BA00402G/00/EN/24.23-00
71614570
2023-05-15

Operating Instructions
NAR300 system

Oil leak detector float sensor

Endress+Hauser
People for Process Automation

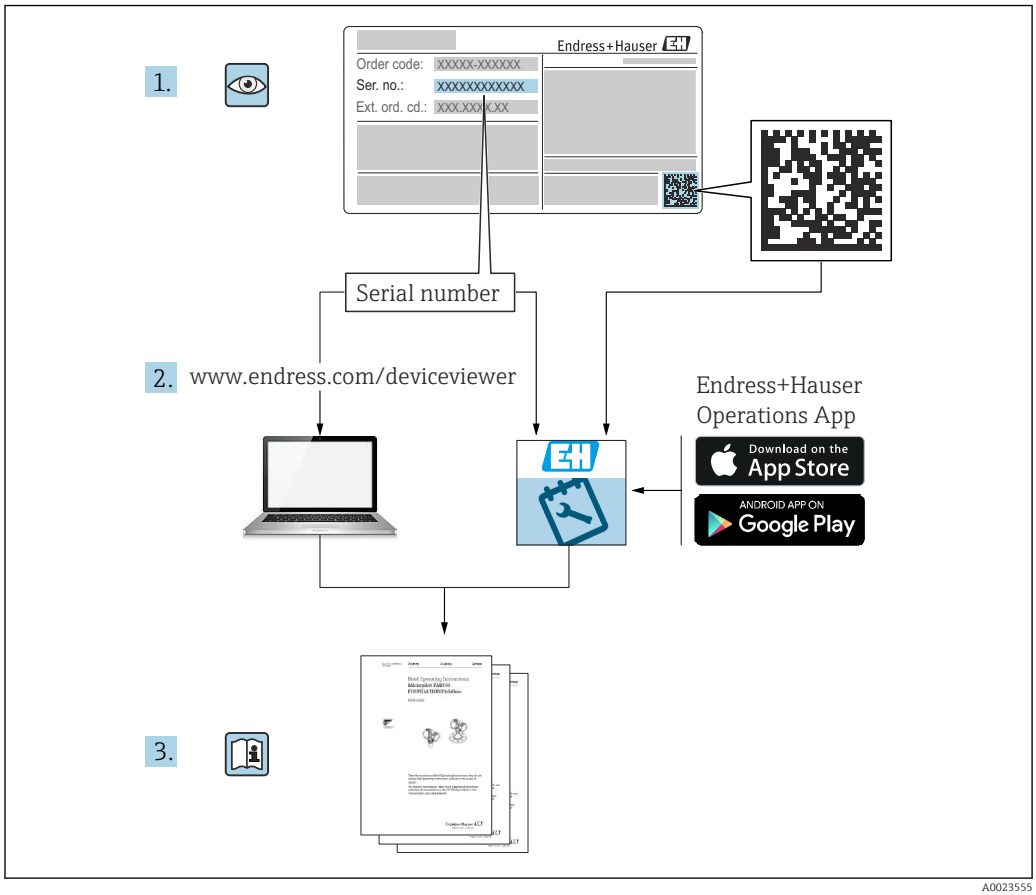

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX XX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
A0023555

Table of contents

1 Document information

1.1 Document function

These 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.

1.2 Symbols used

1.2.1 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.

1.2.2 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.

1.2.3 Tool symbols

Phillips head screwdriver


Flat blade screwdriver


Torx screwdriver


Allen key


Open-ended wrench

1.2.4 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

1.3 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

1.3.1 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.

1.3.2 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.

1.3.3 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.

1.3.4 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.

2 Basic safety instructions

2.1 Basic instructions regarding safety

2.1.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

Application and measured materials
Measuring devices for use in hazardous areas, in hygienic applications or in applications where there is an increased risk due to process pressure are labeled accordingly on the nameplate.

Take the following measures to ensure that the device is used under appropriate conditions while in operation:
- Only use the measuring device in full compliance with the specifications on the nameplate and the general conditions listed in the operating instructions and supplementary documentation.
- Check the nameplate specifications to ensure that the ordered device can be put to its intended use in the approval-related area (e.g. explosion protection, pressure vessel safety).
- When not using this device at atmospheric temperature, it is important to comply with the basic requirements listed in the relevant documentation for the device.
- Protect the device permanently against corrosion caused by environmental effects.
- Observe the limit values in the "Technical Information."

The manufacturer is not liable for damage caused by improper or unintended use.

2.3 Workplace safety

When working with the device:
- Wear personal protection gear required by your regional/national regulations.

2.4 Operational safety

Risk of injury!
- Operate the device only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:
- If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:
- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to the repair of an electrical device.
- Use only original spare parts and accessories from the manufacturer.

Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):
- Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation that is an integral part of these instructions.

2.5 Product safety

The NAR300 system is designed in accordance with GEP (Good Engineering Practice) to meet the latest safety requirements, and it has been tested to ensure that it is ready to be used safely before being shipped from the factory. The NAR300 system meets general safety standards and legal requirements.

2.5.1 CE mark

This measurement system meets the legal requirements of the applicable EU directive. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

3 Product description

The NAR300 system is installed in a pit inside the oil-retaining wall of a tank or in a sump pit near a plant or a pump yard, and it provides the ultimate leak detection function for oils, such as petrochemicals and vegetable oils. Sensors with two different detection principles, a conductive type and a tuning fork type, are used to monitor detection conditions independently. In addition, a two-stage alarm logic allows for an extremely low false-positive alert, ensuring the safety of the tank yard with a precise and simple device configuration.

NOTICE

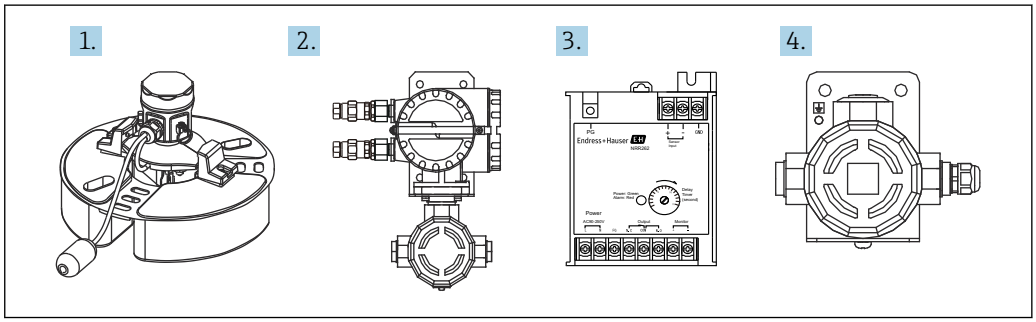
TIIS specifications

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

- If you are using a product with TIIS specifications, download and refer to BA00403G/JA/23.22-00 or an earlier version from our website (www.endress.com/downloads).

3.1 Product design

The NAR300 system is configured mainly in combination with the following products.



1 *Product design*

1 *Float sensor NAR300*
2 *Ex d [ia] Converter NRR261*
3 *Ex [ia] Converter NRR262*
4 *Ex [ia] sensor I/F Ex box*

3.2 Technical data

3.2.1 Float sensor NAR300

Item	Description
Protection class	IP67 (outdoor installation type)
Power supply	Supplied by sensor I/F Ex box or NRR261 (NAR300 sensor I/F Ex box, integrated type)
Wetted material	▪ Float: SUS316L, conductivity sensor: SUS316 and PTFE ▪ Tuning fork sensor: SUS316L equivalent
Detection sensitivity [1)]	▪ Water-filled pit: 10 ± 1 mm (0.04 in) with kerosene at the time of shipment from the factory ▪ Empty pit: 50 ± 5 mm (0.17 in) with kerosene

Item	Description
I/O cable	Dedicated shielded cable (PVC) as well as with cable float (Standard 6 m (19.69 ft))
Weight	Approx. 2.5 kg (5.5 lb) (including the dedicated shielded cable (PVC) 6 m (19.69 ft))

1) Adjusted with oil (kerosene: approx. density 0.8), lower-layer water (water: approx. density 1.0), static level and/or without surface tension.

3.2.2 Ex [ia] sensor I/F Ex box

Item	Description
Protection class	IP67 (outdoor installation type)
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
Weight	3.2 kg (7.1 lb)
Materials	Housing/cover: Aluminum casting

3.2.3 Ex d [ia] Converter NRR261

Item	Description
Protection class	IP67 (outdoor installation type)
Permissible power-supply voltage range	▪ AC power supply: 90 to 250 V_{AC}, 50/60 Hz ▪ DC power supply: 22 to 26 V_{DC} (built-in power supply arrester)
Maximum power consumption	▪ AC power supply: 20 VA ▪ DC power supply: 2 W
Output	▪ Contact output: 1SPDT ▪ Maximum contact rating: 250 V_{AC}, 1 A, 100 VA or 100 V_{DC}: 1 A, 25 W ▪ Fail-safe function: Activated when the power is turned off and under frozen conditions (refer to "Alarm output table")
Cable entry	▪ G3/4 x2 (Ex d), G1/2 x1 (Ex ia) ▪ G1/2 x 2 (Ex d), G1/2 x 1 (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)
Weight	Approx. 10 kg (22 lb)
Materials	Housing/cover: Aluminum casting

3.2.4 Ex [ia] Converter NRR262

Item	Description
Protection class	IP20 (indoor installation), installed in non-hazardous locations
Permissible power-supply voltage range	▪ AC power supply: 90 to 250 V_{AC}, 50/60 Hz ▪ DC power supply: 22 to 26 V_{DC} (built-in power supply arrester)
Maximum power consumption	▪ AC power supply: 20 VA ▪ DC power supply: 2 W

Item	Description
Output	▪ Contact output: 1SPDT ▪ Maximum contact rating: 250 V_{AC}, 1 A, 100 VA or 100 V_{DC}: 1 A, 25 W ▪ Fail-safe function: Activated when the power is turned off and under frozen conditions (refer to "Alarm output table")
Lightning arrester	Built-in (power supply arrester)
Weight	Approx. 0.6 kg (1.3 lb)
Materials	Housing: Plastic

3.3 Process conditions

3.3.1 Float sensor NAR300 / sensor I/F Ex box

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 ▪ Affinity with water is low (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/ [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 sea water
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.

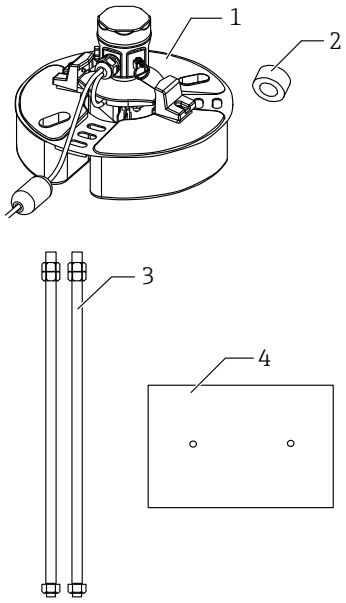
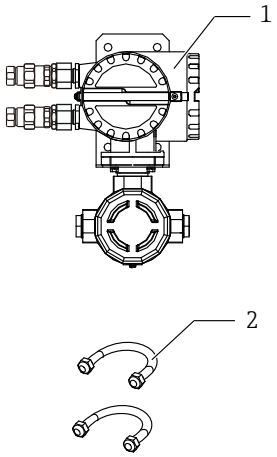
1) Sensitivity will vary with the specific gravity of lower-layer water that differs from the factory-setting environment, such as when an antifreeze is used.

3.3.2 Connecting cable (connection to Converter NRR261/262 from sensor I/F Ex box)

Item	Description
Connecting cables	Maximum inductance: 2.3 mH, maximum capacitance: 83 nF Example: 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 extended cable length: 1.27 km The smaller of 1 or 2 is the maximum cable length (round down instead of rounding off)
Operating temperature	−20 to 60 °C (−4 to 140 °F)

3.4 Delivery example by order code

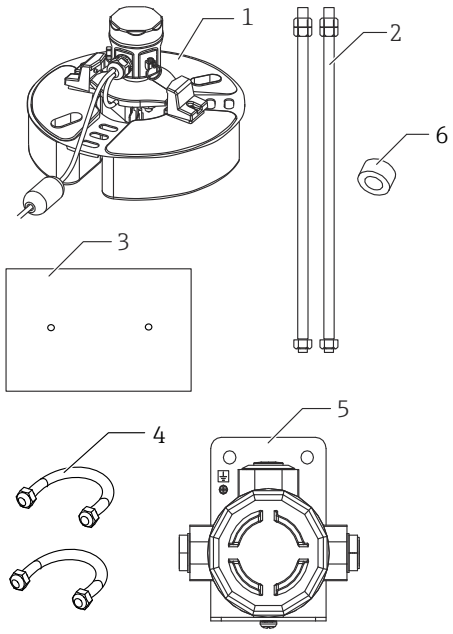
Delivery example 1

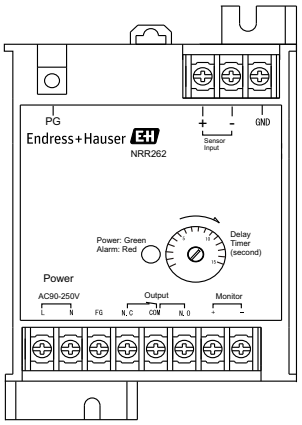
Float sensor order code	Converter order code
NAR300- * 1* * 2 / 3 A	NRR261-A/B/C/4
 *1 Float sensor* *2 Check tool (accessory)* *3 Float guide (bar) packaged separately* *4 Weight (packed at the bottom of the box with the converter)*	 *1 NRR261* *2 U-bolt*

A cable gland (water-proof connection) is only included with the sensor I/F Ex box or NRR261 with JPNEx specifications.

