

Technical Information

Oil leak detector NAR300

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



Application

This system is installed on an oil retaining wall in a tank or in a sump pit near a pump yard, and it provides the ultimate leak detection function for oils, such as petrochemicals and vegetable oils. The system utilizes two different detection principles, conductivity and tuning fork, to monitor detection status individually. With a two-stage alarm logic process, it has an extremely low false alarm rate, and this ensures the safety of the tank yard with an accurate yet simple device configuration.

Flame-proof system

Using converter NRR261 for outdoor installation, it is possible to connect directly to the switch input mechanism, such as an existing liquid level transmitter, and send an alarm to the host controller.

Intrinsically safe system

The alarm system can be configured independently from the tank gauge by combining the indoor converter NRR262 with the outdoor sensor I/F Ex box.

Your benefits

- SIL2: approved for safety instrumented systems in the process industry
- Proprietary sensors with twin functions provide reliable detection:
 - Conductivity sensor: distinguishes between water and other substances (oil and water)
 - Tuning fork sensor: distinguishes between air and liquid (oil and air)
- 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

[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).

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Document information

Symbols

Safety symbols



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



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



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



This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct and alternating 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

Additional documentation

The following documentation types are available in the Downloads area of the Endress+Hauser 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 on the nameplate.

Technical Information (TI)**Planning aid**

This document contains all technical data related to the device, as well as an overview of accessories and other products that can be ordered for the device.

Brief Operating Instructions (KA)**Instructions for using the system for the first time**

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

Operating Instructions (BA)

Operating Instructions contain all the information required for all stages in the device life cycle (from product identification, incoming acceptance, storage, mounting, connection, operation, and setting 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

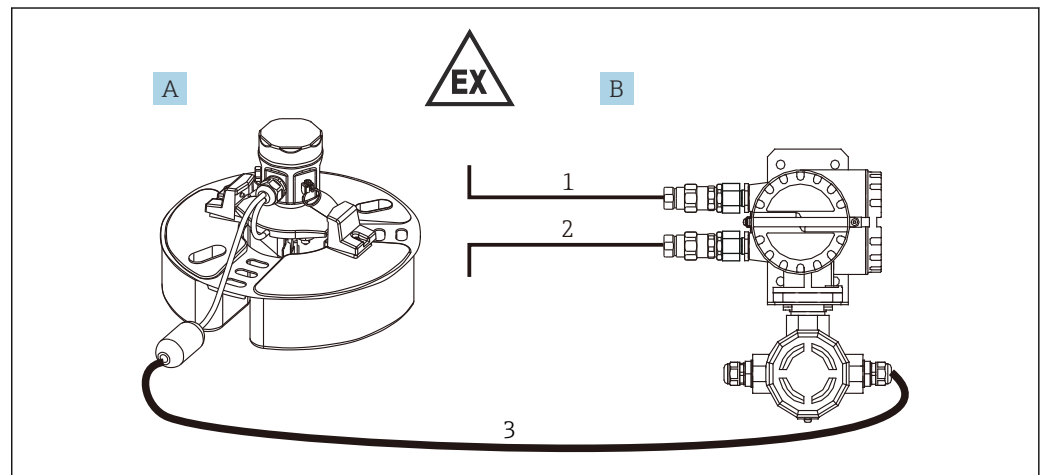
The intrinsically safe Ex ia IIB T4 oil leak detector NAR300 system is available in three configurations for a variety of applications.

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] converter 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] converter NRR261, which 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 converter 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



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1 System configuration 1

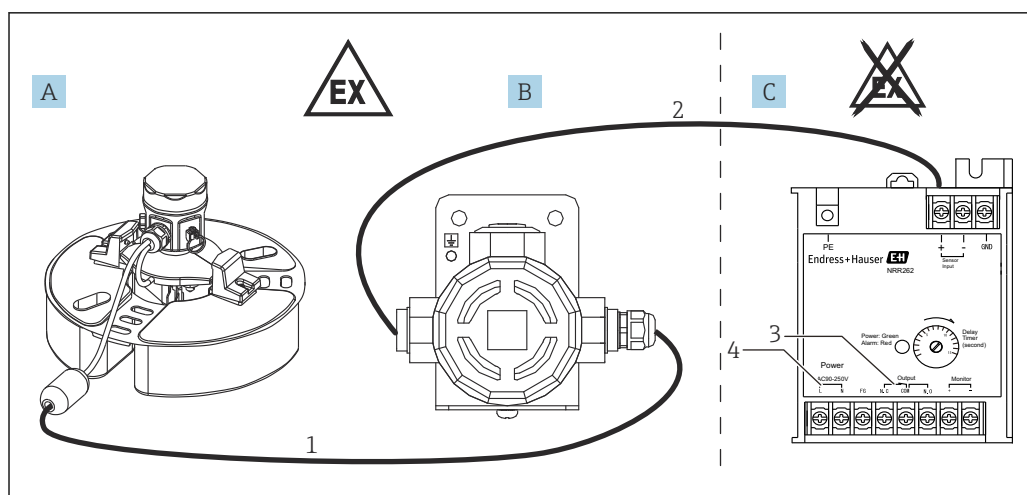
- A Float sensor NAR300-x1xxxx
- B Ex d [ia] converter NRR261 (integrated type)
- 1 Alarm output: alarm/PLC/DCS, etc.
- 2 Power supply (AC/DC)
- 3 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))

Intrinsically safe system (separate type) Ex ia IIB T4

In this system, Ex [ia] converter 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 converter 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



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2 System configuration 2

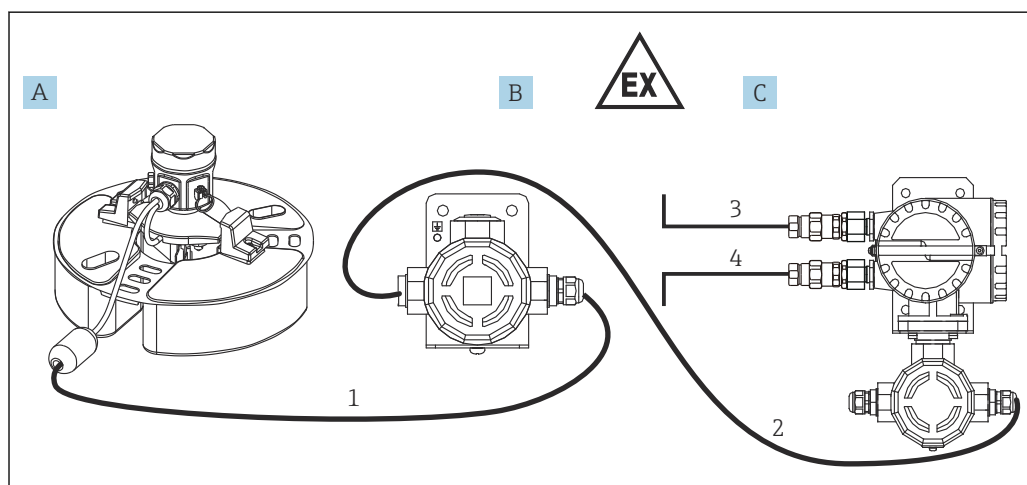
- A Float sensor NAR300-x5xxxx
- B Sensor I/F Ex box
- C Ex [ia] converter NRR262
- 1 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))
- 2 Cable for sensor I/F Ex box and converter (refer to "Process conditions")
- 3 Alarm output: alarm/PLC/DCS, etc.
- 4 Power supply (AC/DC)

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

From oil leak detection to alarm output, this system can monitor the entire process in outdoor hazardous areas.

Ex [ia] specification is used in the circuitry from the NAR300 float sensor to the wiring terminal box of Ex d [ia] converter NRR261. The signal from the NAR300 float sensor is imported by the Ex [ia] wiring of converter NRR261 via a sensor I/F Ex box. Ex d wiring is used from the main unit of Ex d [ia] converter NRR261, which 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.



