

Rosemount™ 1408A Level and Flow Transmitter

Non-Contacting Radar with IO-Link Protocol



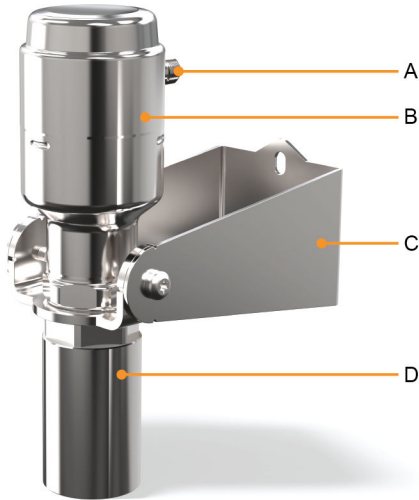
- Ideal for level measurement in small tanks and open air applications
- Volume flow measurement in open channels
- Maintenance free solution unaffected by process conditions such as density, viscosity, temperature, and pressure
- 4-20 mA output and IO-Link deliver ease of integration to existing and new systems
- Cost-effective FMCW radar with 80 GHz technology

Introduction

Good fit for open air applications

Rosemount 1408A delivers reliable level measurements regardless of challenging weather conditions such as condensation, wind, sunlight, and changing temperature. The transmitter can also be used in open channel applications to determine the volume flow.

Figure 1: Bracket Mounting



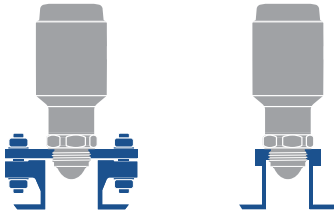
- A. *M12 connector for simple commissioning*
- B. *Polished stainless steel housing*
- C. *Bracket with adjustable device holder*
- D. *Antenna extension for open air installations*

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Installation flexibility on tanks

The compact design of the transmitter allows it to be installed in tight spaces and small vessels, either by using a threaded flange or a threaded fitting.

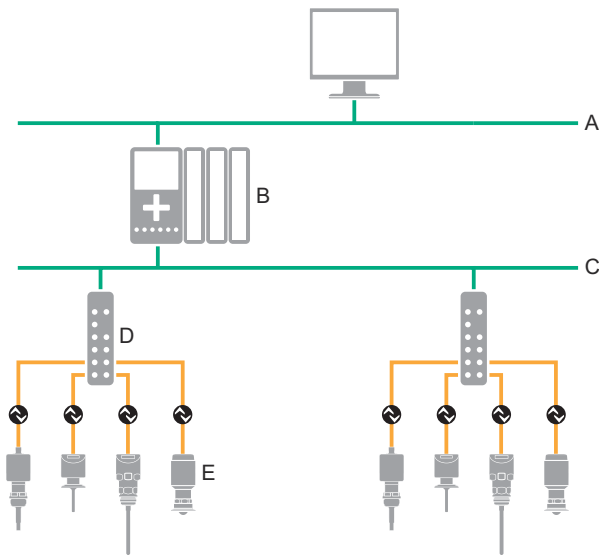


Easy integration with IO-Link

The Rosemount 1408A provides both conventional 4-20 mA and digital switch outputs, enabled by IO-Link connectivity. This supports easy integration into any automation system.

Each IO-Link system consists of an IO-Link master and one or more IO-Link devices (sensors and actuators). The connection between the master and the device is established via unshielded standard cables using standard connectors such as M12. Process data, events and parameters are transferred to the master via IO-Link. The IO-Link master then transfers the data to the controller (PLC) and its fieldbus or industrial ethernet network.

Figure 2: Example of an IO-Link System



- A. Industrial ethernet
- B. Programmable logic controller (PLC)
- C. Industrial Fieldbus
- D. IO-Link master
- E. IO-Link devices

Non-contacting radar technology

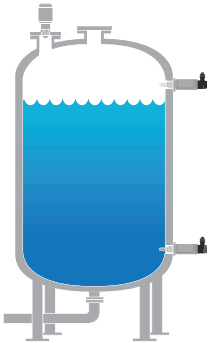
Non-contacting radar technology is ideal for a wide range of applications as it is maintenance-free, has a top-down installation that reduces the risk of leakages, and is unaffected by process conditions such as density, viscosity, temperature, pressure, and pH.

The Rosemount 1408A uses Frequency Modulated Continuous Wave (FMCW) technology and smart algorithms to maximize measurement accuracy and reliability, even in small tanks and challenging fast-filling vessels.