Delivery example 2

Float sensor order code	Converter order code
NAR300- * 5* * 2/3*	NRR262

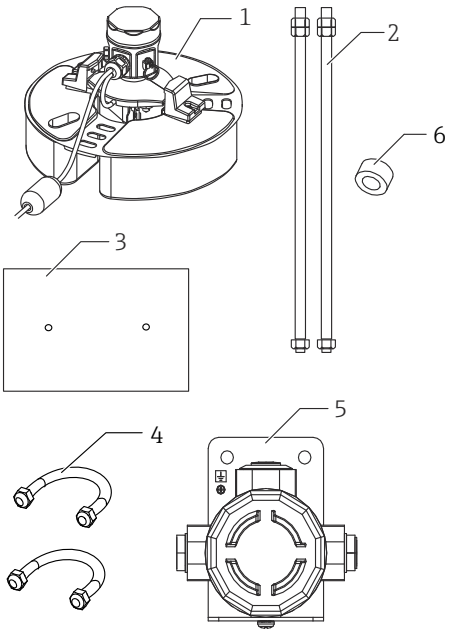
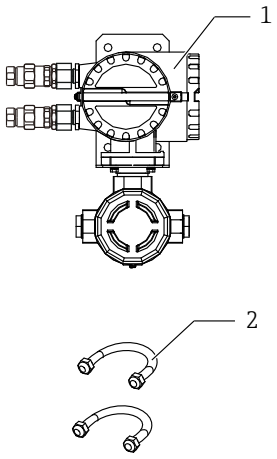




1 *Float sensor*
2 *Float guide (bar) packaged separately*
3 *Weight (packed at the bottom of the box with the converter)*
4 *U-bolt*
5 *Sensor I/F Ex box*
6 *Check tool (accessory)*

- The sensor I/F Ex box is included in the order code NAR300-x5xxxx. The intrinsically safe system is used in combination with NRR262.
- A cable gland (water-proof connection) is only included with the sensor I/F Ex box or NRR261 with JPNEx specifications.

Delivery example 3

Float sensor order code	Converter order code
NAR300- * 5* * 2/3*	NRR261 - 5**
	
1 Float sensor *2 Float guide (bar) packaged separately* *3 Weight (packed at the bottom of the box with the converter)* *4 U-bolt* *5 Sensor I/F Ex box* *6 Check tool (accessory)*	*1 NRR261* *2 U-bolt*

- The sensor I/F Ex box is included in the order code NAR300 - x5xxxx. The Ex d [ia] system is used in combination with NRR261- 5**.
- A cable gland (water-proof connection) is only included with the sensor I/F Ex box or NRR261 with JPNEx specifications.

3.5 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 detection 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

Adjusted with oil (kerosene: approx. density: 0.8), lower-layer water (water: approx. density: 1.0), static level condition and without surface tension.

3.6 Pit water

3.6.1 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 itself due to salt coating
- Corrosion of the float sensor caused by sea water

3.6.2 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.

3.6.3 Pit water with high electrical resistance

Use in pit water with high electrical resistance, such as in a steam drain or 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)

3.6.4 Frozen pit water

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

3.7 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.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Upon receipt of the goods, check the following:
- Are the order codes on the delivery note and the product label identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) enclosed?

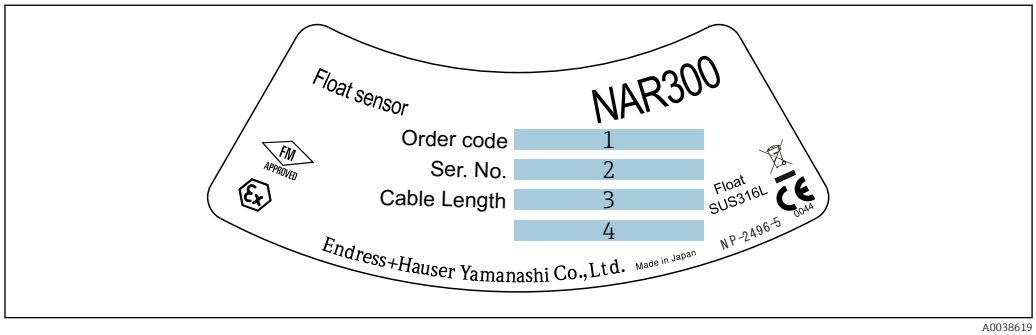
If one or more of these conditions are not satisfied, contact your Endress+Hauser Sales Center or distributor.

4.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Extended order code on the delivery note (including details of the device specification codes)
- Entering the serial number from the nameplate in *W@M Device Viewer* (www.endress.com/deviceviewer) will display all the information about the device.

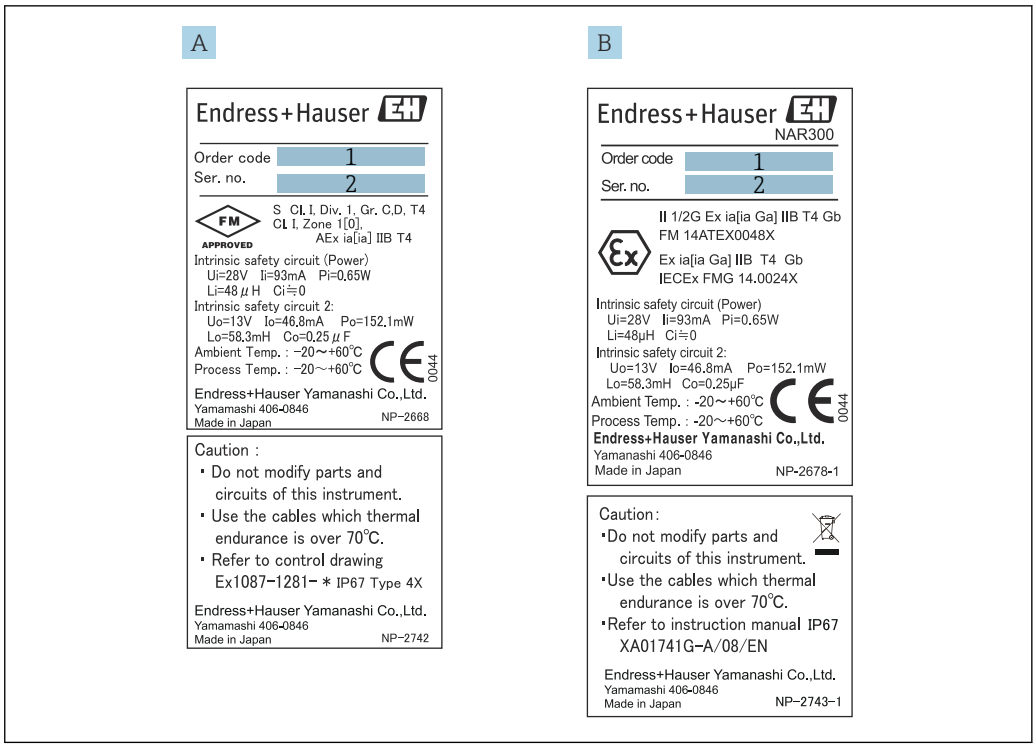
Note that the information on a nameplate may be changed without notice when credentials and certificates are updated.

4.2.1 Nameplate specifications



2 *NAR300 model nameplate*

1 *Order code*
2 *Serial number*
3 *Cable length (order code 040)*
4 *Explosion-proof performance*



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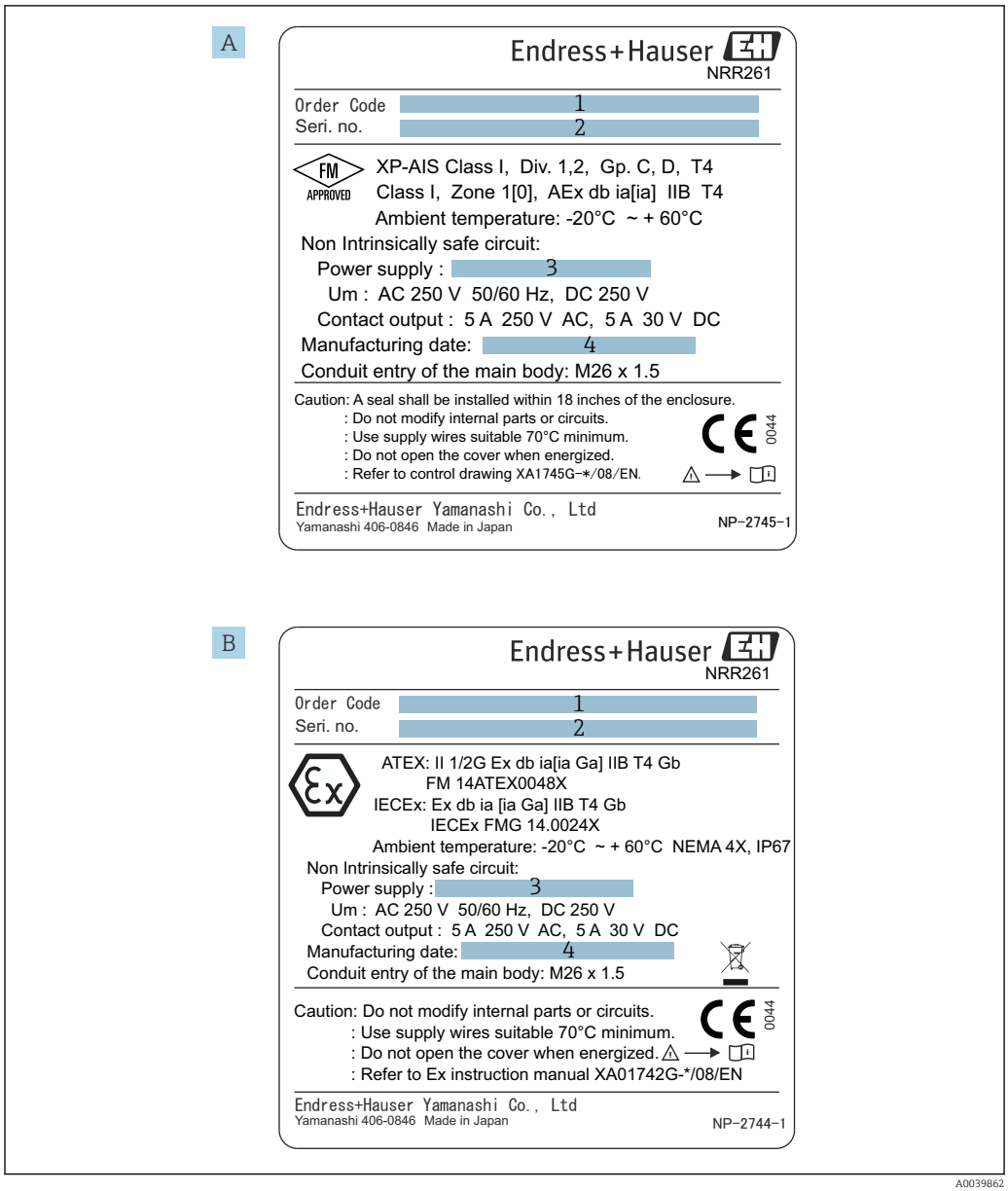
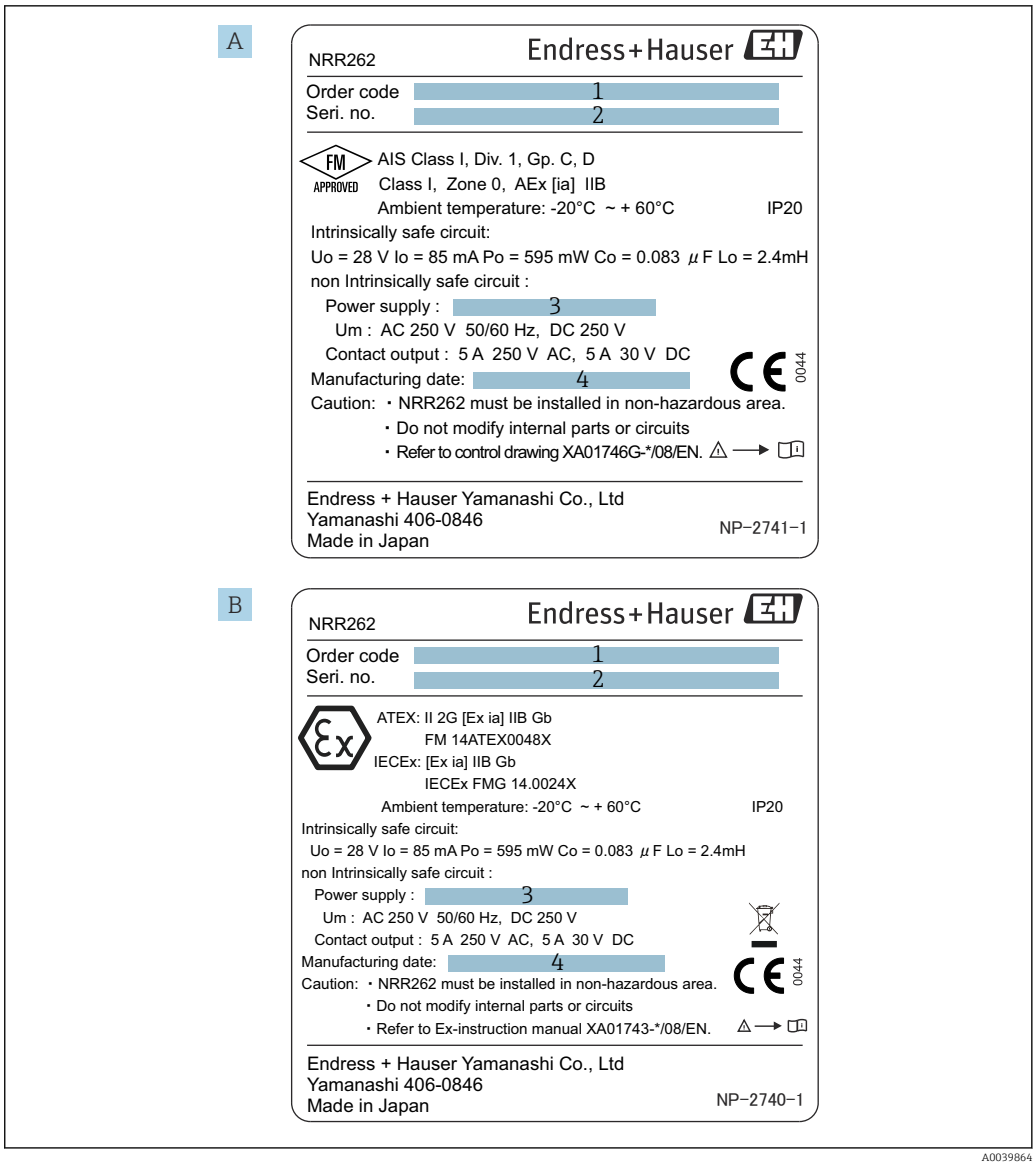
3 Nameplate for NAR300

