

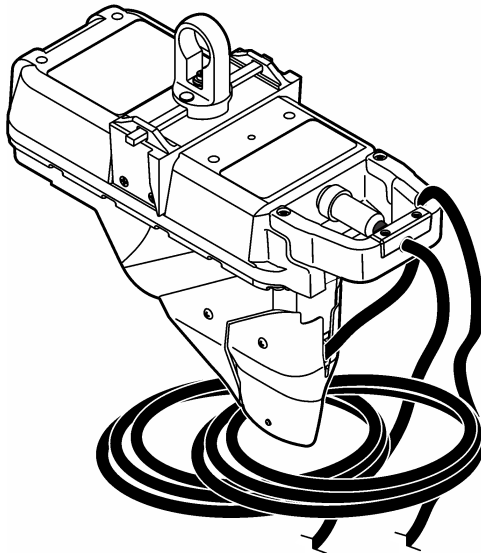


DOC343.53.80380

# Flo-Dar Sensor

09/2024, Edition 8

**User Manual**





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# Section 1 Specifications

Specifications are subject to change without notice.

Specification	Details
Dimensions (W x D x H)	160.5 x 432.2 x 297 mm (6.32 x 16.66 x 11.7 in.); with SVS, D=287 mm (15.2 in.)
Weight	4.8 kg (10.5 lb)
Enclosure	IP68 waterproof rating, polystyrene
Pollution degree	3
Protection class	III
Installation category	I
Operating temperature	-10 to 50 °C (14 to 122 °F)
Storage temperature	-40 to 60 °C (-40 to 140 °F)
Altitude	4000 m (13,123 ft) maximum
Power requirements	Supplied by FL Series flow logger
Interconnecting cable (disconnect at both sensor and logger ends)	Polyurethane, 0.400 (±0.015) inch diameter
	IP68
	Standard length: 9 m (30 ft); maximum length: 305 m (1000 ft)
Depth measurement	Method: Ultrasonic
	Standard operating range from Flo-Dar sensor housing to liquid: 0–152.4 cm (0–60 in.)
	Optional extended operating range from transducer face to liquid: 0–6.1 m (0–20 ft) (with 43.18 cm (17 in.) deadband), temperature compensated
	Accuracy: ±1%; ±0.25 cm (±0.1 in.)
Surcharge depth measurement	Method: Piezo resistive pressure transducer with stainless steel diaphragm
	Auto zero function maintains zero error < 0.5 cm (0.2 in.)
	Range: 3.5 m (138 in.); overpressure rating: 2.5 × full scale
Velocity measurement	Method: Pulsed radar - Doppler
	Range: 0.23–6.10 m/s (0.75–20 ft/s)
	Frequency Range: EU Models—24.175 GHz ± 15 MHz, US/Canada Models—24.125 GHz ± 15 MHz
	Output Power: EU Models—20 mW (13 dBm) nominal ± 10%, US/Canada Models—2.5 V/m at 3 meters (maximum field strength)
	Accuracy: ±0.5%; ±0.03 m/s (±0.1 ft/s)
Certifications	<p>The Flo-Dar transmitter has the wireless certifications that follow:</p> <ul style="list-style-type: none"> <li>• European Union (EU): CE mark</li> <li>• United States (US): FCC ID: VIC-FLODAR24</li> <li>• Canada: IC: 6149A-FLODAR24</li> <li>• Brazil: ANATEL: 01552-13-09098</li> </ul>

Specification	Details
<b>Flow measurement</b>	
Method	Based on the continuity equation
Accuracy	±5% of reading is typical where flow is in a channel with uniform flow conditions and is not surcharged, ±1% full scale maximum
<b>Surcharge conditions depth/velocity</b>	
Depth (standard with Flo-Dar sensor)	Surcharge depth supplied by Flo-Dar sensor
Velocity (with optional surcharge velocity sensor)	Method: Electromagnetic
	Range: ±4.8 m/s (±16 ft/s)
	Accuracy: ±0.046 m/s (±0.15 ft/s) or 4% of reading, whichever is more
	Zero stability: > ±0.015 m/s (±0.05 ft/s) typical

## Section 2 General information

In no event will the manufacturer be liable for damages resulting from any improper use of product or failure to comply with the instructions in the manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

### 2.1 Safety information

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

#### 2.1.1 Use of hazard information

##### **▲ DANGER**

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

##### **▲ WARNING**

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

##### **▲ CAUTION**







Indicates a potentially hazardous situation that may result in minor or moderate injury.

##### **NOTICE**


Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

## 2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicates that care must be taken to prevent damage with the equipment.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol indicates that the marked item requires a protective earth connection. If the instrument is not supplied with a ground plug on a cord, make the protective earth connection to the protective conductor terminal.

## 2.1.3 Confined space precautions

<b>⚠ DANGER</b>	
	Explosion hazard. Training in pre-entry testing, ventilation, entry procedures, evacuation/rescue procedures and safety work practices is necessary before entering confined spaces.

The information that follows is supplied to help users understand the dangers and risks that are associated with entry into confined spaces.

