Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

# Oil Leak Detector NAR300 System

## Equipped with two detection principles: Conductivity and vibration sensor

### Application

This system is set up in a pit, dike or plant, or sump pit near the pump yard, where it provides the ultimate leak detection function for petrochemicals or vegetable oils. The Oil Leak Detector NAR300 System utilizes two different detection principles, namely conductivity and vibronics, to monitor the conditions. Highly accurate alarm recognition is realized by a 2-stage logic process that ensures safe operation of the tank yard with minimal equipment configuration.

Flame proof System:
Alarm output transmitted to Host controller via connected Transmitter NRR261 (outdoor installation) and e.g. level transmitter with switching input

Intrinsically safe System:
Direct alarm output to host controller when connected in combination with Transmitter NRR262 (indoor installation).

### Features and benefits

- Twin detection principle:
  - Conductive sensor detects presence of conductive liquid
  - Vibration sensor determines presence of oil or water
- Easy installation in either water-filled, or empty pits
- No moving parts, low maintenance, long life
- Safe operation assured via advanced diagnostics that power fail, frozen pit-water, etc.
- Independent of dielectric constant when detecting water-insoluble oils
- Improved performance even in harsh pit conditions
- Intrinsically float sensor
- EMC-compliant

TI00045G/08/EN/14.12
71188296

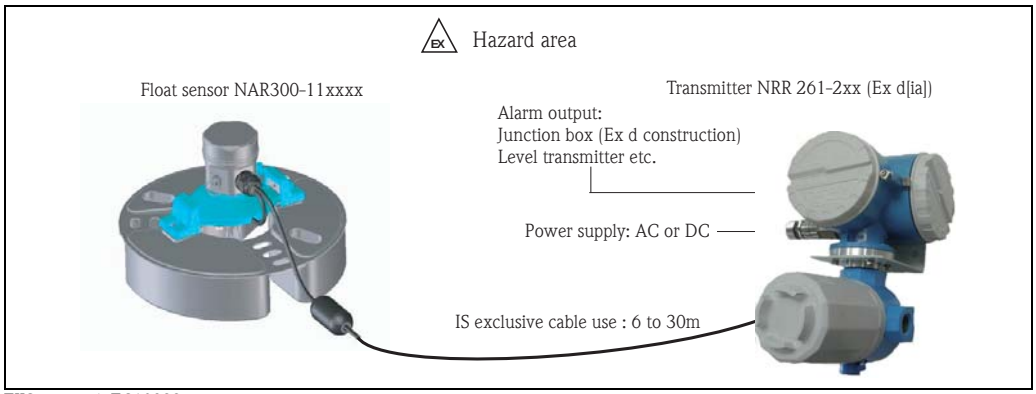
Endress+Hauser
People for Process Automation

# Contents

# Function and system design

Oil Leak Detector NAR300 system is available in three configurations to cover a variety of applications.

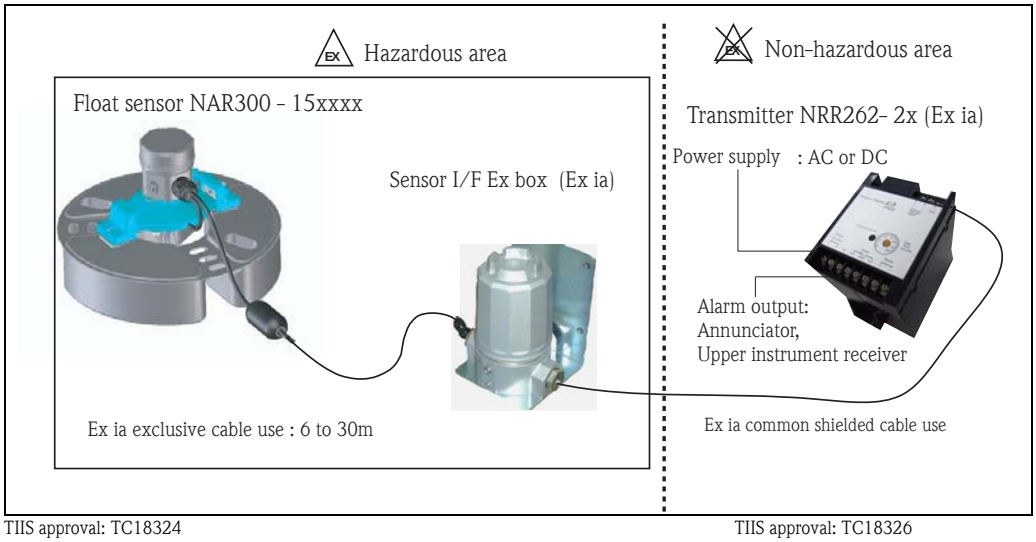
From oil leak detection to alarm output, the Exd [ia] Oil Leak Detection System can monitor the entire process outdoor Ex areas. The circuitry is intrinsically safe from the NAR300 float sensor to the input Exd [ia] side of NRR261 Exd [ia] Transmitter by a special cable supplied as part of the sensor by Endress+Hauser. The NRR261 output (Ex d) side can be connected to a tank yard junction box or alternatively to level transmitter relay inputs. This configuration allows signal transmission from the Float Sensor to the Transmitter over ranges up to maximum 30 meters.




TIIS approval: TC18322

**IS system:**
**Ex ia IIB T4**

The Intrinsically Safe system includes the intrinsically safe transmitter NRR262, which is installed indoors in a non-Ex area, and outputs a signal to an alarm panel or host system located indoors. The signal from NAR300 is output to the Transmitter NRR262 via the Sensor Interface Ex box.

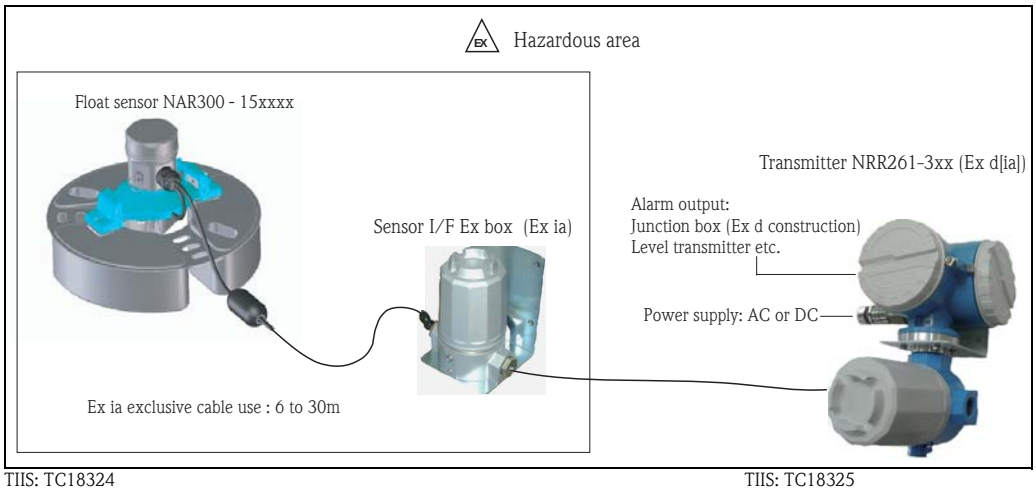



TIIS approval: TC18324

TIIS approval: TC18326

**Ex d[ia]system:**
**Ex d[ia]IIB T4**

From oil leak detection to alarm output, the Exd [ia] Oil Leak Detection System can monitor the entire process outdoor Ex areas. The circuitry is intrinsically safe from the NAR300 float sensor to the input Exd [ia] side of NRR261 Exd [ia] Transmitter by a special cable supplied as part of the sensor by Endress+Hauser. The NRR261 output (Ex d) side can be connected to a tank yard junction box or alternatively to level transmitter relay inputs. This configuration allows signal transmission from the Float Sensor to the Transmitter over ranges up to maximum 2.6 Kilometers.