A NAR300 nameplate for FM
B NAR300 nameplate for ATEX / IECEx
1 Order code
2 Serial number



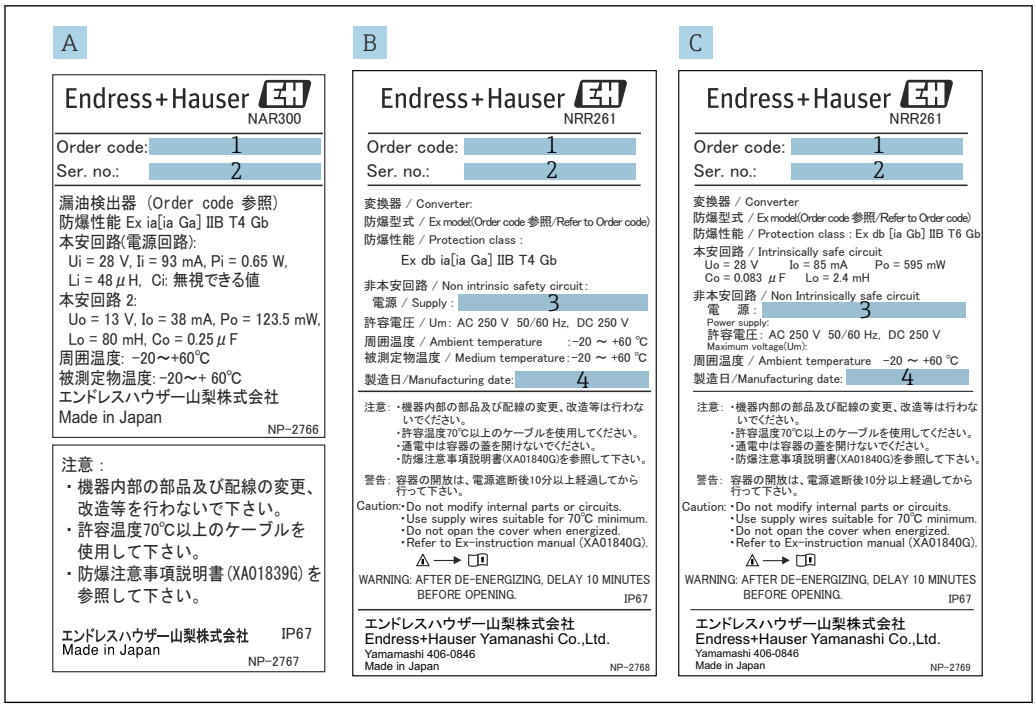
4 *Nameplate for NRR261*

A NRR261 nameplate for FM (NAR300 integrated type)
B NRR261 nameplate for ATEX / IECEx (NAR300 integrated type)
1 Order code
2 Serial number
3 Power supply voltage
4 Manufacturing date



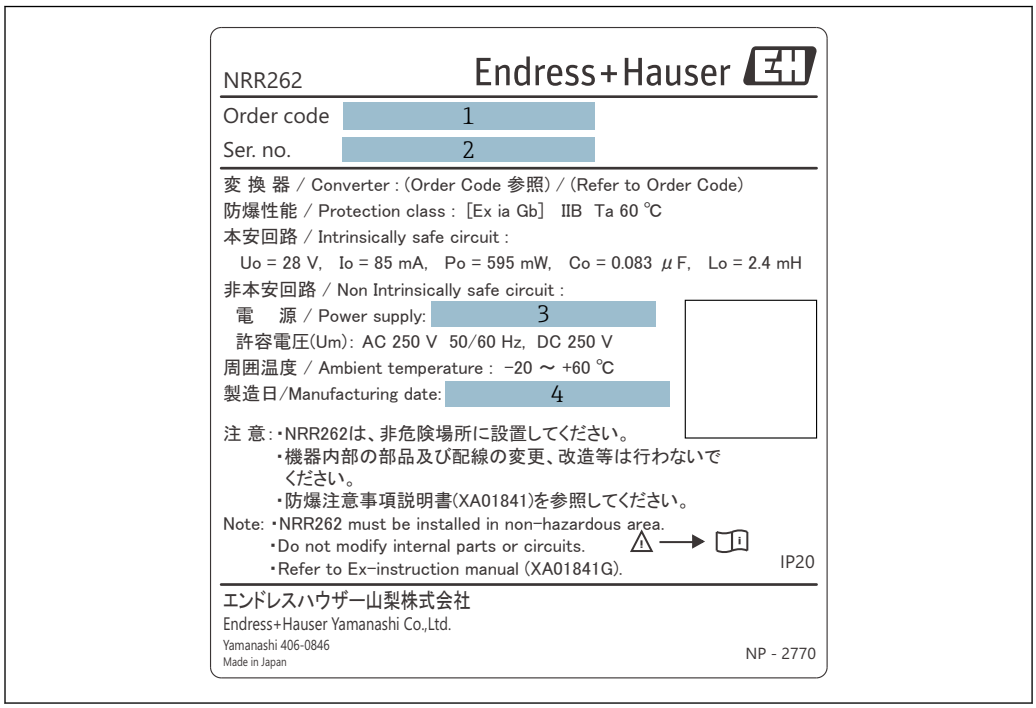
5 Nameplate for NRR262

A NRR262 nameplate for FM
B NRR262 nameplate for ATEX / IECEx
1 Order code
2 Serial number
3 Power supply voltage
4 Manufacturing date



6 NAR300/NRR261 nameplates

A NAR300 nameplate for JPN Ex
B NRR261 nameplate for JPN Ex (NAR300 integrated type)
C NRR261 nameplate for JPN Ex (NAR300 separate type)
1 Order code
2 Serial number
3 Power supply voltage
4 Manufacturing date



7 NRR262 nameplate for JPN Ex

1 Order code
2 Serial number
3 Power supply voltage
4 Manufacturing date

4.3 Manufacturer address

Endress+Hauser Yamanashi Co., Ltd.
406-0846
862-1 Mitsukunugi, Sakaigawa-cho, Fuefuki-shi, Yamanashi

4.4 Storage and transport

4.4.1 Storage conditions

- Storage temperature: −20 to +60 °C (−4 to 140 °F)
- Store the device in its original packaging.

4.4.2 Transport

NOTICE

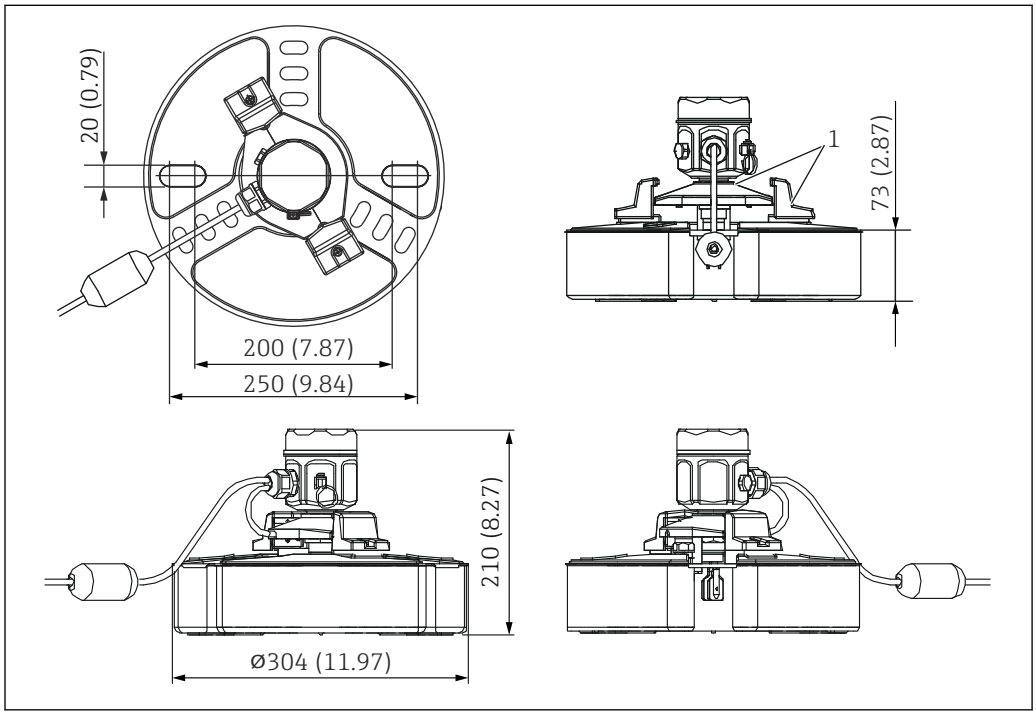
The housing may become damaged or dislodged.
Risk of injury

- ▶ When transporting the device to the measuring point, either use the device's original packaging or hold by the process connector.
- ▶ Secure a hoisting device (such as a hoisting ring or a lifting eye bolt) to the process connector, not to the housing. Pay attention to the device's center of gravity to prevent unexpected tilting.
- ▶ Comply with the safety precautions and transportation conditions for devices that weigh 18 kg (39.6 lbs) or more (IEC61010).

5 Installation

5.1 NAR300 system dimensions

5.1.1 Dimensions of NAR300 float sensor



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

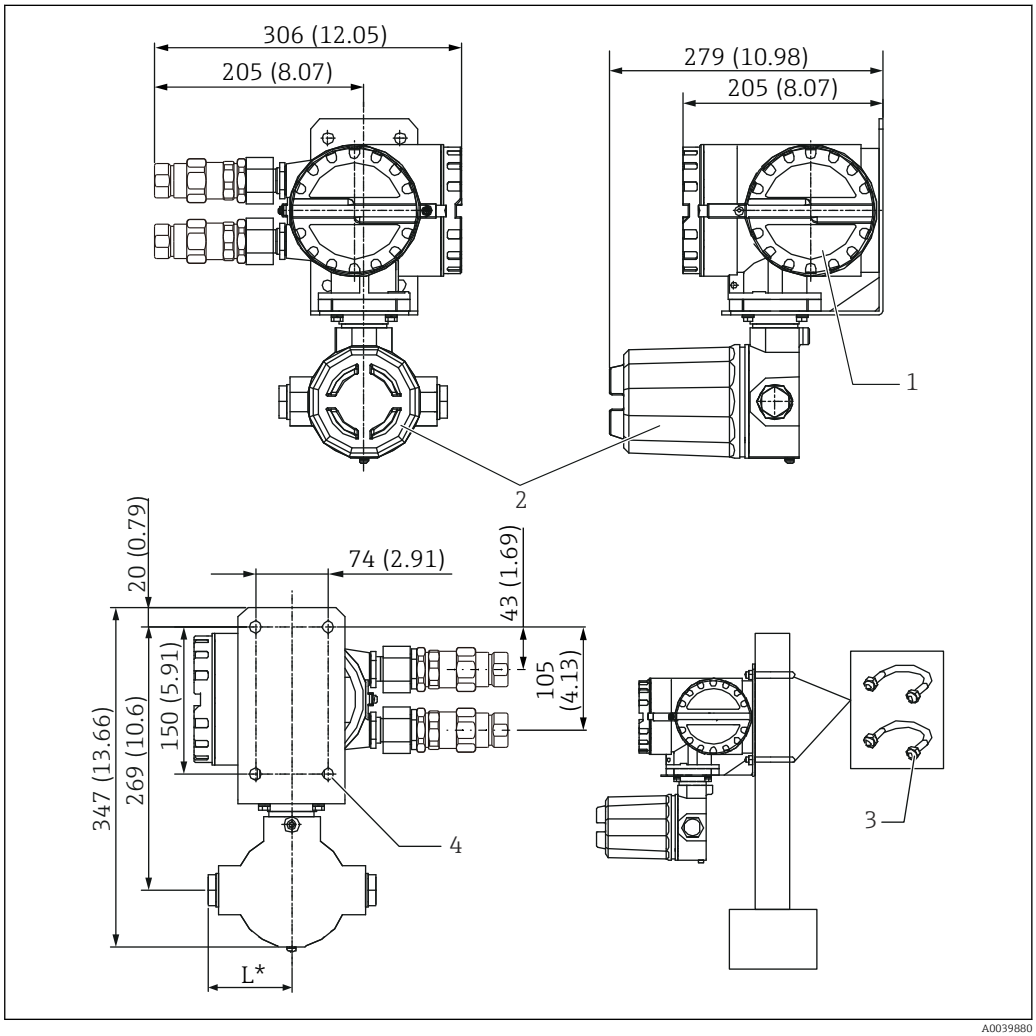
1 Float sensor cover

5.1.2 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: φ12 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-φ12 mm (0.47 in) holes and M10 securing nuts and bolts (not included in the delivery)).