On April 15, 1993, OSHA's final ruling on CFR 1910.146, Permit Required Confined Spaces, became law. This standard directly affects more than 250,000 industrial sites in the United States and was created to protect the health and safety of workers in confined spaces.

### Definition of a confined space:

A confined space is any location or enclosure that has (or has the immediate potential for) one or more of the following conditions:

- An atmosphere with an oxygen concentration that is less than 19.5% or more than 23.5% and/or a hydrogen sulfide (H<sub>2</sub>S) concentration that is more than 10 ppm.
- An atmosphere that can be flammable or explosive due to gases, vapors, mists, dusts or fibers.
- Toxic materials which upon contact or inhalation can cause injury, impairment of health or death.

Confined spaces are not designed for human occupancy. Confined spaces have a restricted entry and contain known or potential hazards. Examples of confined spaces include manholes, stacks, pipes, vats, switch vaults and other similar locations.

Standard safety procedures must always be obeyed before entry into confined spaces and/or locations where hazardous gases, vapors, mists, dusts or fibers can be present. Before entry into a confined space, find and read all procedures that are related to confined space entry.

## 2.1.4 EU/FCC/IC/ANATEL regulations

Use of this device is subject to the conditions that follow:

- There are no user serviceable items inside this device.
- The user must install this device in accordance with the supplied installation instructions and must not modify the device in any manner whatsoever. Any changes or modifications to the device may void the user's authority to operate this equipment.
- Any service that includes the transmitter must only be done by Hach Company.
- This device is considered a "mobile" wireless device per the FCC. For RF exposure safety, the user must maintain a minimum of 20 cm (8 in.) separation distance from the face of the radar transmitter when it is in operation.

## 2.2 Certification

### ⚠ CAUTION

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

### Canadian Radio Interference-Causing Equipment Regulation, ICES-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

### FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

### Flo-Dar Sensor—Part number list:

Standard U-Sonic 890004901, 890004902; Standard U-Sonic I.S. (Intrinsic Safety) 890004801, 890004802, 890004803; Long-Range U-Sonic 890005201, 890005202, 890005206; Long-Range U-Sonic I.S. (Intrinsic Safety) 890004804, 890004805, 890004806; Remote Long-Range U-Sonic 890005204, 890005205, 890005207; Remote Long-Range U-Sonic I.S. (Intrinsic Safety) 890004807, 890004808, 890004809



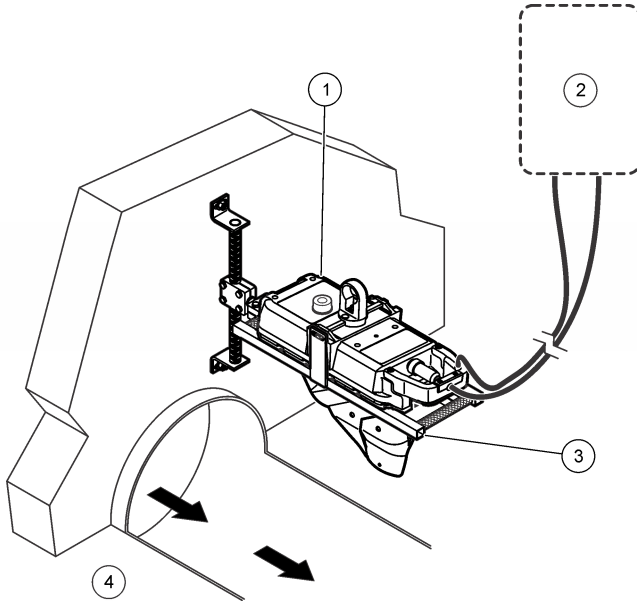
The part numbers above are service only and cannot be purchased – reference only for wireless certifications.

## 2.3 Product overview

The Flo-Dar sensor measures the flow velocity and liquid depth in open channels using radar and ultrasonic technology. The unit is made to withstand submersion during surcharge conditions. The optional surcharge velocity sensor supplies velocity measurements during surcharge conditions.

Figure 1 shows the configuration of a Flo-Dar system in a non-hazardous location.

Figure 1 System overview



1 Flo-Dar sensor with optional surcharge velocity sensor	3 Mounting frame
2 Flow logger or controller	4 Non-hazardous environment

### 2.3.1 Theory of operation

The Flo-Dar sensor is installed above an open channel of water and measures the surface velocity and depth from above the surface of the water. The two measurements are used to calculate the flow rate.

During surcharge (submerged) conditions, a pressure transducer measures depth. The optional surcharge velocity sensor (SVS) can be used to measure velocity during surcharge conditions.

#### 2.3.1.1 Surface velocity measurement

The surface velocity of the water is measured with radar technology. A radar beam is transmitted from the sensor to the water surface at the center of the channel. Some of the signal is reflected back at a slightly different frequency. The difference in frequency, known as the Doppler frequency, is directly proportional to the speed of the flow. Proprietary algorithms are then used to calculate the average speed of the flow stream.