Application examples

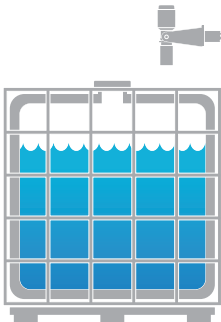
Storage tanks

Gain insights into your tank and ensure production runs smoothly without interruption.



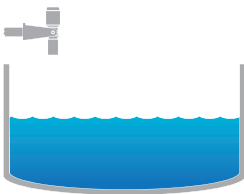
Plastic tanks

Monitor the inventory of your small and medium sized plastic tanks by measuring through the plastic roof.



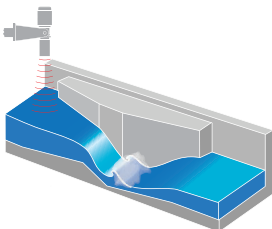
Open air applications

Get reliable level measurements of sumps or ponds, regardless of challenging surface and weather conditions.



Open channel flow

Use the Rosemount 1408A for volume flow measurement of water and wastewater in open channels.



Ordering information

Online product configurator

Many products are configurable online using our product configurator.

Select the **Configure** button or visit [Emerson.com/global](https://emerson.com/global) to start. With this tool's built-in logic and continuous validation, you can configure your products more quickly and accurately.

Specifications and options

Specification and selection of product materials, options, and/or components must be made by the purchaser of the equipment. See the Material selection section for more information.

Related information

[Performance specifications](#)

[Functional specifications](#)

[Physical specifications](#)

[Material selection](#)

Model codes

Model codes contain the details related to each product. Exact model codes will vary; an example of a typical model code is shown in [Figure 3](#).

Figure 3: Model Code Example

1408A I	BZ C10 Q4 Q8
1	2

1. Required model components
2. Additional options (variety of features and functions that may be added to products)

Note

Additional options will not be included in the model string printed on the Rosemount 1408A transmitter. For product reorder, make sure to include any desired optional options in the model string.

Rosemount 1408A Level and Flow Transmitter



The Rosemount 1408A is a non-contacting radar transmitter for continuous measurement of level, and volume flow in open channels.

[CONFIGURE >](#)
[VIEW PRODUCT >](#)

Required model components

Model

Code	Description	Thread type
1408A	Level and Flow Transmitter	G1

Signal output

Code	Description
I	IO-Link

Additional options

Process connection type

Code	Description
BZ	Mounting bracket including antenna extension and lock nut
F2	2-in. flange for non-pressurized applications
F3	3-in. flange for non-pressurized applications
F4	4-in. flange for non-pressurized applications
N1	1½-in. NPT thread
N2	2-in. NPT thread
WX	D50 weld adapter

Related information

[Type 1 Drawing](#)

Cable option

Code	Description	Length
C01	Hygienic cable - M12 female (angled) to flying lead (4 x 22AWG)	6.6 ft. (2 m)
C02	Hygienic cable - M12 female (angled) to flying lead (4 x 22AWG)	16.4 ft. (5 m)
C03	Hygienic cable - M12 female (angled) to flying lead (4 x 22AWG)	32.8 ft. (10 m)
C04	Hygienic cable - M12 female (angled) to flying lead (4 x 22AWG)	65.6 ft. (20 m)
C05	Hygienic cable - M12 female (angled) to flying lead (4 x 22AWG)	164 ft. (50 m) ⁽¹⁾
C06	Hygienic patch cable - M12 female (angled) to M12 male	1.97 ft. (0.6 m)
C07	Hygienic patch cable - M12 female (angled) to M12 male	3.3 ft. (1 m)
C08	Hygienic patch cable - M12 female (angled) to M12 male	6.6 ft. (2 m)
C09	Hygienic patch cable - M12 female (angled) to M12 male	16.4 ft. (5 m)
C10	Hygienic patch cable - M12 female (angled) to M12 male	32.8 ft. (10 m)
C11	Hygienic wireable terminal connector - M12 female (angled) to screw terminals	N/A

(1) For IO-Link communication, the maximum cable length is 65.6 ft. (20 m) between device and master.

Special quality assurance

Special quality assurance	
Q4	Calibration data certificate

Material traceability certification

Not available with flanged process connections or mounting bracket.

