td>C</td>
<td>FM AIS AEx [ia] IIB</td>
</tr>
<tr>
<td>9</td>
<td>Special version, TSP-no. to be spec.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>020</th>
<th>Power Supply:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90-250VAC 50/60Hz</td>
</tr>
<tr>
<td>B</td>
<td>22-26VDC</td>
</tr>
<tr>
<td>Y</td>
<td>Special version, TSP-no. to be spec.</td>
</tr>
</tbody>
</table>

**NRR262-** | Complete product designation
## Specifications

### Float sensor NAR300

<table>
<thead>
<tr>
<th>Protection class</th>
<th>IP67 (outdoor installation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>Supplied by transmitter</td>
</tr>
<tr>
<td>Wetted material</td>
<td>• Float: SUS316L&lt;br&gt;• Conductive sensor: SUS316 and PTFE&lt;br&gt;• Tuning fork sensor: equivalent to SUS316L</td>
</tr>
<tr>
<td>Detection sensitivity (see Information.)</td>
<td>• Water-filled pit: 10 +/- 1 mm, alarm setting prior to delivery with heating oil&lt;br&gt;• Empty pit: 50 +/- 5 mm, alarm setting prior to delivery with heating oil</td>
</tr>
<tr>
<td>I/O cable</td>
<td>Exclusive PVC shield cable, including cable float (6 m standard)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 2.5 kg (including 6 m (PVC) cable)</td>
</tr>
</tbody>
</table>

Heating oil (relative density approx. 0.8 g/cm³), on water (relative density approx. 1.0 g/cm³), static level condition, no surface tension.

### Ex I/F box

<table>
<thead>
<tr>
<th>Protection class</th>
<th>IP67 (for outside installation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>NRR261 or NRR262</td>
</tr>
<tr>
<td>Cable entry</td>
<td>• NAR300 (Float sensor): G1/2 with a cable gland x1&lt;br&gt;• NRR261 or NRR262 (Transmitter): G1/2, NPT1/2, M20</td>
</tr>
<tr>
<td>Weight</td>
<td>Approximately 3.2 kg</td>
</tr>
</tbody>
</table>

### Transmitter NRR261

<table>
<thead>
<tr>
<th>Protection Class</th>
<th>IP67 (for outside installation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>• 90 to 250 VAC, 50/60 Hz&lt;br&gt;• 22 to 26 VDC</td>
</tr>
<tr>
<td>Power consumption</td>
<td>20 VA/2 W</td>
</tr>
<tr>
<td>Input</td>
<td>Approximately 7 to 16 mA from NAR300 / Ex I/F box</td>
</tr>
<tr>
<td>Output</td>
<td>• Contact output: 1 SPDT&lt;br&gt;• Contact rate: 250 VAC, 1 A, 100 VA,&lt;br&gt;• 100 VDC: 1 A, 25 W&lt;br&gt;• Failsafe function: available if power fail, frozen sensor (refer to “Alarm output” table)</td>
</tr>
<tr>
<td>Cable entry</td>
<td>• G3/4 x2 (Ex d), G1/2 x1 (Ex ia)&lt;br&gt;• G1/2 x2 (Ex d), G1/2 x1 (Ex ia)&lt;br&gt;• NPT3/4 x2 (Ex d), NPT1/2 x1 (Ex ia)&lt;br&gt;• NPT1/2 x2 (Ex d), NPT1/2 x1 (Ex ia)&lt;br&gt;• M25 x2 (Ex d), M20 x1 (Ex ia)&lt;br&gt;• M20 (Ex d), M20 x1 (Ex ia)&lt;br&gt;• TIIS Ex specified cable glands model SXBM</td>
</tr>
<tr>
<td>Arrester</td>
<td>Built-into power supply</td>
</tr>
<tr>
<td>Weight</td>
<td>Approximately 10 kg</td>
</tr>
</tbody>
</table>
Transmitter NRR262

<table>
<thead>
<tr>
<th>Protection Class</th>
<th>IP20 (for outside installation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>• 90 to 250 VAC, 50/60 Hz&lt;br&gt;• 22 to 26 VDC</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>20 VA/2 W</td>
</tr>
<tr>
<td>Output</td>
<td>• Contact output: 1 SPDT&lt;br&gt;• Contact rate: 250 VAC, 1 A, 100 VA, 100 VDC: 1 A, 25 W&lt;br&gt;• Failsafe function: available if power fail, frozen sensor (refer to &quot;Alarm output&quot; table)</td>
</tr>
<tr>
<td>Arrester</td>
<td>Built-into power supply</td>
</tr>
<tr>
<td>Weight</td>
<td>Approximately 0.6 kg</td>
</tr>
</tbody>
</table>
## Process condition

### Float sensor NAR300

<table>
<thead>
<tr>
<th>Detective object</th>
<th>Relative density larger than 0.7 g/cm³ and less than 1.0 g/cm³ (When relative density is larger than 0.9 g/cm³, dynamic viscosity must be larger than 1 m Pa·s). Water is approximately 1 m Pa·s.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not soluble in water</td>
</tr>
<tr>
<td></td>
<td>Non-conductivity</td>
</tr>
<tr>
<td></td>
<td>Flowing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>Ambient: -20 to +60 °C (-4 to +140 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measured liquid: 0 to +60 °C (+32 to +140 °F)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water in pit</th>
<th>Relative density larger than 1.0 g/cm³ and less than 1.13 g/cm³ (when kinematic viscosity equals 1 mm²/sec). (see Information.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not frozen</td>
</tr>
<tr>
<td></td>
<td>Conductivity is larger than 10 μS/cm and less than 100 kΩ·cm (larger than 1 μS/cm if float sensor is normally floating on the water).</td>
</tr>
<tr>
<td></td>
<td>Not salt-water</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other</th>
<th>Clean off any debris that sticks to the sensor.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do not let mud cake on the float sensor.</td>
</tr>
<tr>
<td></td>
<td>Avoid pit conditions that cause the float sensor to tilt off-balance or change the draft-line.</td>
</tr>
<tr>
<td></td>
<td>Install measures to avoid cross-currents, standing waves.</td>
</tr>
</tbody>
</table>

> Sensitivity of sensor at the bottom of the water density may vary depending of the factory setting environment such as using antifreeze liquid.