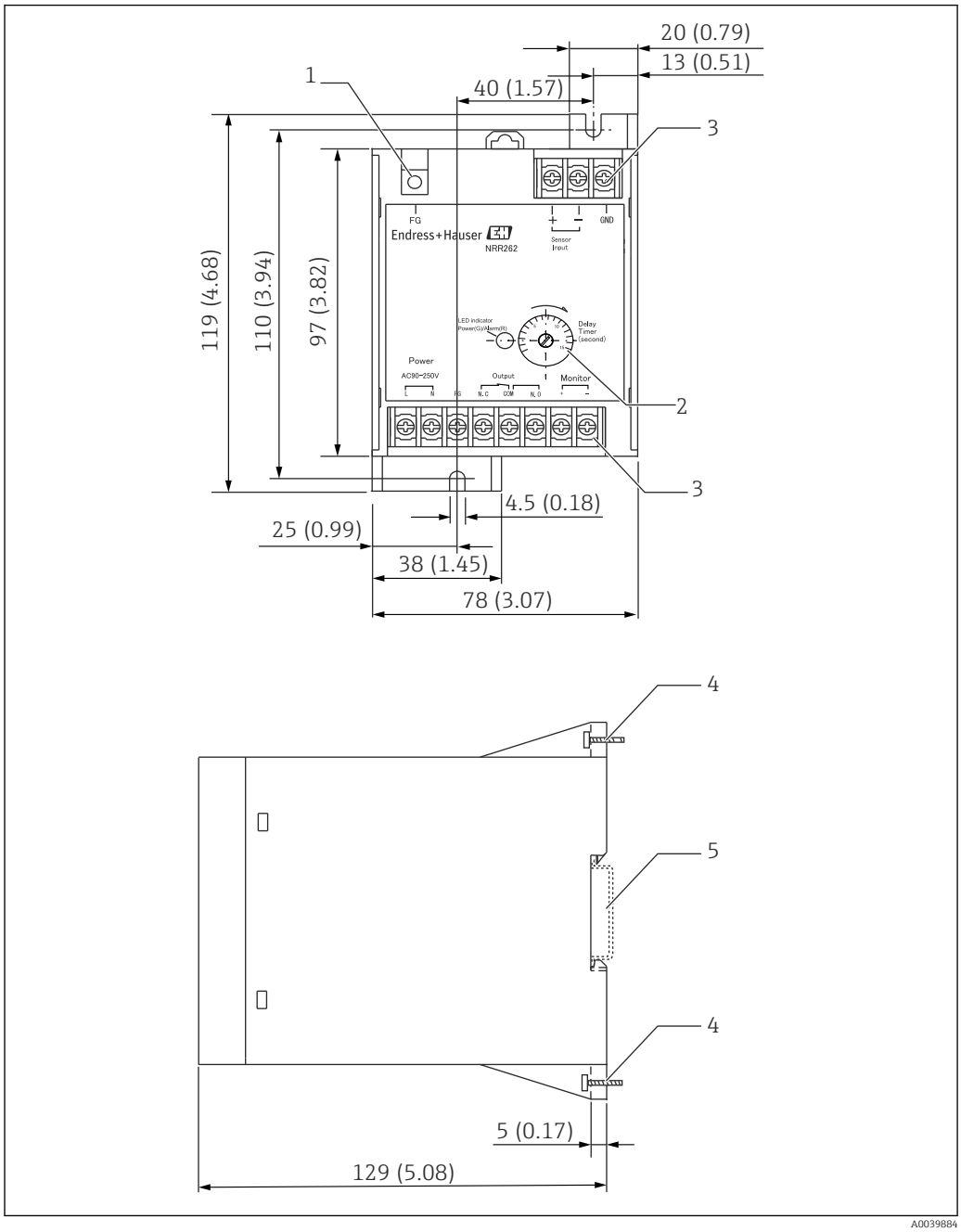


9 *Outline of NRR261. Unit of measurement mm (in)*

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)*

5.1.3 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-mounted method is beneficial in cases where multiple converters are mounted in series, and in cases where installation of additional converters is expected in the future.

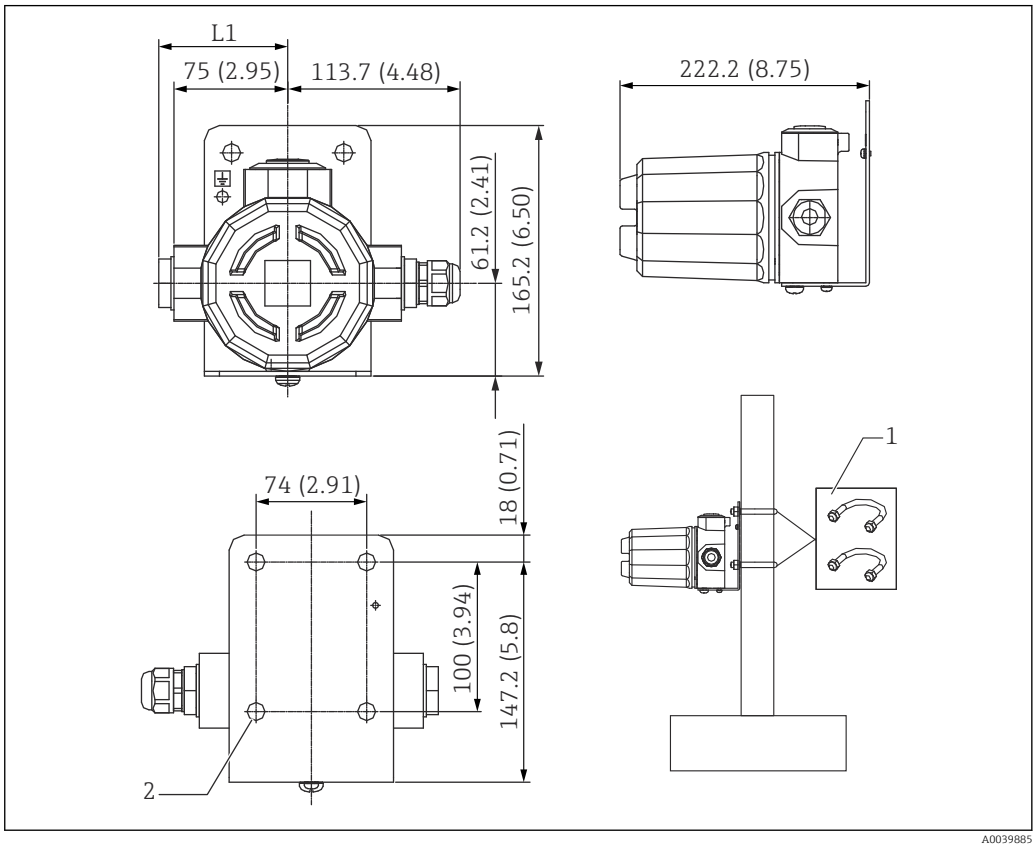


10 Outline of NRR262. Unit of measurement mm (in)

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

5.1.4 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-φ12 mm (0.47 in) holes and M10 securing nuts and bolts (not included in the delivery)).

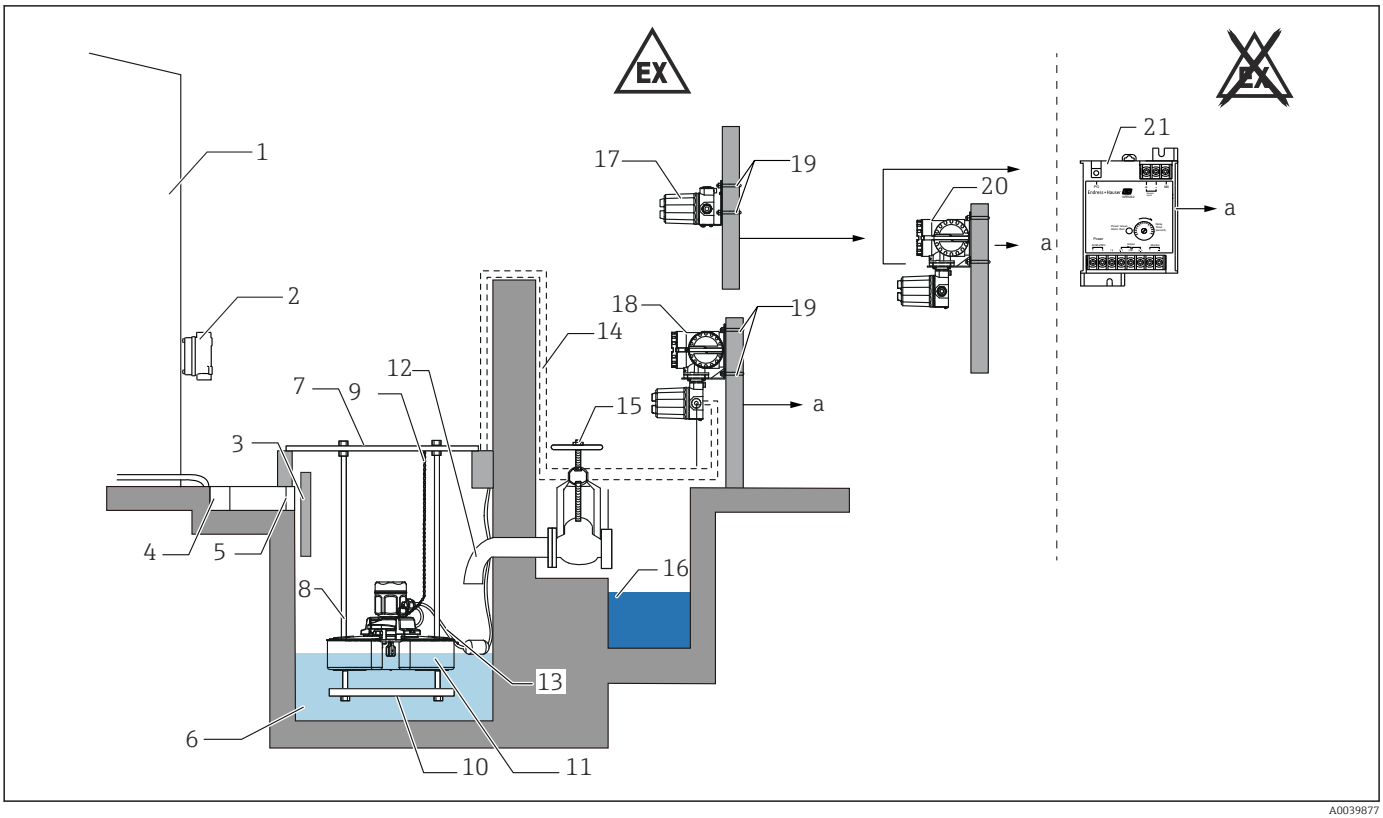


11 Outline of Ex [ia] sensor I/F Ex box. Unit of measurement mm (in)

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.

5.2 Installation conditions



12 *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."

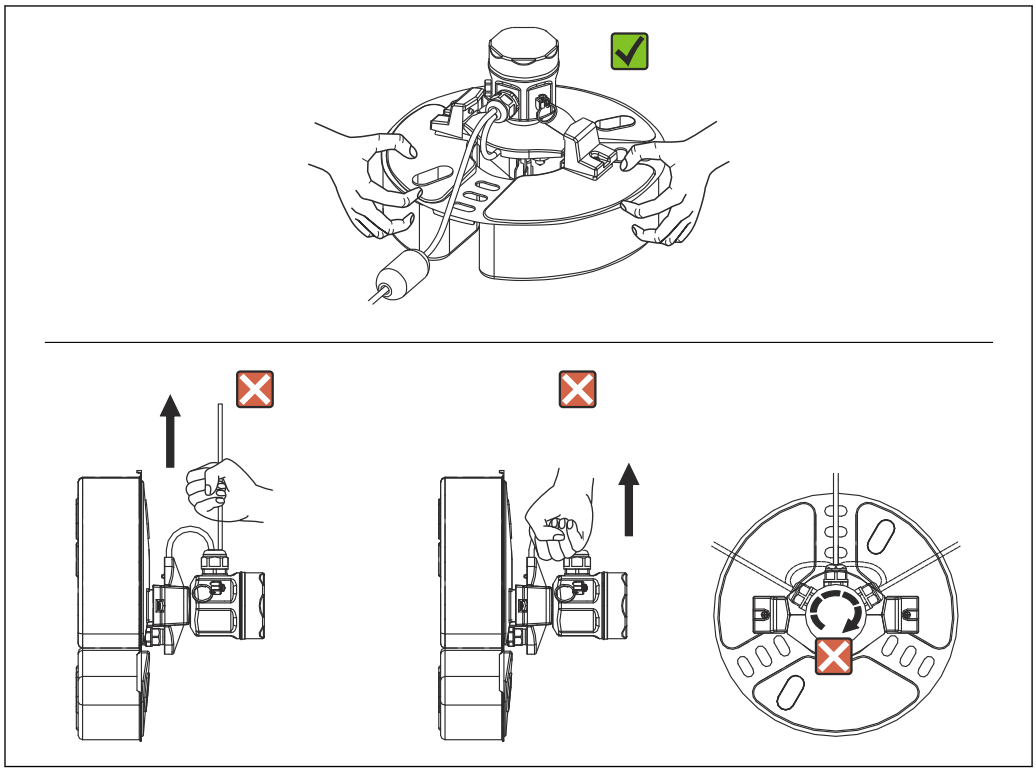
5.2.1 Installation/mounting-related precautions

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.

5.3 Mounting the NAR300 system

5.3.1 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.

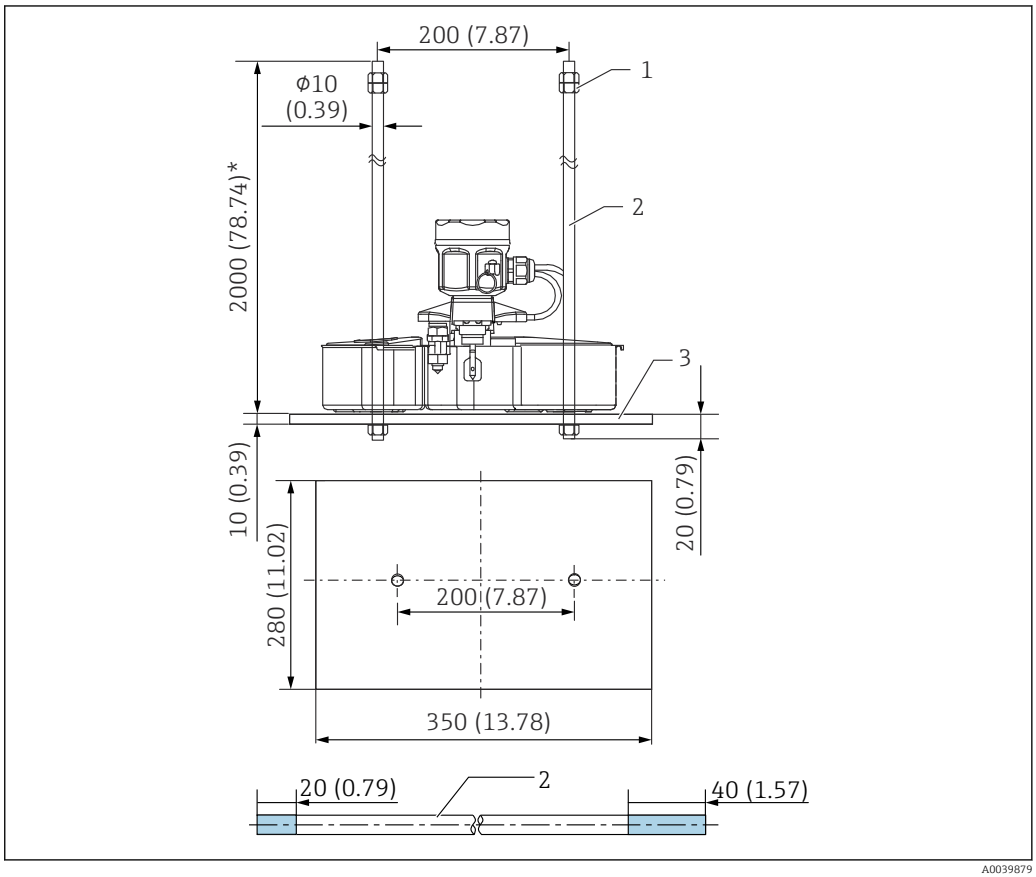


13 *Handling the NAR300*

5.3.2 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.