Code	Description
Q8	Material traceability certification per EN 10204 3.1 (2.1 for non-metallic)

Spare parts and accessories

Process connection adapters and flanges

Description	Part number
2-in. flange for non-pressurized applications	01408-5000-0002
3-in. flange for non-pressurized applications	01408-5000-0003
4-in. flange for non-pressurized applications	01408-5000-0004
1½-in. NPT thread	01408-5000-0005
2-in. NPT thread	01408-5000-0006
D50 weld adapter	01408-5000-0007

Mounting bracket

Description	Part number
Mounting bracket including antenna extension and lock nut	01408-5000-0001

Cables and connectors

Description	Length	Part number
Hygienic wireable terminal connector - M12 female (angled) to screw terminals	N/A	FB-4000
Hygienic cable - M12 female (angled) to flying lead (4 x 22AWG)	6.6 ft. (2 m)	FB-4002
	16.4 ft. (5 m)	FB-4005
	32.8 ft. (10 m)	FB-4010
	65.6 ft. (20 m)	FB-4020
	164 ft. (50 m) ⁽¹⁾	FB-4050
Hygienic patch cable - M12 female (angled) to M12 male	1.97 ft. (0.6 m)	FB-4106
	3.3 ft. (1 m)	FB-4101
	6.6 ft. (2 m)	FB-4102
	16.4 ft. (5 m)	FB-4105
	32.8 ft. (10 m)	FB-4110

(1) For IO-Link, the maximum cable length is 65.6 ft. (20 m) between device and master.

IO-Link Masters

Description	IO-Link ports	Part number
Rosemount Hygienic IO-Link Master Hub with PROFINET® interface	4	FB-5104
	8	FB-5108
Rosemount Hygienic IO-Link Master Hub with EtherNet/IP™ interface	4	FB-5204
	8	FB-5208
Rosemount IO-Link USB Communicator	1	FB-5301

Configuration software

Description	Part number
Rosemount IO-Link Assistant	FB-5401

Performance specifications

General

Reference conditions

- Measurement target: Stationary metal plate, no disturbing objects
- Temperature: 59 to 77 °F (15 to 25 °C)
- Ambient pressure: 14 to 15 psi (960 to 1060 mbar)
- Relative humidity: 25-75%
- Damping: Default value, 2 s
- Frequency range: 77 to 81 GHz⁽¹⁾

Instrument accuracy (under reference conditions)

±0.08 in. (±2 mm)⁽²⁾

Repeatability

±0.04 in. (±1 mm)

Ambient temperature effect

±0.04 in. (±1 mm)/10 K

Sensor update rate

Minimum 1 update per second (typically 5 updates per second)

Maximum level rate

200 mm/s

Measuring range**Maximum measuring range**

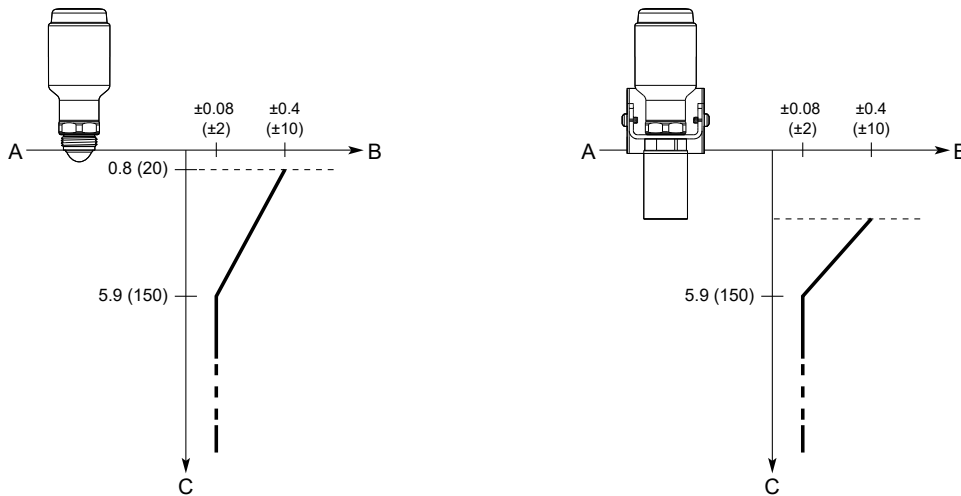
33 ft. (10 m)⁽³⁾

-
- (1) Radar performance may be affected if it is configured for certain local radio spectrum regulations.
 - (2) Refers to inaccuracy according to IEC 60770-1 when excluding installation dependent offset. See the IEC 60770-1 standard for a definition of radar specific performance parameters and if applicable corresponding test procedures.
 - (3) Measurement is possible up to 49 ft. (15 m) if there is good reflection of the product surface (dielectric constant >10, i.e. water based media). Note though that a combination of adverse process conditions, such as heavy turbulence, foam, and condensation, together with products with poor reflection may affect the measuring range.

