TI00045G/00/EN/22.23-00
71614574
2023-05-15

Technical Information
Oil leak detector NAR300

Oil leak detector equipped with two types of immobile sensors: conductive and tuning fork

Application

This system is designed to be installed in an oil dike pit in a tank or a sump pit near a pump yard, where it can provide the ultimate in leak detection function for petrochemicals or vegetable oils. Sensors with two distinct detection functions, conductive and vibronic, are used to closely monitor conditions. Highly accurate alarm recognition is attained through a two-stage logic process that ensures safe tank yard operation with minimal equipment configuration.

Flame proof system

Using transmitter NRR261 for outdoor installation, it is possible to connect directly to switch input from an existing level transmitter, for example, and send alarm output to a host controller.

Intrinsically safe system

Combining transmitter NRR262 for indoor installation with the sensor I/F Ex box for outdoor installation enables the configuration of an alarm system independent from tank gauging.

Features

- SIL2: Certified for safety instrumented systems in the process industry
- Proprietary sensors with twin functions provide reliable detection:
  - Conductive sensor: Distinguishes between water and other substances (oil and air)
  - Tuning fork sensor: Distinguishes between air and liquid (oil and water)
- Does not require any special attachments, even for empty pits
- No moving parts, long service life and reduced maintenance costs
- Safe and reliable fail-safe function with alarm output in the event of power failure, frozen pit water, etc.
- Detection mechanism that is not affected by the dielectric constant of the object to be detected, as long as the oil is water-insoluble
- Mechanical construction that is less susceptible to material deposits
- Ex [ia] structure

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[Continued from front page]

NOTICE

TIIS specifications

These operating instructions are not intended for products with TIIS specifications.

- If you are using a product with TIIS specifications, download and refer to TI00045G/33/JA21.22 or an earlier version from our website (www.endress.com/downloads).

Table of contents

Document information

Symbols used

Safety symbols

DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

WARNING
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

CAUTION
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Alternating current

Direct current and alternating current

Direct current

Ground connection

A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

Protective earth (PE)

Ground terminals that must be connected to ground prior to establishing any other connections.

The ground terminals are located on the interior and exterior of the device:
- Interior ground terminal: protective earth is connected to the mains supply.
- Exterior ground terminal: device is connected to the plant grounding system.

Tool symbols

Phillips head screwdriver

Flat blade screwdriver

Torx screwdriver

Allen key

Open-ended wrench

Symbols for certain types of information and graphics

Permitted
Procedures, processes or actions that are permitted

Preferred
Procedures, processes or actions that are preferred

Forbidden
Procedures, processes or actions that are forbidden

Tip
Indicates additional information

Reference to documentation

Reference to graphic

▶
Notice or individual step to be observed

1., 2., 3.
Series of steps

Result of a step

Visual inspection

Operation via operating tool

Write-protected parameter

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

⚠ → **Safety instructions**
Observe the safety instructions contained in the associated Operating Instructions

Temperature resistance of the connection cables
Specifies the minimum value of the temperature resistance of the connection cables

Documentation

The following documents can be found in the Download area of our website (www.endress.com/downloads).

For an overview of the scope of the associated Technical Documentation, refer to the following: *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate

Technical Information (TI)

Planning aid
The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

Brief Operating Instructions (KA)

Guide that takes you quickly to the 1st measured value
The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

Operating Instructions (BA)

The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

Function and system design

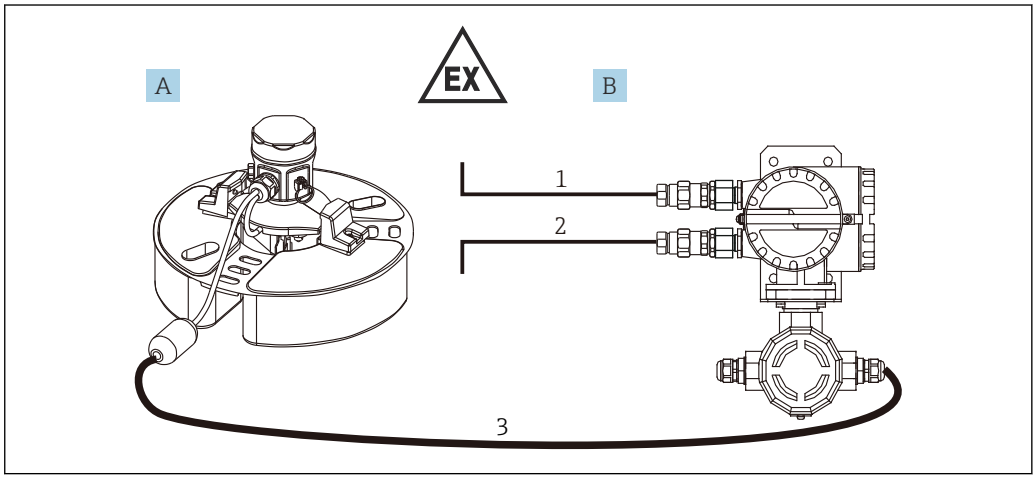
The intrinsically safe Ex ia IIB T4 oil leak detector NAR300 system is available in three configurations for a variety of applications.

Flame-proof system (integrated type) Ex d [ia] IIB T4

This system can handle the entire process, from oil leak detection to alarm output, in hazardous outdoor locations.

Ex [ia] specification is used in the circuitry from the NAR300 float sensor to the wiring terminal box of Ex d [ia] transmitter NRR261 (the dedicated cable and cable entry in between are supplied by Endress+Hauser). Ex d wiring is used from the main unit of Ex d [ia] transmitter NRR261, and it can be connected directly to the junction box that is installed in a yard or to the liquid level transmitter relay input. In this system, the maximum distance between the float sensor and the transmitter is 30 m (98.43 ft).

- JPN Ex: NAR300-21xxxx + NRR261-4xx
- ATEX: NAR300-A1xxxx + NRR261-Axx
- IECEx: NAR300-B1xxxx + NRR261-Bxx
- FM: NAR300-C1xxxx + NRR261-Cxx



1 System configuration 1

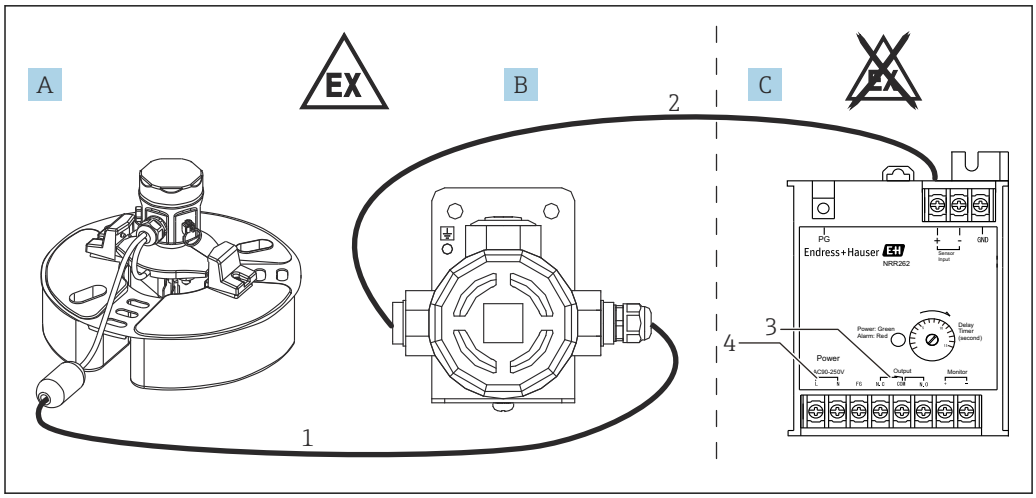
A Float sensor NAR300-x1xxxx
B Ex d [ia] transmitter NRR261 (integrated type)
1 Alarm output: Alarm/PLC/DCS, etc.
2 Power supply (AC/DC)
3 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))

Intrinsically safe system (separate type) Ex ia IIB T4

In this system, Ex [ia] transmitter NRR262 is installed in a non-hazardous location, such as an instrument room, and alarm output is imported by the indoor alarm panel and the host instrumentation receiver.

The signal from the NAR300 float sensor is imported by the Ex [ia] wiring of transmitter NRR262 via a sensor I/F Ex box. For the connection between the float sensor and the sensor I/F Ex box, a dedicated cable and cable entry are provided by Endress+Hauser.

- JPN Ex: NAR300-25xxxx + NRR262-4x
- ATEX: NAR300-A5xxxx + NRR262-Ax
- IECEx: NAR300-B5xxxx + NRR262-Bx
- FM: NAR300-C5xxxx + NRR262-Cx



2 *System configuration 2*

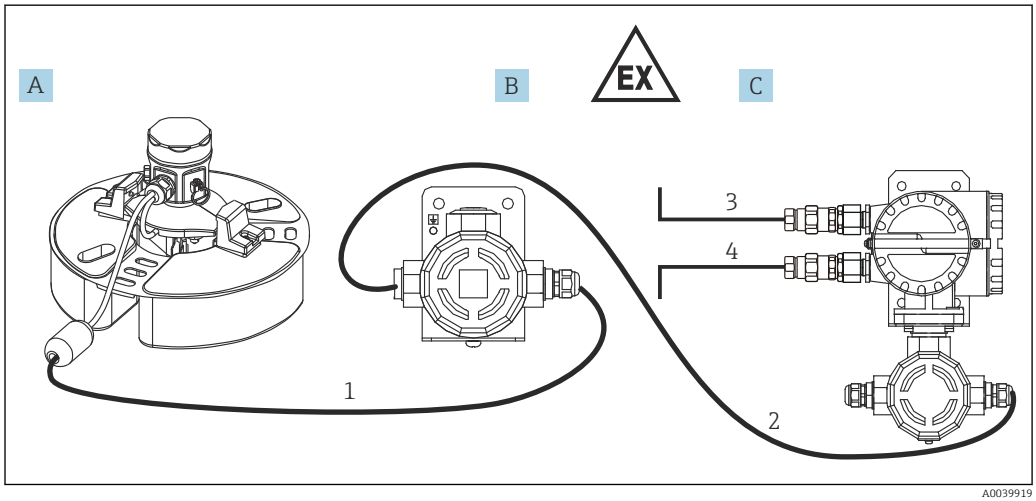
A Float sensor NAR300-x5xxxx
B Sensor I/F Ex box
C Ex [ia] transmitter NRR262
1 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))
2 Cable for sensor I/F Ex box and transmitter (refer to Process conditions)
3 Alarm output: Alarm/PLC/DCS, etc.
4 Power supply (AC/DC)

Flame-proof system (separate type) Ex d [ia] IIB T4

This system can handle the entire process, from oil leak detection to alarm output, at hazardous outdoor locations.

Ex [ia] specification is used in the circuitry from the NAR300 float sensor to the wiring terminal box of Ex d [ia] transmitter NRR261. The signal from the NAR300 float sensor is imported by the Ex [ia] wiring of transmitter NRR261 via a sensor I/F Ex box. Ex d wiring is used from the main unit of Ex d [ia] transmitter NRR261, and it can be connected directly to the junction box that is installed in a yard or to the liquid level transmitter relay input.