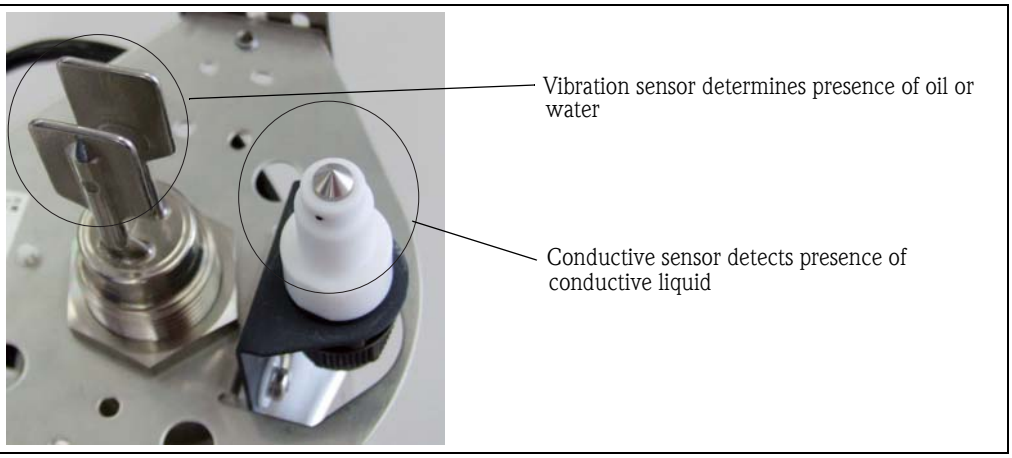


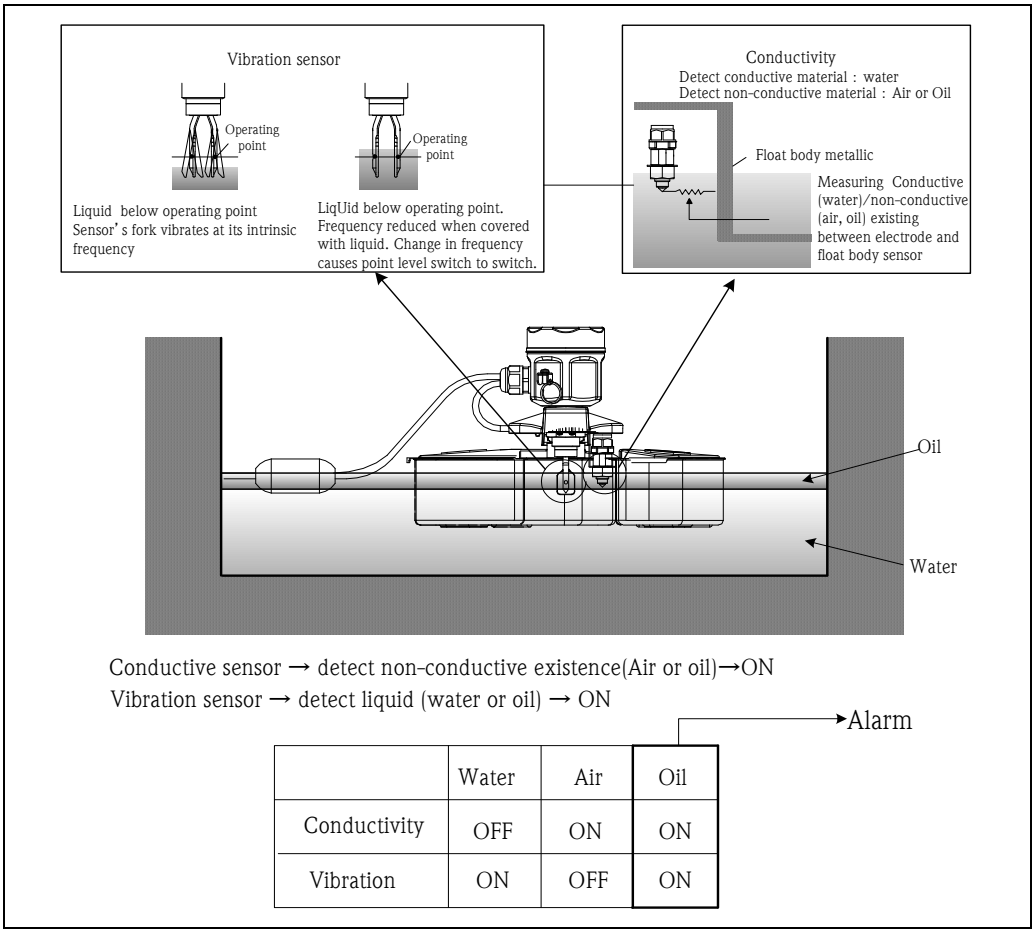

TIIS: TC18324 TIIS: TC18325

# Operating Principle

**Detection Principle**

**Sensing element**




| | Water | Air | Oil |
|---|---|---|---|
| Conductivity | OFF | ON | ON |
| Vibration | ON | OFF | ON |

**Detection in water-filled pit**

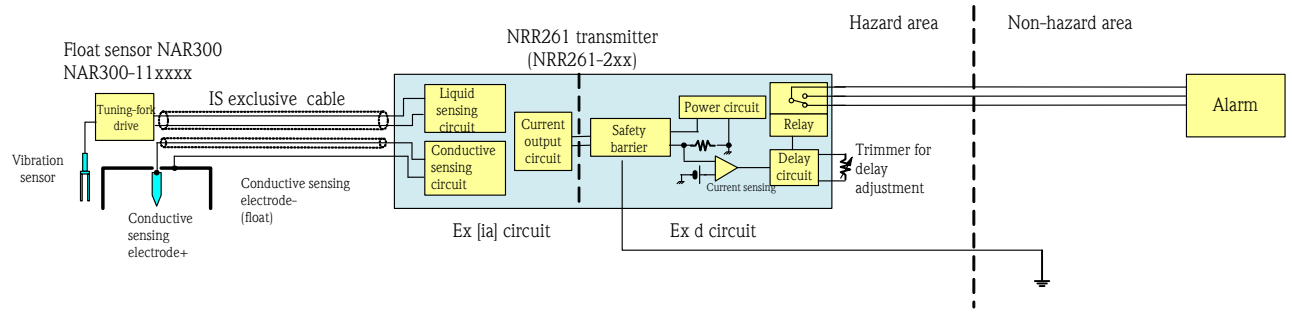
1. Conductive sensor continuously monitors conductivity between probe and float body.
2. When water is detected by the conductive sensor, it is considered the normal condition and conductive probe alarm status is OFF, regardless of the vibration sensor condition.
3. When an oil layer forms on the water the conductivity between probe and float body decreases, and conductive probe alarm status turns to ON.
4. Since the vibration sensor is continuously in liquid its alarm condition is ON, thus an ON / ON logic is achieved.
5. In this ON / ON condition an alarm is output.

**Detection in empty pit**

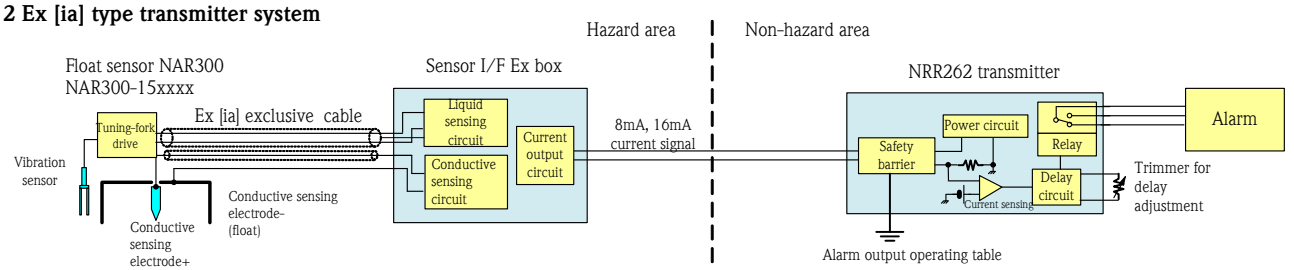
1. Opposite from the water-filled pit case, the conductive probe is in air, and its alarm status is ON.
2. Since no liquid is present, the vibration sensor alarm condition is OFF, and an alarm condition is not recognized.
3. If rain-water enters the pit causing the float sensor to float on the water, the same condition as above (Detection in water-filled pit, 2) is achieved.
4. Since the vibration sensor is continuously in liquid its alarm condition is ON, thus an ON / ON logic is achieved.
5. In this ON / ON condition an alarm is output.

## Alarm principle

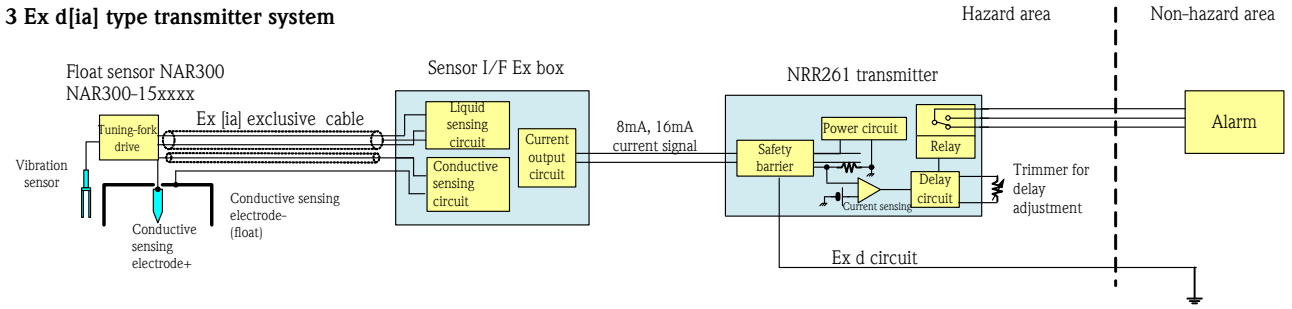
**1 Ex d type transmitter system**




**2 Ex [ia] type transmitter system**




**3 Ex d[ia] type transmitter system**




**Principle of Alarm operation**

The oil leak detection signal generated at the float sensor NAR300 is converted to 8mA (alarm ON) or 16mA (alarm OFF) by the current output circuit at the transmitter or Sensor I/F Ex box. It is further connected to the current detection circuit thru an IS safety barrier.