Accuracy over measuring range

Figure 4 illustrates the accuracy over measuring range at reference conditions.

Figure 4: Accuracy Over Measuring Range



- A. Device Reference Point
- B. Accuracy in inches (millimeters)
- C. Distance in inches (millimeters)

Environment

Vibration resistance

2 g at 10-1000 Hz according to IEC 61298-3, level “field with general application”

Electromagnetic compatibility (EMC)

- EMC Directive (2014/30/EU): EN 61326-1
- NAMUR recommendations NE21 (only 4-20 mA output)

Pressure Equipment Directive (PED)

Complies with 2014/68/EU article 4.3

Built-in lightning protection

EN 61326, IEC 61000-4-5, level 1kV

Radio approvals

- Radio Equipment Directive (2014/53/EU):
 - ETSI EN 302 372 (without antenna extension)
 - ETSI EN 302 729 (with antenna extension)
 - EN 62479
- Part 15 of the FCC Rules
- Industry Canada RSS 211
- Other country approvals

Related information

[Product certifications](#)

Functional specifications

General

Field of application

Continuous measurement of level and open channel flow.

Minimum dielectric constant

2

Measurement principle

Frequency Modulated Continuous Wave (FMCW)

Frequency range

77 to 81 GHz (76 to 77 GHz in applicable countries)

Note

Operating the device without selecting the relevant radio spectrum may constitute a violation of the regulations of the radio approvals of the respective country.

Maximum output power

3 dBm (2 mW)

Internal power consumption

< 2 W (normal operation at 24 Vdc, no outputs)

< 3.6 W (normal operation at 24 Vdc, digital and analog outputs active)

Humidity

0 - 100% relative humidity, non-condensing

Turn-on time

< 15 s⁽⁴⁾

Outputs

The transmitter provides two configurable outputs:

Output 1 Digital output / IO-Link mode

Output 2 Digital output or active 4-20 mA analog output

Digital output

Switching signal for high and low limits (using the same pin)

Output type

PNP/NPN configurable

Switching function

Normally open

Permanent current rating

< 50 mA

Maximum voltage drop

2.5 V

4-20 mA analog output

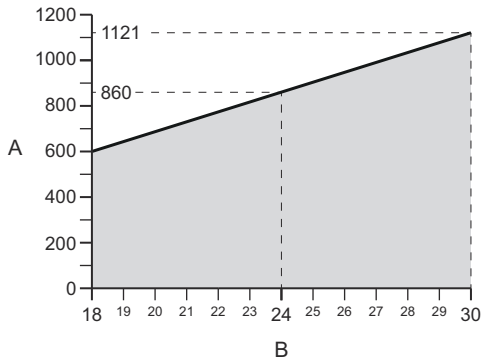
Load limitations

Maximum loop resistance is determined by the voltage level of the external power supply:

Maximum Loop Resistance = $43.5 \times (\text{External Power Supply Voltage} - 18) + 600 \Omega$

(4) Time from when power is applied to the transmitter until performance is within specifications.

Figure 5: Load Limits



- A. Loop Resistance (Ω)
- B. External Power Supply Voltage (Vdc)

Analog signal on alarm

The transmitter automatically and continuously performs self-diagnostic routines. If a failure or a measurement error is detected, the analog signal will be driven offscale to alert the user. High or low failure mode is user-configurable.

Table 1: Signal on Alarm

Level	Custom levels	NAMUR NE43 (default)
Low	3.5 to 4.0 mA	3.5 mA (NAMUR \leq 3.6 mA)
High	20.0 to 22.5 mA	21.5 mA (NAMUR \geq 21.0 mA)

Analog saturation levels

The transmitter will continue to set a current that corresponds to the measurement until reaching the associated saturation limit (and then freeze).

Table 2: Saturation Levels

Level	Custom levels	NAMUR NE43 (default)
Low	3.5 to 4.0 mA	3.8 mA
High	20.0 to 22.5 mA	20.5 mA

IO-Link specifications

IO-Link revision

1.1

Transfer type

COM2 (38.4 kBaud)

SIO mode

Yes

IO-Link master port

Class A

Minimum cycle time

6 ms

Configuration

Configuration tools

- IO-Link Device Descriptor (IODD) compliant systems
- Device Type Manager (DTM™) compliant systems (an IODD DTM Interpreter is required)

Related information

[Emerson.com/RosemountIO-LinkAssistant](https://emerson.com/RosemountIO-LinkAssistant)