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3 System configuration 3

- A Float sensor NAR300-x5xxxx
- B Sensor I/F Ex box
- C Ex d [ia] converter 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 converter (refer to "Process conditions")
- 3 Alarm output: alarm/PLC/DCS, etc.
- 4 Power supply (AC/DC)

Operating principle

Tuning fork sensor

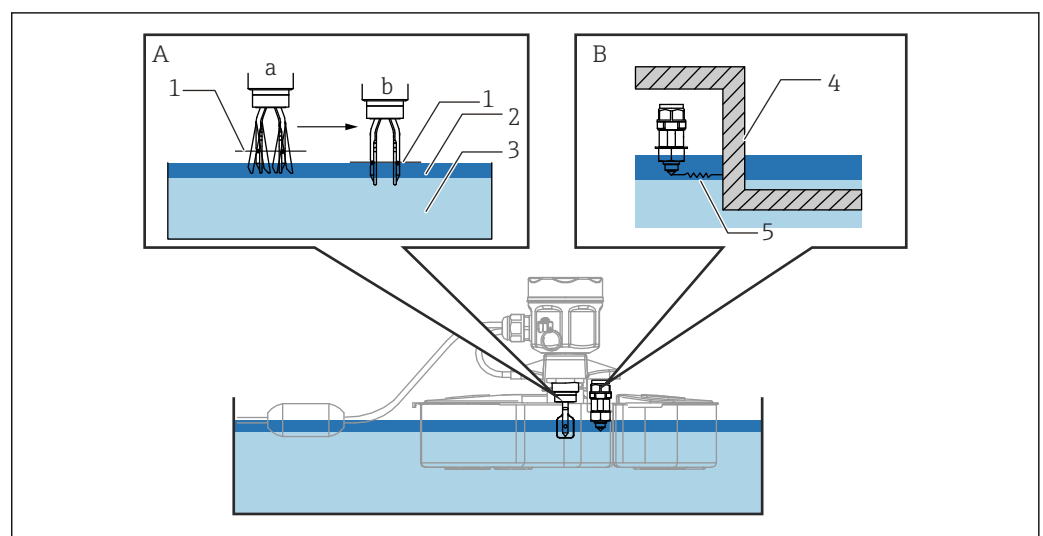
The tuning fork sensor determines if there is liquid (water or oil, ON) or no liquid (air, OFF). In addition, it vibrates when the liquid is below the operating point (no liquid), and stops vibrating when the liquid is above the operating point (liquid is present).

Conductivity sensor

The conductivity 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
Conductivity sensor	OFF	ON	ON

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



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4 Sensor principles

- A Tuning fork sensor
- B Conductivity 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 Metallic part of the float body
- 5 Measuring conductivity

Detection in water-filled pits

1. The conductivity sensor continuously monitors conductivity between the probe and the float body before the tuning fork sensor does.
2. Since the conductivity 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 conductivity 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 conductivity 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 surface of water, 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 conductivity sensor, which is already ON, establishing an ON/ON logic.
5. An alarm is activated.

Alarm activation principle

An oil leak detection signal detected by the NAR300 float sensor is converted into an electric current signal inside the converter or sensor I/F Ex box. The signal is then connected to the current detection circuit through the intrinsically safe safety barrier inside the converter. In the current detection circuit, the presence or absence of an oil leak alarm signal is determined based on the size of the current value, and the alarm output relay is turned ON/OFF through the operation delay circuit. The alarm delay circuit is equipped with a trimmer that can be used to set the delay time. Fail-safe operation is also available for relay contact point output, which is explained in the following "Alarm output operation table."

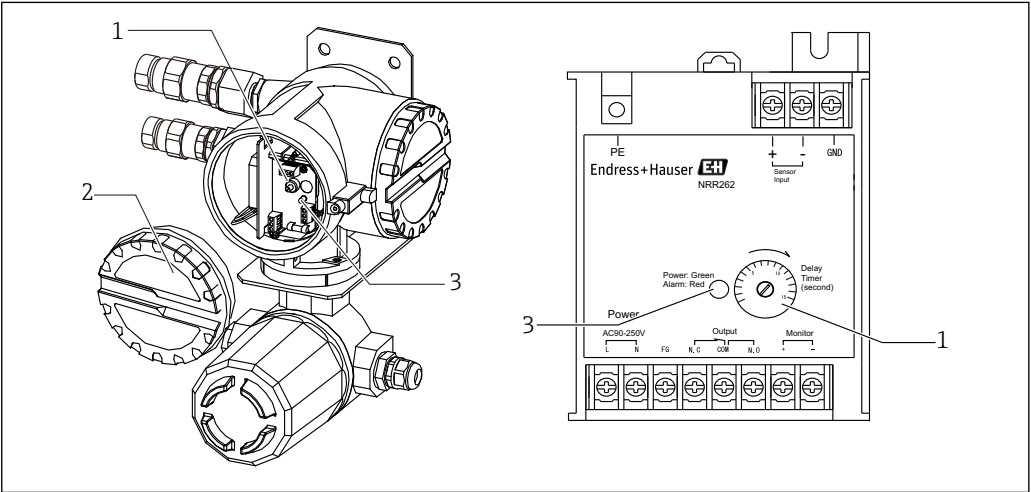
Alarm output operation table

NRR261/NRR262 terminals		Between NC and COM	Between NO and COM
State	Non-alarm	Open contact point	Closed contact point
	Oil leak alarm	Closed contact point	Open contact point
	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 converter 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.

i 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 Converter NRR261 (left) / converter 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 of water due to increased oil layer thickness, water may cling onto the electrode tip like an icicle even if the electrode tip is in oil. This may raise the detection sensitivity point 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 $10\ (0.39) \pm 1\ \text{mm}\ (0.04\ \text{in})$ with kerosene at the time of shipment from the factory
- Empty pit: $50\ (1.97) \pm 5\ \text{mm}\ (0.2\ \text{in})$ with kerosene



The setting was established under the following conditions: oil (kerosene: approx. specific gravity 0.8), lower-layer water (water: approx. specific gravity 1.0), static liquid surface state, and 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 conductivity 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 $10\ \mu\text{S}/\text{cm}$ (not more than $100\ \text{k}\Omega \cdot \text{cm}$).

Example, pure water: 1 to $0.1\ \mu\text{S}/\text{cm}$ (1 to $10\ \text{M}\Omega \cdot \text{cm}$)

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))

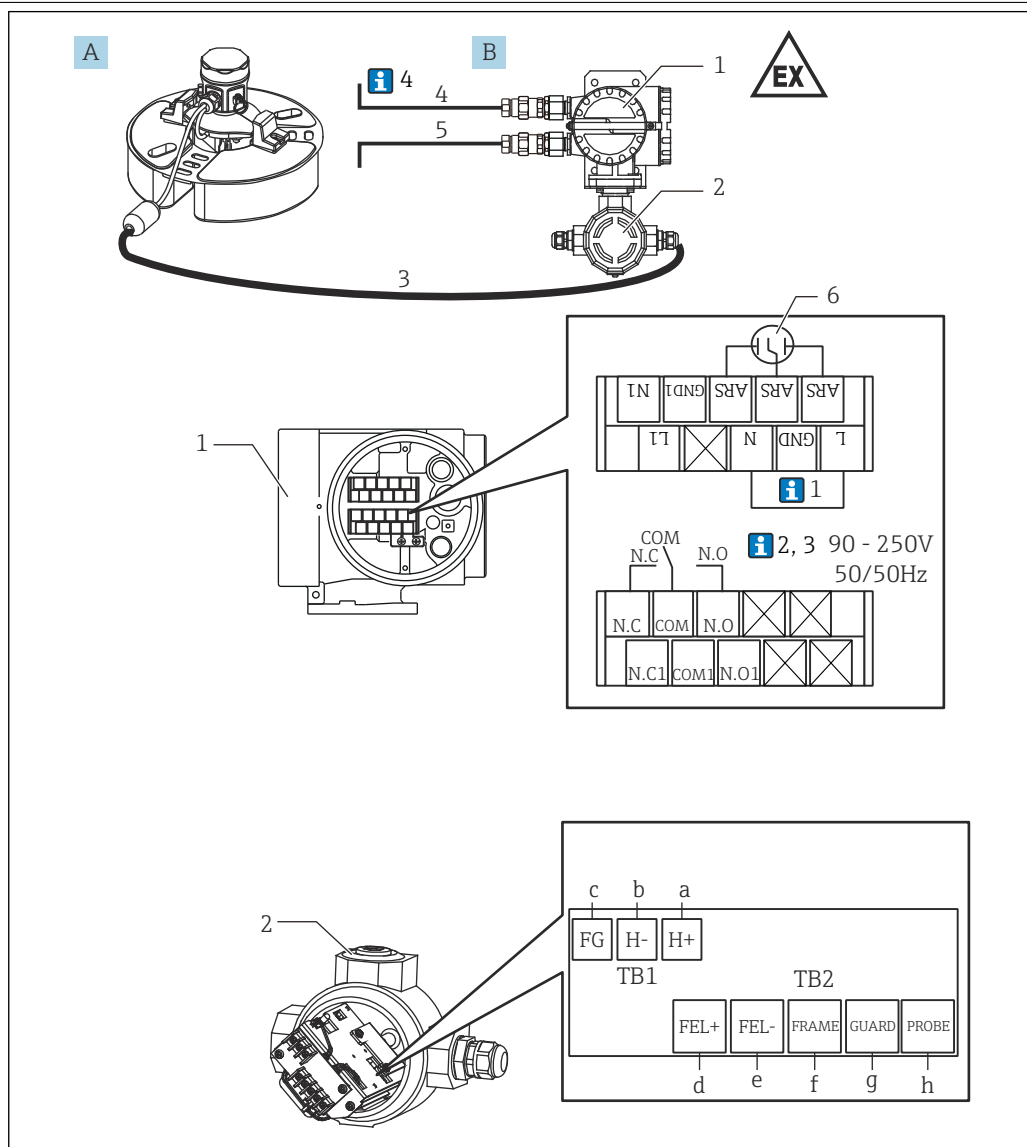
Ex [ia] sensor I/F Ex box	Power supply	Supplied by NRR261 or NRR262
	Cable entry	■ NAR300 (float sensor) side: G1/2, with cable gland ■ NRR261 or NRR262 (converter) side: G1/2, NPT1/2, M20