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

1 Nut (M10)
2 Float guide
3 Weight

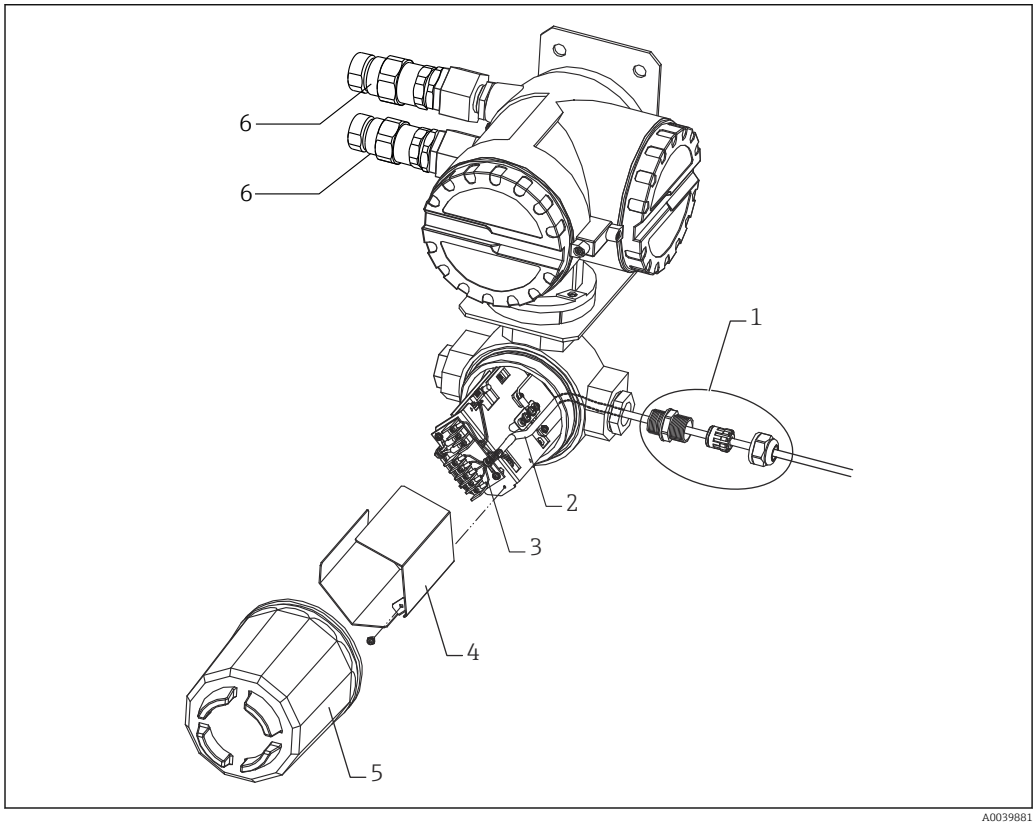
The 20 mm (0.73 in) and 40 mm (1.57 in) of the float guide in the diagram represent lengths of the thread grooves.

5.3.3 NRR261-4xx (integrated type) cable mounting

Mounting procedure

1. Remove the intrinsically safe terminal box cover [7] and the circuit board guard [6].
2. Insert the float sensor cable [4] into the cable gland [1] and cable entry for the intrinsically safe terminal box.
3. Connect the cable to the terminal block (refer to "Electrical connection").
4. Tighten the main unit of the cable gland [1] and the seal nut.
   ↳ Tightening torque (main unit and seal nut): approx. 1.96 N·m (20 kgf cm)
5. Secure the cable in place with a cable holder [5].
6. Install the circuit board guard and close the cover of the intrinsically safe terminal box.

This completes the mounting procedure.



15 NRR261-4xx cable mounting

1 Cable gland mounting example
2 Float sensor cable
3 Cable holder
4 Circuit board guard
5 Intrinsically safe terminal box cover
6 Cable gland (Ex d) (supplied with JPN Ex specifications only)

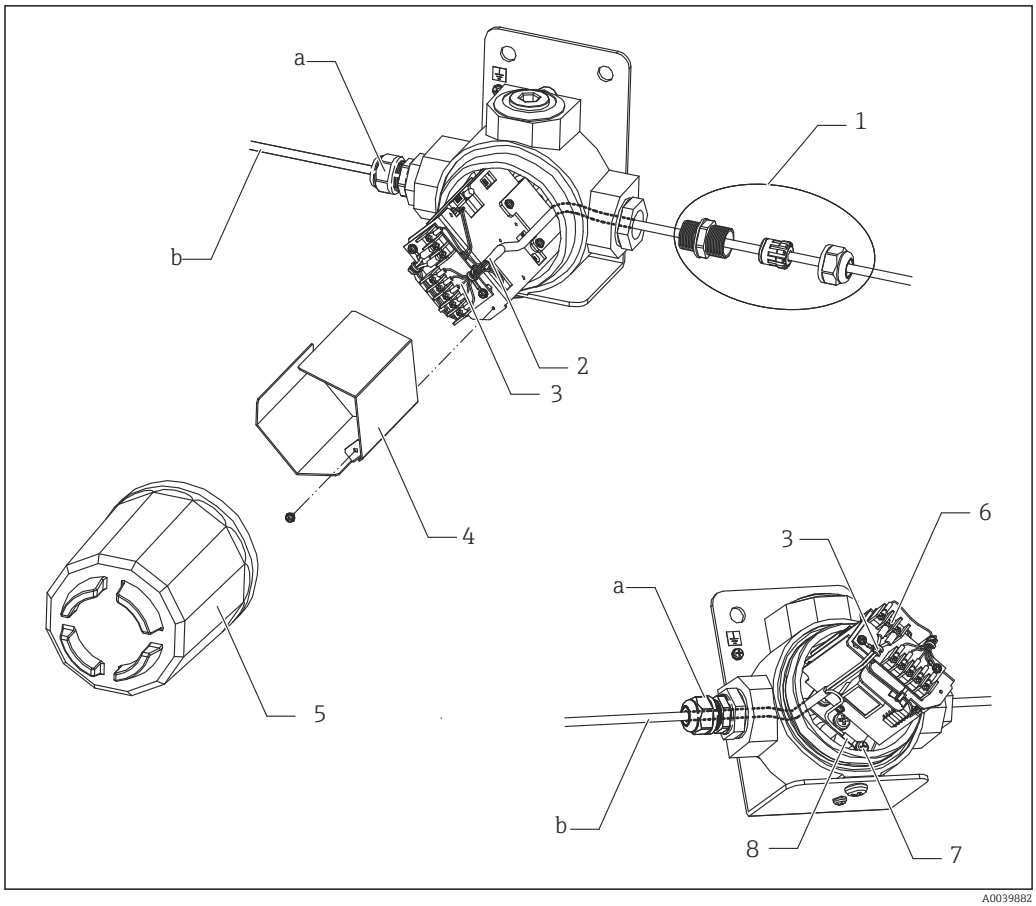
Since the cable gland [1] shown in the diagram is not supplied with products that do not have JPN Ex specifications, a water-proof cable gland that is IP67 or higher must be procured separately.

5.3.4 NAR300-x5xxxx and sensor I/F Ex box cable mounting

Mounting procedure

1. Remove the intrinsically safe terminal box cover [5] and the circuit board guard [4].
2. Insert the float sensor cable [2] into the cable gland [1] and cable entry for the intrinsically safe terminal box.
3. Connect the cable to the terminal block (refer to "Electrical connection").
4. Tighten the main unit of the cable gland [1] and the seal nut.
   ↳ Tightening torque (main unit and seal nut): approx. 1.96 N·m (20 kgf cm)
5. Insert the NRR262/NRR261 connection cable into the cable entry of the terminal box, and connect it to the terminal block.
6. Secure the cable in place with a cable holder [3].
7. Install the circuit board guard and close the cover of the intrinsically safe terminal box.

This completes the mounting procedure.



16 *NAR300-x5xxxx and sensor I/F Ex box cable mounting*

a *Cable gland*
b *Shielded cable for NRR261/262 (must be procured separately)*
1 *Cable gland mounting example*
2 *Float sensor cable*
3 *Cable holder*
4 *Circuit board guard*
5 *Intrinsically safe terminal box cover*
6 *Shielded cable screw (M3)*
7 *Screw (M5)*
8 *Shielded cable gland*

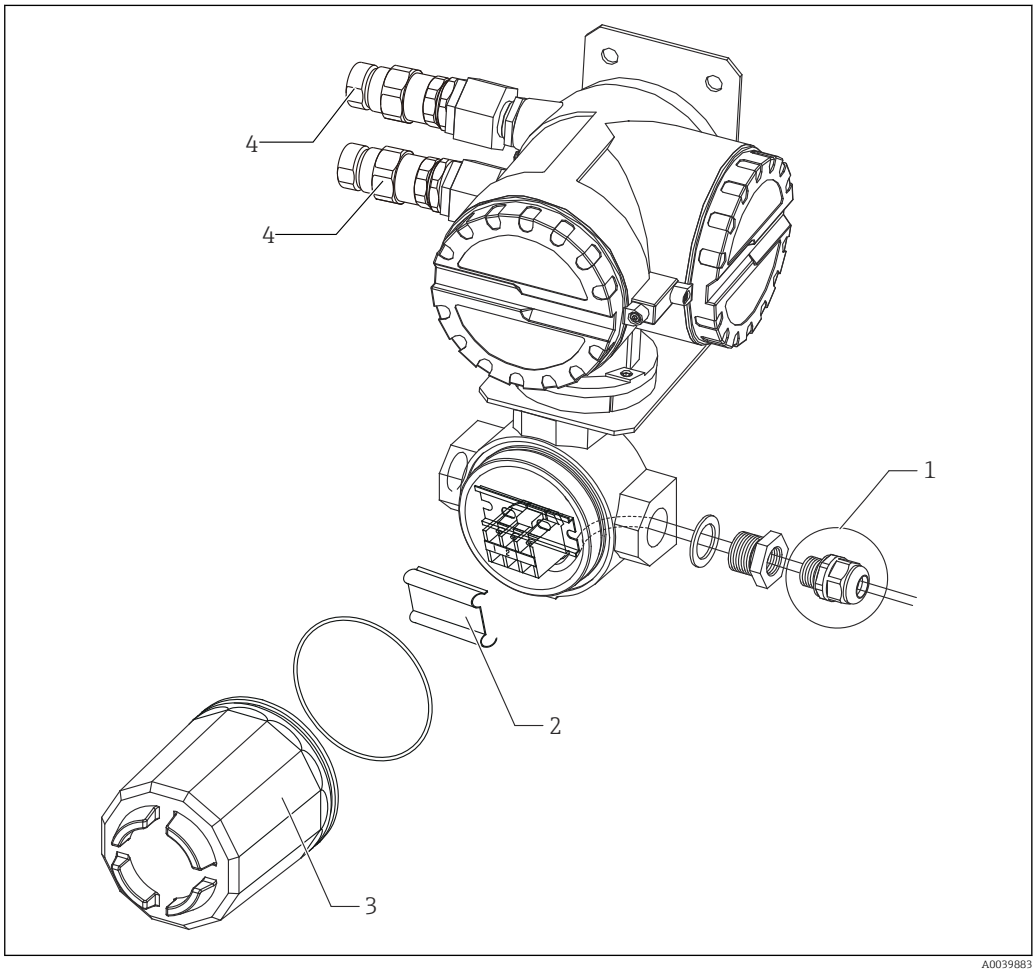
Since the cable gland a shown in the diagram is not supplied with products that do not have JPN Ex specifications, a water-proof cable gland that is IP67 or higher must be procured separately.

5.3.5 NRR261-5xx cable mounting

Mounting procedure

1. Remove the intrinsically safe terminal box cover [6] and the terminal block cover [5].
2. Insert the float sensor cable [2] into the cable gland [1] and cable entry for the intrinsically safe terminal box.
3. Connect the cable to the terminal block (refer to "Electrical connection").
4. Mount the cable gland [1] according to the operating instructions.
5. Secure the cable in place with the cable holder.
6. Install the terminal block cover and close the cover of the intrinsically safe terminal box.

This completes the mounting procedure.



17 *NRR261-5xx cable mounting*

1 *Cable gland mounting example*
2 *Terminal block cover*
3 *Intrinsically safe terminal box cover*
4 *Cable gland (Ex d) (supplied with JPN Ex specifications only)*

Since the cable gland [1] shown in the diagram is not supplied with products that do not have JPN Ex specifications, a water-proof cable gland that is IP67 or higher must be procured separately.

5.4 Adjustment

5.4.1 Verification of detection sensitivity in actual liquid

Verification of detection sensitivity when the lower layer is water and the upper layer is oil

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. When an accurate detection check is required, apply a small amount of neutral detergent to the electrode tip to keep water from clinging to the electrode.

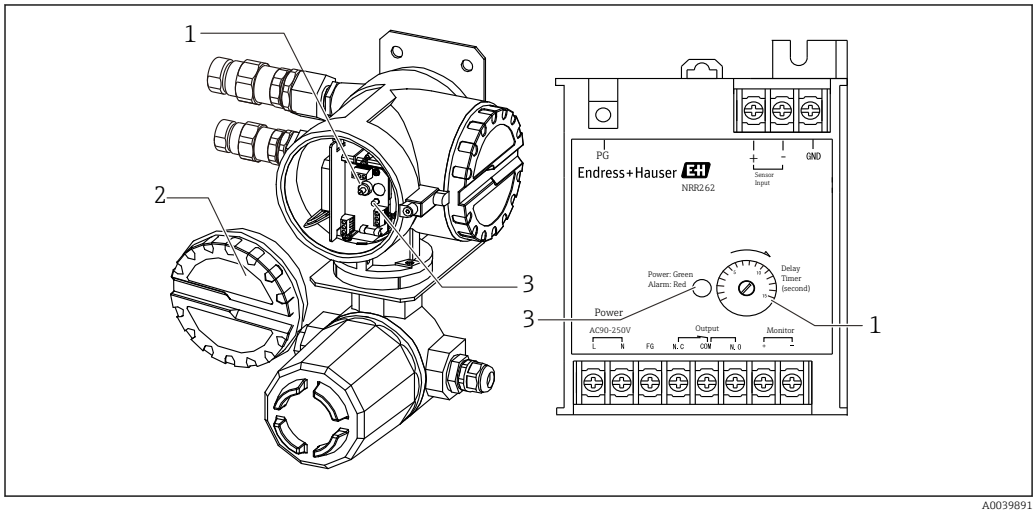
Verification of the oil layer thickness in a transparent container

Exercise caution as a reading error may occur due to the liquid's surface tension, liquid adhesion to the container wall and for other reasons.