Damping

User selectable (default is 2 s, minimum is 0 s)

Output units

- Level: in., m
- Temperature: °F, °C
- Volume flow: US gal/h, m³/h
- Signal strength: mV

Output variables

Variable	4-20 mA	DO1 and DO2	Digital, service tools using IODD	IO-Link PDIn (to the PLC)
Level	✓	✓	✓	✓
Distance (ullage)	N/A	N/A	✓	N/A
Volume flow	✓	✓	✓	✓
Electronics temperature	N/A	N/A	✓	N/A
Signal strength	N/A	N/A	✓	N/A

Volume flow calculations

- Linearization table
- Parshall flume
- Khafagi-Venturi flume

Process pressure

-15 to 116 psig (-1 to 8 bar)

Atmospheric pressure at temperatures below -4 °F (-20 °C)

Note

The flanges must be used only in non-pressurized applications.

Temperature limits

Process temperature

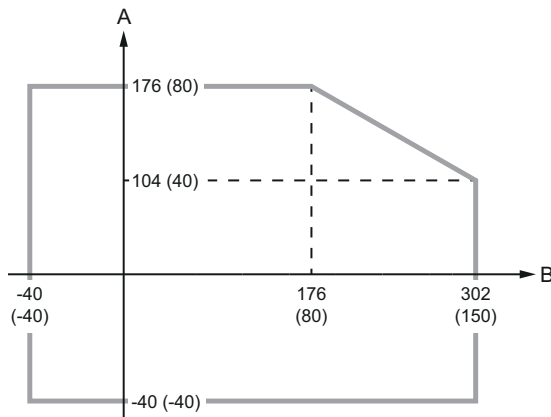
-40 to 302 °F (-40 to 150 °C)

Ambient temperature

-40 to 176 °F (-40 to 80 °C)

The ambient temperature limits may be further restricted by the process temperature as described by [Figure 6](#).

Figure 6: Ambient Temperature vs. Process Temperature



- A. Ambient temperature °F (°C)
- B. Process temperature °F (°C)

Storage temperature

-40 °F to 194 °F (-40 °C to 90 °C)

Physical specifications

Material selection

Emerson provides a variety of Rosemount products with various product options and configurations, including materials of construction that can be expected to perform well in a wide range of applications.

The product information presented is intended as a guide for the purchaser to make an appropriate selection for the application. It is the purchaser’s sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product, materials, options, and components for the particular application. Emerson is not in a position to evaluate or

guarantee the compatibility of the process fluid or other process parameters with the product, options, configuration, or materials of construction selected.

Housing and enclosure

Process connection

ISO 228/1-G1 thread with a wide choice of adapters and flanges

Materials

- Transmitter housing: Polished stainless steel 316L (EN 1.4404)
- M12 housing: 316L (EN 1.4404)
- M12 contact body: Polyamide (PA)

Transmitter weight

1.1 lb (0.5 kg)

Ingress protection

- IP66/68⁽⁵⁾/69 (IEC 60529)
- IP6K9K (ISO 20563:2013)
- NEMA[®] 4X⁽⁶⁾

The stated ingress protection only applies when plugged in using a suitable M12 connector that has the appropriate ingress protection.

Mounting bracket

Materials

- Bracket and device holder: Stainless steel 316L
- Antenna extension for open air: Stainless steel 316L, polyacetal copolymer (POM-C ELS), stainless steel EN 10270-3-1.4310
- Lock nut: Stainless steel A4

Flanges

Materials

316L

(5) IP68 at 9.8 ft. (3 m) for more than 30 minutes.

(6) Tested for NEMA 4X by Intertek.

Threaded adapters

Materials

316/316L (EN 1.4404)

Material exposed to tank atmosphere

- PTFE sealing: PTFE fluoropolymer
- O-ring: FVMQ
- G1 thread: 316L (EN 1.4404)
- Profile ring: FKM
- Flange: 316L
- NPT threaded and D50 weld adapters: 316/316L (EN 1.4404)

Electrical connection

Power supply

The transmitter operates on 18-30 Vdc at the transmitter terminals.

Connector type

M12 male (A-coded)

Protection class

III

Wiring diagram

Figure 7: Connection

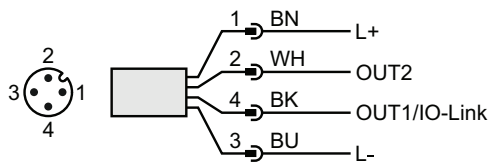


Table 3: Pin Assignment

Pin	Wire color ⁽¹⁾		Signal	
1	BN	Brown	L+	24 V
2	WH	White	OUT2	Digital output or active 4-20 mA analog output
3	BU	Blue	L-	0 V
4	BK	Black	OUT1/IO-Link	Digital output or IO-Link mode

(1) According to IEC 60947-5-2.