- JPN Ex: NAR300-25xxxx + NRR261-5xx
- For ATEX, IECEx and FM specifications, contact your nearest Endress+Hauser Sales Center or distributor.



3 *System configuration 3*

A Float sensor NAR300-x5xxxx
B Sensor I/F Ex box
C Ex d [ia] transmitter NRR261 (separate type)
1 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))
2 Cable for sensor I/F Ex box and transmitter (refer to Process conditions)
3 Alarm output: Alarm/PLC/DCS, etc.
4 Power supply (AC/DC)

Operating principles

Tuning fork sensor

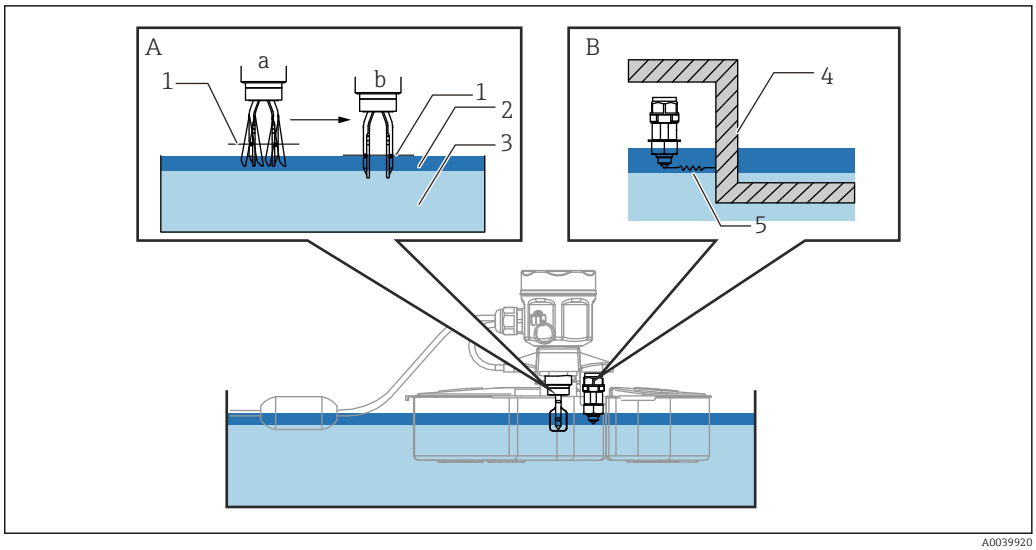
The tuning fork sensor determines if there is liquid (water or oil, ON) or no liquid (air, OFF). In addition, it vibrates when the liquid is below the operating point (no liquid), and stops vibrating when the liquid is above the operating point (liquid is present).

Conductive sensor

The conductive sensor detects and determines whether there is a conductive substance (water, OFF) or non-conductive substance (air or oil, ON) between the electrode and the float body.

Name	Water	Air	Oil
Tuning fork sensor	ON	OFF	ON
Conductive sensor	OFF	ON	ON

An alarm is activated when the tuning fork sensor and the conductive sensor are both ON.



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4 *Principles of the sensors*

A Tuning fork sensor
B Conductive sensor
a Vibrating (liquid is below the operating point)
b Vibration stopped (liquid is above the operating point)
1 Operating point
2 Oil
3 Water
4 Metal portion of the float body
5 Measuring conductivity

Detection in water-filled pits

1. The conductive sensor continuously monitors conductivity between the probe and the float body before the tuning fork sensor does.
2. Since the conductive sensor is normally detecting water, which is a conductive substance, it stays OFF and an alarm status is not recognized regardless of the status of the tuning fork sensor.
3. If an accident causes oil flow and an oil layer begins to form on the water surface, the conductive sensor will detect the non-conductive oil and the alarm status switches to ON.
4. Since the tuning fork sensor has already detected liquid and its alarm status is ON, this establishes an ON/ON logic.
5. An alarm is activated.

Detection in an empty pit (installed on a ground surface)

1. In an empty pit with no water, the alarm status is ON because the conductive sensor is monitoring non-conductive air.
2. However, since it is an empty pit and there is no liquid, the tuning fork sensor remains OFF, and therefore an alarm status is not recognized.
3. If the main unit of the float sensor floats on a water surface, such as when water has entered the pit due to rainfall, water is now present and it will switch to detection logic.
4. If an accident causes oil infiltration, the tuning fork sensor will detect liquid following the conductive sensor, which is already ON, establishing an ON/ON logic.
5. An alarm is activated.

Operating principles of alarm activation

The oil leak detection signal detected by the NAR300 float sensor is converted to a current signal in the transmitter or the sensor I/F Ex box. After this, it is connected to the current detection circuit via the Ex [ia] safety barrier in the transmitter. In the current detection circuit, the presence or absence of an oil leak alarm signal is determined by the magnitude of electrical current values, and the alarm output relay is turned on or off by the operation delay circuit. The delay time can be set, and there is a trimmer for setting the delay time in the alarm delay circuit. A fail-safe function is available in the relay contact output (refer to the "Alarm output table" below).

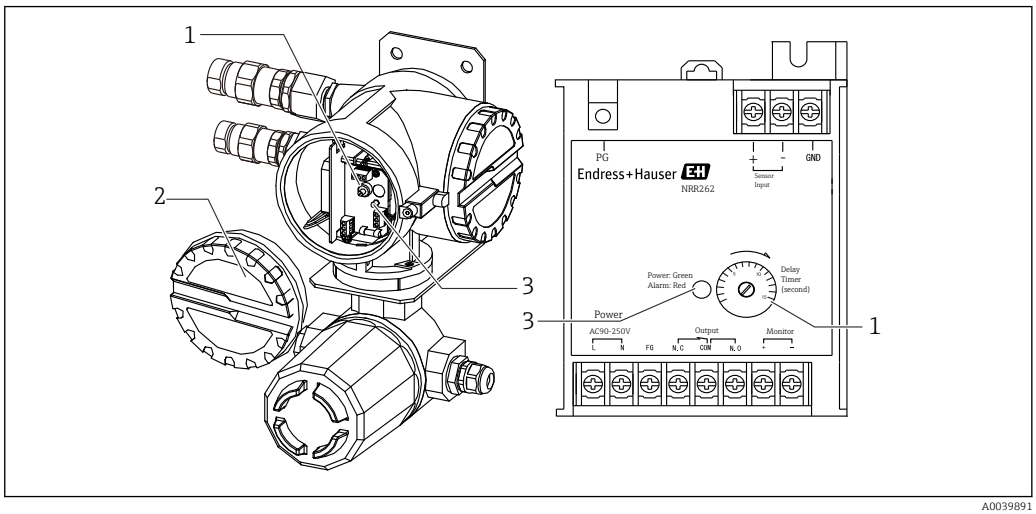
Alarm output table

NRR261/NRR262 terminals		Between NC and COM	Between NO and COM
Condition	Non-alarm	Contact point is open	Contact point is closed
	Oil leak alarm	Contact point is closed	Contact point is open
	Power OFF		
	Frozen liquid		

NAR300 current value	
Non-alarm	12 mA
Oil leak alarm	16 mA
Other trouble	< 10 mA or 14 mA <

The only adjustment that can be made on the transmitter is the delayed activation time (ON delay) setting for the alarm output relay. Time is set on the delay trimmer. In NRR261, the delay trimmer can be found by turning off the power and opening the main unit's cover. In NRR262, the delay trimmer is found on the case surface. Match the setting to the necessary delay time in units of seconds. Delayed activation is used to prevent a false alarm by recognizing an alarm condition that continues over a certain period of time as an alarm while not outputting an alarm when the alarm condition stops within the delay time setting. This can be set up to a maximum of 15 seconds for SIL specifications.

A response delay time in the detection circuit of approximately 6 seconds is always added to the delay time of the delay trimmer.



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5 *Transmitter NRR261 (left) / transmitter NRR262 (right)*

1 *Delay trimmer*
2 *Cover*
3 *LED power (green) / alarm (red)*

Operating conditions

Detection sensitivity

If the electrode tip is pulled out of the lower-layer water due to increased thickness of the oil layer, water may cling onto the electrode tip like an icicle even if the electrode tip is in oil. In this case, detection sensitivity may increase by 1 to 2 mm (0.04 to 0.08 in). When an accurate sensitivity check is required, apply a small amount of neutral detergent to the electrode tip to keep water from clinging to the electrode.

- Water-filled pit: Set to 10 (0.39) ± 1 mm (0.04 in) with kerosene at the time of shipment from the factory
- Empty pit: 50 (1.97) ± 5 mm (0.2 in) with kerosene

Set with oil (kerosene: specific gravity approx. 0.8), lower-layer water (water: specific gravity approx. 1.0), static level condition and/or without surface tension.

Pit water

Do not use in sea water

The oil leak detector is not designed for use in sea water. The following problems may occur if it is used in sea water:

- Failed or delayed alarm when overturned by waves
- Delayed alarm caused by generation of a bypass circuit between the conductive sensor and the float body due to salt coating
- Corrosion of the float sensor caused by sea water

Special pit water

- If the float sensor is used in certain special pit water, such as pit water containing solvents, it may become corroded or damaged.
- It cannot measure highly hydrophilic liquids, such as alcohol.

Pit water with high electrical resistance

Use in pit water with high electrical resistance, such as in a steam drain and pure water, may activate the alarm. Ensure that the conductivity of pit water is at least 10 µS/cm (not more than 100 kΩ·cm).

Example, pure water: 1 to 0.1 µS/cm (1 to 10 MΩ·cm)

Frozen pit water

If ice forms in the pit, the alarm may be triggered (fail-safe function). Implement anti-freeze measures to prevent freezing.

Gasoline application

If the substance to be detected is gasoline, or if the system is to be used in an atmosphere that is constantly exposed to volatile oil vapor, contact your nearest Endress+Hauser Sales Center and order the gasoline application specifications under special specifications.