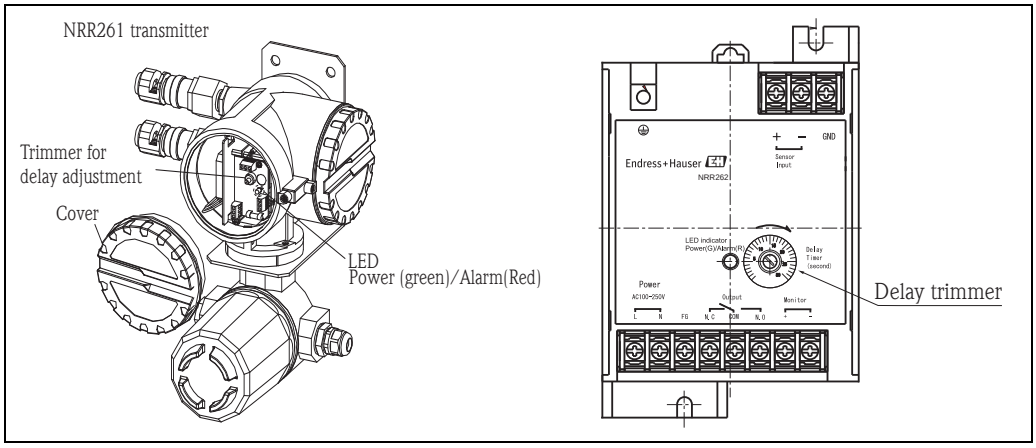
In the current detection circuit, the existence/absence of oil leak alarm signal is judged according to the current value, sent through a delay circuit and turns the alarm output relay ON or OFF. The alarm delay circuit is configurable from 1-30 seconds (additional 6 seconds is added as the base delay value).
Fail-safe performance of the relay output is also available (see below).

**Alarm output operating table**

| Terminals / Condition | NRR262 N.C. to COM<br>NRR261N.C. to COM terminal :11,13 | NRR262 N.O. to COM<br>NRR261N.O. to COM terminal:13,15 |
|---|---|---|
| Oil leak alarm | Contact Close | Contact Open |
| Power OFF | Contact Close | Contact Open |
| Liquid freezing | Contact Close | Contact Open |
| Non-alarm | Contact Open | Contact Close |

The ON delay time is adjustable via delay trimmer. After turning off power to Transmitter NRR261, remove the electronics compartment cover to see the trimmer. On NRR262 the trimmer is located on the surface of the case. It is possible to set the delay from 1-30 seconds. When an alarm condition continues longer than the delay time setting it is judged as an alarm output. If the alarm condition stops within the delay time setting, an alarm is not output, thus preventing false alarms.

**Note!**
A delay time of approximately 6 seconds is automatically added.
Response delay time of approx. 6 sec. is always added to the detection circuit except for delay time by the trimmer.



# Operating conditions

## Detection Sensitivity

Depending on actual condition, watar may sometimes cling to the electrode, even though the sensor is floating on oil above the water (see figure 3). In such case, oil detection sensitivity may be affected by 1 to 2 mm. When absolute precision is required we recommend coating the electrode with a mild detergent in order to keep water from clinging to the electrode.

## Water-filled pits

**Not for use in salt -water pits**

The Float Sensor NAR300 is not designed for use in salt-water. If used in salt-water the following abnormal performance may occur:

- Failure to output an alarm if overturned by waves
- Salt content may create a short between float sensor and probe, causing alarm delay
- Failure due to salt-water corrosion

**Pits with liquids other than water**

When using the Float Sensor on particular liquids such as a solvent blend, it may be corroded and damaged.

**High electrical resistance water in pit**

When using the Float Sensor on high electrical resistance water such as a steam drain or pure water,an alarm may ring. Eelectric conductivity should be $\geq 10\ \mu$ S/cm and $\leq$ 100k$\Omega \cdot$ cm.
As an example:
Pure water - 1 to 0.1 $\mu$ S/cm (1 to 10M$\Omega \cdot$ cm)

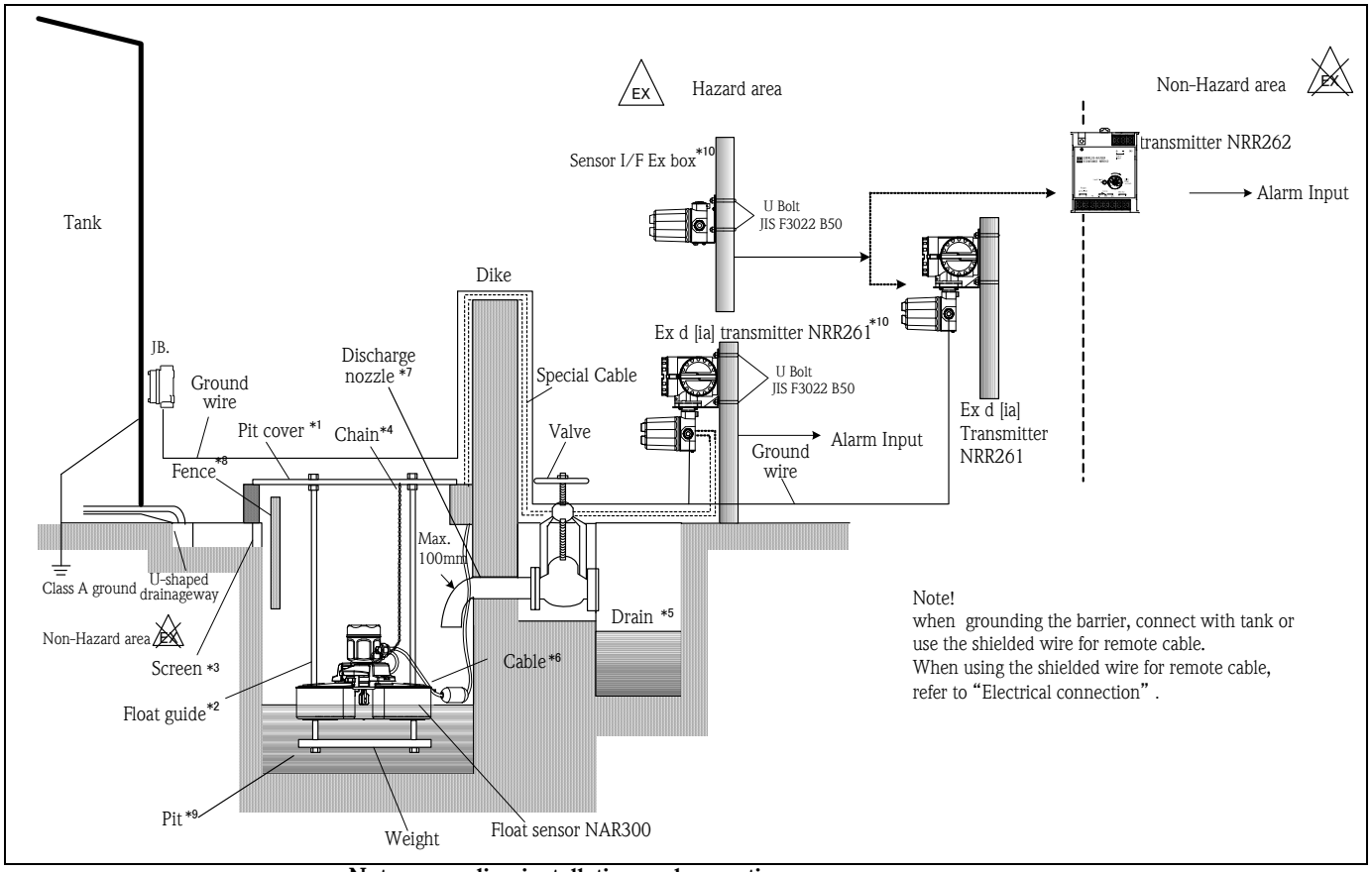
**The water freezing in a pit**

When water in the pit freezes , the alarm may ring (fail safe function).
Please implement countermeasures to prevent freezing.

## Gasolin application

For gasolin application, please choose NAR300 with technically special product by your Endress+Hauser representative.