**Note:** The radar velocity sensor does not operate under surcharge conditions.

### 2.3.1.2 Velocity measurements during surcharge

The optional surcharge velocity sensor (SVS) is activated when the flow level increases to within 17.78 cm (7 in.) of the sensor mounting frame and stays active until the flow decreases to 17.78 cm (7 in.) below the sensor mounting frame. The mounting frame is installed 12.7–15.24 cm (5–6 in.) above the crown of the pipe. This location puts the velocity-sensing electrodes at the correct location in the flow below the elevation of the crown of the pipe.

The SVS measures velocity with an electromagnetic sensor that makes a magnetic field. When the water passes through the magnetic field, a voltage results that is directly proportional to the speed of the water passing the sensor.

### 2.3.1.3 Depth measurement

The water depth is measured with an ultrasonic pulse echo sensor. An electronic pulse is sent to the water surface and some of the signal is reflected back to the sensor. The transit time to the surface and back is used to calculate the distance from the water surface to the sensor. The pipe diameter is used to convert the distance to a water depth.

The depth sensor on the Flo-Dar unit can measure distances up to 1.5 m (5 ft). For larger channels, an extended range sensor is available to measure up to 6.1 m (20 ft).

During surcharge conditions, a pressure transducer in the Flo-Dar unit is used to measure the water depth.

### 2.3.1.4 Flow calculations

The velocity and depth measurements are used with the pipe diameter to identify the flow rate. The flow rate is calculated from the continuity equation (1):

$$(1) \text{ Flow rate} = \text{Average velocity} \times \text{Area}$$

where

Flow rate = volume of liquid passing the sensor per unit of time (e.g., 200 gallons per minute)

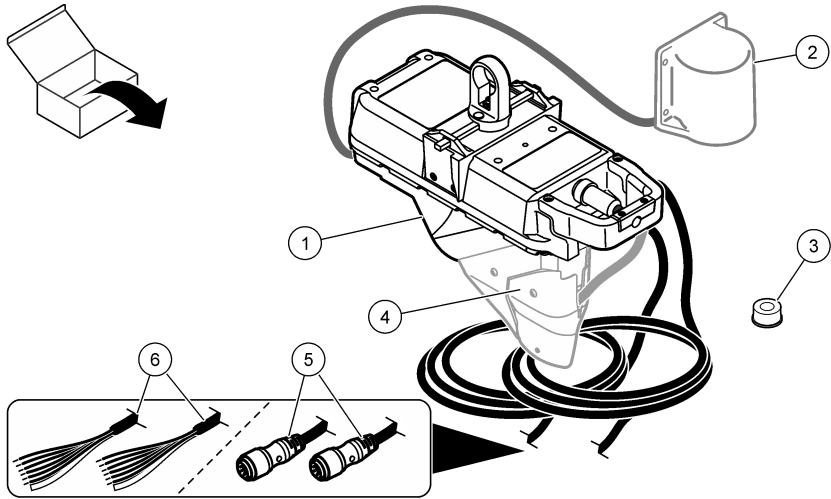
Average velocity = average velocity of the liquid, calculated with surface velocity measurements and algorithms

Area = cross-sectional area of the liquid in the channel, calculated with the channel dimensions and depth measurement

## 2.4 Product components

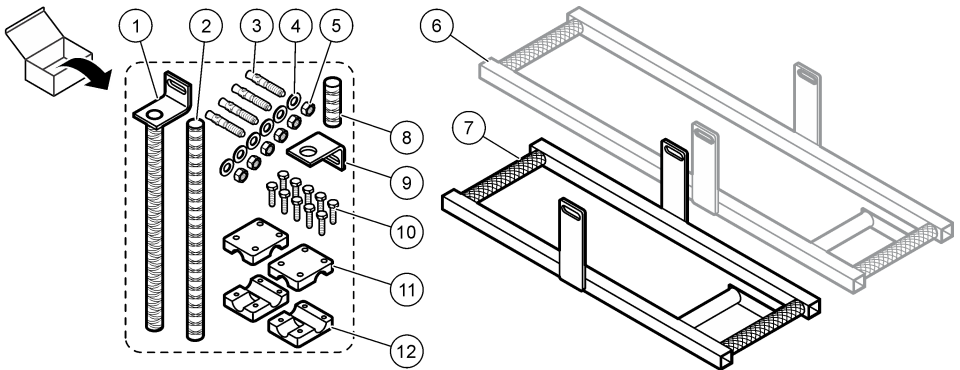
Make sure that all components have been received. Refer to [Figure 2](#) and [Figure 3](#). If any items are missing or damaged, contact the manufacturer or a sales representative immediately.