Input and output

Ex d [ia] transmitter NRR261

Contact output	1SPDT
Maximum contact rating	250 V_{AC}, 1 A, 100 VA 100 V_{DC}: 1 A, 25 W
Fail-safe function	Fail safe function: When the power is off, when frozen (see "Alarm output operation table")

Ex [ia] transmitter NRR262

Contact output	1SPDT
Maximum contact rating	250 V_{AC}, 1 A, 100 VA 100 V_{DC}: 1 A, 25 W
Fail-safe function	Fail safe function: When the power is off, when frozen (see "Alarm output operation table")

Power supply

Float sensor NAR300

Power supply	Provided by a sensor I/F Ex box or NRR261 (NAR300 integrated type)
I/O cable	Dedicated shielded cable (PVC) / with cable float (standard 6 m (19.69 ft))

Ex [ia] sensor I/F Ex box

Power supply	Supplied by NRR261 or NRR262
Cable entry	▪ NAR300 (float sensor) side: G1/2, with cable gland ▪ NRR261 or NRR262 (transmitter) side: G1/2, NPT1/2, M20

Ex d [ia] transmitter NRR261

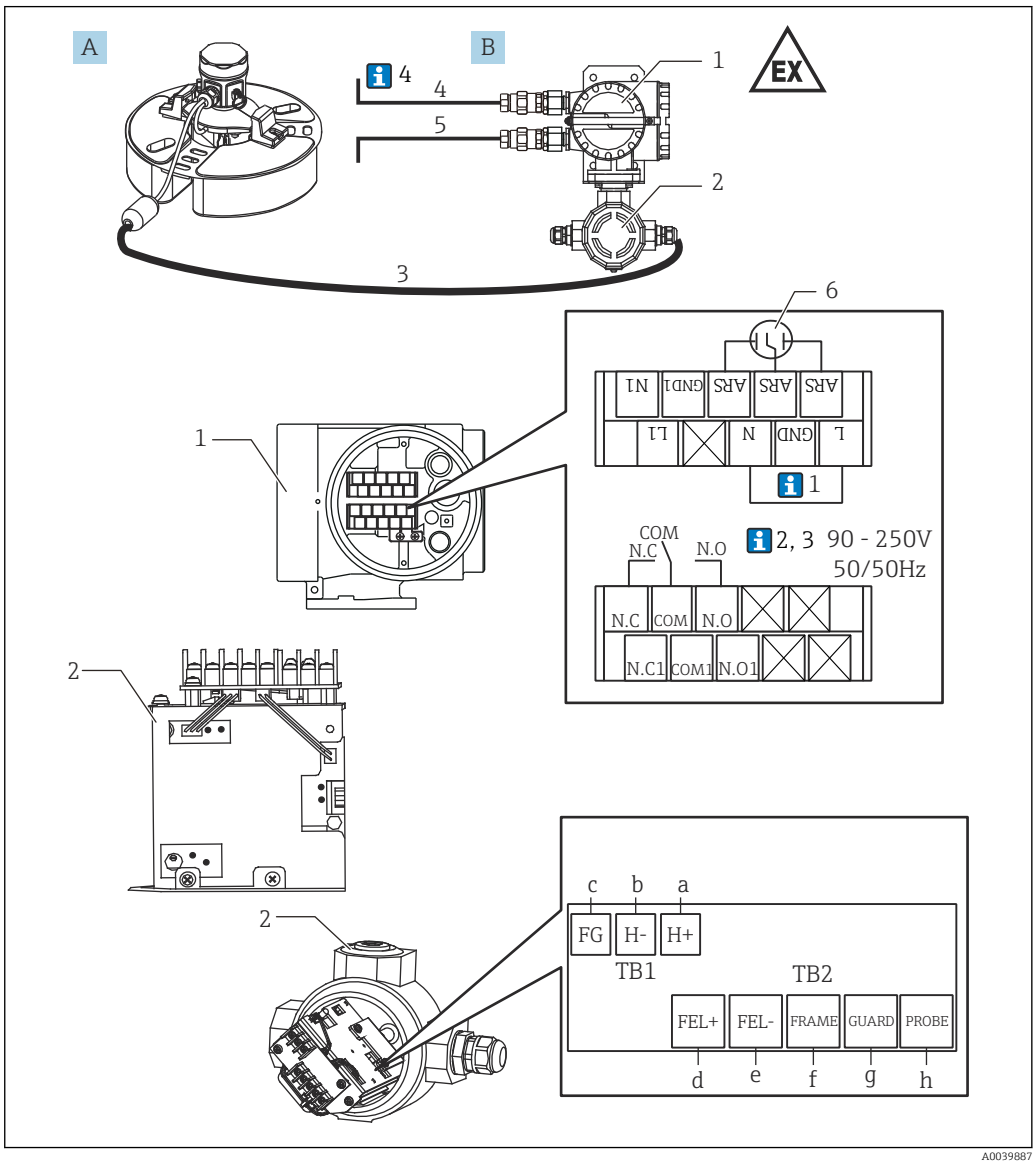
Permissible power-supply voltage range	▪ AC power supply type: 90 to 250 V_{AC}, 50/60 Hz ▪ DC power supply type: 22 to 26 V_{DC} (built-in power supply arrester)
Maximum power consumption	▪ AC power supply type: 20 VA ▪ DC power supply type: 2 W
Power supply port	▪ G3/4 x2 (Ex d), G1/2 x1 (Ex ia) ▪ G1/2 x2 (Ex d), G1/2 x1 (Ex ia) ▪ NPT3/4 x2 (Ex d), NPT1/2 x1 (Ex ia) ▪ NPT1/2 x2 (Ex d), NPT1/2 x1 (Ex ia) ▪ M25 x2 (Ex d), M20 x1 (Ex ia) ▪ M20 (Ex d), M20 x1 (Ex ia) ▪ JPNEx explosion-proof specifications are equipped with cable gland model SFLU
Lightning arrester	Built-in (power supply arrester)

Ex [ia] transmitter NRR262

Permissible power-supply voltage range	▪ AC power supply type: 90 to 250 V_{AC}, 50/60 Hz ▪ DC power type: 22 to 26 V_{DC} (built-in power supply arrester AV3P-2)
Maximum power consumption	▪ AC power supply type: 20 VA ▪ DC power supply type: 2 W
Lightning arrester	Built-in (power supply arrester)

Electrical connection

NRR261-4/A/B/C wiring



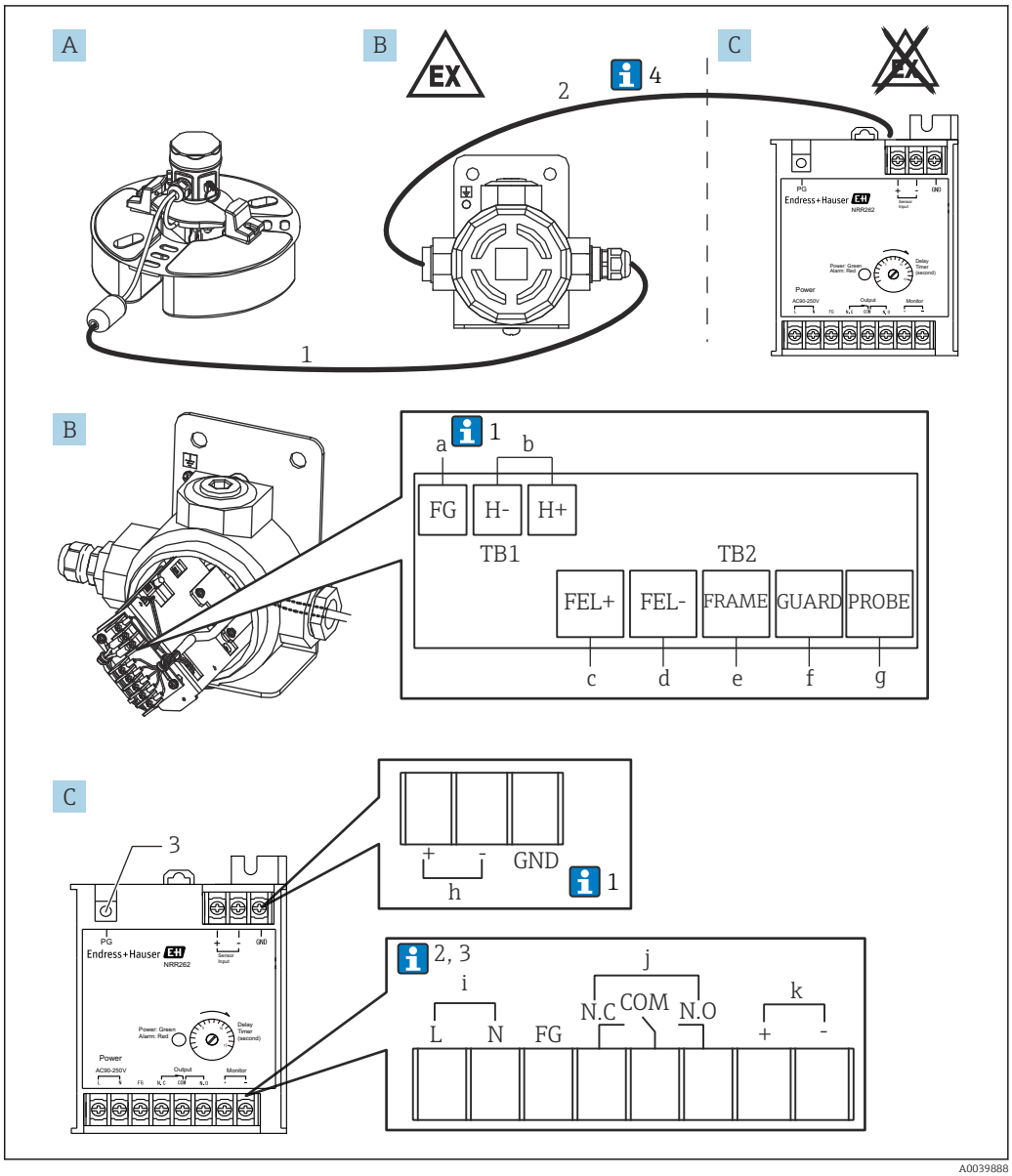
6 *Wiring of Ex d [ia] Converter NRR261-4/A/B/C*

A Float sensor NAR300-x1xxxx
B Ex d [ia] Converter NRR261 (integrated type)
a Blue 1 (already wired at shipping), screw (M3)
b Blue 2 (already wired at shipping), screw (M3)
c Green, screw (M3)
d Red, screw (M3)
e Blue 3, screw (M3)
f Yellow, screw (M3)
g Black, screw (M3)
h White, screw (M3)
1 Ex d terminal
2 Ex [ia] terminal
3 Ex [ia]-dedicated connection cable used (6 to 30 m (19.69 to 98.43 ft): Supplied with the product depending on the option code)
4 Power supply: AC/DC
5 Alarm output: Alarm/PLC/DCS, etc.
6 Power supply arrester (installed)

Below, the numbers correspond to the description in the diagram.

1. The GND between L and N of NRR261 is connected when an FG-equipped AC cable is used.
2. When the power supply is 22 to 26 V_{DC}, terminal number L is + (plus) and N is - (minus).
3. In order to maintain the Ex [ia] performance, ensure that the power supply voltage does not exceed 250 V_{AC}50/60 Hz and 250 V_{DC} during normal time and abnormal time, respectively.
4. The cable for connecting NAR300 and NRR261 (3) is included with NAR300. The alarm output cable (4) from NRR261 and the power cable (5) to NRR261 are not included and must be procured by the customer. For detailed information on the connection cables, refer to the "Process conditions" section.