# Installation

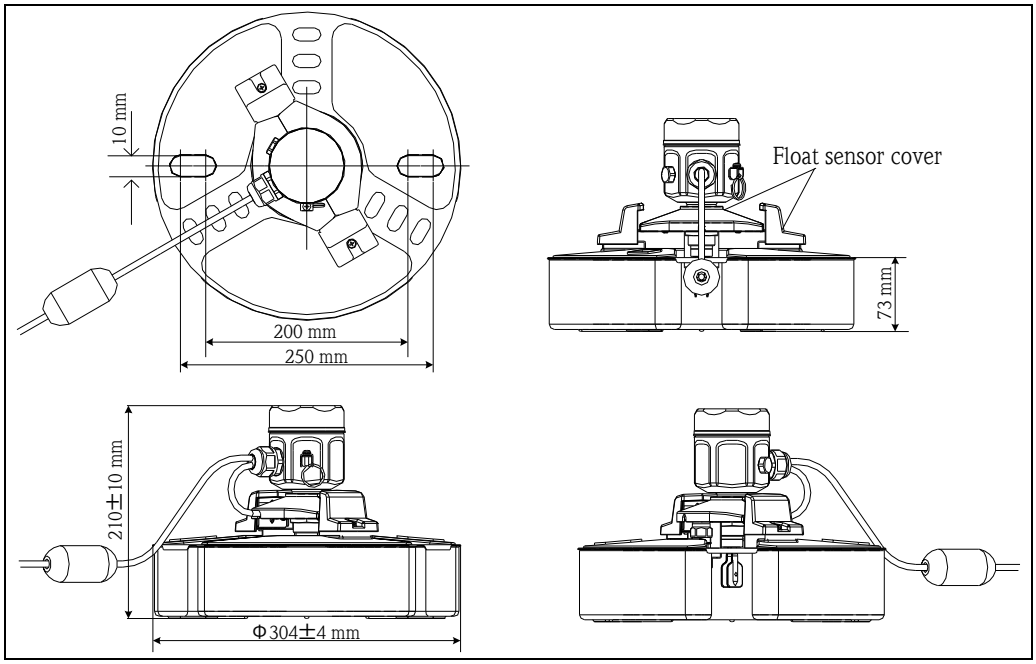



**Notes regarding installation and mounting**

1. Take precautions to prevent rubbish or snow from entering the pit, e.g. rubbish guard, roof, cover etc. If snow accumulates on the Float Sensor NAR300, it will float lower in the water and reduce oil detection sensitivity. When ambient temperatures rise above 50 °C, set up a sunshade to block direct sunlight. Mount covers higher than the top of the pit to avoid submerging the Float Sensor NAR300 during heavy rains. If the float sensor is submerged it may not perform as intended.
2. The Float Sensor NAR300 may not perform as intended if it becomes unbalanced by more than about 3 degrees horizontally. Use float guides as recommended to keep balance, and take care that chains and cables are not tangled in the float or guides.
3. We recommend mounting a screen at the water inlet to prevent rubbish from entering the pit. Conduct periodical inspections/cleaning to maintain optimal performance of the system.
4. It may be convenient to attach a lifting chain to the float sensor head for inspecting. In the case the weight of the chain should be less than 50 grams, else it may affect the balance of the float sensor. Do not use excessive force when pulling the chain.
5. When the pit becomes completely filled with water, even if an oil leak occurs, an oil layer cannot form on the surface of the water due to overflowing from the pit.
6. Do not pull the sensor by its signal cable. Pulling the signal cable may damage the sensor.
7. When the drain valve is kept continuously open, it should be formed such that it curves downward at least 100mm. Failure to do so may cause any oil to discharge from the pit before it can form a detectable layer on the water surface, resulting in a delayed alarm condition or failure to detect. In the case of a pit without discharge nozzle as illustrated above, install water-fence or other mechanism such that oil will forma detectable layer on the water surface.
8. If necessary, set up a divider to prevent extreme waves, crosscurrents, or water splashing onto the float sensor.
9. If the pit is too wide, it may not allow a detectable oil layer to form on the water surface. In this case install a divider to reduce the surface area such that a detectable oil layer will form.
10. Mount the NAR300, NRR261 and I/F Ex box at least 50 cm apart.

# Dimensions

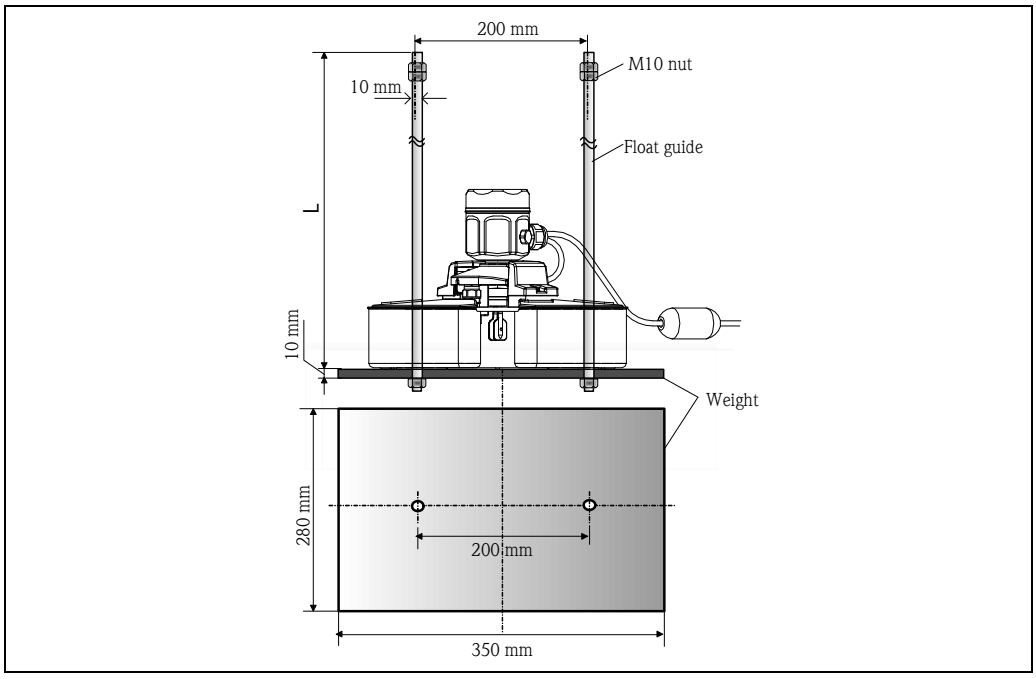
Float sensor NAR300



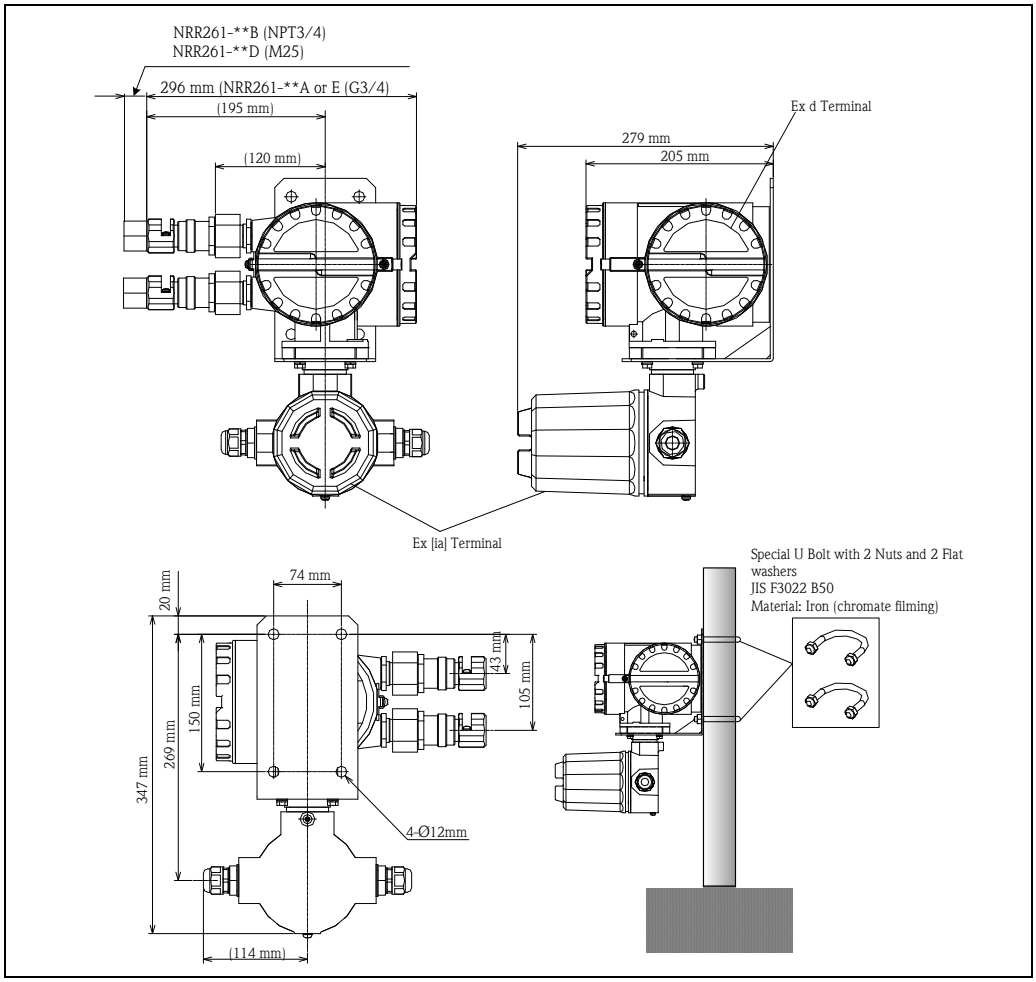

**Note!**

- If the float sensor cover is broken of missing, detection sensitivity may decrease. Replace the broken cover with authorized spare parts from Endress+Hauser.
- If the Float Sensor NAR300 is used in a pit that contains a liquid/substance that is corrosive to the float sensor material, it should only be used during an actual oil leak. In case of continued use after an oil leak, carry our regular inspections.
- Take precautions to prevent steam from directly flowing onto the Float Sensor NAR300.
- Do not try to disassemble or adjust the float sensor electrical components. Such actions may cause damage or failure to the sensor.