**Figure 2 Instrument components**



1 Flo-Dar sensor	4 Surcharge velocity sensor (SVS) (optional)
2 Extended range sensor (optional)	5 Flo-Dar connector and SVS connector
3 Bubble level	6 Flo-Dar with bare-wire and SVS with bare-wire <sup>1</sup>

**Figure 3 Wall mount hardware**



1 Wall mount bracket	7 Standard frame
2 Spacer, 12-inch	8 Spacer, 2 1/4-inch
3 Anchor, 3/8 x 2 1/4 in. (4x)	9 Adjustable wall bracket
4 Anchor washer (6x)	10 Clamp bolts, 1/4-20 x 1 in. (10x)
5 Anchor nut, 3/8-16 (6x)	11 Clamp half, not threaded (2x)
6 Frame for extended range sensor (optional)	12 Clamp half, threaded (2x)

<sup>1</sup> Bare-wire is an alternative to the connector.

## Section 3 Installation

**⚠ DANGER**



Explosion hazard. Trained personnel only must install or commission the equipment.

### 3.1 Mechanical installation

#### 3.1.1 Site location guidelines

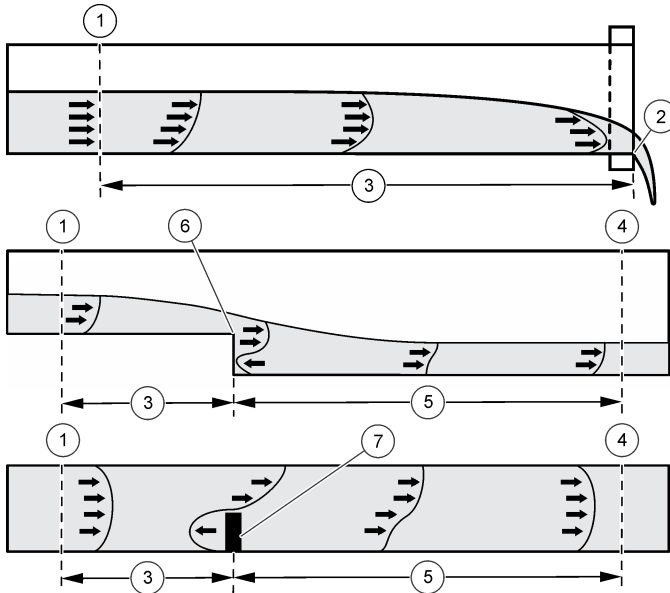
#### NOTICE

To prevent damage to the enclosure, install the instrument away from direct sunlight, ultraviolet radiation (UV), heat sources and severe weather. Install a sun shade or protective cover above the instrument when the location is outdoors.

For the best accuracy, install the sensor where the flow is not turbulent. The ideal location is in a long, straight channel or pipe. Outfalls, vertical drops, baffles, curves or junctions cause the velocity profile to become distorted.

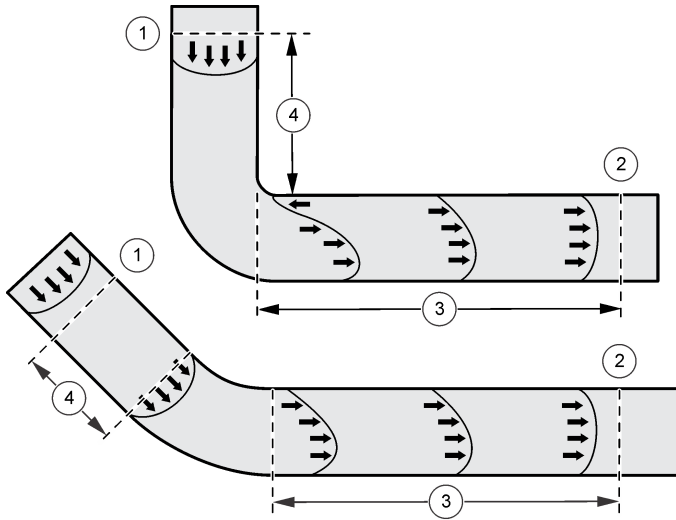
Where there are outfalls, vertical drops, baffles, curves or junctions, install the sensor upstream or downstream as shown in [Figure 4–Figure 6](#). For upstream locations, install the sensor at a distance that is at least five times the pipe diameter or the maximum fluid level. For downstream locations, install the sensor at a distance that is at least ten times the pipe diameter or the maximum fluid level. If the location contains a junction and the flow in one pipe is much higher, install the sensor on the wall near the lower flow pipe.