Installation considerations

Before installing the device, follow recommendations for mounting position, sufficient free space, nozzle requirements, etc.

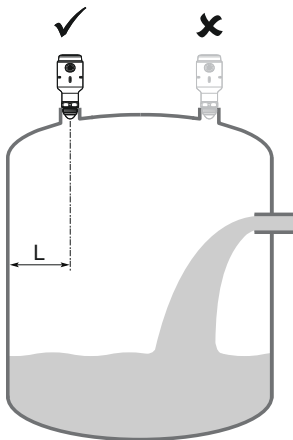
Mounting position

When finding an appropriate location on the tank for the device, the conditions of the tank must be carefully considered.

Consider the following guidelines when mounting the device:

- For optimal performance, the device should be installed in locations with a clear and unobstructed view of the product surface.
- The device should be mounted with as few internal structures as possible within the radar beam.
- Do not mount close to or above the inlet stream.
- Do not mount the device on a manway cover.
- Do not position the device directly over a side manway door.
- Multiple Rosemount 1408A devices can be used in the same tank without interfering with each other.

Figure 8: Recommended Mounting Position



Free space requirements

If the device is mounted close to a wall or other tank obstruction such as heating coils and ladders, noise might appear in the measurement signal. See [Table 4](#) for recommended clearance.

Figure 9: Free Space Requirements

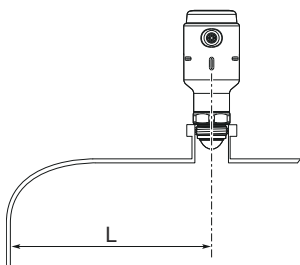


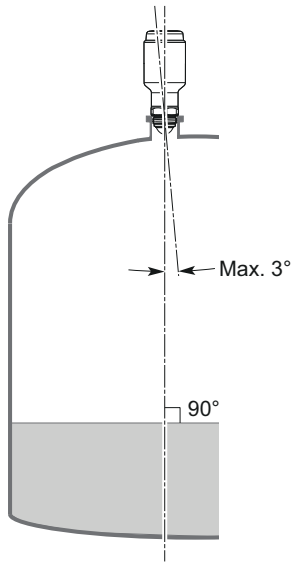
Table 4: Distance to Tank Wall (L)

Minimum	Recommended
8 in. (200 mm)	½ of tank radius

Inclination

The device should be mounted vertically to ensure a good echo from the product surface. See [Figure 10](#) for recommended maximum inclination.

Figure 10: Inclination



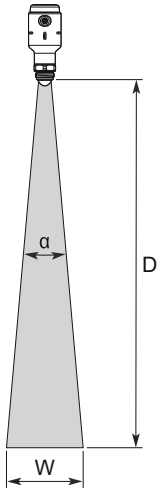
Non-metallic tanks

Nearby objects outside the tank may cause disturbing radar echoes. Wherever possible, the device should be positioned so that objects close to the tank are kept outside the radar beam.

Beam angle and beam width

The device should be mounted with as few internal structures as possible within the radar beam.

Figure 11: Beam Angle and Beam Width



Beam angle (α)

10° (8° with antenna extension)

Beam width

See [Table 5](#) for beam width at different distances.

Table 5: Beam Width

Distance (D)	Beam width (W)	
	α = 8°	α = 10°
6.6 ft. (2 m)	0.9 ft. (0.3 m)	1.2 ft. (0.4 m)
13.1 ft. (4 m)	1.8 ft. (0.6 m)	2.3 ft. (0.7 m)
19.7 ft. (6 m)	2.8 ft. (0.8 m)	3.4 ft. (1.0 m)
26.2 ft. (8 m)	3.7 ft. (1.1 m)	4.6 ft. (1.4 m)
32.8 ft. (10 m)	4.6 ft. (1.4 m)	5.7 ft. (1.7 m)

Nozzle requirements

See [Table 6](#) for recommended nozzle dimensions. The inside of the nozzle must be smooth (i.e. avoid bad welding, rust, or deposit).