5.4.2 Alarm output adjustment

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.

- A response delay time in the detection circuit of approximately 6 seconds is always added to the delay time of the delay trimmer.
- Open the NRR261 main unit cover after the power has been turned off for at least 10 minutes.

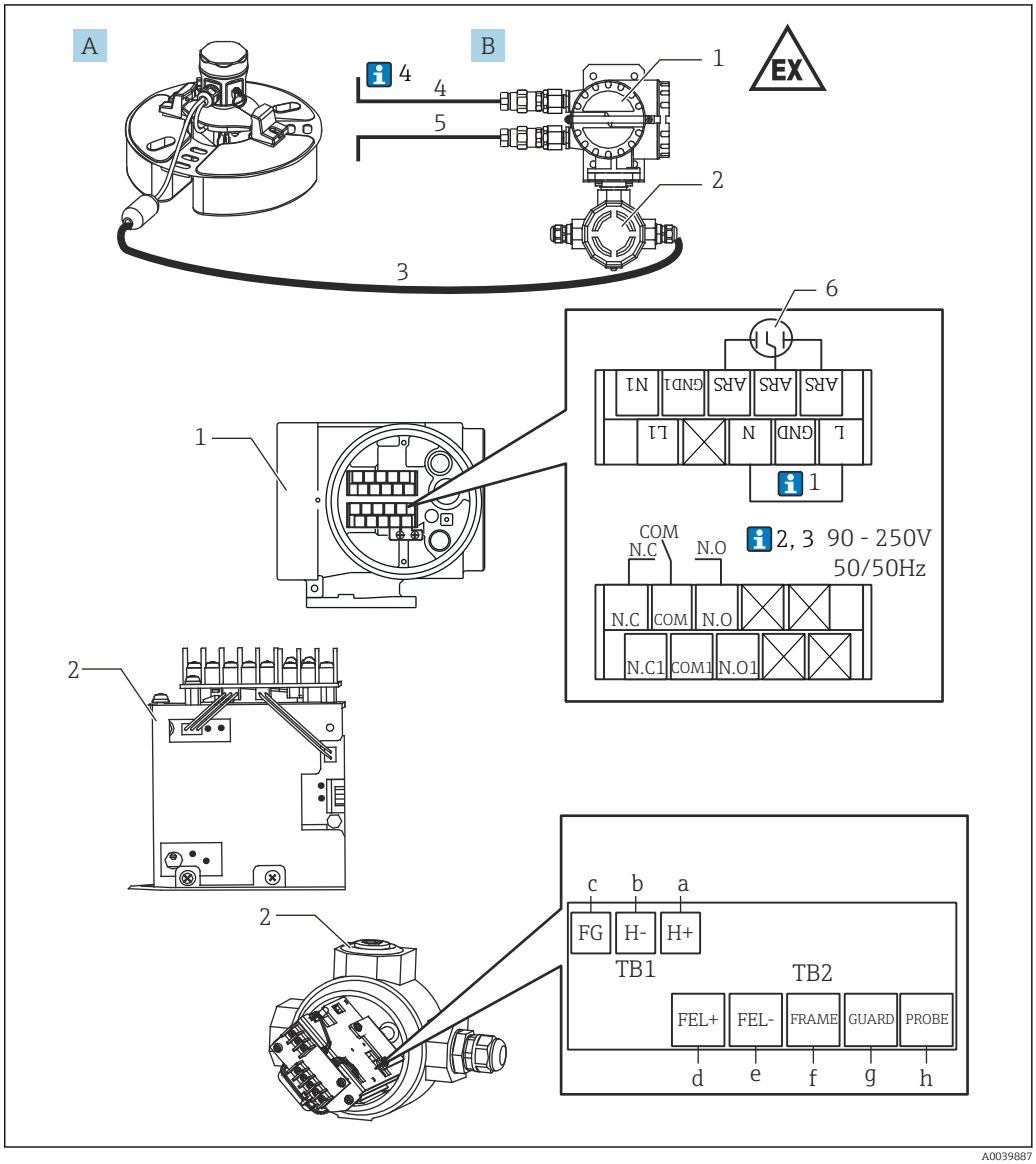


18 *Alarm output relay*

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

6 Electrical connection

6.1 NRR261-4/A/B/C wiring



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

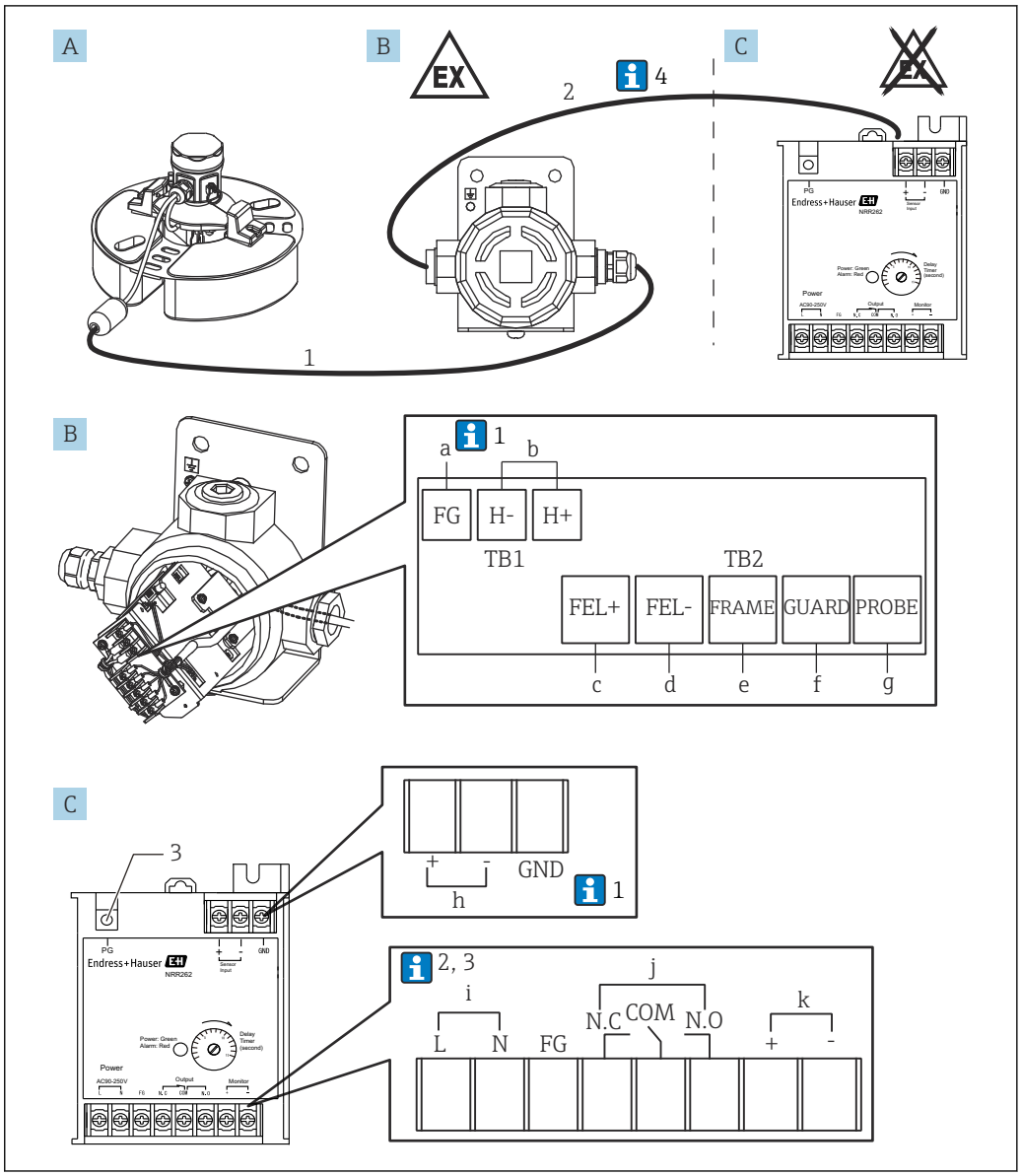
A Float sensor NAR300-x1xxxx
B Ex d [ia] Converter NRR261 (integrated type)
a Blue 1 (already wired at shipping), screw (M3)
b Blue 2 (already wired at shipping), screw (M3)
c Green, screw (M3)
d Red, screw (M3)
e Blue 3, screw (M3)
f Yellow, screw (M3)
g Black, screw (M3)
h White, screw (M3)
1 Ex d 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.

6.2 NRR262-4/A/B/C wiring



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

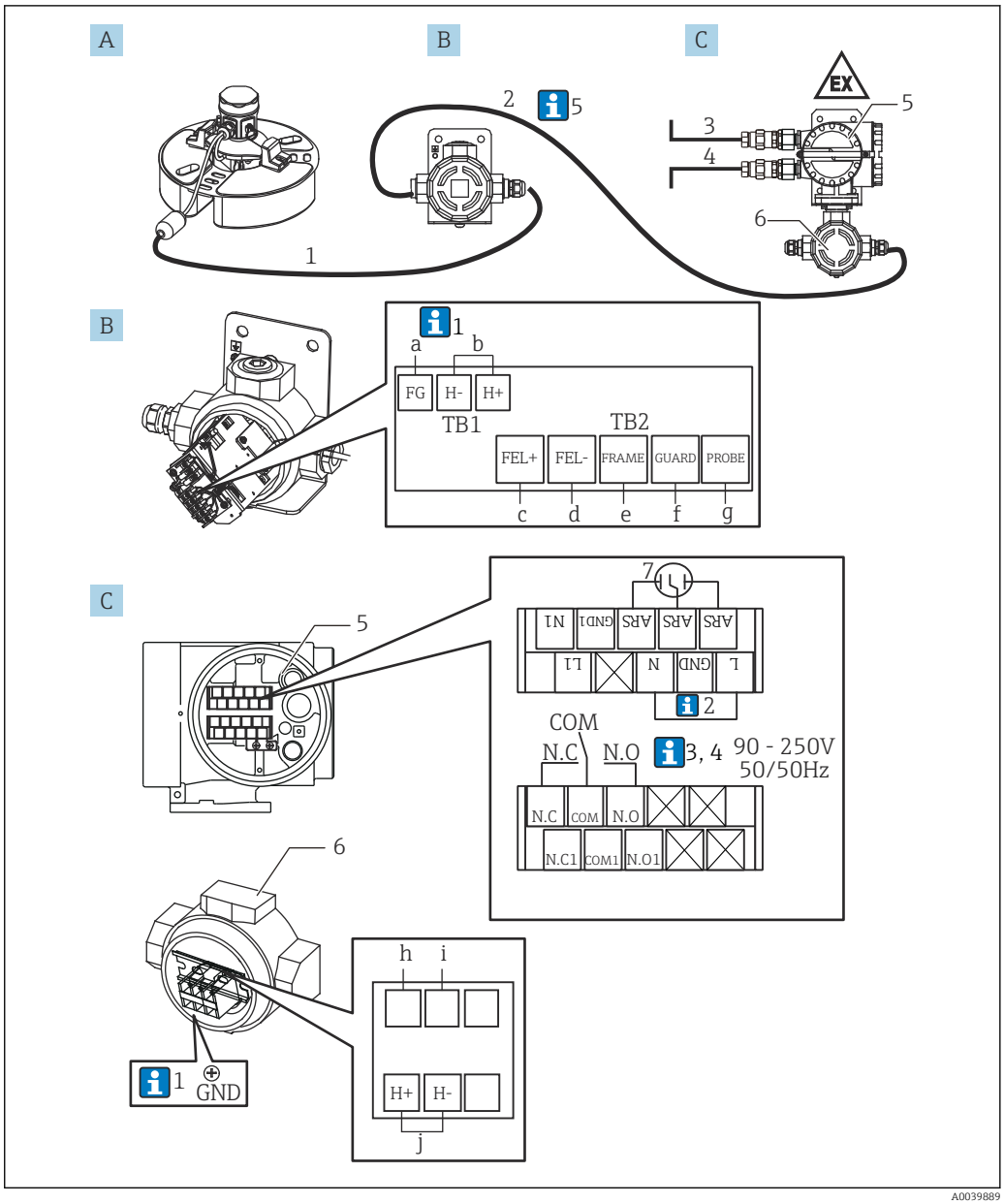
A *Float sensor NAR300-x5xxxx (sensor I/F Ex box is also included in the code)*
B *Sensor I/F Ex box*
C *Ex [ia] Converter NRR262*
a *Green, screw (M3) (see 1 below)*
b *Output to NRR262, screw (M3)*
c *Red, screw (M3)*
d *Blue, screw (M3)*
e *Yellow, screw (M3)*
f *Black, screw (M3)*
g *White, screw (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.