**Figure 4 Sensor location near an outfall, vertical drop or baffle**



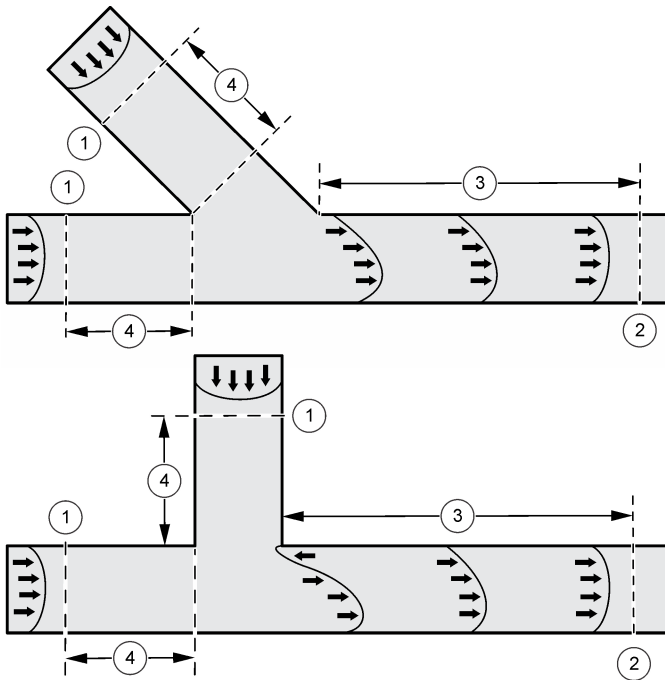
1 Acceptable upstream sensor location	5 Distance downstream: $10 \times$ pipe diameter
2 Outfall	6 Vertical drop
3 Distance upstream: $5 \times$ maximum level	7 Baffle
4 Acceptable downstream sensor location	

**Figure 5 Sensor location near a curve or elbow**



1 Acceptable upstream sensor location	3 Distance downstream: 10 × pipe diameter
2 Acceptable downstream sensor location	4 Distance upstream: 5 × pipe diameter

**Figure 6 Sensor location near a junction**



1 Acceptable upstream sensor location	3 Distance downstream: 10 × pipe diameter
2 Acceptable downstream sensor location	4 Distance upstream: 5 × pipe diameter

### 3.1.2 Install the sensor

#### ▲ WARNING



Explosion hazard. In hazardous locations, friction between surfaces can generate sparks that can cause an explosion. Make sure that no friction is possible between the instrument and any surrounding surfaces.

#### ▲ CAUTION



Potential hearing loss risk. Hearing protection required. The level transducer emits ultrasonic sound energy when powered. Ear protection must be worn when working within 1 meter of this device. Do not point the transducer output towards ears during installation, calibration and maintenance.

#### Ultrasonic pressure:

- Dimensions of useful beam: Long range
- Ultrasonic pressure: > 110 dB at 1 m (3.3 ft) on axis
- Sound pressure inside beam: 111.9 dB maximum

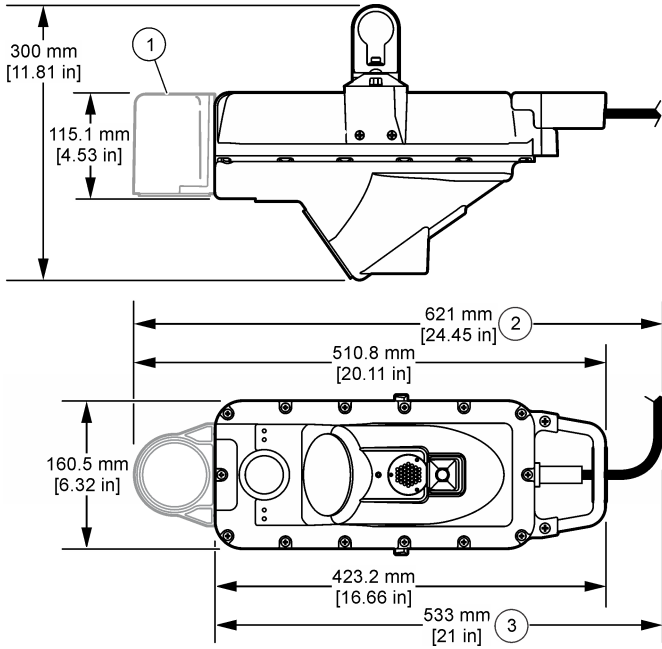
Mount the Flo-Dar sensor above the open channel on the wall of the manhole. For hazardous locations, a barrier must be installed outside of the hazardous area.

For temporary installation, an optional Jack-bar is available. Instructions are supplied with the Jack-bar.

The sensor dimensions are shown in [Figure 7](#) and [Figure 8](#).

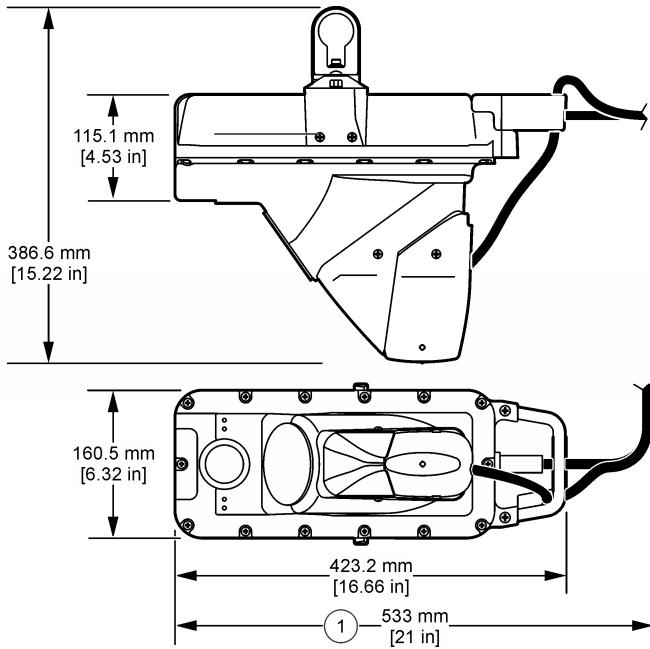
The dimensions of the standard frame for wall installation are shown in [Figure 9](#).