Ex d [ia] converter 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: 2 VA ■ DC power-supply type: 3 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] converter NRR262	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 AV3P-2)
	Maximum power consumption	■ AC power-supply type: 2 VA ■ DC power-supply type: 3 W
	Lightning arrester	Built-in (power supply arrester)

Electrical connection

NRR261-4/A/B/C wiring



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

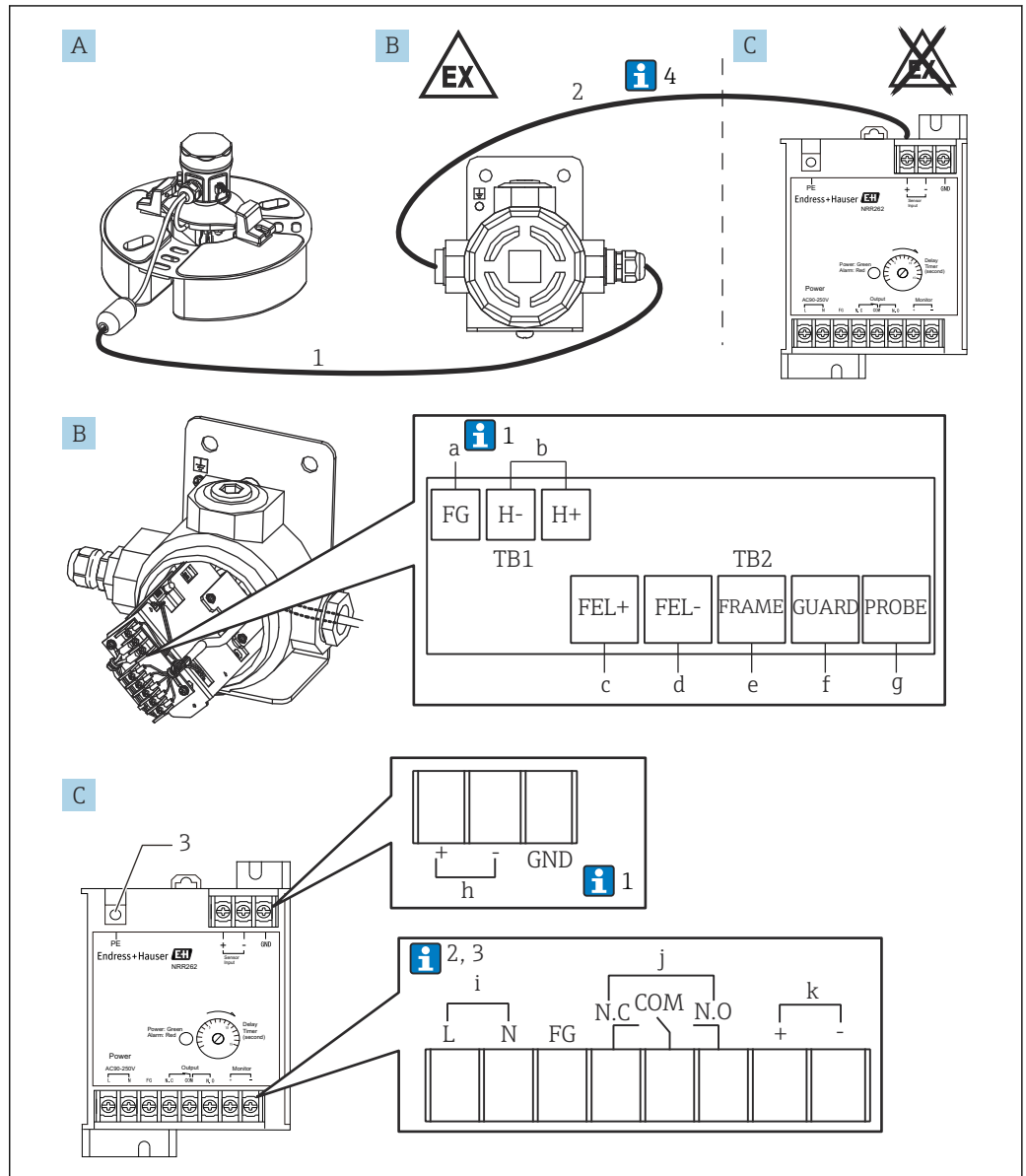
- A Float sensor NAR300-x1xxxx
- B Ex d [ia] converter NRR261 (integrated type)
- a Blue 1 (already wired upon delivery), screw (M3)
- b Blue 2 (already wired upon delivery), screw (M3)
- c Green, screw (M3)
- d Red, screw (M3)
- e Blue 3, screw (M3)
- f Yellow, screw (M3)
- g Black, screw (M3)
- h White, screw (M3)
- 1 Ex d terminal
- 2 Ex [ia] terminal
- 3 Using an Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft): included 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. GND between "L" and "N" of NRR261 is connected when an AC cable with FG is used.
2. When using a 22 to 26 V_{DC} power supply, the terminal number "L" becomes positive (+) and "N" becomes negative (-).
3. To maintain Ex [ia] performance, ensure that the power supply voltage does not exceed 250 V_{AC} 50/60 Hz during normal times and 250 V_{DC} during emergencies.
4. Cable (3) for connecting NAR300 and NRR261 is included with NAR300. Alarm output cable (4) from NRR261 and power supply cable (5) to NRR261 are not included and must be procured by the customer. For more details on connection cables, refer to "Process conditions."