6.3 NRR261-5 wiring



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

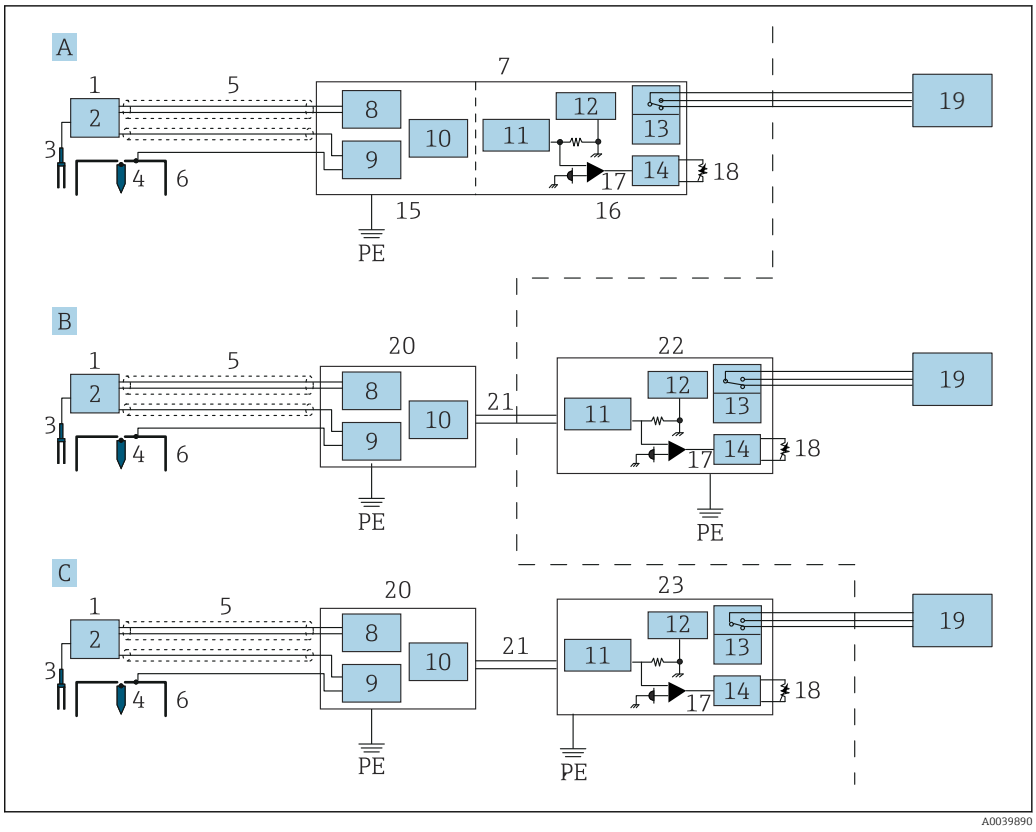
A Float sensor NAR300-x5xxxx (sensor I/F Ex box is also included in the code)
B Sensor I/F Ex box
C Ex d [ia] Converter NRR261 (separate type)
a Green, screw (M3) (see 1 below)
b Output to NRR261-3/5xx, screw (M3)
c Red, screw (M3)
d Blue 1, screw (M3)
e Yellow, screw (M3)
f Black, screw (M3)
g White, 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.

6.4 Wiring diagram



22 *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)

6.5 Operating principles of alarm activation

The oil leak detection signal detected by the NAR300 float sensor is converted to a current signal in the converter 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 converter. 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 <

7 Troubleshooting

7.1 Fail-safe (alarm is output when there is no oil leak)

There is a risk of an alarm being output due to the following causes even if there is no actual oil leak.

Item	Description
Frozen pit water	An alarm is activated when the pit water freezes and the conductivity sensor recognizes it as an insulator.
Tilted float sensor	When the conductivity sensor is tilted so much that it is no longer submerged in water while it is floating on pit water, an alarm is activated because it recognizes insulating air. When the pit is empty, an alarm will be activated if the tuning fork sensor detects liquid first and then the conductivity sensor detects insulating air.
Debris at the bottom of an empty pit	When rain causes water levels to rise in an empty pit, materials with a certain strength, such as Styrofoam, accumulate around the tip of the tuning fork sensor. This causes the tuning fork sensor to interpret them as liquid while the conductivity sensor detects them as insulating air, thereby activating an alarm. When the conductivity sensor becomes covered with such items as a plastic sheet or a bag, it detects them as an insulator while the tuning fork sensor detects them as a liquid (water), thereby activating an alarm.
Sensor buried in mud	When the float sensor becomes buried in mud and the mud dries out and hardens, the tuning fork sensor interprets it as a liquid while the conductivity sensor detects an insulator in the layer of air from the dried mud, thereby activating an alarm.
Snow covering the sensor	When the sensor becomes covered with snow in an empty pit, the conductivity sensor detects it as an insulator while the tuning fork sensor detects it as a liquid, thereby activating an alarm.
Essentially pure water in pit	In pit water with a large electrical resistance value, such as drain water, the conductivity sensor detects it as an insulator, thereby activating an alarm.

7.2 Delayed alarm (alarm is not output when there is an oil leak)

There is a risk of an alarm not being output due to the following causes even if there is an oil leak.

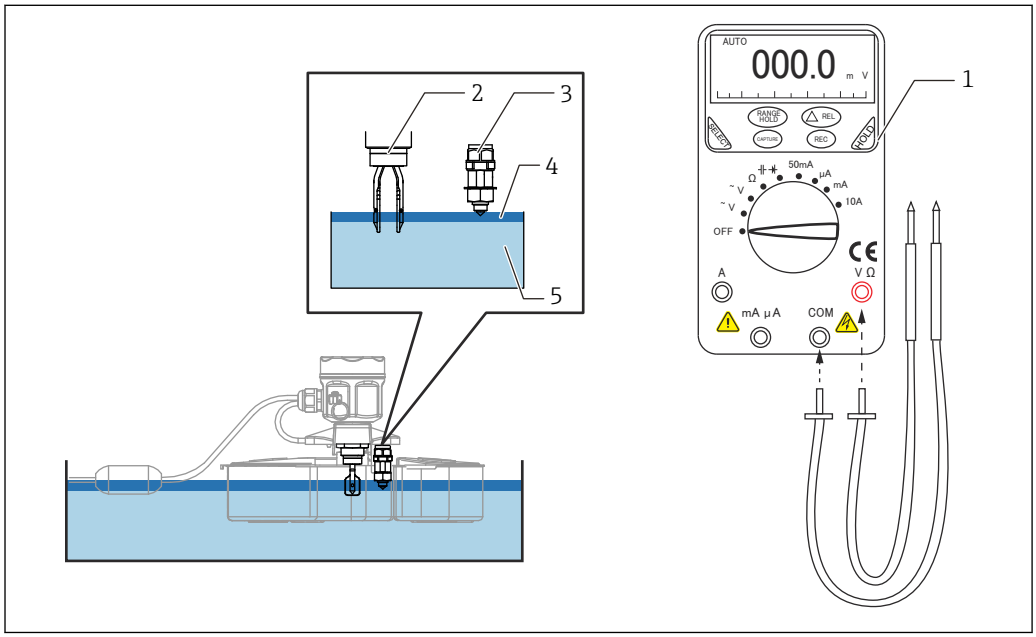
Item	Description
Waves and cross-currents on the liquid surface	If the oil layer and the pit water are not stable due to strong waves on the surface of leaked oil caused by wind, etc., the conductivity sensor will detect the pit water and therefore will not activate the alarm.
Tilted float sensor	When the float sensor tilts significantly to one side due to snow, an animal on the float sensor or cable/chain becoming tangled, the conductivity sensor detects the pit water under the oil layer while the tuning fork sensor moves away from the oil layer, and no alarm will be activated.
Sunk float sensor	If snow, garbage or an animal lands on the float, the float will sink and the conductivity sensor will detect the pit water under the oil layer, and no alarm will be activated.
Moist garbage, etc.	If moist garbage or algae comes in contact between the conductivity sensor and the earth (such as the float body or the ground) and generates conductivity, an alarm will not be activated.
Oil leak during snowfall	If there is snow floating on the oil layer surface, the water from melted snow will be recognized as water by the conductivity sensor, and an alarm will not be activated.
Pit water density change	When an antifreeze is used to prevent freezing, the detection sensitivity is lower than normal and causes alarm delay because pit water density increases and the sensor float rises.

7.3 Operation check

To perform an operation check, assign one person to operate the float sensor and another person to check the operation of the on-site sensor I/F Ex box or Ex d Converter NRR261. Avoid electrostatic charge on the sensor.

Items to prepare

Digital voltmeter, rags, neutral detergent, cup containing kerosene

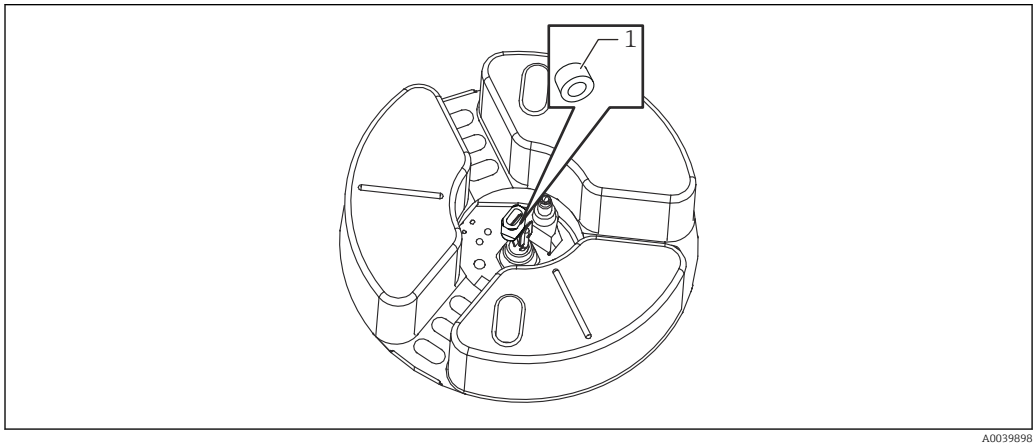


23 *Sensor operation check*

1 *Digital multimeter*
2 *Tuning fork sensor*
3 *Conductivity sensor*
4 *Oil*
5 *Water*

Check tool (accessory)

An operation check using a check tool (accessory) is a simplified method, and its binding force may decrease over time. If this occurs, either increase the binding force by gently pressing down with a hand or order an operation checker (specialty tool) (see "Operation checker (specialty tool)" in the next section).

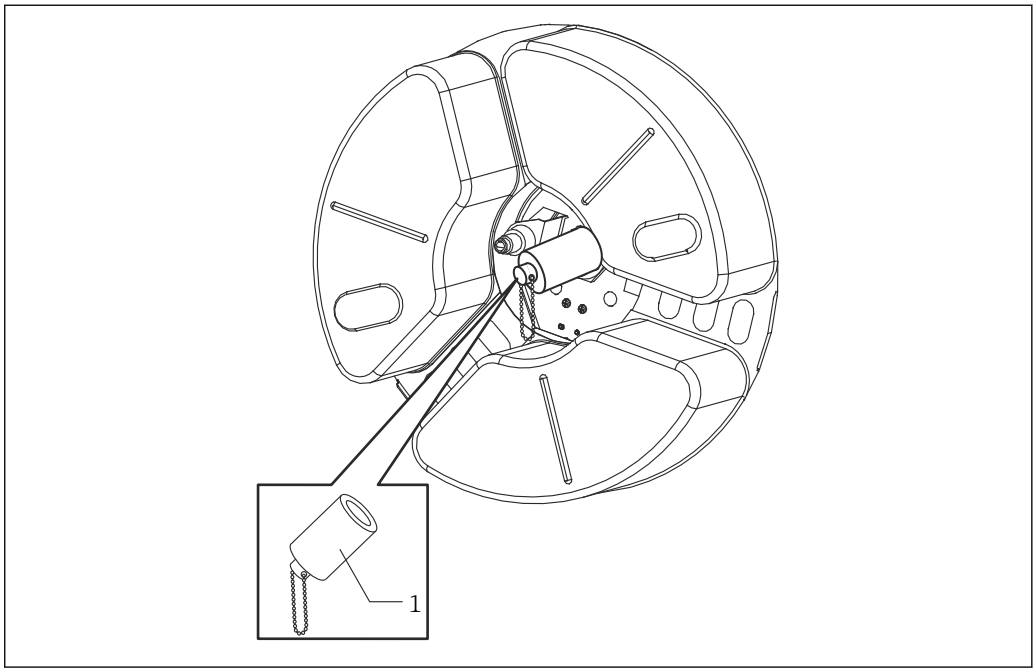


24 *Check tool (accessory)*

1 *Check tools*

Operation checker (specialty tool)

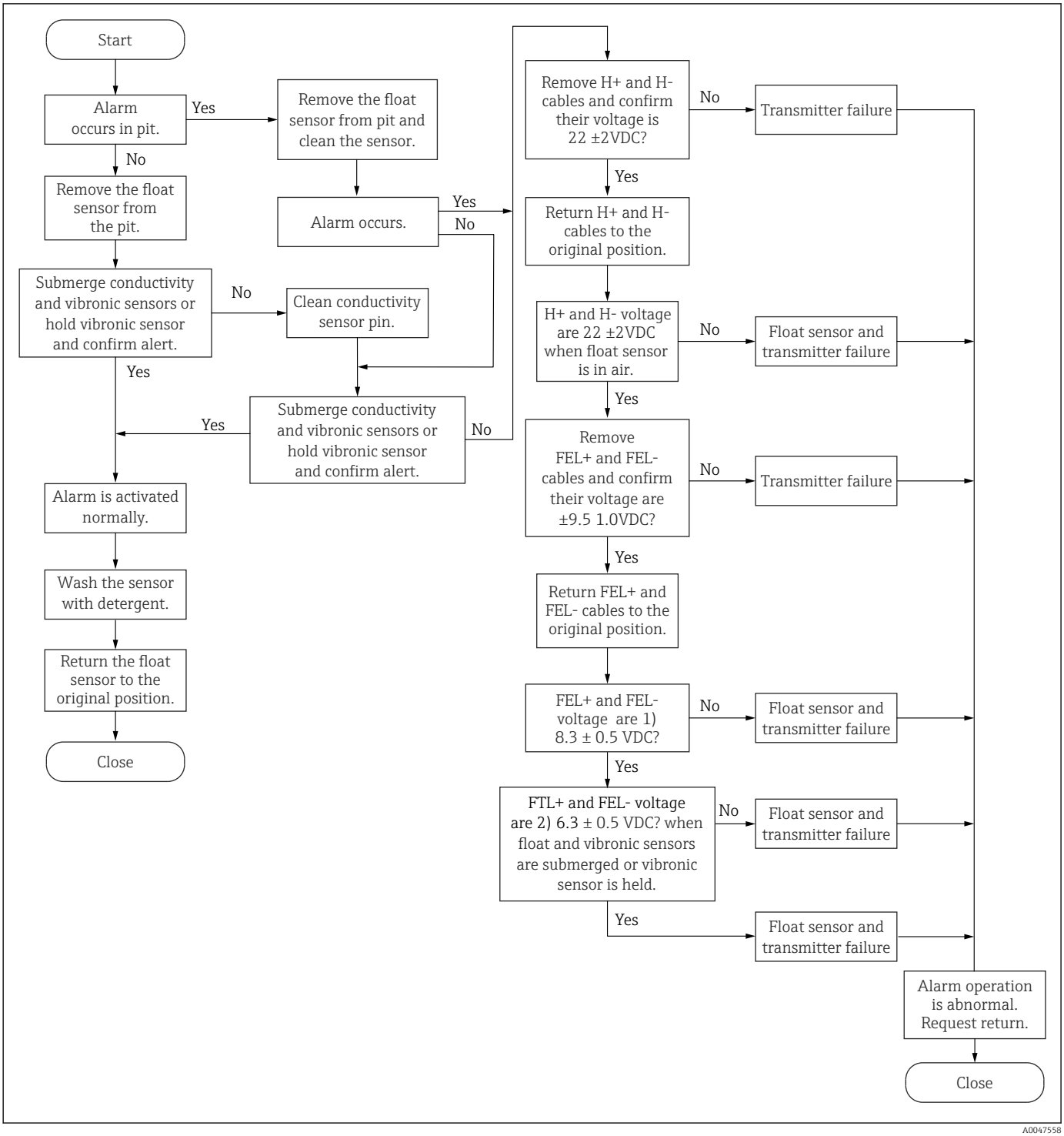
Screw the operation checker into the tuning fork unit. This can be ordered under Product No.71137732.