**Figure 7 Sensor dimensions**



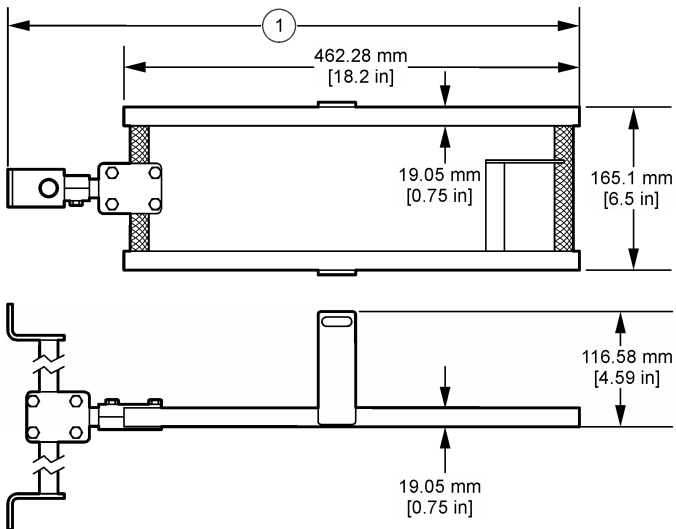
<p><b>1</b> Optional extended range sensor</p>	<p><b>3</b> Minimum clearance for cable</p>
<p><b>2</b> Minimum clearance for cable with extended range sensor</p>	

**Figure 8 Sensor with SVS dimensions**



1 Minimum clearance for cable

**Figure 9 Standard frame dimensions**



1 579.12 mm (22.8 in.) with 2¼ in. spacer; 828.04 mm (32.6 in.) with 12 in. spacer

**3.1.2.1 Assemble the clamps on the frame and wall bracket**

Install the clamps on the frame and wall mount bracket before installation on the wall.



**Items to collect:** Wall mount hardware ([Figure 3](#) on page 9)

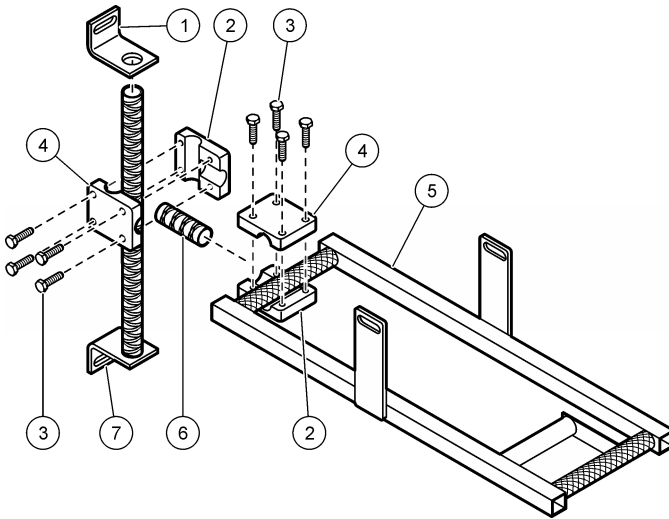
- Frame
- Wall mount bracket
- Clamps
- Hardware: wall bracket, spacer, nuts and bolts

1. Put two clamp halves (one with threads and one without threads) around the wall mount bracket. Refer to [Figure 10](#).
2. Connect the clamp halves together with four bolts. Tighten the bolts sufficiently to temporarily hold the clamp in position.
3. Put the other two clamp halves around the front end of the frame. Refer to [Figure 10](#).

**Note:** Typically, the front of the frame will point toward the wall. Refer to [Figure 10](#) and [Figure 14](#) on page 20. If flow conditions make it necessary to point the sensor away from the wall, use the 12-inch spacer and put the two clamp halves around the back end of the frame.

4. Connect the clamp halves together with four bolts. Tighten the bolts sufficiently to temporarily hold the clamp in position.

**Figure 10 Assemble the clamps on the wall bracket and frame**



1 Adjustable wall bracket	5 Frame
2 Clamp half, threaded	6 Spacer
3 Clamp bolt, ¼–20 x 1 in.	7 Wall mount bracket
4 Clamp half, not threaded	

### 3.1.2.2 Install the frame on the wall

**⚠ DANGER**



Explosion hazard. Review the safety information in [Confined space precautions](#) on page 5 before entering a confined space.

Review the guidelines that follow to find the best location for the sensor.