NRR262-4/A/B/C wiring



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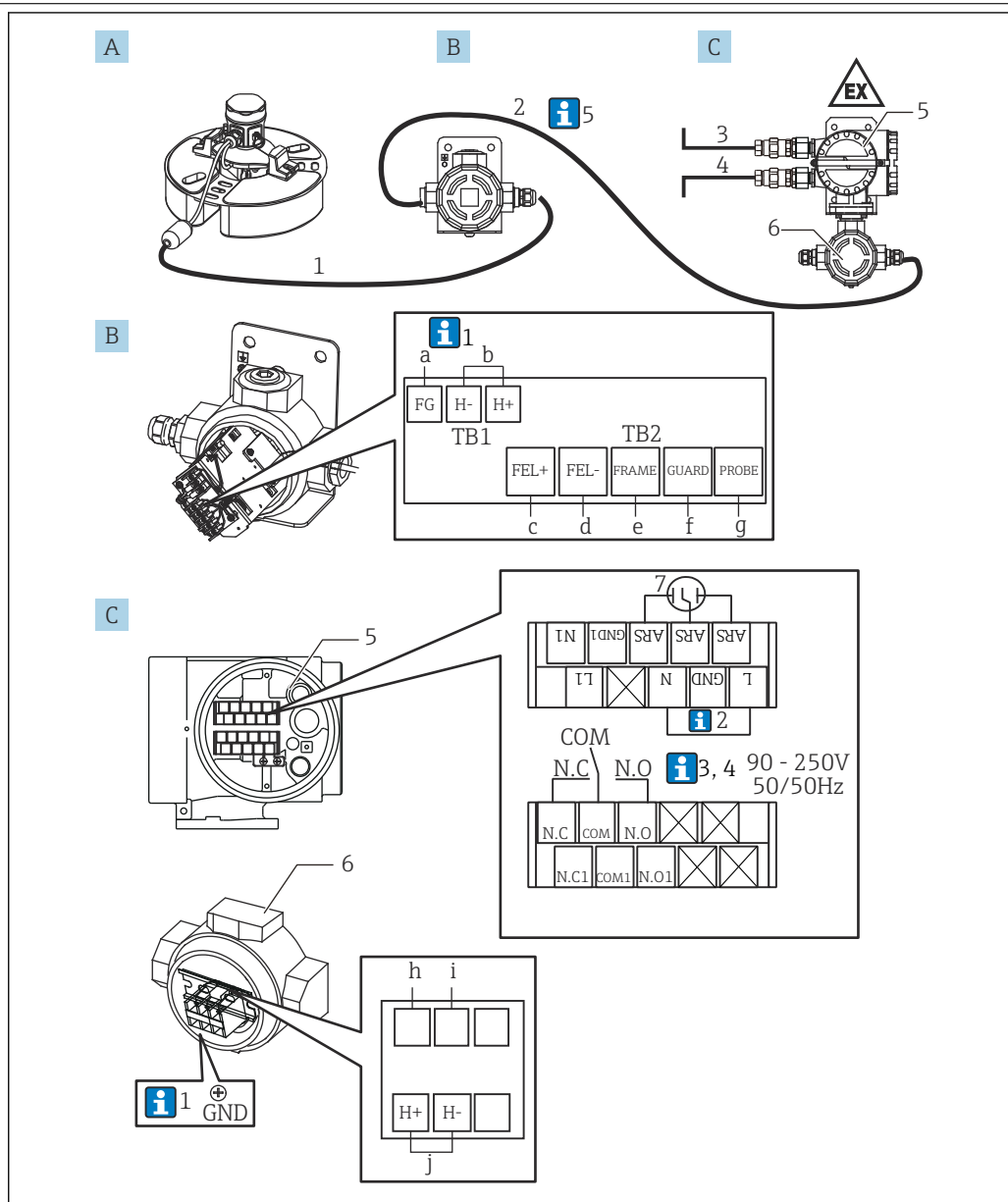
7 Wiring of Ex [ia] converter NRR262-4/A/B/C

- 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 Note 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 Power supply: AC/DC, screw (M3)
- j Alarm output, screw (M3)
- k Checking monitor output, screw (M3)
- 1 Using an Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft): included with the product depending on the option code)
- 2 Cable for sensor I/F Ex box and NRR262 (must be procured by the customer)
- 3 For protective grounding, screw (M4)

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

1. Normally, only the FG of a sensor I/F Ex box is connected to the cable's shielded wire; 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 using a 22 to 26 V_{DC} power supply, the terminal number "L" becomes positive (+) and "N" becomes negative (-).
3. To maintain Ex [ia] performance, ensure that the power supply voltage does not exceed 250 V_{AC} 50/60 Hz during normal times and 250 V_{DC} during emergencies..
4. While cable (1) for connecting NAR300 and sensor I/F Ex box is included with the device, cable (2) for connecting sensor I/F Ex box and NRR262 is not included with the device and must be procured by the customer. For more details on connection cables, refer to "Process conditions."

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 Note 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) (already wired upon delivery) |
| i | Blue 3, screw (M4) (already wired upon delivery) |
| j | Input from sensor I/F Ex box, screw (M4) |
| 1 | Using an Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft): included with the product depending on the option code) |
| 2 | Cable for sensor I/F Ex box and NRR261 (must be procured by the customer) |
| 3 | Power supply: AC/DC |
| 4 | Alarm output: alarm/PLC/DCS, etc. |

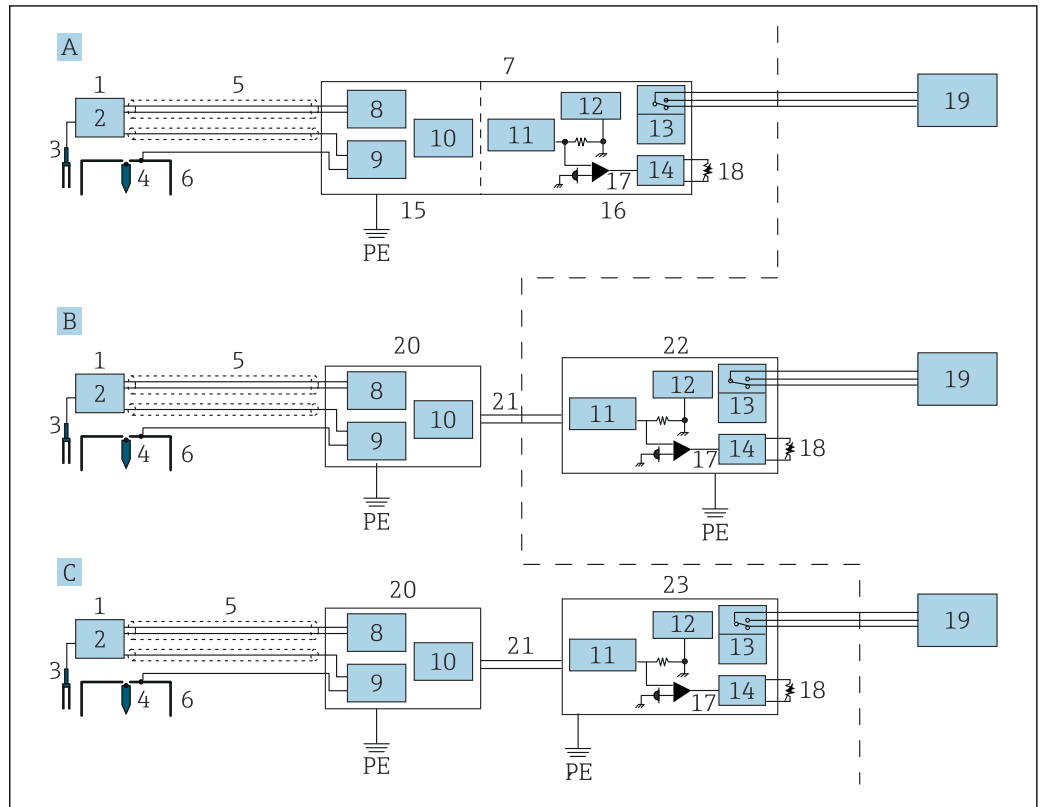
- 5 *Ex d terminal*
- 6 *Intrinsically safe terminal*
- 7 *Power supply arrester (installed), screw (M3)*



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

1. Normally, only the FG of a sensor I/F Ex box is connected to the cable's shielded wire; however, depending on the installation environment, either the GND of NRR261 alone or both the FG of the sensor I/F Ex box and the GND of NRR261 are connected.
2. GND between "L" and "N" of NRR261 is connected when an AC cable with FG is used.
3. When using a 22 to 26 V_{DC} power supply, the terminal number "L" becomes positive (+) and "N" becomes negative (-).
4. To maintain Ex [ia] performance, ensure that the power supply voltage does not exceed 250 V_{AC} 50/60 Hz during normal times and 250 V_{DC} during emergencies.
5. Cable (1) for connecting NAR300 and sensor I/F Ex box is included with NAR300. Cable (2) for connecting sensor I/F Ex box and NRR262, alarm out cable (3) from NRR261, and power supply cable (4) for NRR261 are not included and must be procured by the customer. For more details on connection cables, refer to "Process conditions."