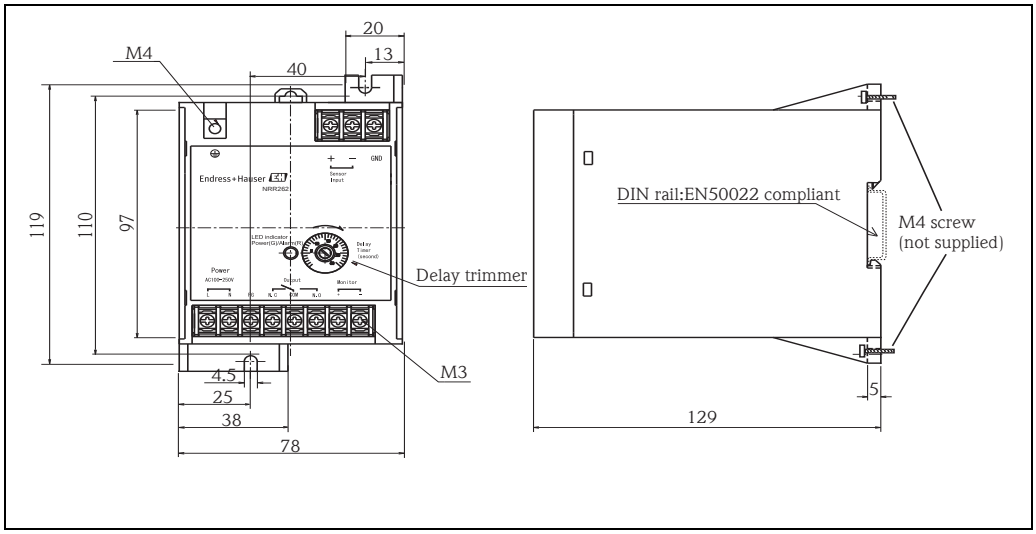
## Float guide



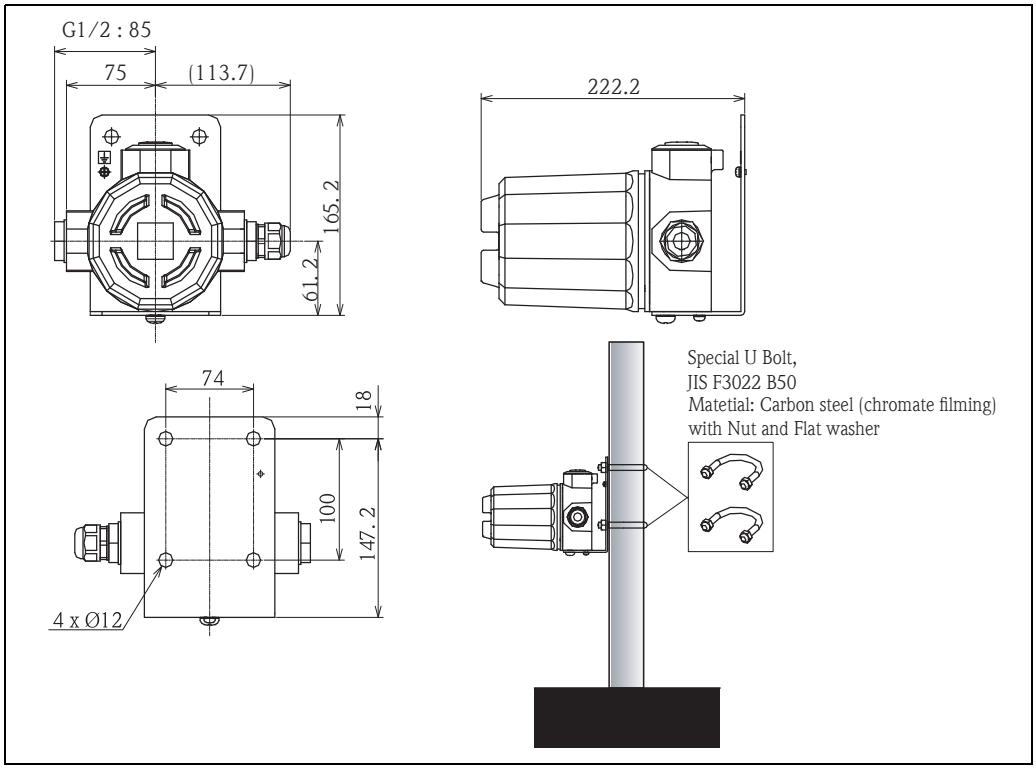
## Ex d [ia] Transmitter NRR261




## Ex ia Transmitter NRR262



## Ex ia Sensor I/F Ex box




**Note!**
Sensor I/F Ex box is included in the order code of NAR300-15xxxx. This device is used in combination with NRR262-2x (Ex ia) and NRR261-3xx (Ex d [ia]).

# Electrical connection

When using float sensor NAR300 Ex ia together with transmitter NRR261 Ex d[ia], it is necessary to ground the NRR 261 to a safety per barrier the following procedure.

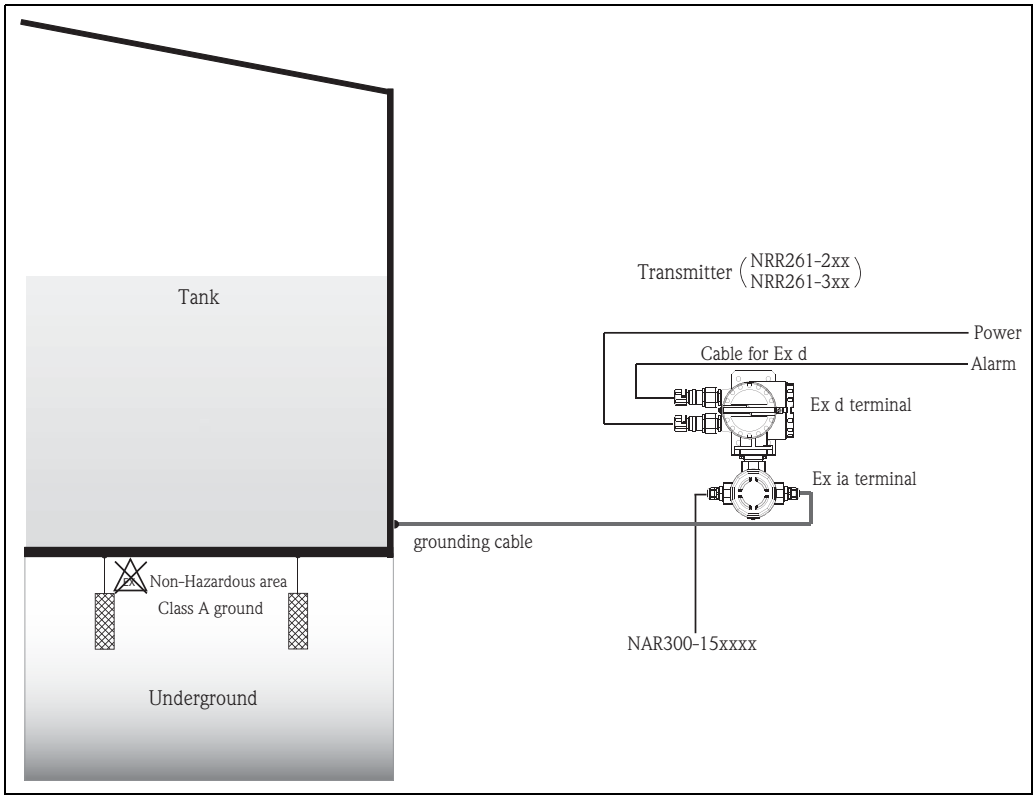
**Note!**
The grounding cable for safety barrier should be connected independent of any other devices or purpose, according to “Class A grounding” standards.

Use a conductive grounding wire with cross-sectional dimensions at least 2 $mm^2$.
In an instrumentation room, a field device with Class A ground may be connected in common with the communication cable shield.