Figure 12: Mounting in Nozzles

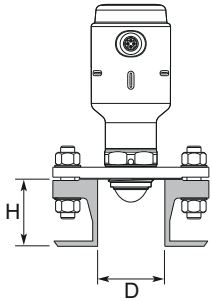


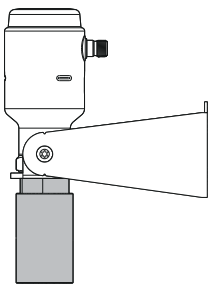
Table 6: Nozzle Requirements

Nozzle diameter (D)	Maximum nozzle height (H)
1 in. (25 mm)	3.9 in. (100 mm)
1.5 in. (40 mm)	5.9 in. (150 mm)
2 in. (50 mm)	7.9 in. (200 mm)
3 in. (80 mm)	11.8 in. (300 mm)
4 in. (100 mm)	15.8 in. (400 mm)
6 in. (150 mm)	23.6 in. (600 mm)

Open air installations

The antenna extension must be fitted to the transmitter to comply with open air requirements. The antenna extension is included in the bracket mount option.

Figure 13: Antenna Extension



Related information

[Ordering information](#)

Product certifications

See the Rosemount 1408A [Product Certifications](#) document for detailed information on the existing approvals and certifications.

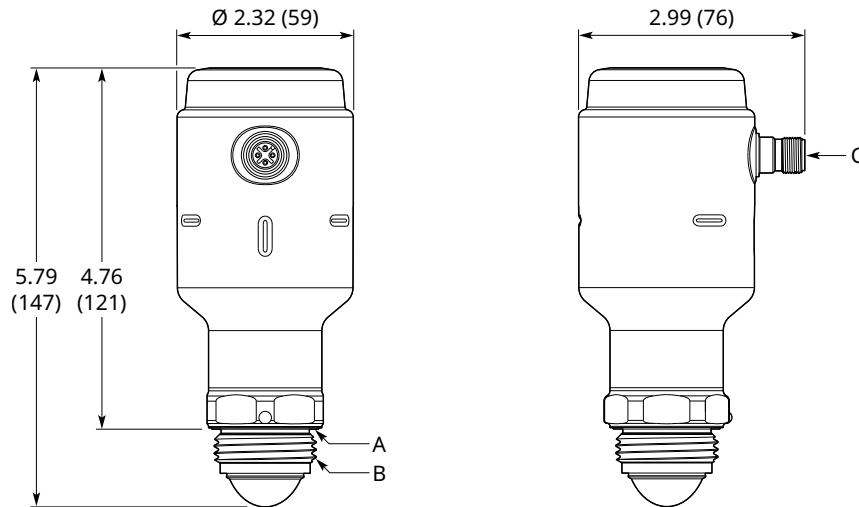
Dimensional drawings

Related information

[Type 1 Drawing](#)

Transmitter

Figure 14: Rosemount 1408A

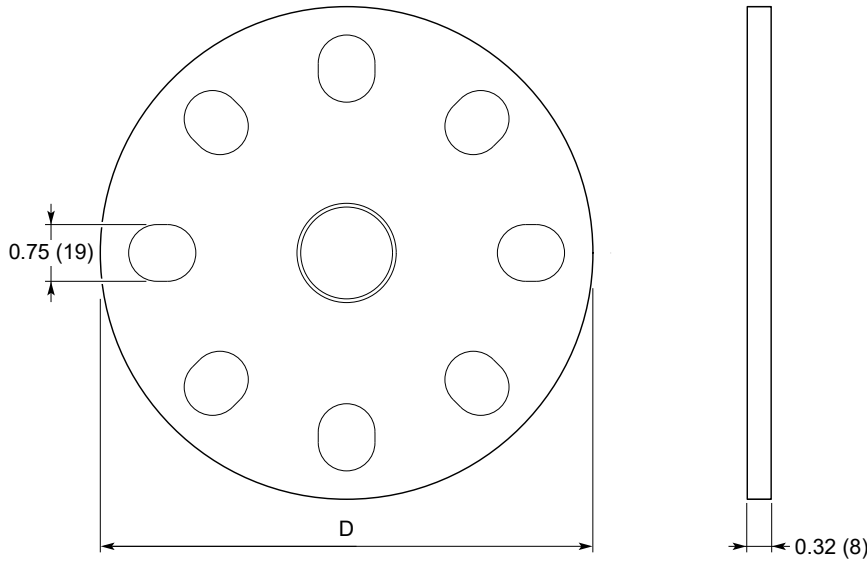


- A. DIN 3869 profile ring
- B. ISO 228/1-G1 thread
- C. M12 male connector (A-coded)

Dimensions are in inches (millimeters).