Wiring diagram



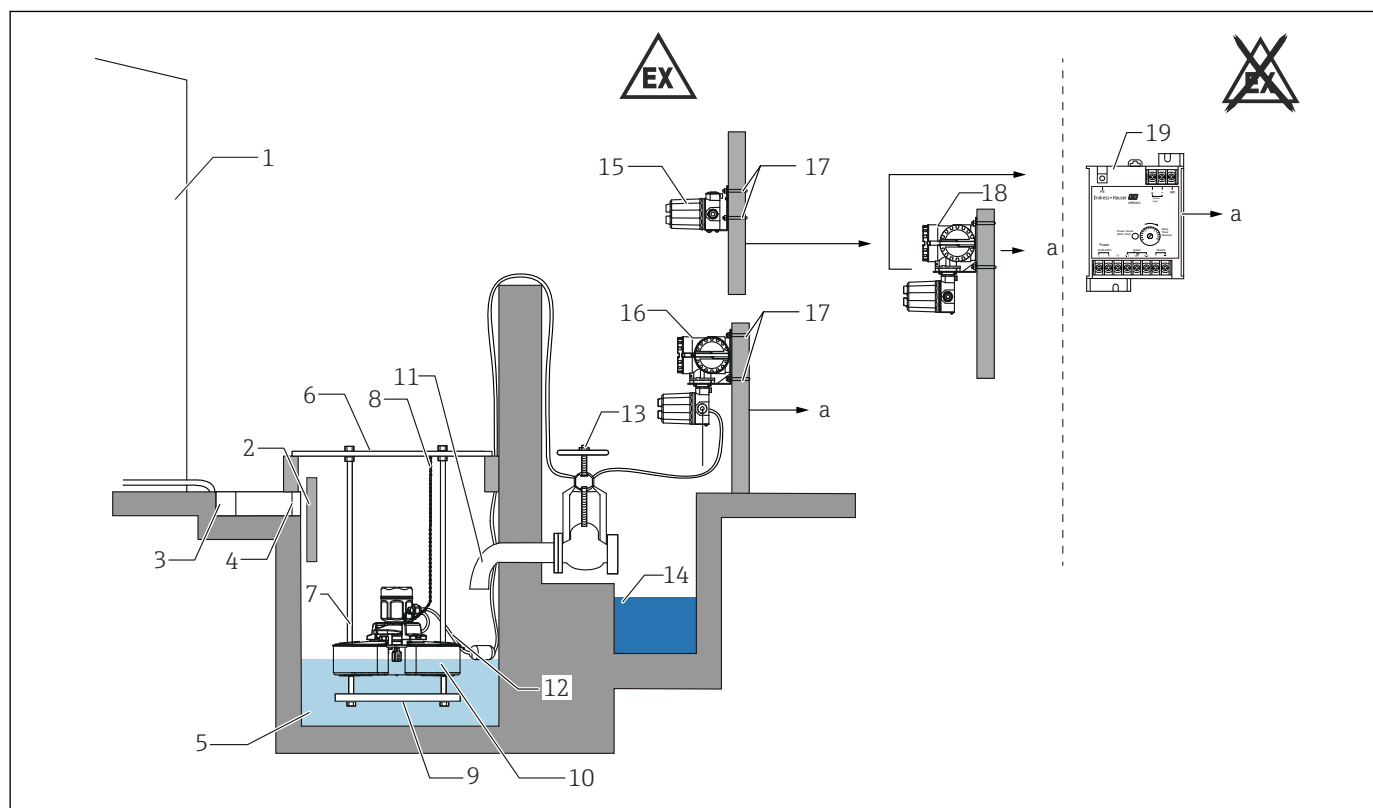
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9 Wiring diagram

- A Explosion proof-type converter system (integrated type)
- B Intrinsically safe-type converter system (separate type)
- C Intrinsically safe, explosion proof-type converter (separate type)
- PE Protective earth (protective grounding)
- 1 Float sensor NAR300
- 2 Tuning fork drive 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



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10 NAR300 + NRR26x

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

i To ground the barrier, either connect it to the tank or use the shielded wire for the remote cable. Refer to "Electrical connection" for more information on using the shielded wire for the remote cable.

Installation and mounting precautions

1. To prevent snow and debris from entering the pit, installing a waste guard, roof, or other covering is recommended. If snow accumulates on the float sensor, each 50 g of accumulation will cause an increase in the draft line by 1 mm (0.04 in), resulting in reduced sensitivity. In addition, if there is a risk of the ambient temperature exceeding 50 °C (122 °F), install an awning 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. If the float sensor becomes submerged, malfunctions or damage may result.
2. If the float sensor becomes off-balance (tilted by approx. 3 ° or more), it may cause faulty operation or a delayed alarm. Use a float guide as much as possible, and also pay attention to the way the cables and chains are laid out.
3. Install a screen at the pit's inlet to remove any debris. If debris or foreign matter clogs the sensor unit or inside the pit, it may cause malfunctions. Inspect and clean the screen regularly.
4. Attach a chain to the ring on the side of the float sensor head in advance for added convenience. However, each 50 g of increased load on the float will increase the draft line by 1 mm (0.04 in), resulting in reduced sensitivity. If using a chain to anchor the float, do not forcibly pull on the chain during inspection.
5. If the pit is completely filled with water, no oil layer will form even when oil is leaking. Ensure that the water is drained as necessary so that an oil layer can form.
6. Do not forcibly pull or grab and carry the cable as it may cause malfunctions or compromised waterproofing.
7. Bend the top of the discharge nozzle downward by 100 mm (3.94 in) or more when the valve is kept open so that an oil layer can form. Failure to do so may cause oil to drain 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, such as the one shown in the diagram above, install an oil-water separation divider so that an oil layer can form.
8. Depending on the liquid flowing into the pit, install a divider to prevent waves, crosscurrents, or liquid from splashing on top of the float.
9. If the pit is too large, divide the pit using an oil separator. Oil leakage cannot be detected unless there is significant outflow of oil in proportion to the surface area.
10. NAR300, NRR261, and sensor I/F Ex box must be installed at least 50 cm (1.64 ft) apart from each other.

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 0.7 g/cm³ or higher but less than 1.0 g/cm³ ▪ Floats in water (if the density is 0.9 g/cm³ or higher, then viscosity should be 1 mPa·s or higher. Water ≈ 1 mPa·s) ▪ Water-insoluble ▪ Non-conductive ▪ Liquid ▪ Low affinity to water (a layer of detected substance must form on water surface)
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 1.0 g/cm³ or higher but less than 1.13 g/cm³ (however, only when kinematic viscosity is 1 mm²/sec)¹⁾ ▪ Non-freezing ▪ Electric conductivity of 10 µS/cm or higher (up to 100 kΩ·cm) ▪ Cannot be used on the sea surface or in places that may be penetrated by seawater
Other requirements	▪ Promptly remove any debris that adheres to the sensor unit. ▪ Ensure that there is no caked-on mud (dried solids), etc. ▪ Avoid use in an environment where the float sensor may become submerged or constantly wet. ▪ Avoid installation environments that may cause the float sensor to tilt off-balance or change the draft line. ▪ Install a breakwater or other similar means to protect against cross-currents and waves.

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

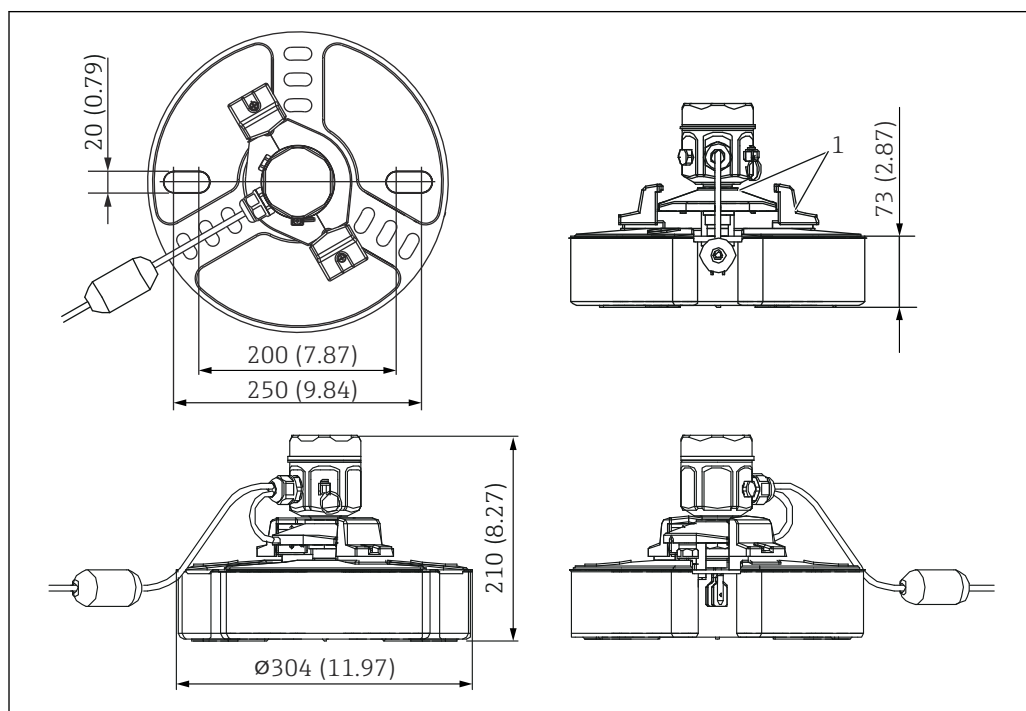
Sensor I/F Ex box / converter NRR261/NRR262