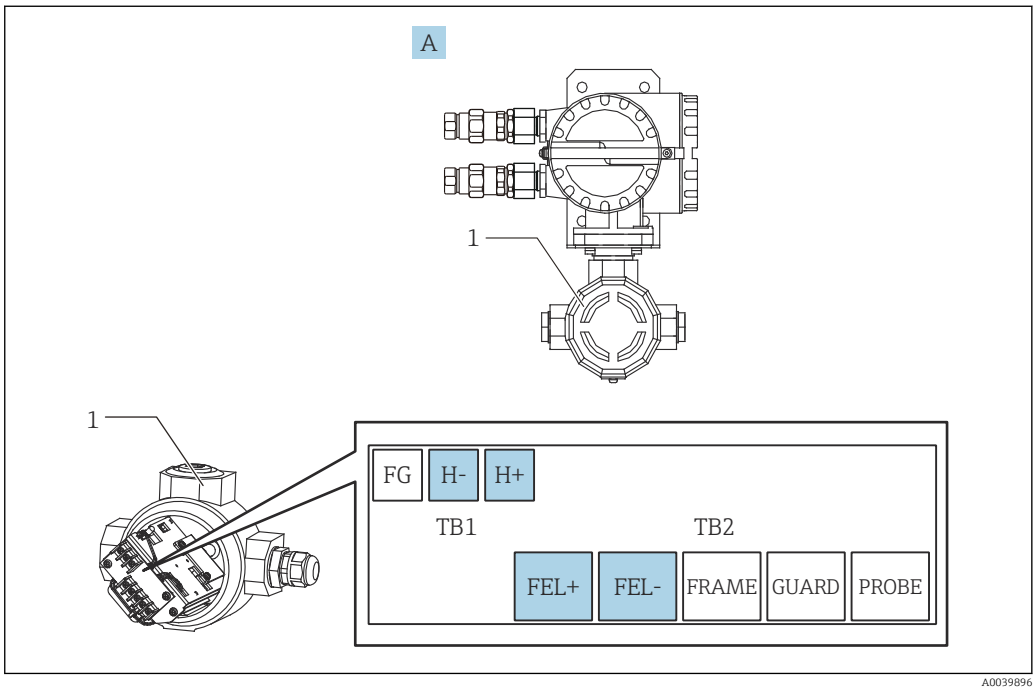
25 Operation checker (specialty tool)

1 Operation checker

7.3.1 Operation check flowchart



Prior to performing an alarm operation check, take preemptive measures to ensure that the alarm system will not be impacted even if an oil leak alarm is activated. See the previous section "Operation check flowchart" for how to perform an operation check. The following diagram shows the voltage check point that was described in the flowchart.



26 *Intrinsically safe terminal box*

A Ex d Converter NRR261 (integrated type)
1 Ex [ia] terminal
H- Blue
H+ Blue
FEL+ Red
FEL- Blue

7.3.2 Converter / alarm system problems

Item	Description
LED is lit red: Normal alarm activation	An alarm is activated even if the sensor voltage has not been detected. Replace the converter if there is no problem with the wiring between the converter and the sensor I/F Ex box.
LED is lit green: There is no alarm signal from the sensor	If an alarm has been activated under this condition, investigate the resistance values of the converter's alarm output terminal in the following order: 1. Turn off the power supply to the alarm activation system. 2. Disconnect the alarm output wire from the converter. 3. Check to ensure that the LED is continuously lit green. 4. Measure the resistance between 1: COM and NO and 2: COM and NC. The converter is normal if 1: 0Ω (short) and 2: several MΩ or higher (open). Otherwise, replace the converter.
LED is not lit: The converter is not turned on	If there is rated voltage between terminal L and N on the converter, replace the converter. If the voltage cannot be measured between the L and N terminals,check the power supply or the power cable.

7.4 Cleaning the conductivity sensor unit

Normally, NAR300 checks the conductivity state between the tip of the electrode and the float body. With conductivity, it determines that there is "water" and without conductivity, it determines that there is "oil or air." Since the electrode holder is connected to the float body, if the holder becomes conductive with the tip of the electrode, it determines that "water" is present, thereby preventing the alarm from being activated and causing erroneous operation. Clean the space between the tip of the electrode and the holder periodically to maintain non-conductivity.

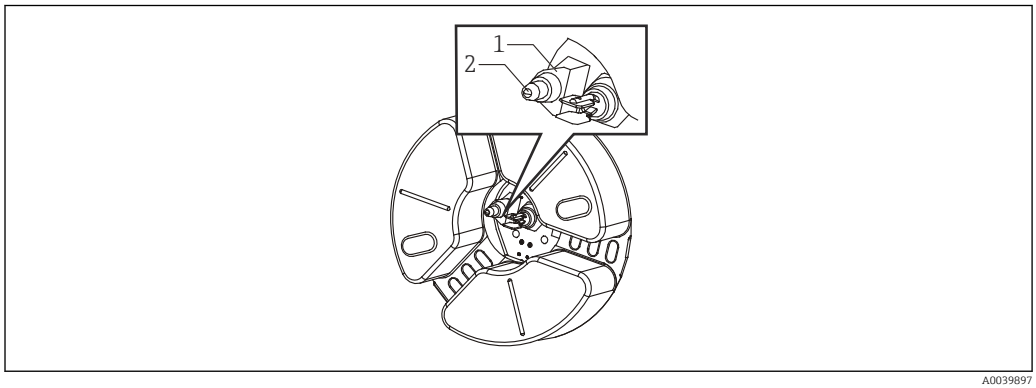
Items to prepare

- Rag
- Neutral detergent

Cleaning procedure

1. Remove the NAR300 sensor from the pit.
2. Clean from the tip of the conductivity sensor's electrode (metal portion) to the electrode holder (metal portion), and remove any moss, algae or dust.
3. Clean the entire electrode using a neutral detergent that has been diluted to a suitable concentration.

This completes the cleaning procedure.



27 Sensor cleaning

1 Electrode holder
2 Electrode tip

7.5 Firmware history

Date	Software version	Changes	Documentation	
			Operating instructions	Technical information
11.2003	V1.40	Initial software	BA027N/08/ja/02.04	TI045N/08/ja/01.05
04.2015	V1.50	SIL2 obtained	BA00402G08JA17.16	TI00045G08JA16.16

8 Maintenance

8.1 Maintenance work

No special maintenance work is required.

8.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

8.1.2 Periodic maintenance

While the NAR300 float sensor is not easily affected by deposits or adhered material, conduct overall periodic inspections of the cable and wiring, etc., semi-annually along with an operation check as follows.

- Inspect and clean the sensor and the pit periodically as clogging caused by debris, foreign matter and algae may result in a malfunction. To clean the float sensor, wipe it with a soft cloth that has been soaked in water.
- Remove any accumulated debris, sand or snow on the float sensor periodically as they can lower the draft position and cause changes in sensitivity.
- Check operation after ensuring that the cables are not damaged and that there are no wiring issues (loose terminal screw, etc.).

8.2 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

9 Repair

9.1 General information on repairs

9.1.1 Repair concept

The Endress+Hauser repair concept assumes that the devices have a modular design and that repairs can be done by the Endress+Hauser Service Department or specially trained customers.

Spare parts are contained in suitable kits. They also come with relevant replacement instructions.

For more information on service and spare parts, contact the Service Department at Endress+Hauser.

9.1.2 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, Safety Instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

9.2 Spare parts

Some interchangeable device components are listed on an overview sign in the connection compartment cover.

The spare part overview sign contains the following information:
- A list of the most important spare parts for the device, including their ordering information
- The URL for the *W@M Device Viewer* (www.endress.com/deviceviewer):
  All the spare parts for the device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.

9.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

9.4 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the website for more information:
   http://www.endress.com/support/return-material
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

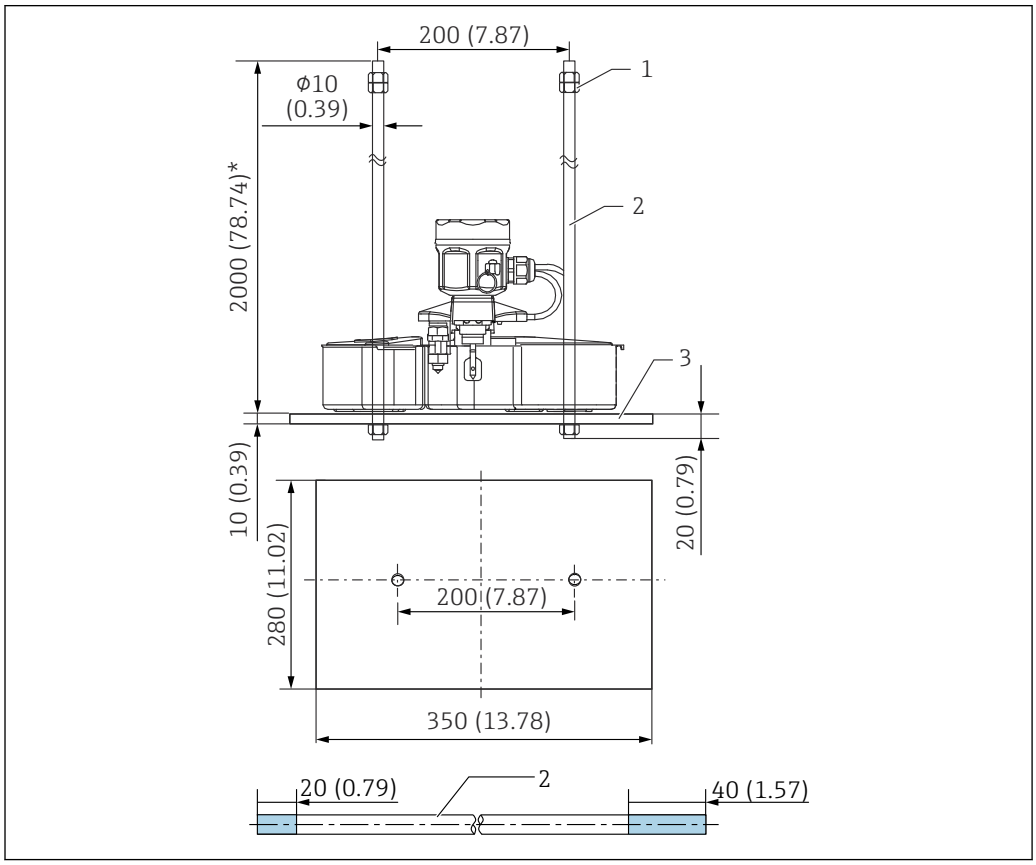
9.5 Disposal

Observe the following notes during disposal:
- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

10 Accessories

10.1 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.



28 Float guide. Unit of measurement mm (in)

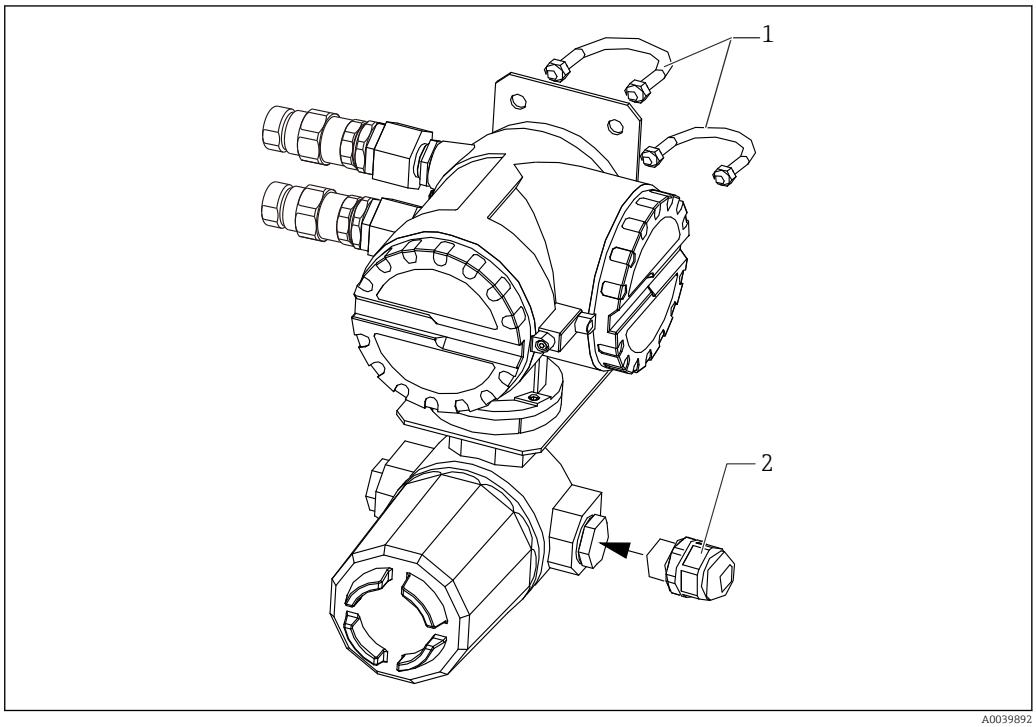
1 Nut (M10)
2 Float guide
3 Weight

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.

10.2 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.



29 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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