NRR262-4/A/B/C wiring



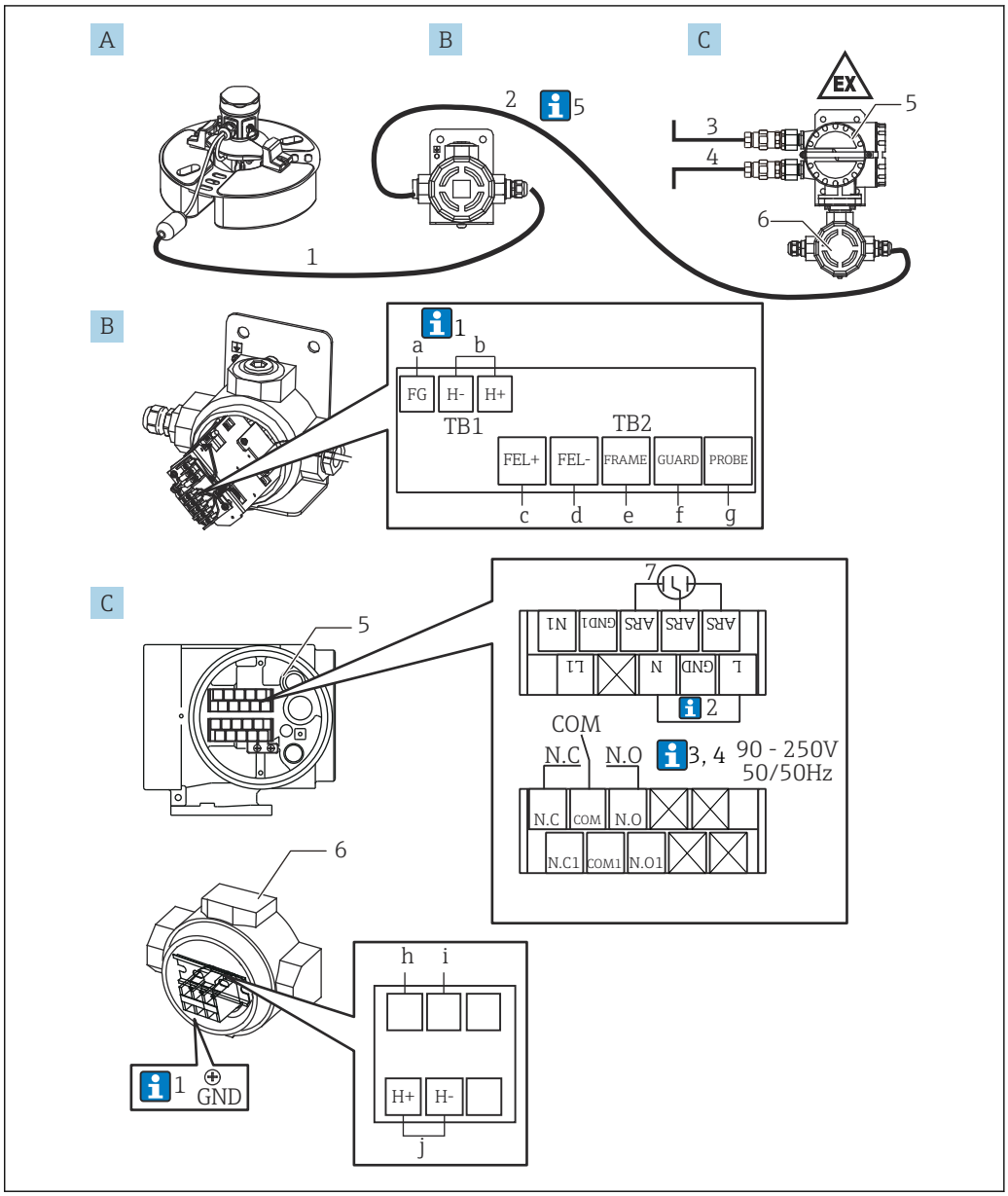
7 *Wiring of Ex [ia] Converter NRR262-4/A/B/C*

A Float sensor NAR300-x5xxxx (sensor I/F Ex box is also included in the code)
B Sensor I/F Ex box
C Ex [ia] Converter NRR262
a Green, screw (M3) (see 1 below)
b Output to NRR262, screw (M3)
c Red, screw (M3)
d Blue, screw (M3)
e Yellow, screw (M3)
f Black, screw (M3)
g White, screw (M3)
h Input from sensor I/F Ex box, screw (M3)
i 90 to 250 V_{AC} 50/60 Hz, screw (M3)
j Alarm output, screw (M3)
k Check monitor output, screw (M3)
1 Ex [ia]-dedicated connection cable used (6 to 30 m (19.69 to 98.43 ft): Supplied with the product depending on the option code)
2 Sensor I/F Ex box and NRR262 cable (must be prepared by the customer)
3 For protective grounding, screw (M4)

Below, the numbers correspond to the description in the diagram.

1. Normally, only the FG of a sensor I/F Ex box is shielded; however, depending on the installation environment, either the GND of NRR262 alone or both the FG of the sensor I/F Ex box and the GND of NRR262 are connected.
2. When the power supply is 22 to 26 V_{DC}, terminal number L is + (plus) and N is - (minus).
3. In order to maintain the Ex [ia] performance, ensure that the power supply voltage does not exceed 250 V_{AC}50/60 Hz and 250 V_{DC} during normal time and abnormal time, respectively.
4. Although cable (1) that connects NAR300 and a sensor I/F Ex box is included with the device, a cable (2) that connects a sensor I/F Ex box and NRR262 is not included, and it must be procured by the customer. For detailed information on the connection cables, refer to the "Process conditions" section.

NRR261-5 wiring



8 *Wiring of Ex d [ia] Converter NRR261-5*

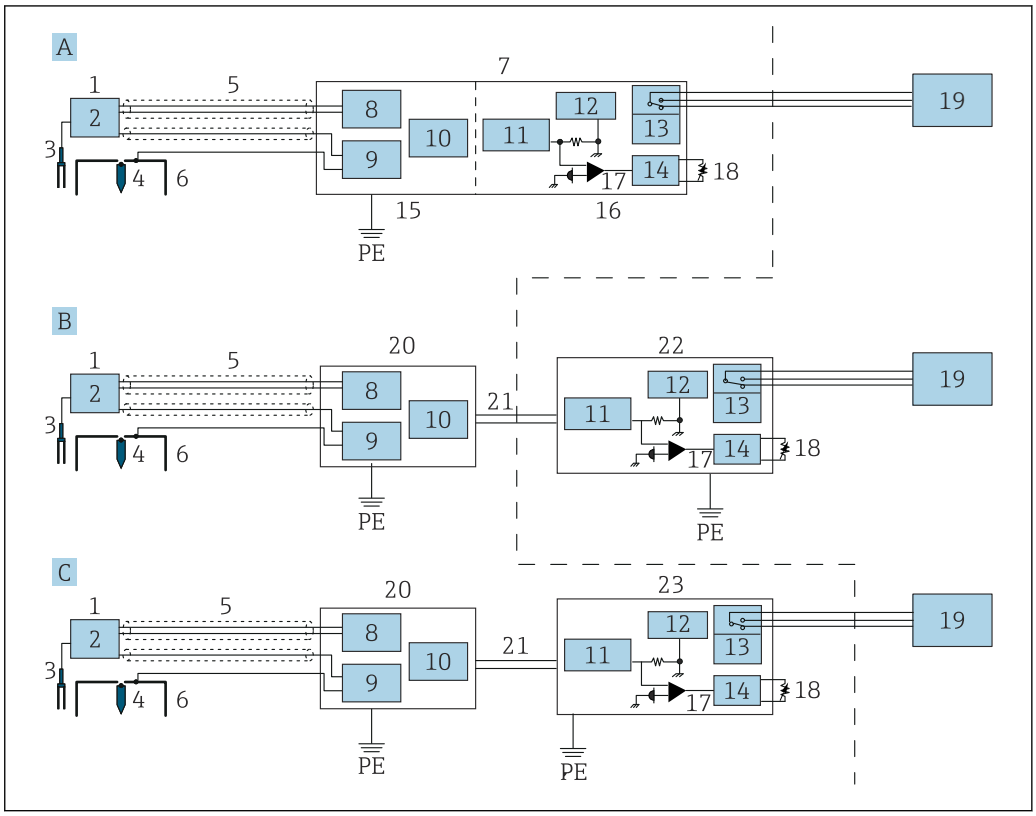
A *Float sensor NAR300-x5xxxx (sensor I/F Ex box is also included in the code)*
B *Sensor I/F Ex box*
C *Ex d [ia] Converter NRR261 (separate type)*
a *Green, screw (M3) (see 1 below)*
b *Output to NRR261-3/5xx, screw (M3)*
c *Red, screw (M3)*
d *Blue 1, screw (M3)*
e *Yellow, screw (M3)*
f *Black, screw (M3)*
g *White, screw (M3)*
h *Blue 2, screw (M4) (connected at the time of shipping)*
i *Blue 3, screw (M4) (connected at the time of shipping)*
j *Input from sensor I/F Ex box, screw (M4)*
1 *Ex [ia]-dedicated connection cable used (6 to 30 m (19.69 to 98.43 ft): Supplied with the product depending on the option code)*
2 *Sensor I/F Ex box and NRR261 cable (must be prepared by the customer)*
3 *Power supply: AC/DC*
4 *Alarm output: Alarm/PLC/DCS, etc.*

5 Ex d terminal
6 Intrinsically safe terminal
7 Power supply arrester (installed), screw (M3)

Below, the numbers correspond to the description in the diagram.

1. Normally, only the FG of a sensor I/F Ex box is shielded; however, depending on the installation environment, either the GND of NRR262 alone or both the FG of the sensor I/F Ex box and the GND of NRR262 are connected.
2. The GND between L and N of NRR261 is connected when an FG-equipped AC cable is used.
3. When the power supply is 22 to 26 V_{DC}, terminal number L is + (plus) and N is - (minus).
4. In order to maintain the Ex [ia] performance, ensure that the power supply voltage does not exceed 250 V_{AC}50/60 Hz and 250 V_{DC} during normal time and abnormal time, respectively.
5. The cable for connecting NAR300 and the sensor I/F Ex box (1) is included with NAR300. Cable (2) for connecting the sensor I/F Ex box to NRR261, the alarm output cable (3) from NRR261, as well as the power cable (4) to NRR261 are not included and must be procured by the customer. For detailed information on the connection cables, refer to the "Process conditions" section.