Item	Description
Connector cable (connection to converter 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 / 0.065 µF / km = 1.276 km.....1 ▪ LW/L = 2.3 mH / 0.65 mH / km = 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



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

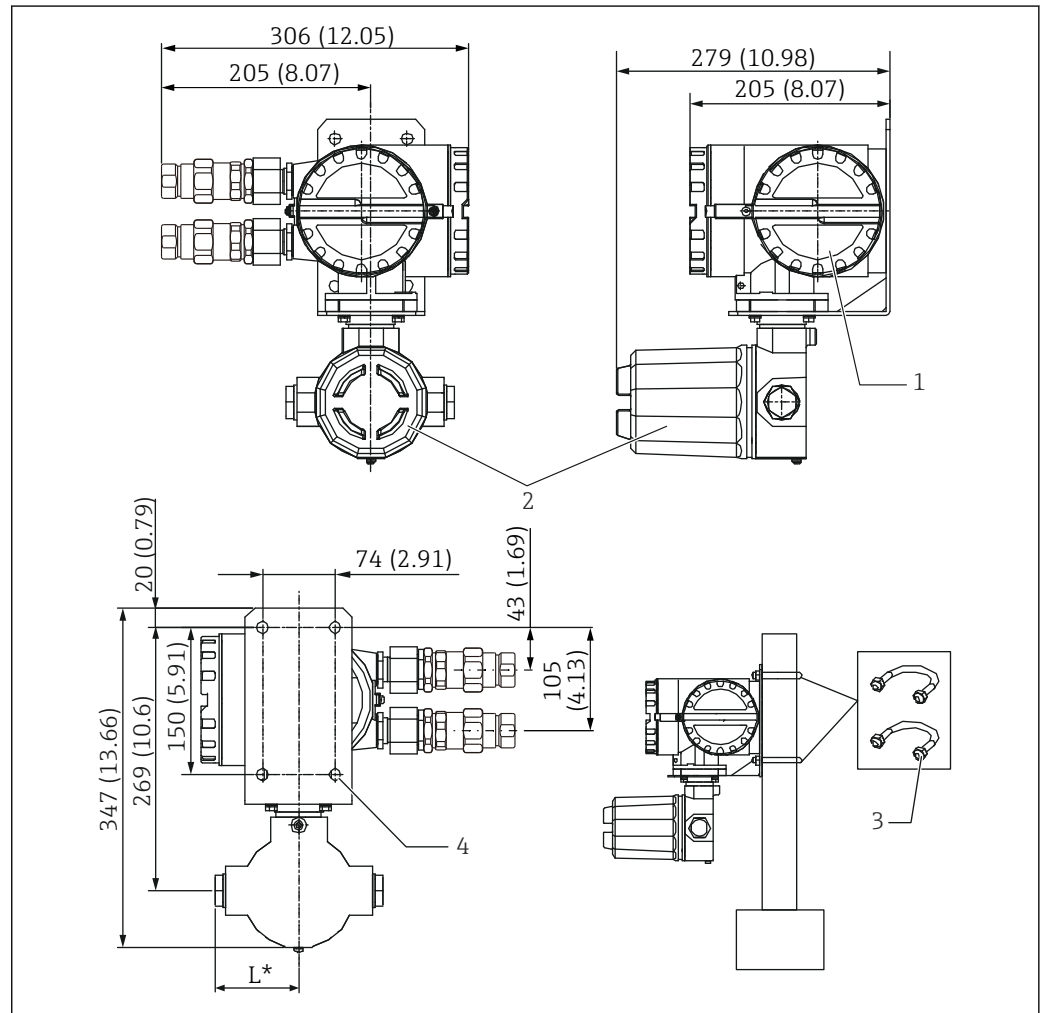
1 Float sensor cover

Dimensions of Ex d [ia] converter NRR261

Only NRR261 with JPN Ex explosion-proof specifications are delivered with a cable gland (external diameter of compatible cables: $\phi 12$ to 16 mm (0.47 to 1.02 in)).

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

Normally, Ex d [ia] converter 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 $\phi 12$ mm (0.47 in) holes and M10 securing nuts and bolts (not included in the delivery)).



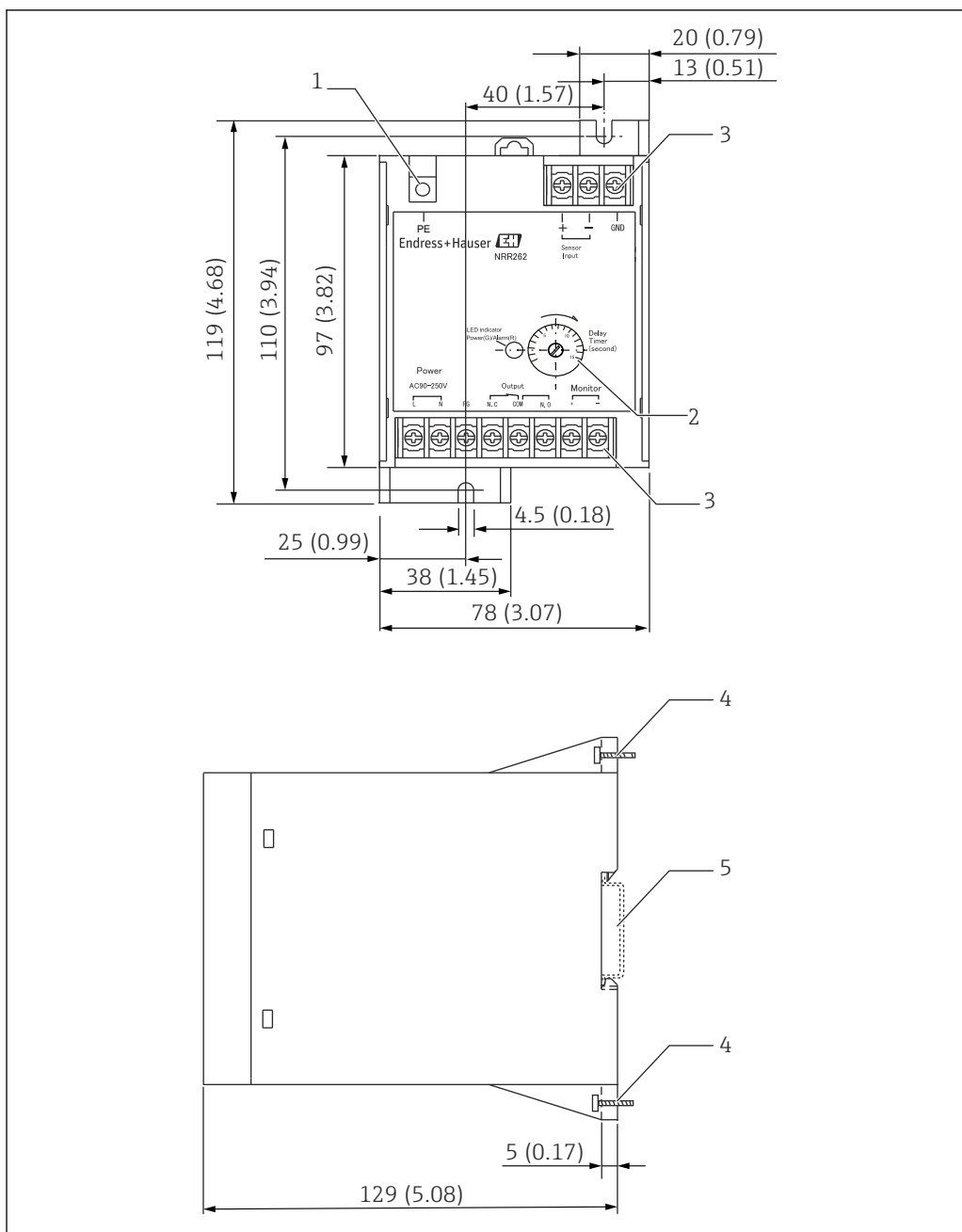
A0039880

12 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 $\phi 12$ 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] converter 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-mounting method is convenient for mounting multiple converters in a row or for when additional converters are scheduled to be installed in the future.