- Examine the upstream and downstream flow characteristics. Use a mirror if necessary. Install the sensor above the water where the flow is stable. Do not install the sensor where there are standing waves, pools or objects or materials that can disrupt the flow profile.
- If the upstream flow characteristics are acceptable, install the sensor on the upstream wall of the manhole with the sensor pointing upstream. This location will make sure that the measured flow is the same as the flow in the pipe and that the sensor cable points away from the wall.
- Install the sensor away from the sides of the pipe and in the very center of the flow where the fluid is at the maximum depth.
- Install the sensor in a location that is accessible for maintenance.

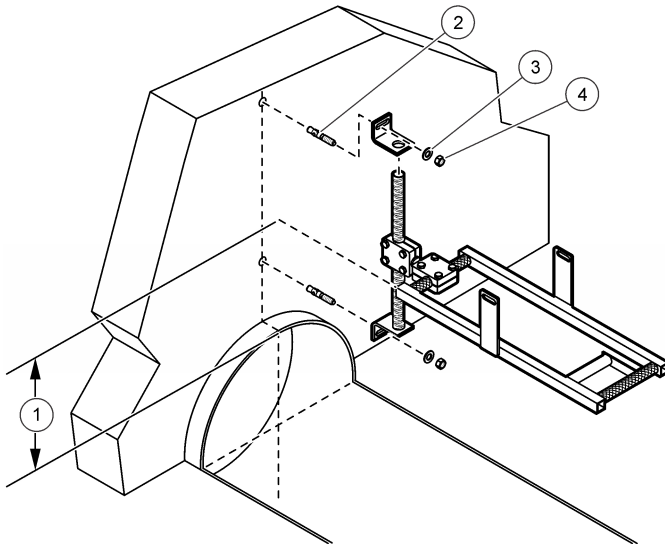
**Items to collect:**

- Assembled frame and wall mount bracket assembly
- Anchors with nuts and washers
- Tools: mirror, ruler or tape measure, marker

Complete the steps to install the frame on the wall of the manhole above the flow. Make sure to obey all codes and/or directives that are relevant to the location. Refer to [Site location guidelines](#) on page 10.

1. Make a mark on the wall that identifies the location of the top of the sensor frame. Refer to [Figure 11](#). The wall brackets will be installed above and below this mark.
  - Sensor without SVS—make sure that when the sensor is in the frame, the radar beam is not stopped by the wall or channel. Refer to [Figure 13](#) on page 19.
  - Sensor with SVS—the top of the sensor frame must be installed at an exact distance above the top of the channel. For pipe diameters that are more than 635 mm (25 in.), measure 127 mm (5 in.) from the interior crown of the pipe to the top of the frame. For pipe diameters that are less than 635 mm (25 in.), measure 152.4 mm (6 in.) from the interior crown of the pipe to the top of the frame.
2. Put the wall mount brackets above and below this mark.
3. Attach the brackets to the wall using the supplied anchors. Install the anchors into 3/8-in. diameter holes at a depth of 38.1 mm (1.5 in.).
4. Connect the frame to the wall bracket with a spacer. Refer to [Figure 11](#). It may be necessary to use the 12-inch spacer to position the sensor farther from the wall when there is a large pipe lip.

**Figure 11 Wall installation**



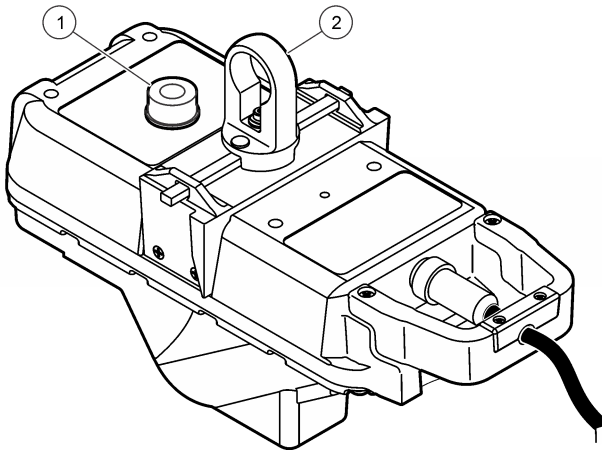
1 Distance from interior crown of pipe to top of frame	3 Washer
2 Anchor	4 Nut

**3.1.2.3 Install the sensor on the frame**

The sensor fits in the frame in only one direction and is held in position when the bail on the sensor is turned. Refer to [Figure 12](#). The sensor can be removed from the frame and installed without entry into the manhole when the optional retrieval pole is used.

1. Make sure that the cable is tightly connected to the sensor.
2. Turn the bail to retract the locking bars on the sensor.
3. Put the sensor on the frame. Make sure that the cable points toward the center of the manhole.
4. Turn the bail to hold the sensor on the frame. Refer to [Figure 12](#).