Wiring diagram

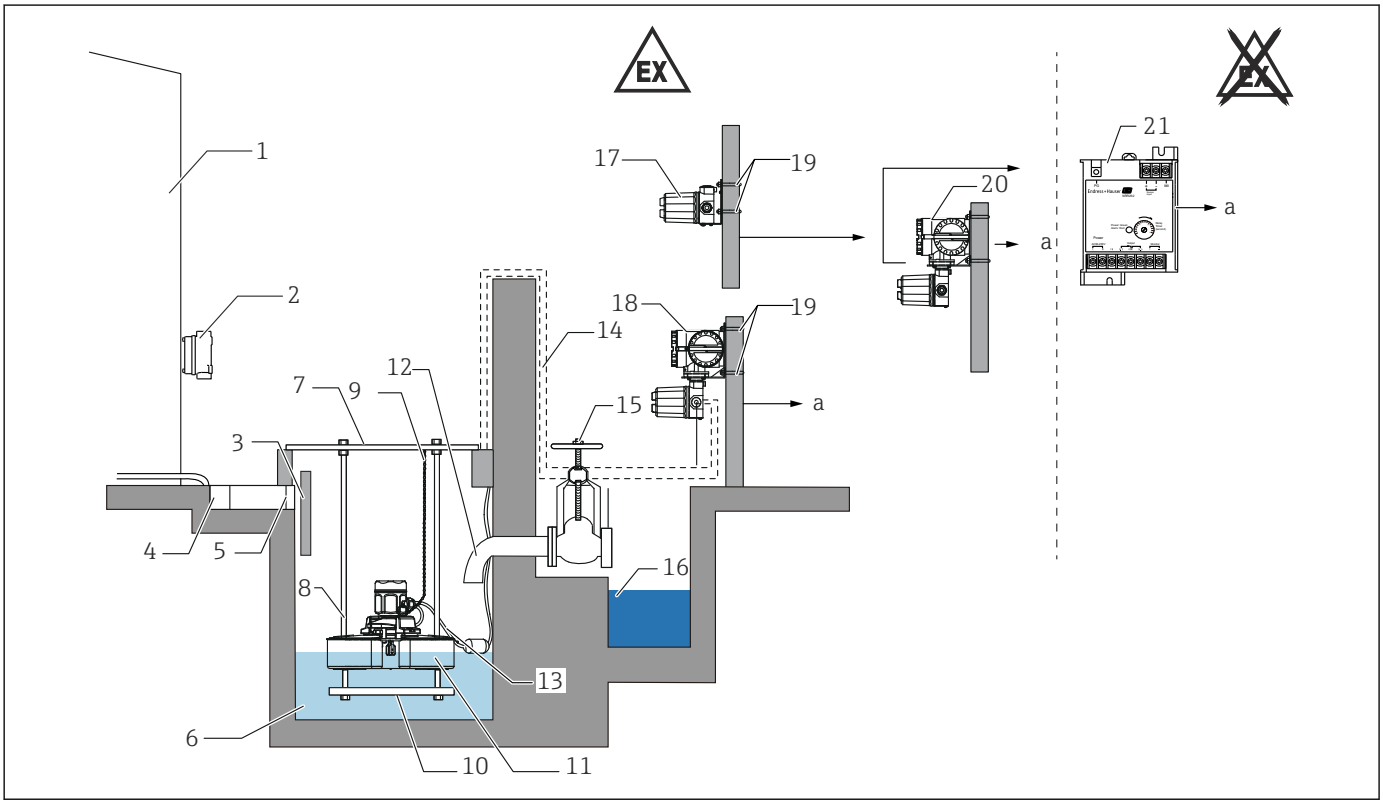


9 *Wiring diagram*

A *Ex d-type converter system (integrated type)*
B *Intrinsically safe-type converter system (separate type)*
C *Ex d [ia] converter system (separate type)*
PE *Protection earth (protective grounding)*
1 *Float sensor NAR300*
2 *Tuning fork driving unit*
3 *Tuning fork*
4 *Conductivity detection electrode (sensor)*
5 *Dedicated cable*
6 *Conductivity detection electrode (float)*
7 *Converter NRR261 (integrated type)*
8 *Liquid detection circuit*
9 *Conductivity detection circuit*
10 *Current output circuit*
11 *Safety barrier*
12 *Power supply circuit*
13 *Relay*
14 *Delay circuit*
15 *Ex [ia] circuit*
16 *Ex d circuit*
17 *Current detection*
18 *Delay trimmer*
19 *Alarm*
20 *Sensor I/F Ex box*
21 *Current signal*
22 *Converter NRR262*
23 *Converter NRR261 (separate type)*

Installation

Installation conditions



10 NAR300 + NRR26x

a Alarm output
1 Tank
2 Junction box
3 Divider
4 U-shaped groove
5 Screen
6 Pit
7 Pit cover
8 Float guide
9 Chain
10 Weight
11 Float sensor NAR300
12 Dispensing nozzle (at least 100 mm (3.94 in))
13 Dedicated cable (included with NAR300)
14 Cable
15 Valve
16 Drainage groove
17 Ex [ia] sensor I/F Ex box
18 NRR261 (Ex d [ia] converter)
19 U-bolts (JIS F3022 B50)
20 NRR261 (Ex d [ia] converter)
21 NRR262 (Ex [ia] converter)

To ground the barrier, connect to the tank or use the remote cable's shield. For more information on using the remote cable's shield, refer to "Electrical connection."

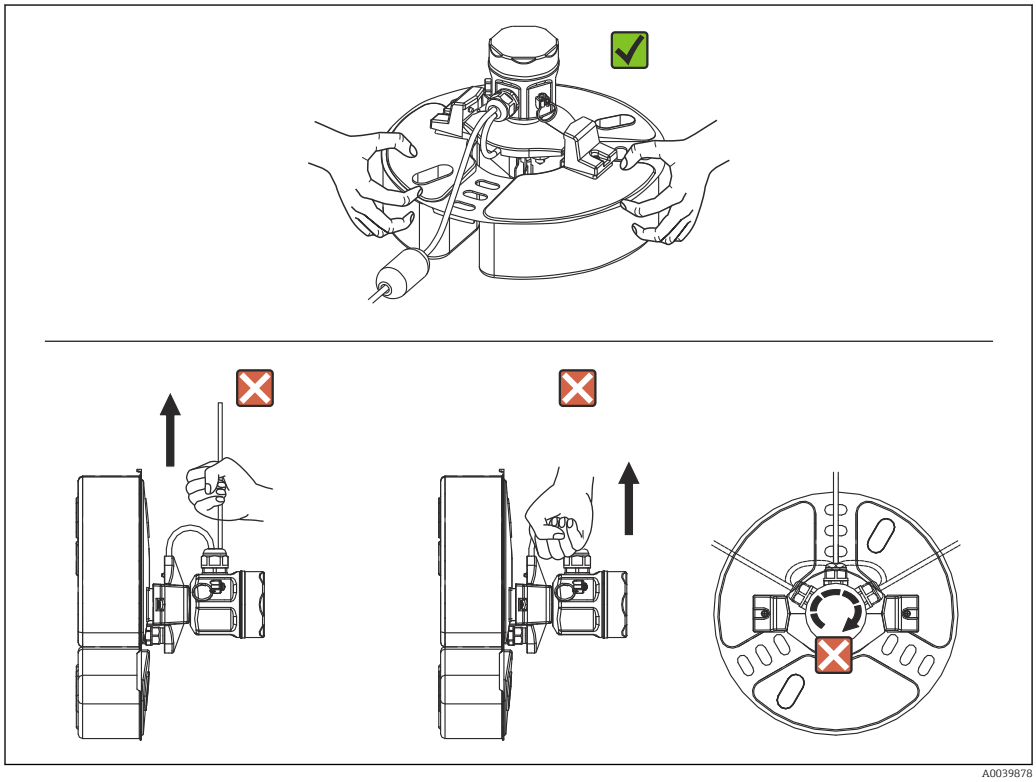
Installation/mounting-related precautions

1. Installation of debris protection, a roof or a cover is recommended to prevent debris or snow from entering the pit. If there is snow accumulation on the float sensor, each 50 g of snow will cause an increase in draft by 1 mm (0.04 in), resulting in reduced sensitivity. If there is a risk of the ambient temperature exceeding 50 °C (122 °F), install a sun shade to protect the float sensor from direct sunlight. Mount a covering above the top of the pit inlet to avoid submerging the float sensor housing if the pit water overflows due to heavy rainfall, etc. If the float sensor becomes submerged, it may result in a malfunction or damage.
2. If the float sensor becomes off balance (tilted by approximately 3 ° or more), it may cause a malfunction or delayed alarm. To prevent this, use a float guide as much as possible, and arrange the cables and chains strategically.
3. Install a screen at the pit inlet so that debris can be removed. Inspect and clean the sensor and the pit periodically as clogging caused by debris and foreign matter may result in a malfunction.
4. Attaching a chain to the side ring on the float sensor head in advance will improve convenience. However, each 50 g of increased load on the float will increase the draft by 1 mm (0.04 in), resulting in reduced sensitivity. Also, if a chain is used to prevent the float sensor from flowing out, do not yank on the chain during inspection, etc.
5. When the pit is completely filled with water, an oil layer will not form inside the pit even if oil spills out. Ensure that the water is drained as necessary so that an oil layer can form.
6. Do not yank on the cables or carry the device by holding on to the cables as this may cause a malfunction and/or poor waterproofing.
7. If the valve is constantly open, ensure that an oil layer can form, such as by bending the tip of the discharge nozzle downwards by at least 100 mm (3.94 in). 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 shown above, install an oil-water divider so that an oil layer can form.
8. Install a divider to prevent large waves, cross-currents or water from splashing onto the float when liquid flows in.
9. If the pit is too large, divide the pit with an oil separator. Oil leakage cannot be detected unless there is significant outflow of oil in proportion to the surface area.
10. Install NAR300, NRR261 and a sensor I/F Ex box at least 50 cm (1.64 ft) apart from each other.

Mounting the NAR300 system

Handling precautions

Always use both hands to hold the float when carrying NAR300. Do not lift or hold by any of the components shown in the figure below, and do not lift by the upper portion of the float sensor. In addition, do not rotate the housing. Doing so may cause device failure.

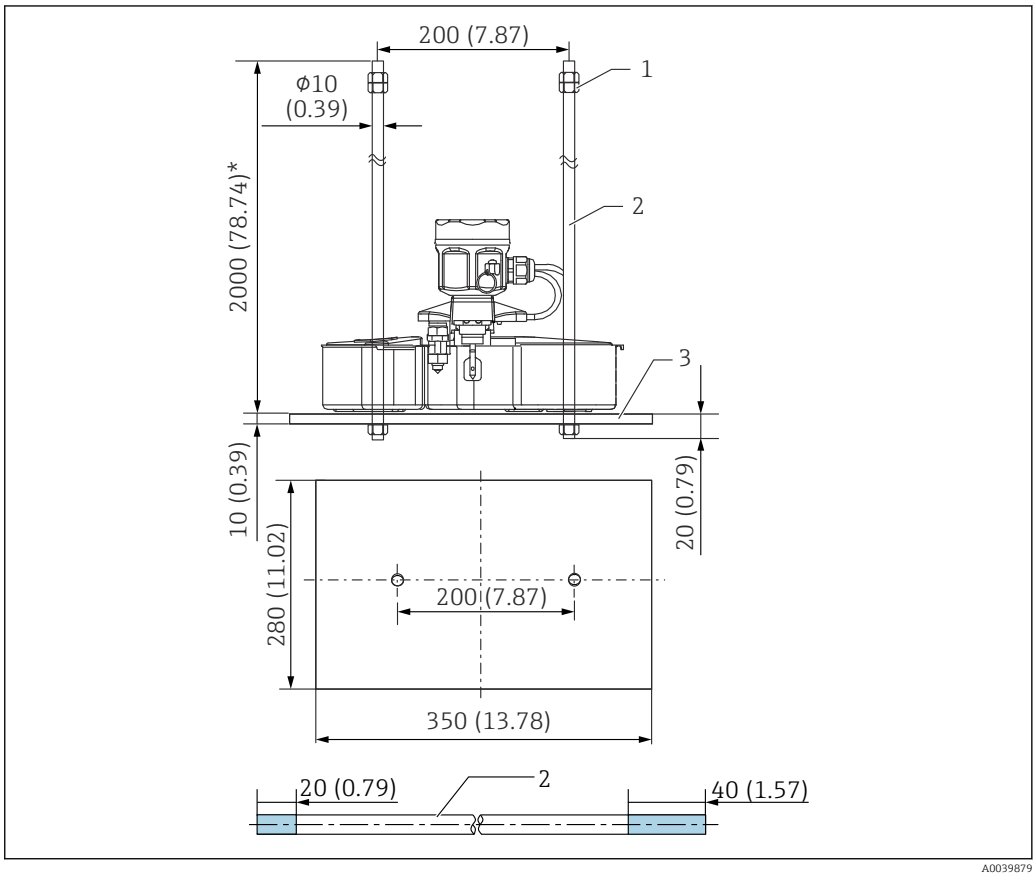


11 *Handling the NAR300*

Float guide mounting

NAR300 may be mounted on a float guide that has been installed for existing products (CFD10, CFD30, UFD10, NAR291, NAR292).