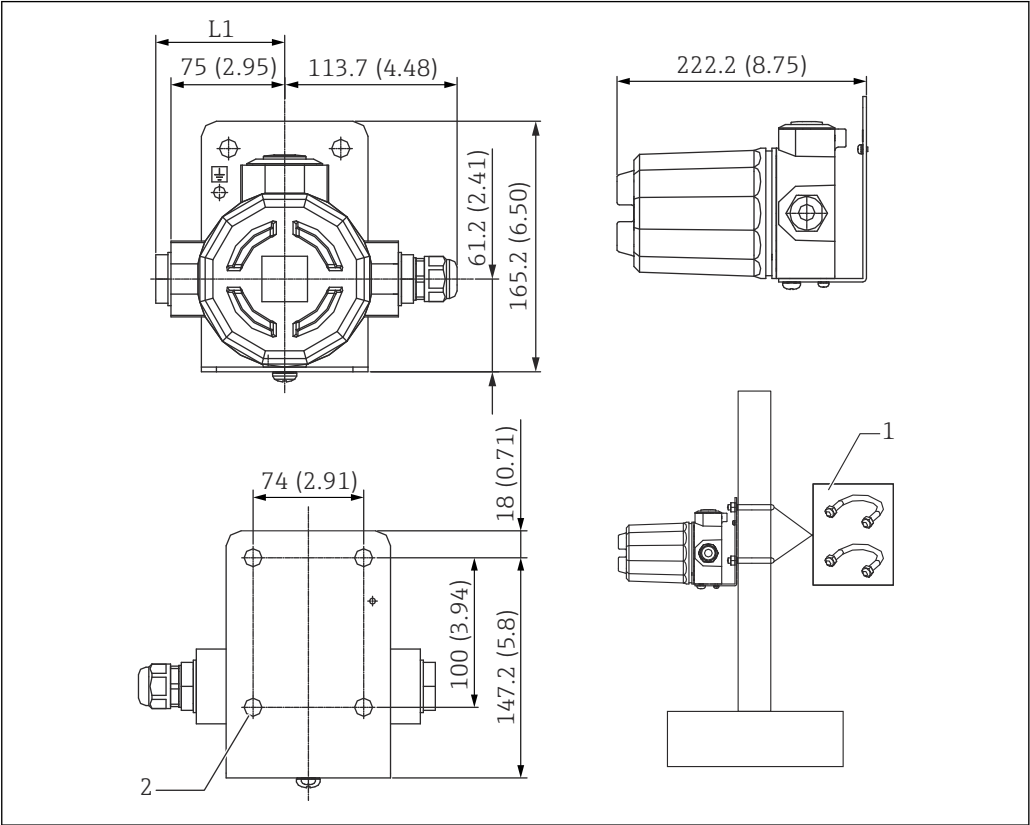
A0039884

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

- 1 Screw (M4) for protective grounding
- 2 Delay trimmer
- 3 Screw (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] converter NRR261 or Ex [ia] converter 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 ϕ 12 mm (0.47 in) holes and M10 securing nuts and bolts (not included in the delivery)).



14 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 ϕ 12 mm (0.47 in) holes

i 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] converter NRR261	Approx. 10 kg (22.05 lb)
	Ex [ia] converter NRR262	Approx. 0.6 kg (1.32 lb)
Detection sensitivity	Float sensor NAR300	- Water-filled pit: set to 10 (0.39) $\pm$ 1 mm (0.04 in) with kerosene at the time of shipment from the factory - Empty pit: 50 (1.97) $\pm$ 5 mm (0.2 in) with kerosene
Materials	Wetted material: NAR300	- Float: SUS316L - Conductivity 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] converter NRR261	Housing/cover: aluminum casting
Ex [ia] converter 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.

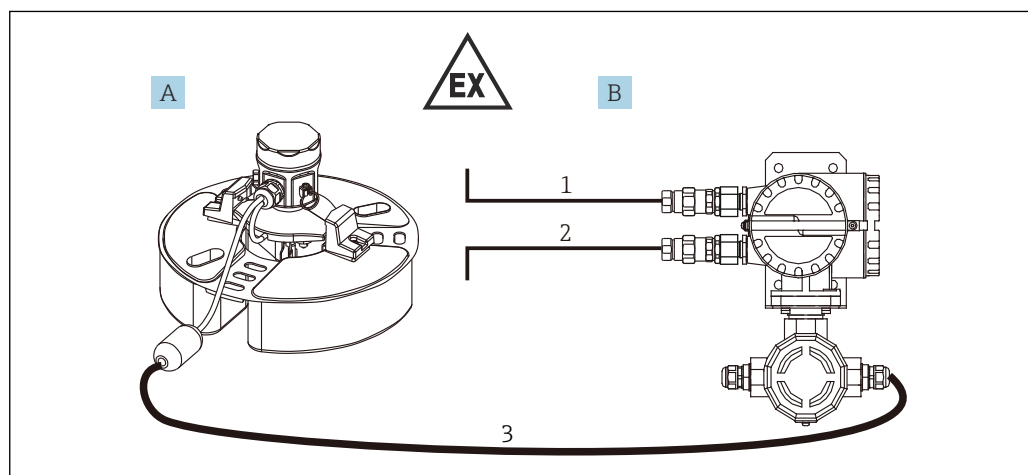
Ex approvals

The NAR300 system has the following four certificates and qualifications:

- ATEX approval: FM14ATEX0048X
- IECEx approval: IECEx FMG 14.0024X
- FM approval: FM24US0015X
- JPN Ex qualification: CML 18JPN8362X

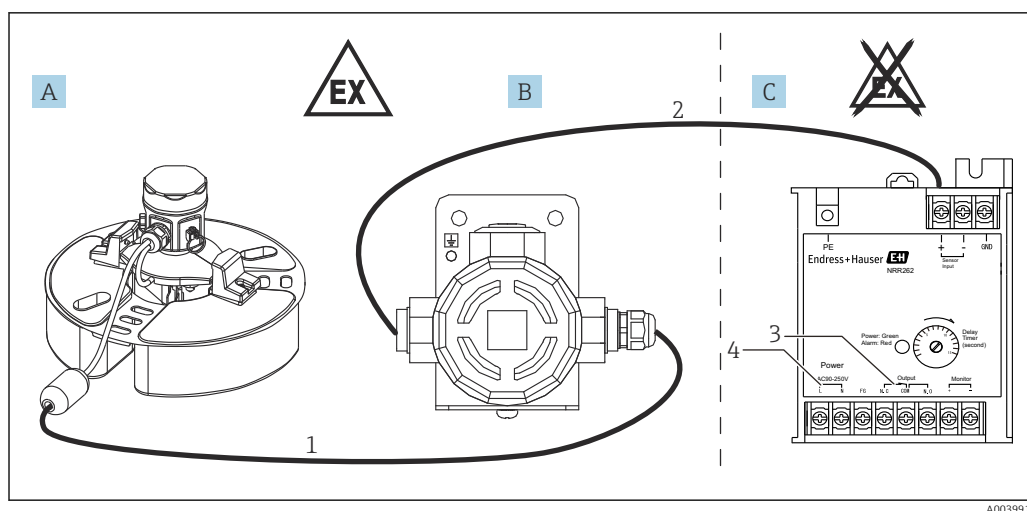


TIIS and JPN Ex devices cannot be mixed.