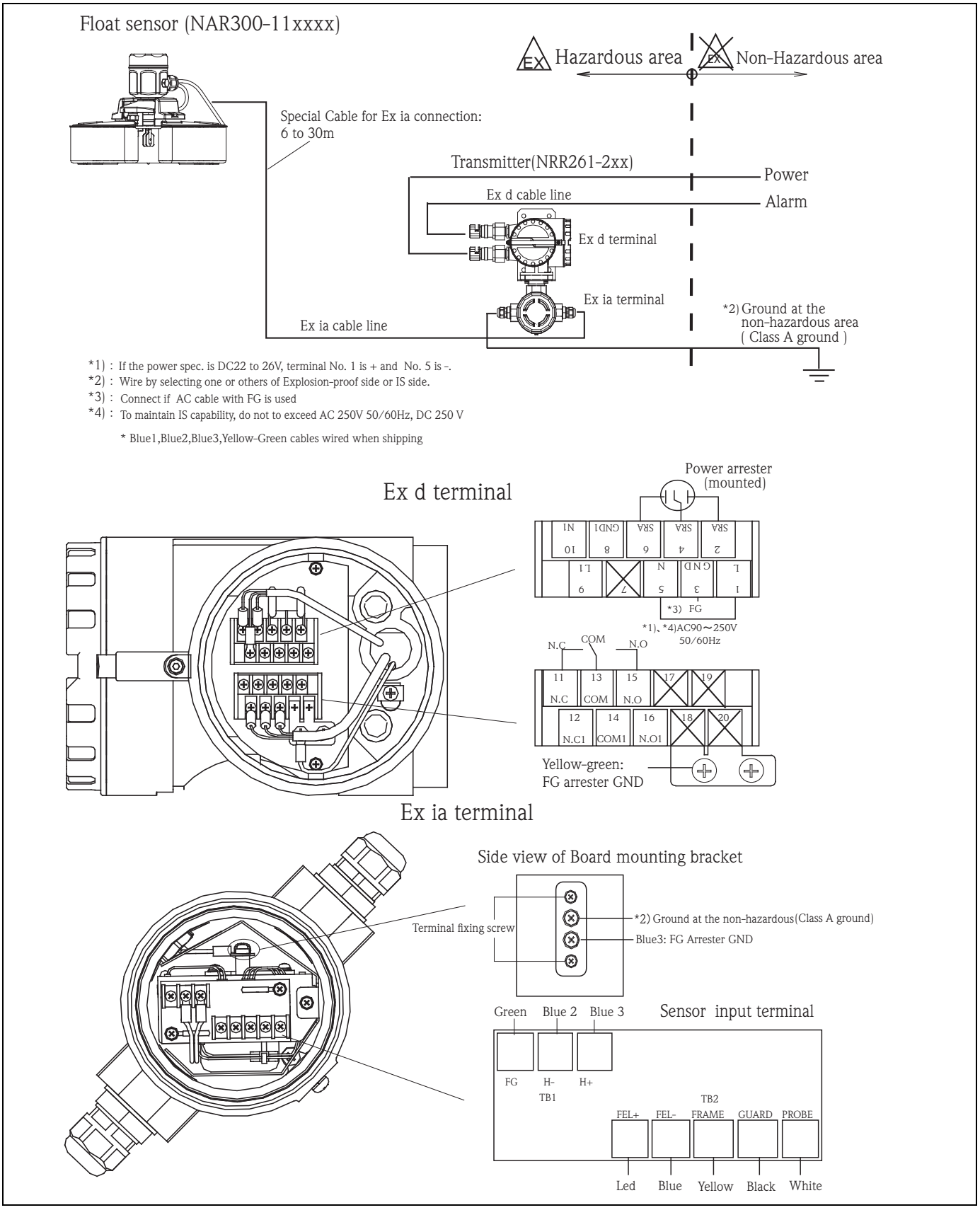
"Class A ground" general description

| | |
|---|---|
| Ground resistance value | 10 Ω |
| Grounding cable | Tensile strength : more 1.04kN and Metallic wire or copper wire (more 2.6 mm in diameter) |