If the float guide is shorter than 2 000 mm (78.74 in), either cut and use it or follow the protocol for when it is 2 000 mm (78.74 in) or longer and contact your nearest Endress+Hauser Sales Center or distributor.



12 *NAR300 / float guide. Unit of measurement mm (in)*

1 Nut (M10)
2 Float guide
3 Weight

The 20 mm (0.73 in) and 40 mm (1.57 in) of the float guide in the diagram represent lengths of the thread grooves.

Environment

Protection class

Item	Description
Float sensor NAR300	IP67 (outdoor installation)
Ex [ia] sensor I/F Ex box	
Ex d [ia] transmitter NRR261	
Ex [ia] transmitter NRR262	IP20 (indoor installation)

Process

Float sensor NAR300

Item	Description
Requirements for substance detection	▪ Density is at least 0.7 g/cm^3 but less than 1.0 g/cm^3 ▪ Floats in water (if the density is 0.9 g/cm^3 or higher, the viscosity must be at least 1 mPa·s. Water ≒ 1 mPa·s) ▪ Water-insoluble ▪ Non-conductive ▪ Liquid ▪ Low affinity with water (a layer of the substance must be formed on the water)
Operating temperature	▪ Ambient temperature: −20 to 60 °C (−4 to 140 °F) ▪ Measured liquid temperature: 0 to 60 °C (32 to 140 °F)
Requirements for pit water	▪ Density is at least 1.0 g/cm^3 but less than 1.13 g/cm^3 (only if the kinematic viscosity is 1 mm^2/sec) [1)] ▪ Not frozen ▪ Conductivity is at least 10 µS/cm (not more than 100 kΩ·cm) ▪ Cannot be used at sea level or in locations that may be penetrated by seawater
Other	▪ Promptly remove any debris that adheres to the sensor unit. ▪ Ensure that there is no caked-on mud (dried solids), etc. ▪ Avoid installation conditions that cause the float sensor to tilt off-balance or change the draft line. ▪ Install measures, such as a breakwater, to avoid cross-currents and waves.

1) Sensitivity will vary with the specific gravity of lower-layer water that differs from the factory-setting environment, such as when an antifreeze is used.

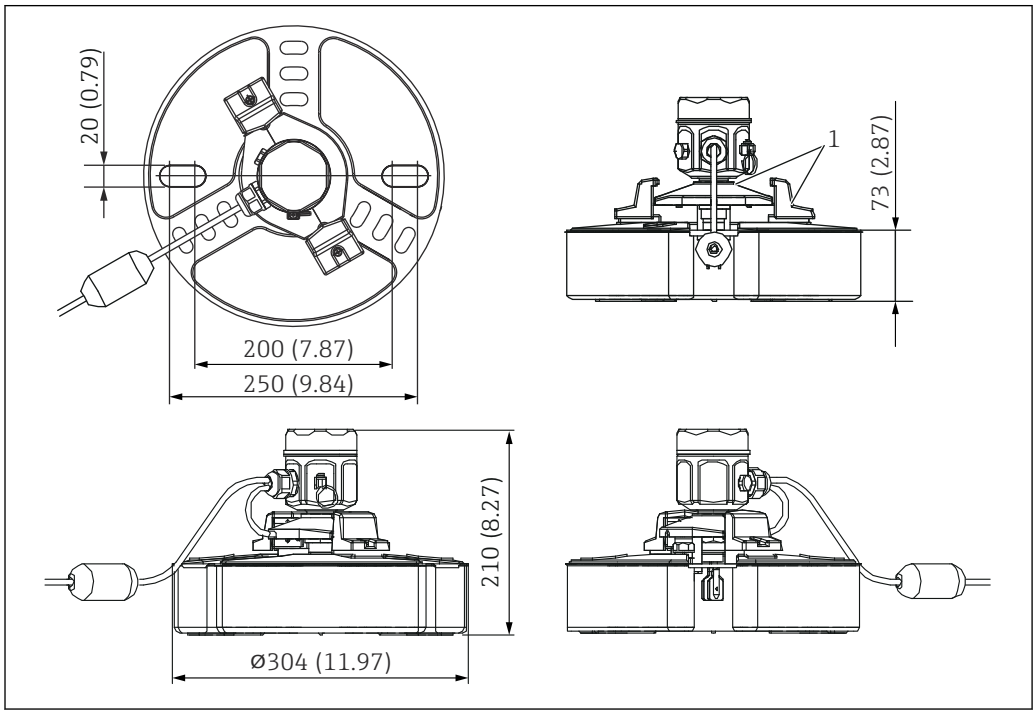
Sensor I/F Ex box / transmitter NRR261/NRR262

Item	Description
Connector cable (connection to transmitter NRR261/NRR262 from sensor I/F Ex box)	Maximum inductance: 2.3 mH, maximum capacitance: 83 nF Reference case: Use of KPEV-S (instrumentation cable) ▪ C = 65 nF/km, L = 0.65 mH/km ▪ CW/C = 0.083 µF / 65 nF = 1.276 km.....1 ▪ LW/L = 2.3 mH / 0.65 mH = 3.538 km.....2 ▪ Maximum cable extension: 1.27 km; the maximum cable length is 1 and/or 2, whichever is shorter (round down instead of rounding off)
Operating temperature	Ambient temperature: −20 to 60 °C (−4 to 140 °F)

Mechanical construction

NAR300 system dimensions

Dimensions of NAR300 float sensor



13 Outline of float sensor NAR300. Unit of measurement mm (in)

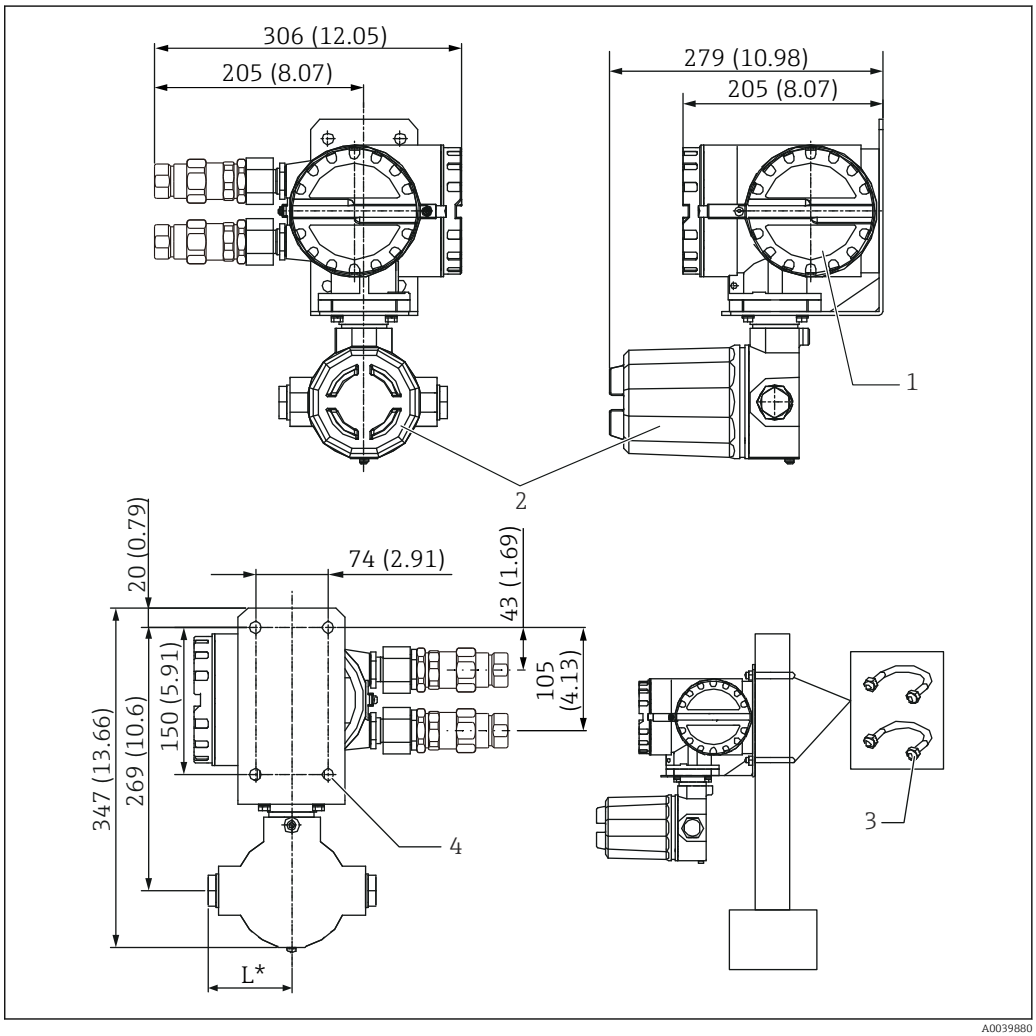
1 Float sensor cover

Dimensions of Ex d [ia] transmitter NRR261

Only NRR261 with JPN Ex explosion-proof specifications are delivered with a cable gland (external diameter of compatible cables: φ12 to 16 mm (0.47 to 1.02 in)).

Use the order code of Ex d [ia] transmitter NRR261 to specify the electrical conduit connection port.

Normally, Ex d [ia] transmitter NRR261 is mounted on a tank yard's pipe and secured in place with a U-bolt (JIS F 3022 B 50 type). It can also be mounted directly onto wall surfaces (requires 4-φ12 mm (0.47 in) holes and M10 securing nuts and bolts (not included in the delivery)).