### Ex I/F box and transmitter

<table>
<thead>
<tr>
<th>Connecting cable (connection between Ex I/F box and transmitter NRR261/262)</th>
<th>Maximum inductance 3 mH, maximum capacitance 83 nF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting cable (connection between Ex I/F box and transmitter NRR261/262)</td>
<td>e.g. KPEV-5 (instrumentation cable)</td>
</tr>
<tr>
<td>Connecting cable (connection between Ex I/F box and transmitter NRR261/262)</td>
<td>C = 65 nF/km, L = 0.65 mH/km</td>
</tr>
<tr>
<td>Connecting cable (connection between Ex I/F box and transmitter NRR261/262)</td>
<td>CW/C = 0.83 μF/65 mH = 1.276 km [1]</td>
</tr>
<tr>
<td>Connecting cable (connection between Ex I/F box and transmitter NRR261/262)</td>
<td>LW/L = 3 mH/0.65 mH = 4.615 km [2]</td>
</tr>
<tr>
<td>Connecting cable (connection between Ex I/F box and transmitter NRR261/262)</td>
<td>Maximum cable length = 1.27 km</td>
</tr>
<tr>
<td>Connecting cable (connection between Ex I/F box and transmitter NRR261/262)</td>
<td>* The smaller of [1] or [2] is the maximum usable cable length.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>Ambient: -20 to +60 °C (-4 to +140 °F)</th>
</tr>
</thead>
</table>

---

---
Accessory

Float guide

Install the float guide weight horizontally. Remove any debris and stones from the bottom of the pit so that the sensor can be mounted horizontally.

The length of a standard float guide is 2 m (meter). When ordering a length other than 2 m, contact Endress+Hauser representatives.

Figure 17: Float Guide, Unit: mm (in)

1. Nuts (M10)
2. Float guide
3. Weight

<table>
<thead>
<tr>
<th>Name</th>
<th>Delivery quantity</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float guide</td>
<td>2</td>
<td>SUS304</td>
</tr>
<tr>
<td>Weight</td>
<td>1</td>
<td>SS400, SUS304</td>
</tr>
<tr>
<td>Nut (M10)</td>
<td>6</td>
<td>SUS304</td>
</tr>
</tbody>
</table>
**U bolt and cable gland (Waterproof)**

U bolts (JIS F3022 B50) are used to install transmitter. Use a guide pipe; 50A, 2B, Ø60.5 mm. Tighten and secure the cable gland after inserting the cable from NAR300.

Cable gland is only supplied for TII5 flame-proof specification.

![Figure 18: U Bolt and Cable Gland](image)

1. **U bolts (JIS F3022, B50)**
2. **Cable gland (waterproof)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Delivery quantity</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>U bolt</td>
<td>2</td>
<td>Iron (chromate)</td>
</tr>
<tr>
<td>U bolt accessory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nut</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Flat washer</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Cable grand (waterproof)</td>
<td>1</td>
<td>Nylon</td>
</tr>
</tbody>
</table>
Certificates and approvals

Ex approval

- ATEX Approval: FM.14ATEX0048X
- IECEx Approval: IECEx FMG 14.0024X
- FM Approval: 3049525

- The combination of the TIIS certifications varies depending on that of the NAR300 system.
- The FLT certificate is provided separately for TIIS specification. For other specifications, it is included as a set.

Figure 19: System configuration 1 (TIIS Approval: TC18322 (NAR300)/TC18327 (FTL))
A. Float sensor NAR300-x1xxxx
B. Transmitter NRR261 (integrated type)
1. Alarm output: Alarm, PLC, DCS
2. Power supply (VAC or VDC)
3. Special cable for IS connection: 6 to 30 m

Figure 20: System configuration 2 (TIIS Approval: TC18324 (NAR300)/TC18327 (FTL)/TC18326 (NRR262))
A. Float sensor NAR300-x5xxxx
B. Ex I/F box
C. Transmitter NRR262
1. Special cable for IS connection: 6 to 30 m
2. Cable for Ex I/F box and transmitter (refer to 'Process condition' for details).
3. Alarm output (Alarm, PLC, DCS)
4. Power supply (VAC or VDC)
Safety function approval

SIL2 IEC61508 (ATEX, IECEx, FM specifications)

For details of TIIS specifications, contact Endress+Hauser representatives.
## Documentations

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating instructions</td>
<td>BA00402G</td>
<td>Float sensor NAR300 system</td>
</tr>
<tr>
<td>Safety instruction</td>
<td>XA00587G-A</td>
<td>TC18324 (Oil leak sensor NAR300-15)</td>
</tr>
<tr>
<td></td>
<td>XA00588G-A</td>
<td>TC18325 (Transmitter NRR261)</td>
</tr>
<tr>
<td></td>
<td>XA00589G-A</td>
<td>TC18326 (Transmitter NRR261)</td>
</tr>
<tr>
<td>Functional safety manual</td>
<td>SD01357G</td>
<td>Oil leak detector NAR300 system</td>
</tr>
</tbody>
</table>