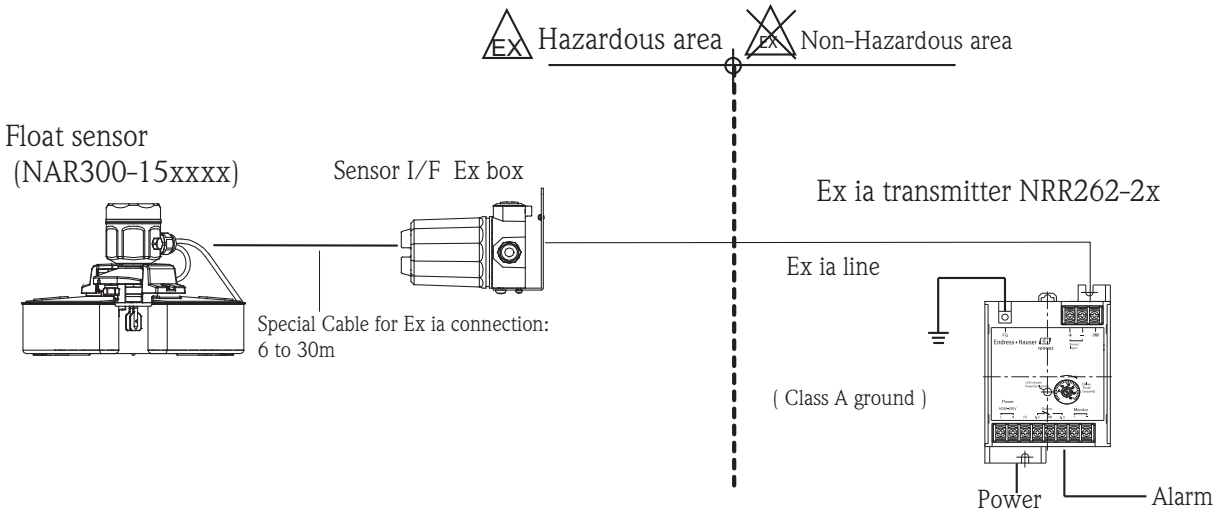
**Grounding cable**

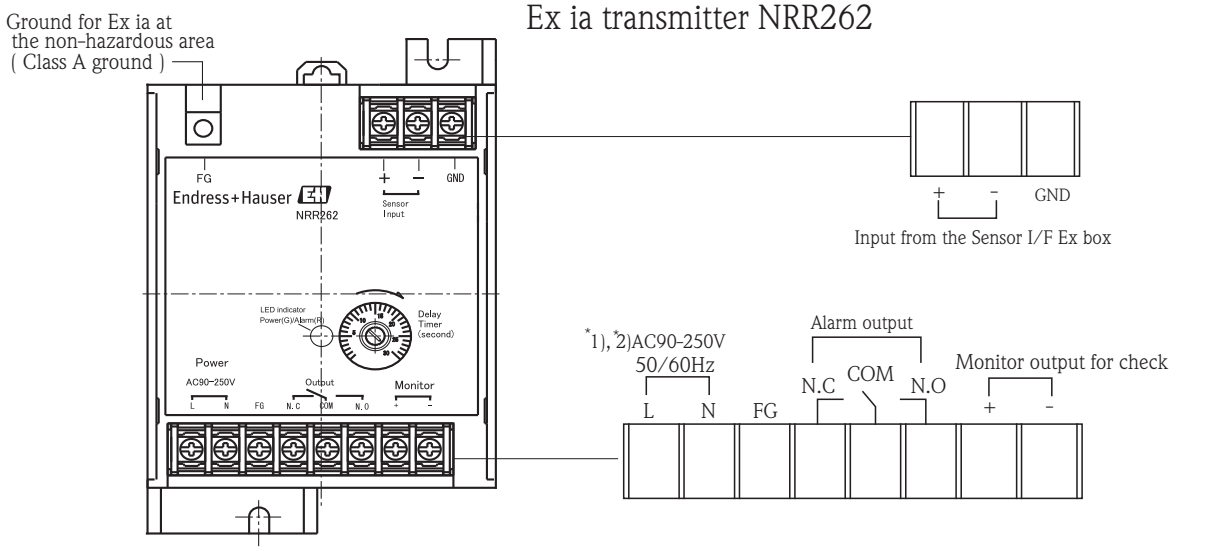


## Ex d[ia] transmitter
## NRR261-2xx

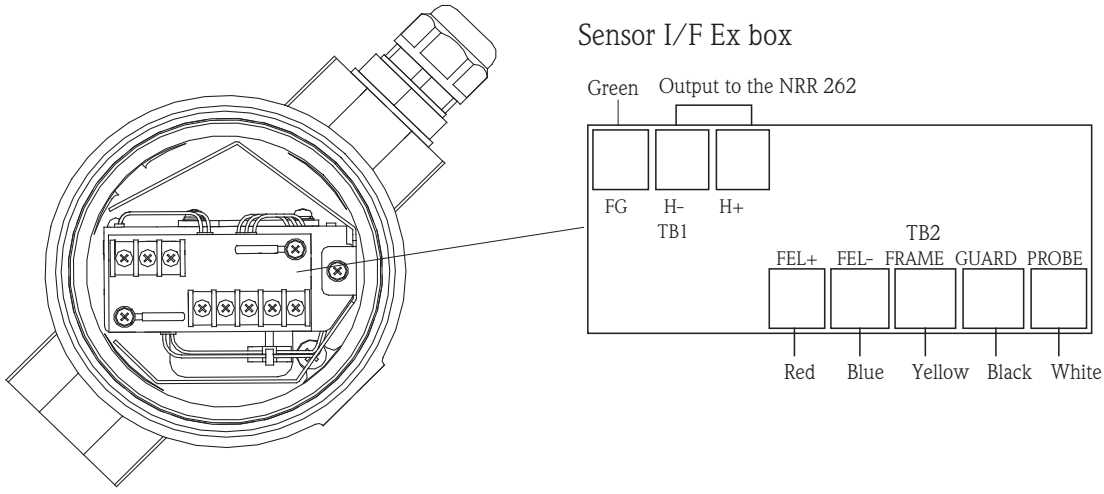


## Ex ia transmitter NRR262-2x

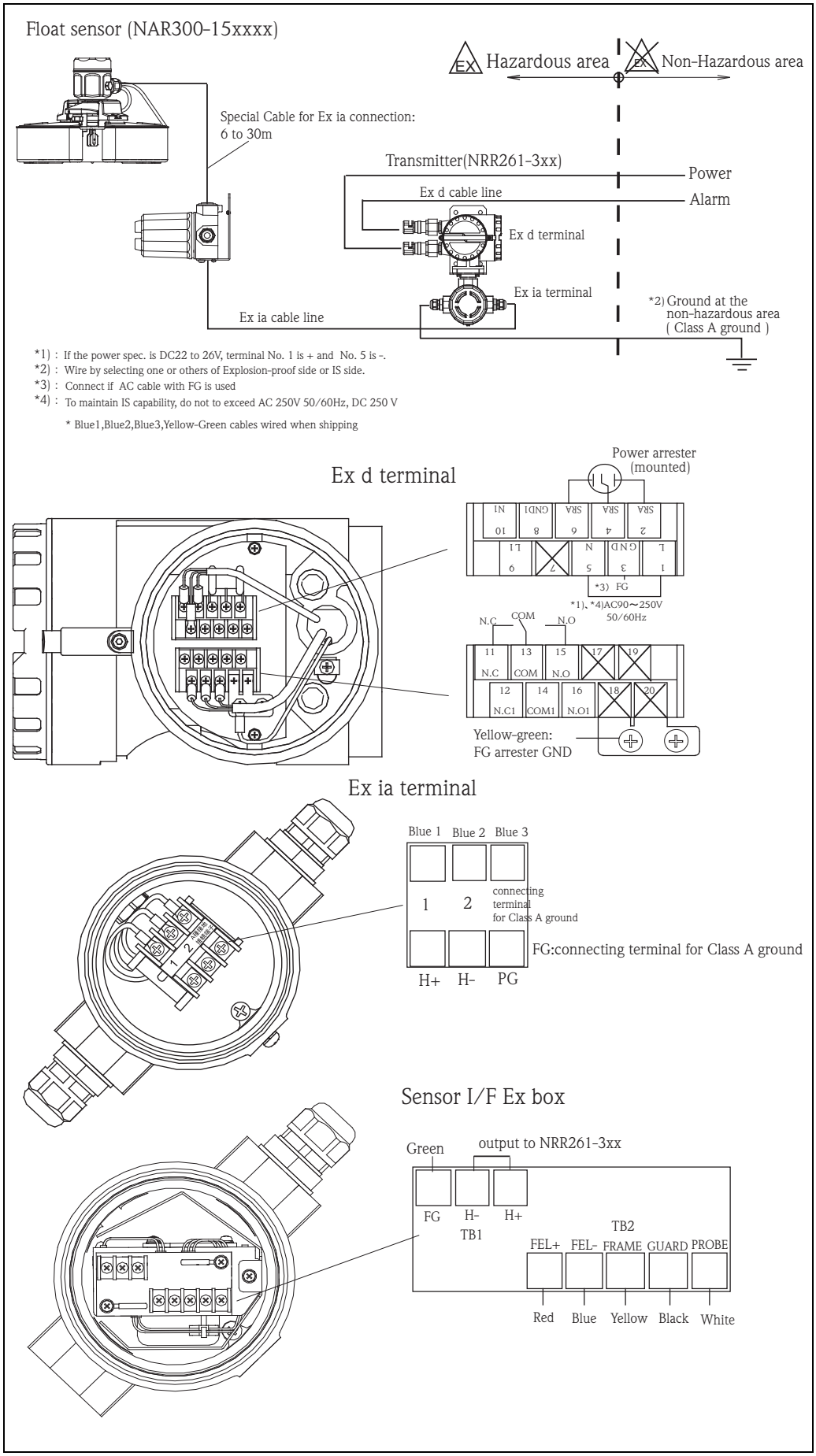


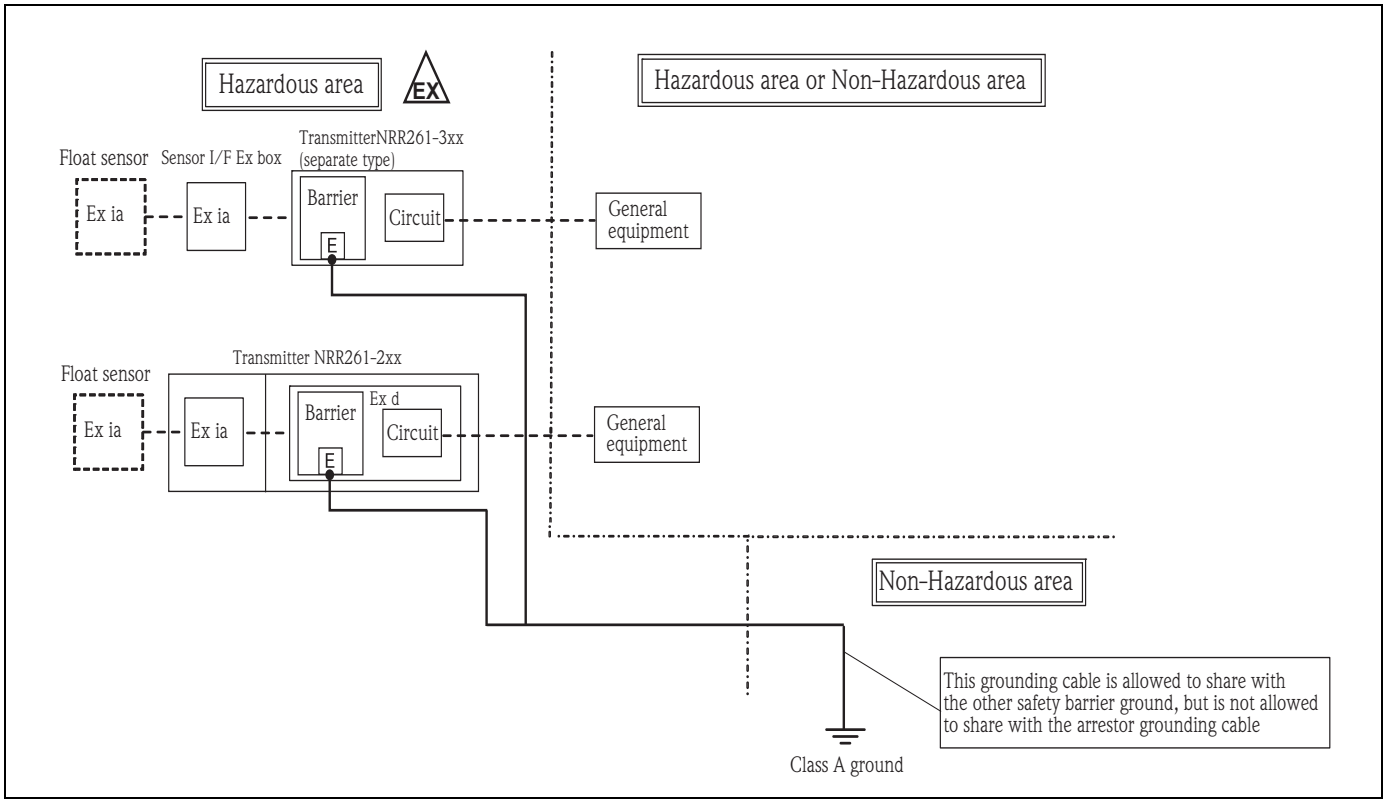

*1) When the power spec. is DC22 to 26V, terminal No. L is + and No. N is –.
*2) To maintain IS capability, do not to exceed AC 250V 50/60Hz, DC 250 V.



## Ex d transmitter NRR261-3xx



**Connection diagram**



# Ordering Information

**Float Sensor NAR300**

| | | |
|---|---|---|
| 10 | | Approval: |
| | 1 | Ex ia IIB T4, TIIS |
| | 9 | Special version, TSP-no. to be spec. |

| | | |
|---|---|---|
| 20 | | Type: |
| | 1 | Float |
| | 2 | Float, Module set (Econounce NRR261 upgrade) |
| | 4 | Float, Ex box(Econounce NRR262 upgrade) |
| | 5 | Float, Ex box (separate type) |
| | 6 | Float, high temperature, Ex box (separate type) |
| | 9 | Special version, TSP-no. to be spec. |

| | | |
|---|---|---|
| 30 | | Output: |
| | A | 2-wire current |
| | Y | Special version, TSP-no. to be spec. |

| | | |
|---|---|---|
| 40 | | Signal Cable: |
| | 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. |

| | | |
|---|---|---|
| 50 | | Float Guide: |
| | 1 | Not used |
| | 2 | Guide 304, weight SS400 |
| | 3 | Guide 304, weight 304 |
| | 9 | Special version, TSP-no. to be spec. |

| | | |
|---|---|---|
| 60 | | Cable Entry: |
| | A | Not needed |
| | B | G1/2 |
| | C | NPT 1/2 |
| | E | M25 |
| | Y | Special version, TSP-no. to be spec. |

| | |
|---|---|
| NAR300- | Complete product designation |

### Transmitter NRR 261

| | | |
|---|---|---|
| 10 | | Approval: |
| | 2 | Ex d[ia] IIB T4, TIIS (NAR300) |
| | 3 | TIIS, Ex d[ia] IIB T4 (NAR300 separate type) |
| | 9 | Special version, TSP-no. to be spec. |

| | | |
|---|---|---|
| 20 | | Power Supply: |
| | A | 90-250VAC 50/60Hz |
| | B | 22-26VDC |
| | Y | Special version, TSP-no. to be spec. |

| | | |
|---|---|---|
| 30 | | Cable Entry: |
| | A | G 3/4 x 2 (Ex d) |
| | B | NPT3/4 x 2 (Ex d) |
| | D | M25 x 2 (Ex d) |
| | E | G3/4 x 2 (Ex d), G1/2 x 1 (Ex ia) |
| | K | G1/2 x 2 (Ex d), G1/2 x 1 (Ex ia) |
| | Y | Special version, TSP-no. to be spec. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NRR261- | | | | | | | | | Complete product designation |