15 System configuration 1

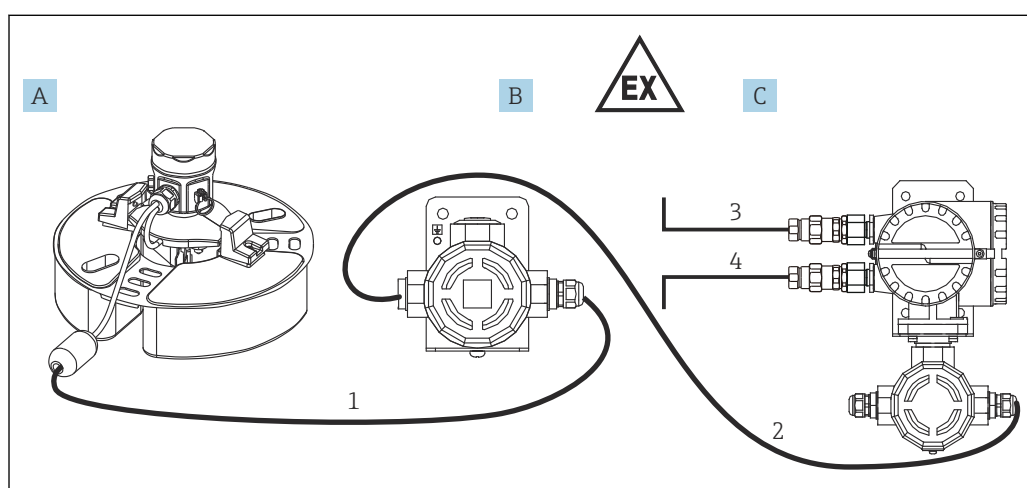
- A Float sensor NAR300-x1xxxx
- B Ex d [ia] converter NRR261 (integrated type)
- 1 Alarm output: alarm/PLC/DCS, etc.
- 2 Power supply (AC/DC)
- 3 Ex [ia]-dedicated connection cable (6 to 30 m (19.69 to 98.43 ft))



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16 System configuration 2

- A Float sensor NAR300-x5xxxx
- B Sensor I/F Ex box
- C Ex [ia] converter 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 converter (refer to "Process conditions")
- 3 Alarm output: alarm/PLC/DCS, etc.
- 4 Power supply (AC/DC)



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17 System configuration 3

- A Float sensor NAR300-x5xxxx
- B Sensor I/F Ex box
- C Ex d [ia] converter 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 converter (refer to "Process conditions")
- 3 Alarm output: alarm/PLC/DCS, etc.
- 4 Power supply (AC/DC)

Functional safety approval

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

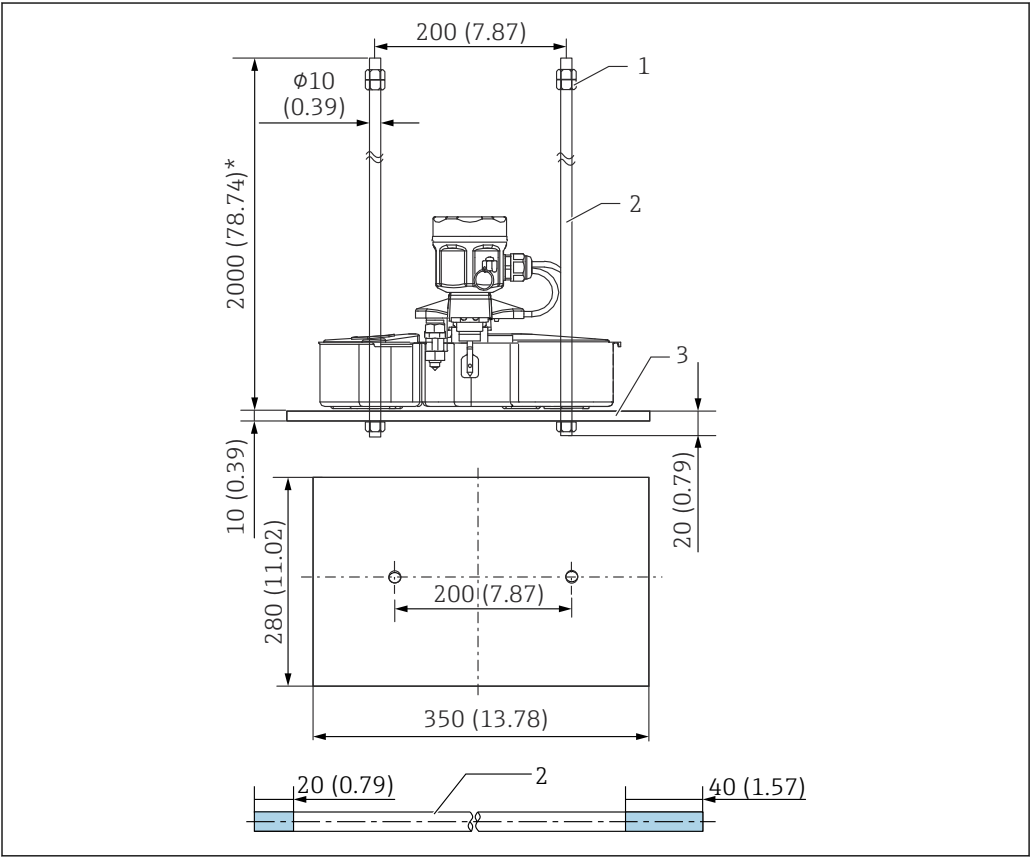
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output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

Accessories

Float guide

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

The float guide is 2 000 mm (78.74 in) in size. If a length shorter than 2 000 mm (78.74 in) is required for use, cut it to size. If a float guide longer than 2 000 mm (78.74 in) is required, contact your nearest Endress+Hauser service center or distributor.



18 Float guide. Unit of measurement mm (in)

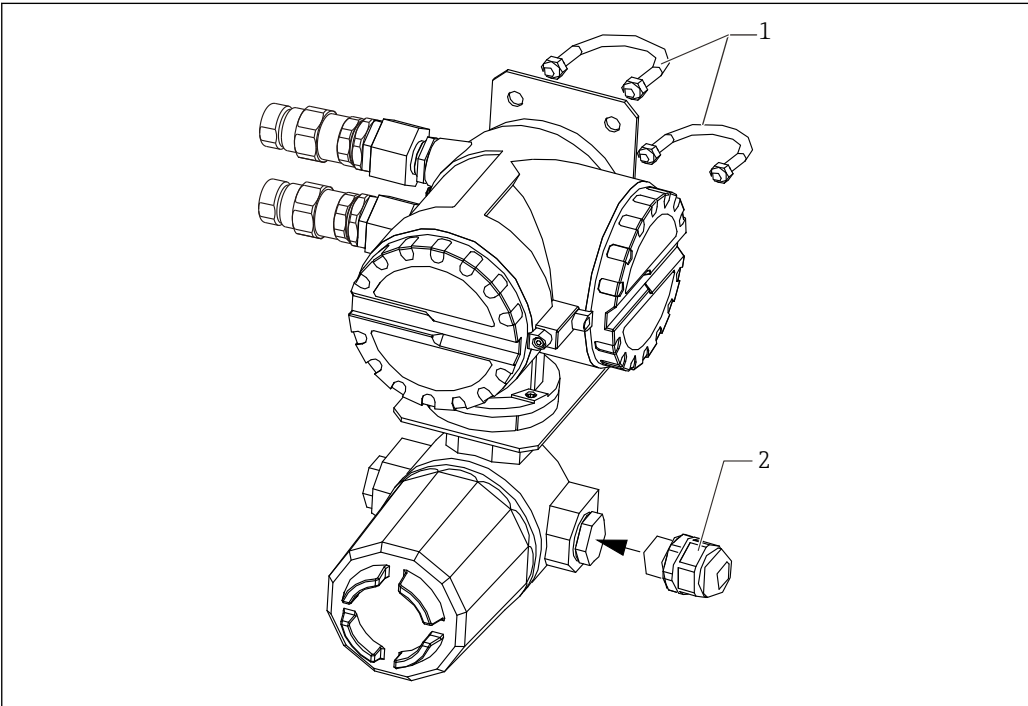
- 1 Nut (M10)
- 2 Float guide
- 3 Weight

Name	Delivered quantity	Materials
Float guide	2	SUS304
Weight	1	SS400 or SUS304 options available for selection
Nut (M10)	6	SUS304

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

**U-bolt / cable gland
(waterproof connection for
JPNE_x)**

A U-bolt (JIS F3022 B50) is used when mounting the converter. Have a pipe with an internal diameter of 50A (2B $\phi 60.5$ mm (198.5 in)) ready. Tighten and secure the cable gland after inserting the cable from NAR300.



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- 19 U-bolt / cable gland
- 1 U-bolt (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



71720721

www.addresses.endress.com