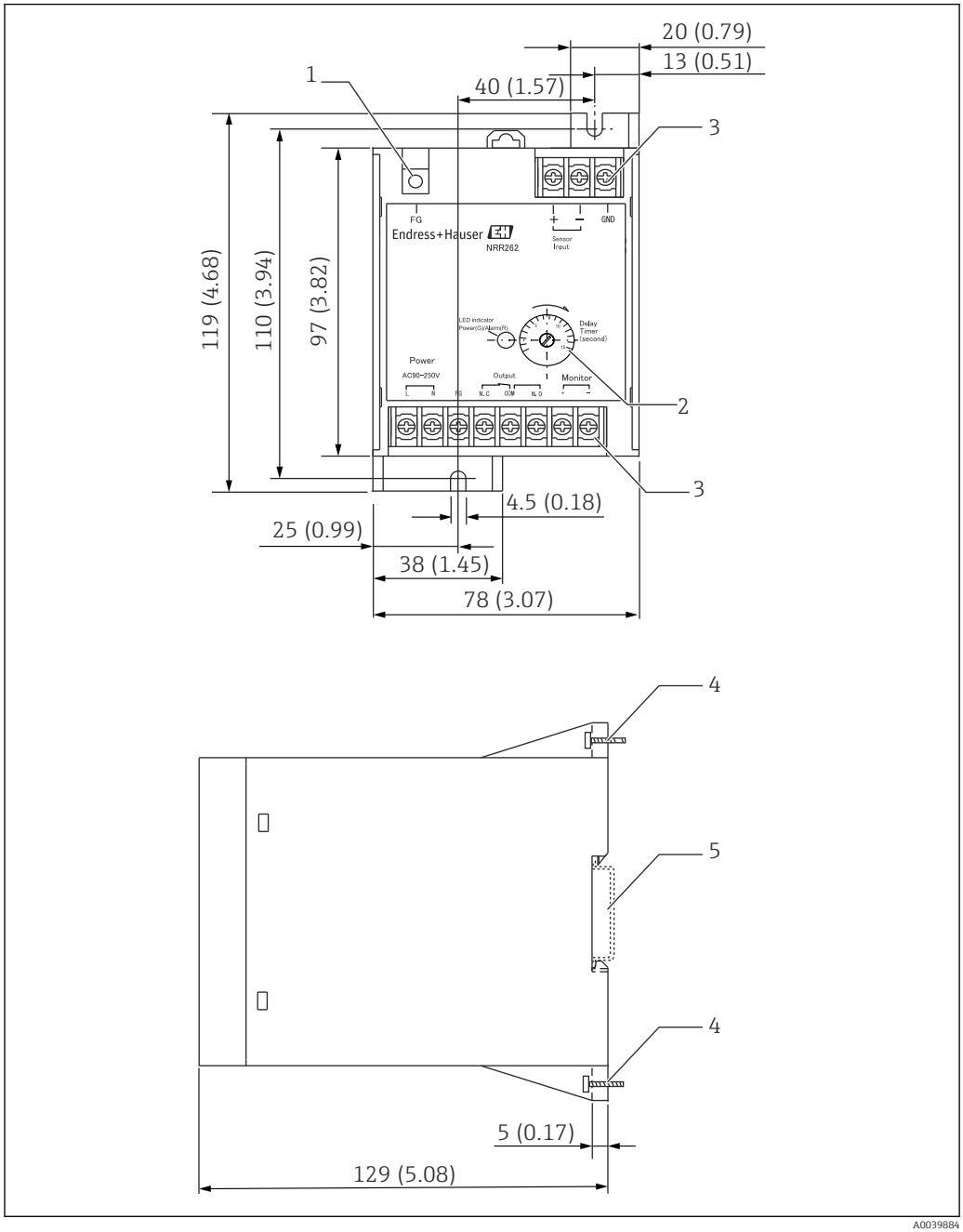


14 *Outline of NRR261. Unit of measurement mm (in)*

1 Ex d side terminal
2 Ex [ia] side terminal
3 U-bolt (JIS F3022 B50 material: Iron (chromate), 2 nuts and 2 flat washers included)
4 4-φ12 holes
L G1/2: 85 mm (3.35 in), NPT1/2: 97 mm (3.82 in), M20: 107 mm (4.21 in)

Dimensions of Ex [ia] transmitter NRR262

NRR262 is installed indoors, such as in instrument rooms, and it can be mounted easily with two M4 screws. In addition, "one-touch" snap-in mounting is possible using a DIN rail EN50022 (not included in the delivery). This rail-mounted method is beneficial in cases where multiple transmitters are mounted in series, and in cases where installation of additional transmitters is expected in the future.

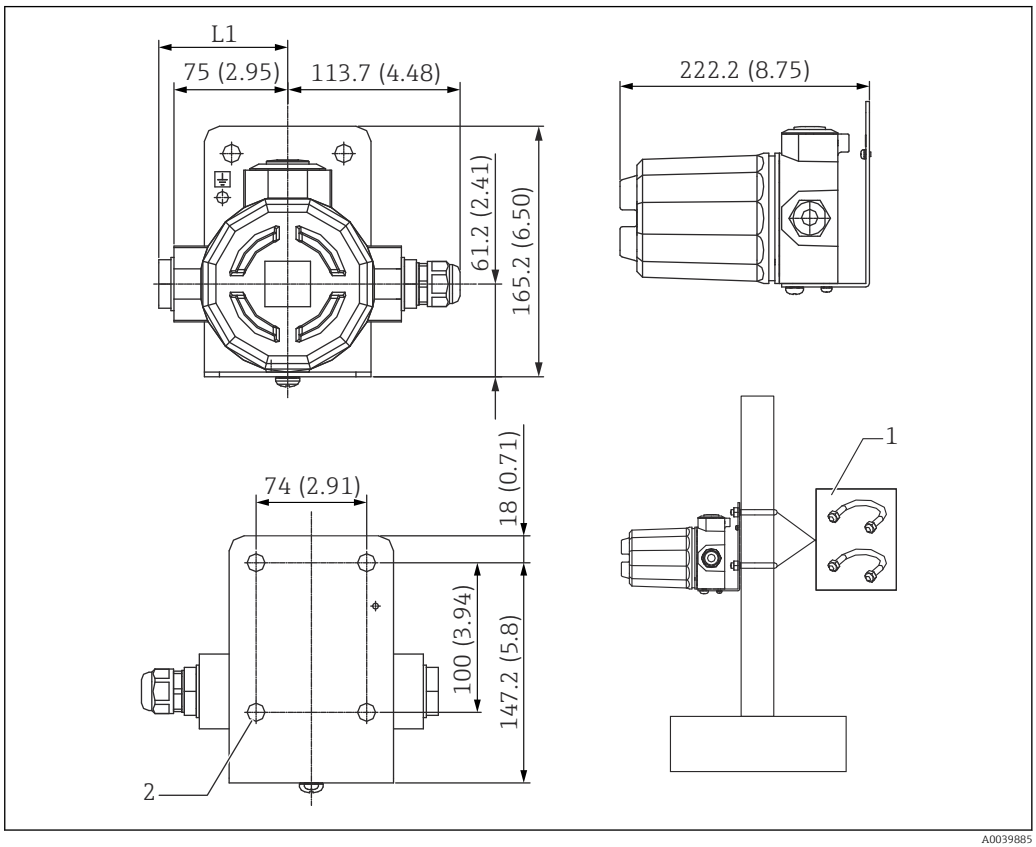


15 Outline of NRR262. Unit of measurement mm (in)

1 *Thread (M4) for protective grounding*
2 *Delay trimmer*
3 *Thread (M3)*
4 *Screw (M4)*
5 *DIN rail: EN50022 compliant*

Dimensions of Ex [ia] sensor I/F Ex box

The Ex [ia] sensor I/F Ex box is used in combination with Ex d [ia] transmitter NRR261 or Ex [ia] transmitter NRR262 in order to convert signals from the float sensor into electric current signals. Normally, it is mounted on a tank yard's pipe and secured in place with a U-bolt (JIS F 3022 B 50 type). It can also be mounted directly onto wall surfaces (requires 4-φ12 mm (0.47 in) holes and M10 securing nuts and bolts (not included in the delivery)).



16 Outline of Ex [ia] sensor I/F Ex box. Unit of measurement mm (in)

L1 G1/2 / NPT1/2: 85 mm (3.35 in), M25: 107 mm (4.21 in)
1 U-bolt (JIS F3022 B50 material: Iron (chromate), 2 nuts and 2 flat washers included)
2 4-φ12 mm (0.47 in) holes

Use the order code of float sensor NAR300 to specify the conduit connection port.

Weight of the NAR300 system

Float sensor NAR300	Approx. 2.5 kg (5.51 lb) (including the dedicated shielded cable (PVC) 6 m (19.69 ft))
Ex [ia] sensor I/F Ex box	Approx. 3.2 kg (7.05 lb)
Ex d [ia] transmitter NRR261	Approx. 10 kg (22.05 lb)
Ex [ia] transmitter NRR262	Approx. 0.6 kg (1.32 lb)

Detection sensitivity

Float sensor NAR300	▪ Water-filled pit: Set to 10 (0.39) ± 1 mm (0.04 in) with kerosene at the time of shipment from the factory ▪ Empty pit: 50 (1.97) ± 5 mm (0.2 in) with kerosene

Materials

Wetted material: NAR300	▪ Float: SUS316L ▪ Conductive sensor: SUS316+PTFE ▪ Tuning fork sensor: SUS316L equivalent
Non-wetted parts: Ex [ia] sensor I/F Ex box	Housing/cover: Aluminum casting

Ex d [ia] transmitter NRR261	Housing/cover: Aluminum casting
Ex [ia] transmitter NRR262	Housing: Plastic

Certificates and approvals

CE mark

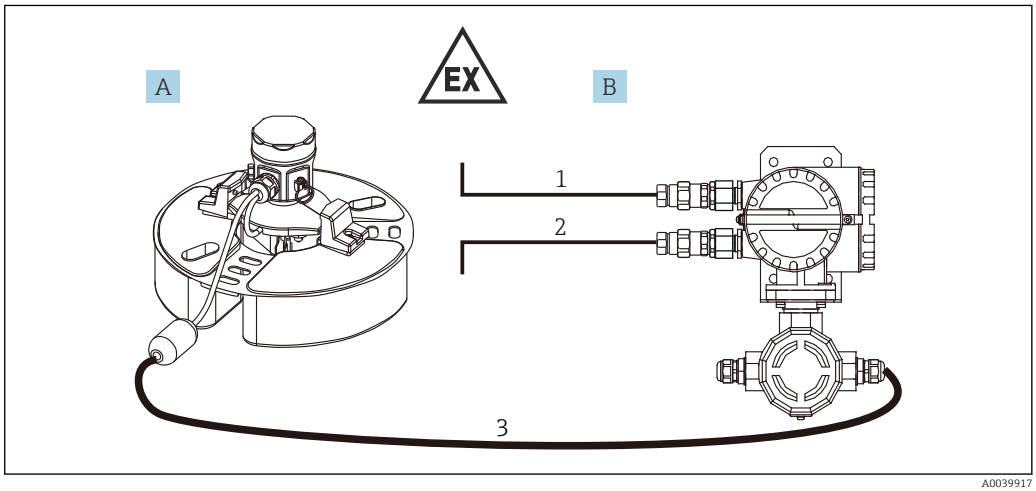
The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding "EC Declaration of Conformity" along with the standards applied. Endress +Hauser confirms successful testing of the device by affixing to it the CE mark.