### Transmitter NRR 262

| | | |
|---|---|---|
| 10 | | Approval: |
| | 2 | Ex ia IIB T4, TIIS (NAR 300) |
| | 9 | Special version, TSP-no. to be spec. |

| | | |
|---|---|---|
| 20 | | Power Supply: |
| | A | 90-250VAC 50/60Hz |
| | B | 22-26VDC |
| | Y | Special version, TSP-no. to be spec. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NRR262- | | | | | | | | | Complete product designation |

# Specifications

**Float sensor**
**NAR300**

| | |
|---|---|
| Protection class | IP67 (outdoor installation) |
| Power Supply | by transmitter |
| Wetted material | Float: SUS316L<br>Conductive sensor: SUS316 and PTFE<br>vibration sensor: SUS316 |
| Detection sensitivity*1 | Water-filled pit: 10 +/- 1mm, alarm setting before delivery with kerosene<br>Empty pit: 50 +/- 5mm, alarm setting before delivery with kerosene |
| I/O cable | Exclusive PVC shield cable, including cable float (6m standard) |
| Weight | Approx. 2.5kg (including 6m (PVC) cable). |

*1: Kerosene (relative density approx. 0.8 g/cm3), on water (relative density approx. 1.0 g/cm3), static level condition, no surface tension

**Sensor I/F Ex box**

| | |
|---|---|
| Protection class | IP67 (for outside installation ) |
| Power Supply | NRR262 or NRR262 |
| output signal | Approximately 7 to 16mA |
| Cable entry | NAR300 (Float sensor): G1/2 with a cable gland x1<br>NRR261 or NRR262 (Transmitter): G1/2 thread x1 |
| Weight | Approximately 3.2kg |

**Transmitter NRR261**

| | |
|---|---|
| Protection class | IP67 (for outside installation ) |
| Power Supply | 90 to 250VAC, 50/60Hz<br>22 to 26VDC |
| Power consumption | 20VA/2W |
| Input | Approximately 7 to 16mA from NAR300 / Sensor I/F Ex box |
| Output | Contact output :1SPDT<br>contact rate : 250VAC, 1A, 100VA,<br>100VDC : 1A, 25W<br>Delay setting: 1 to 30 seconds (add 6 seconds as base delay)<br>Failsafe function: available if power fail, frozen sensor (see "alarm output table") |
| Cable entry | Ex d side: G 3/4 x 2, TIIS Ex specified cable glands model SXBM<br>Exi side: G 1/2 x 1, with cable gland |
| Arrester | built-into power supply |
| Weight | Approximately 10 kg |

**Transmitter NRR262**

| | |
|---|---|
| Protection class | IP20 (for outside installation ) |
| Power Supply | 90 to 250VAC, 50/60Hz<br>22 to 26VDC |
| Power consumption | 20VA/2W |
| Input | Approximately 7 to 16mA from NAR300 / Sensor I/F Ex box |
| Output | Contact output :1SPDT<br>contact rate : 250VAC, 1A, 100VA,<br>100VDC : 1A, 25W<br>Delay setting: 1 to 30 seconds (add 6 seconds as base delay)<br>Failsafe function: available if power fail, frozen sensor (see "alarm output table" ) |
| Arrester | built-into power supply |
| Weight | Approximately 0.6 kg |

# Process Conditions

### Float sensor NAR300

| | |
|---|---|
| Detective object | Relative density greater than 0.7 g/cm$^3$ and less than 1.0 g/cm$^3$. When relative density is greater than 0.9 g/cm$^3$, dynamic viscosity must be greater than 1mPa-s.<br>Water is approximately 1 mPa-s.<br>Not soluble in water<br>Non-conductivity<br>Flowing |
| Operating temperature | Ambient: -20 to +60 °C (- 4 to +140 °F)<br>Measured liquid: 0 to +60 °C (+ 32 to +140 °F) |
| Water in pit | Relative density greater than 1.0 g/cm3 and less than1.13 g/cm3. (when kinematic viscosity equals 1mm2/sec) *2<br>Not frozen<br>Conductivity is greater than 10 µS/cm and less than 100 Ω-cm. (greater than 1 µS/cm if float sensor is normally floating on the water)<br>Not salt-water |
| Other | Clean off any debris that sticks to the sensor.<br>Do not let mud cake on the float sensor.<br>Avoid pit conditions that cause the float sensor to tilt off-balance or change the draft-line.<br>Install measures to avoid cross-currents, standing waves. |

*2 pre-delivery setting is done with kerosene on water; therefore sensitivity may differ if the lower liquid is diluted with e.g. antifreeze.

### Sensor I/F Ex box

| | |
|---|---|
| Connecting cable | Maximum inductance 3mH, maximum capacitance 83nF<br>e.g. KPEV (instrumentation cable)<br>C=65nF/km, L=0.65mH/km<br>CW/C=0.83µF/65mH=1.276km [1]<br>LW/L=3mH/0.65mH=4.615 [2]<br>Maximum cable length = 1.27km<br>* The smaller of [1] or [2] is the maximum usable cable length.. |
| Operating temperature | Ambient: -20 to +60 °C (- 4 to +140 °F) |

### Transmitter NRR261

| | |
|---|---|
| Connecting cable | Maximum inductance 3mH, maximum capacitance 83nF<br>e.g. KPEV (instrumentation cable)<br>C=65nF/km, L=0.65mH/km<br>CW/C=0.83µF/65mH=1.276km [1]<br>LW/L=3mH/0.65mH=4.615 [2]<br>Maximum cable length = 1.27km<br>* The smaller of [1] or [2] is the maximum usable cable length.. |
| Operating temperature | Ambient: -20 to +60 °C (- 4 to +140 °F) |

**Transmitter NRR262**

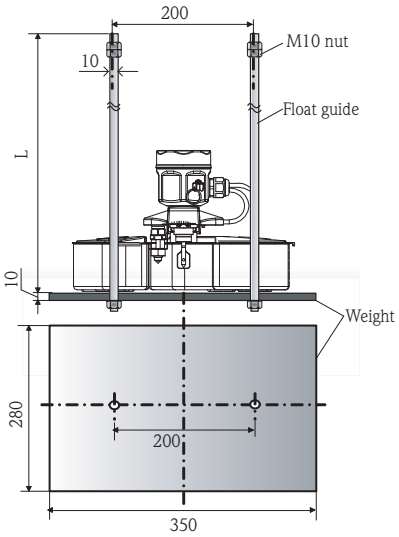
| | |
|---|---|
| Connecting cable | Maximum inductance 3mH, maximum capacitance 83nF<br>e.g. KPEV (instrumentation cable)<br>C=65nF/km, L=0.65mH/km<br>CW/C=0.83µF/65mH=1.276km [1]<br>LW/L=3mH/0.65mH=4.615 [2]<br>Maximum cable length = 1.27km<br>* The smaller of [1] or [2] is the maximum usable cable length.. |
| Operating temperature | Ambient: -20 to +60 °C (- 4 to +140 °F) |

# Accessory

**Float guide**

**Note!**

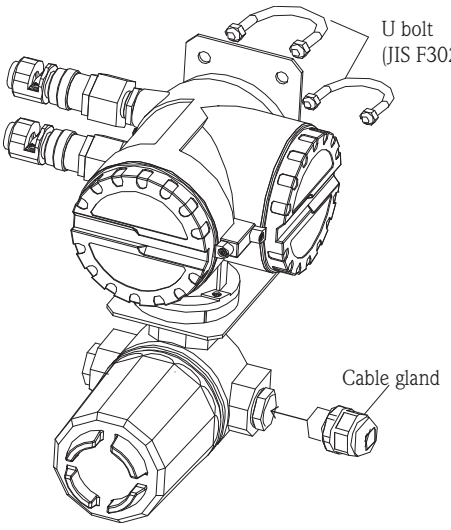
When mounting the float guide weight, set it up horizontally. Remove trash and stones on the pit bottom before mounting the Float Sensor. The length of float guide is 2m (standard), but if you need anything else, please order as special version.




| Name | Delivery quantity | Material |
|---|---|---|
| Float guide | 2 | SUS304 |
| Weight | 1 | SS400<br>SUS304 |
| M10 nut | 6 | SUS304 |

**U bolt and cable gland**

U bolt (JIS F3022 B50) is used for mounting the transmitter. Please prepare a pipe of nominal 50A (2B Ø60.5 mm).
Tighten and fix the cable gland after insert a cable from the float sensor NAR 300.




| Name | Delivery quantity | Material |
|---|---|---|
| Mounting U bolt<br>Accessory : nut<br>: Washer | 2<br>4<br>4 | Carbon steel<br>(chromate) |
| Cable gland | 1 | Nylon |

# Certificates and approvals

**Ex approval**

**TIIS**
Ex ia IIB T4 (Float sensor NAR300-15xxxx、separate type)
Ex d [ia] IIB T4 (Transmitter RR261-3xx、separate type)
Ex d [ia] IIB T4 (Float sensor NAR300-11xxxx + transmitter NRR261-2xx)
Ex ia IIB T4 (NRR262-2x、separate type)

# Documentation

**Operating instructions**

**BA00402G**
Oil leak detecter NAR300 system

**Safety instruction**

**XA00587G-A**
TC18324 (NAR300-15)

**XA00588G-A**
TC18325 (NRR261)

**XA00589G-A**
TC18326 (NRR261)

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