Flanges

Figure 15: Flanges for Non-pressurized Applications

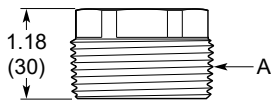


Size	Outer diameter (D)	Hole pattern
2-in.	6.50 (165)	2-in. ASME B16.5 Class 150/300, EN1092-1 DN50 PN16/40, and JIS B2220 50A 10K/20K
3-in.	7.87 (200)	3-in. ASME B16.5 Class 150/300, EN1092-1 DN80 PN16/40, and JIS B2220 80A 10K/20K
4-in.	9.25 (235)	4-in. ASME B16.5 Class 150/300, EN1092-1 DN100 PN16/40, and JIS B2220 100A 10K/20K

Dimensions are in inches (millimeters).

Threaded adapters

Figure 16: NPT Threaded Adapters

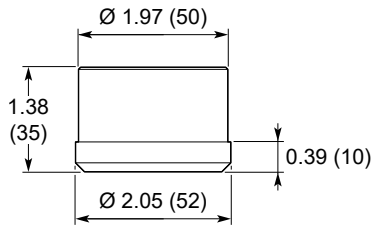


A. 1½-, 2-in. NPT thread

Dimensions are in inches (millimeters).

Weld adapter

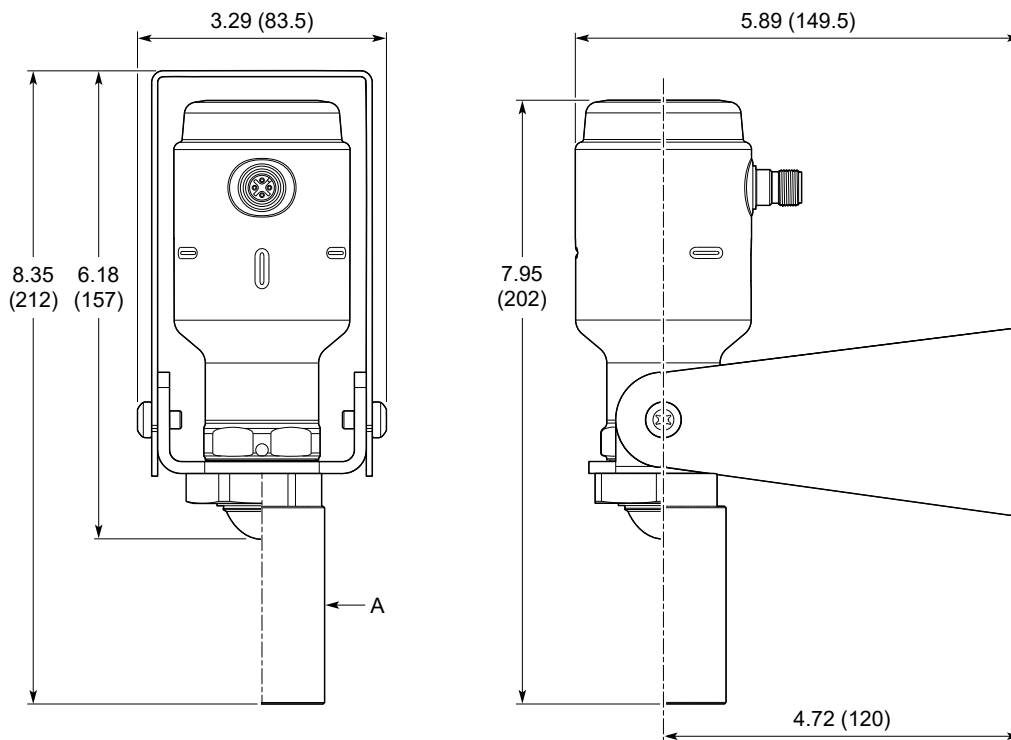
Figure 17: D50 Weld Adapter



Dimensions are in inches (millimeters).

Mounting bracket

Figure 18: Mounting Bracket

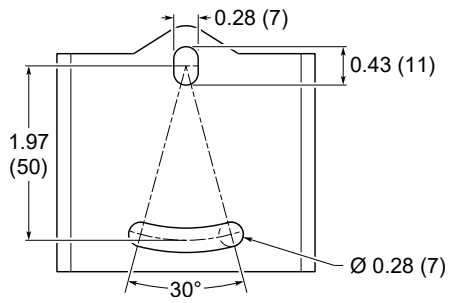


A. Antenna extension for open air installations

Dimensions are in inches (millimeters).

Bracket hole pattern

Figure 19: Hole Pattern



Dimensions are in inches (millimeters).

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