Ex approval

The NAR300 system has the following four certificates and qualifications:

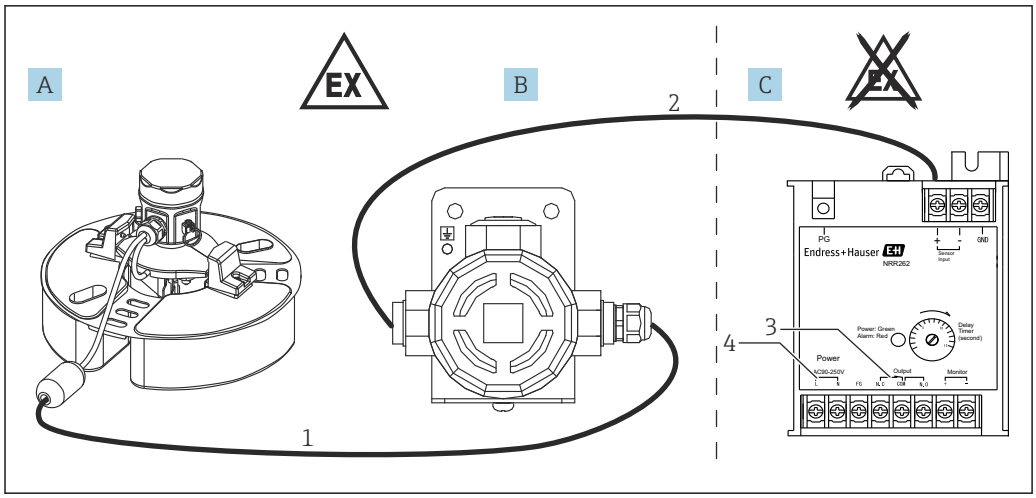
- ATEX certificate: FM.14ATEX0048X
- IECEx certificate: IECEx FMG 14.0024X
- FM certificate: 3049525
- JPN Ex qualification: CML 18JPN8362X

TIIS and JPN Ex devices cannot be mixed.



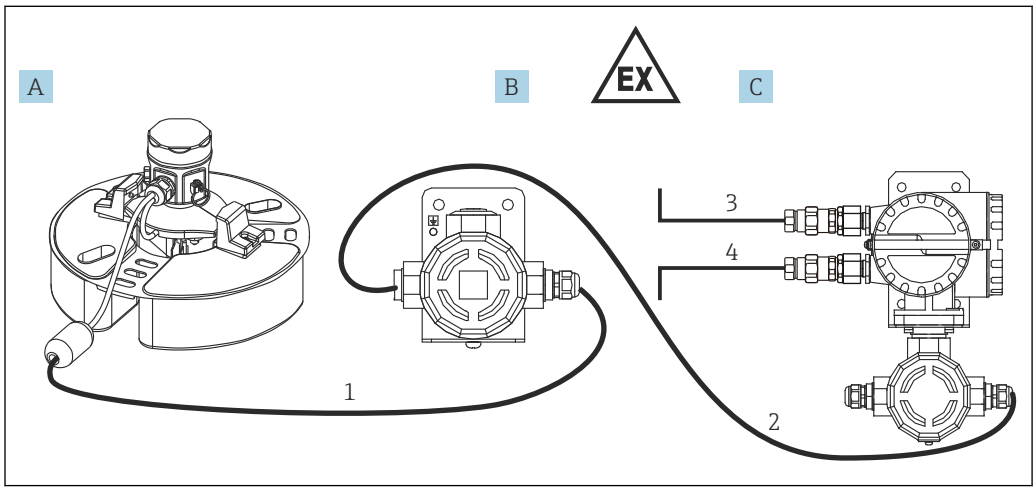
17 *System configuration 1*

A Float sensor NAR300-x1xxxx
B Ex d [ia] transmitter NRR261 (integrated type)
1 Alarm output: Alarm/PLC/DCS, etc.
2 Power supply (AC/DC)
3 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))



18 *System configuration 2*

A Float sensor NAR300-x5xxxx
B Sensor I/F Ex box
C Ex [ia] transmitter NRR262
1 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))
2 Cable for sensor I/F Ex box and transmitter (refer to Process conditions)
3 Alarm output: Alarm/PLC/DCS, etc.
4 Power supply (AC/DC)



19 *System configuration 3*

A Float sensor NAR300-x5xxxx
B Sensor I/F Ex box
C Ex d [ia] transmitter NRR261 (separate type)
1 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))
2 Cable for sensor I/F Ex box and transmitter (refer to Process conditions)
3 Alarm output: Alarm/PLC/DCS, etc.
4 Power supply (AC/DC)

Functional safety certification

SIL2 IEC61508 (ATEX, IECEx, FM, JPN Ex)

Order information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your nearest Endress+Hauser sales organization: www.addresses.endress.com

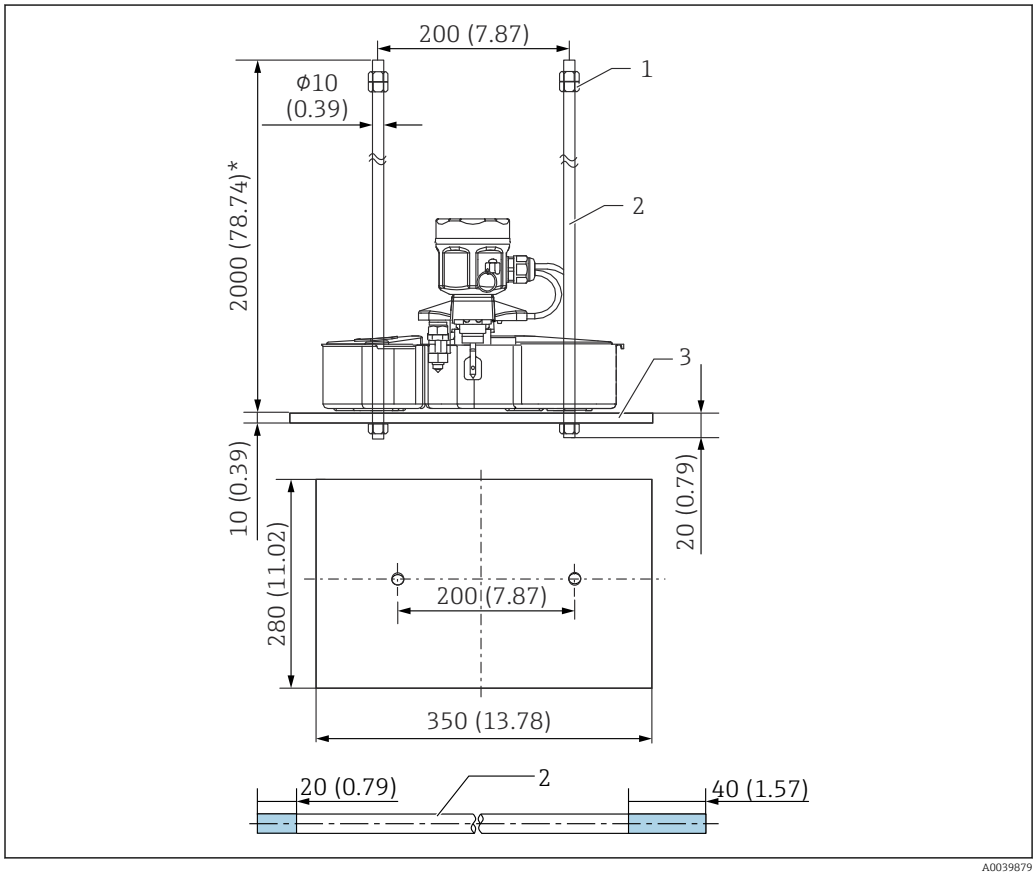
Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Float guide

If you ordered a device that is equipped with a float guide, install the float horizontally. Remove any debris or stones so that the float sensor can land horizontally. The standard length of a float guide is 2 m (6.57 in); however, if you need a different length, contact your Endress+Hauser Sales Center.



20 *Float guide. Unit of measurement mm (in)*

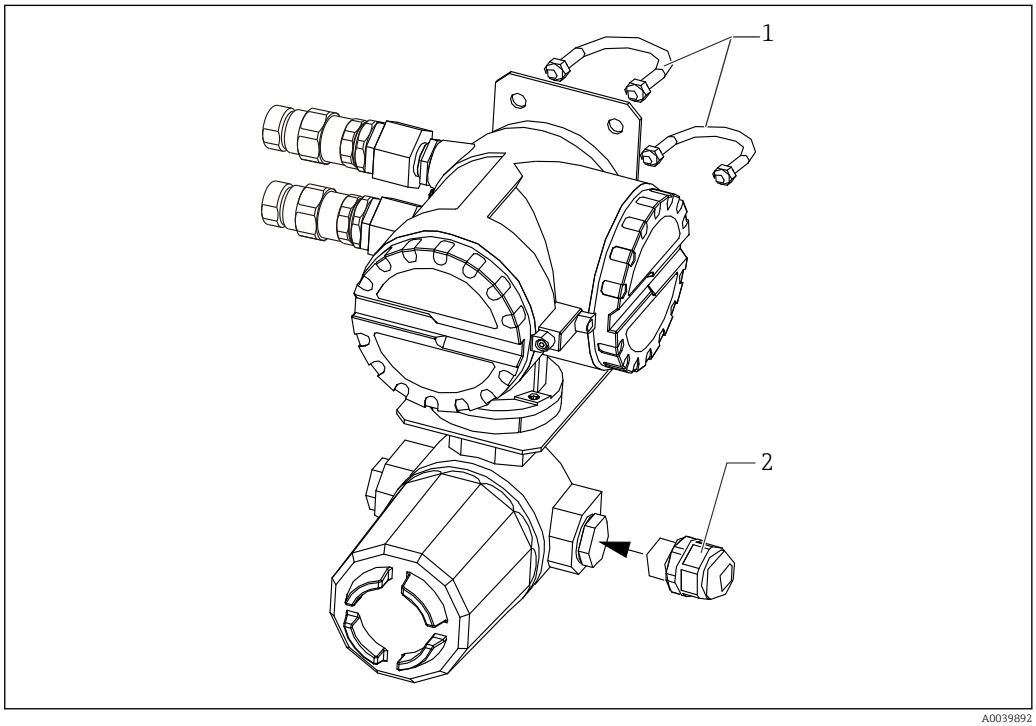
1 Nut (M10)
2 Float guide
3 Weight

Name	Delivered quantity	Materials
Float guide	2	SUS304
Weight	1	Selectable as options from SS400 or SUS304
Nut (M10)	6	SUS304

The 20 mm (0.73 in) and 40 mm (1.57 in) of the float guide in the diagram represent lengths of the thread grooves.

U-bolt / cable gland (waterproof connection for JPNEx)

The U-bolt (JIS F3022 B50) is used when mounting a converter. Have a spare 50A (2B φ60.5 mm (198.5 in)) pipe ready. Tighten and secure the cable gland after inserting the cable from NAR300.



21 U-bolt / cable gland

1 U-bolts (JIS F3022 B50)
2 Cable gland (waterproof connection)

Name		Delivered quantity	Materials
U-bolt		2	Iron (chromate)
U-bolt accessory	Nut	4	
	Flat washer	4	
Cable gland (waterproof connection)		1	Nylon

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