**Figure 12 Horizontal alignment**



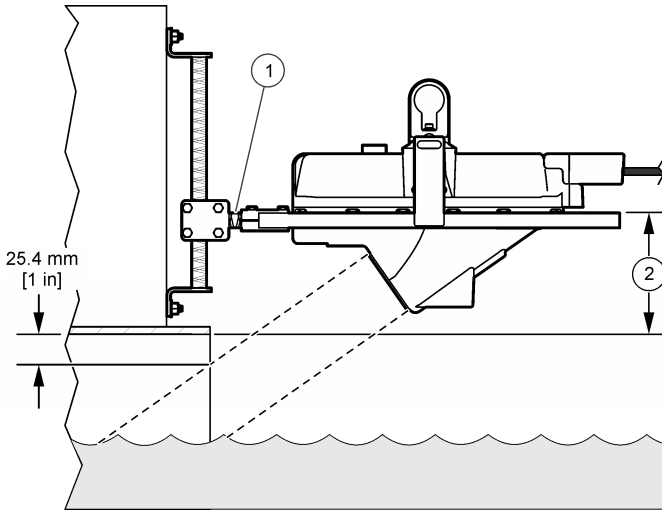
1 Bubble level	2 Bail
----------------	--------

#### **3.1.2.4 Align the sensor vertically – Flo-Dar without SVS**

The sensor must be aligned vertically to make sure that the sensor is above the flow and that the radar beam will not be stopped by the wall or pipe. Refer to [Figure 13](#).

1. Make an estimate of where a line that extends from the top of the radar lens perpendicular to where the lens will point. Refer to [Figure 13](#).
2. Loosen the clamp on the wall mount bracket and put the frame so that the radar beam will point below the crown of the pipe by at least 25.4 mm (1 in.). Refer to [Figure 13](#). It may be necessary to install the 12-inch spacer to extend the frame farther from the wall.
3. Tighten the clamp and measure the frame position. Make sure that the radar beam is not stopped by the wall or pipe. If the beam is stopped, move the frame further away from the wall with the 12-inch spacer or lower the frame.

**Figure 13 Vertical alignment of the sensor**



1 Spacer

2 Distance from interior crown of pipe to top of frame

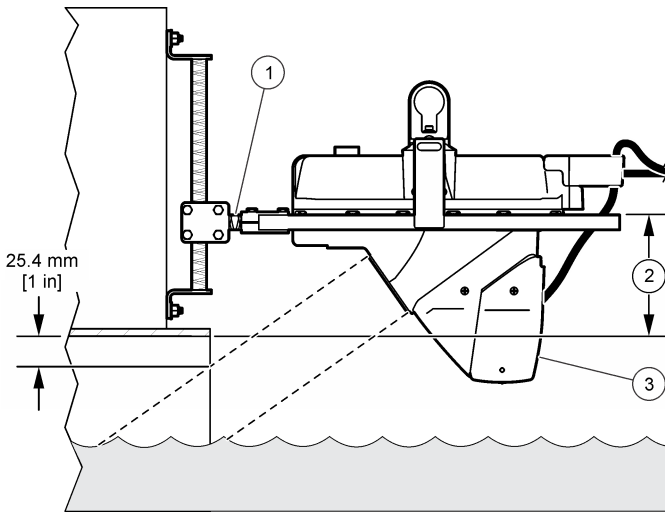
### 3.1.2.5 Align the sensor vertically – Flo-Dar with SVS

The sensor must be aligned vertically to make sure that the sensor is above the flow under normal full flow conditions and that the SVS is activated under surcharge conditions.

**Item to collect:** Ruler or tape measure

1. Measure directly above the crown of the pipe to the top of the frame. Refer to [Figure 11](#) on page 17.
2. If the pipe lip is longer than 140 mm (5.5 in.), install the 12-inch spacer between the wall mount bracket and the frame. Refer to [Figure 14](#).
3. Loosen the clamp on the wall mount bracket and put the top of the frame above the crown of the pipe at the specified distance:
  - 152.4 mm (6 in.) for a pipe diameter that is less than 610 mm (24 in.)
  - 127 mm (5 in.) for a pipe diameter that is equal to or larger than 610 mm (24 in.)
4. Tighten the clamp and measure the frame position again to make sure that it is at the correct position.

**Figure 14 Vertical alignment of the sensor with SVS**



1 Spacer	3 SVS sensor (optional)
2 Distance from interior crown of pipe to top of frame	

### 3.1.2.6 Align the sensor horizontally

The sensor must be aligned horizontally to make sure that the sensor is over the center of the flow. If the pipe is not level and has a slope of 2 degrees or more, align the sensor to be parallel with the surface of the water.

**Item to collect:** Bubble level

1. Remove the paper backing from the bubble level and attach the level to the sensor. Refer to [Figure 12](#) on page 18.
2. Loosen the clamps and tap the frame into position.
3. Tighten both clamps and measure the frame position to make sure that it is at the correct position.

### 3.1.2.7 Make a final alignment check

The correct vertical and horizontal alignment of the sensor is necessary for accurate measurements.

1. Measure the vertical alignment and make adjustments if necessary. Refer to [Align the sensor vertically – Flo-Dar without SVS](#) on page 18 or [Align the sensor vertically – Flo-Dar with SVS](#) on page 19.
2. Measure the horizontal alignment and make adjustments if necessary. Refer to [Align the sensor horizontally](#) on page 20.
3. Repeat steps 1 and 2 until no further adjustments are necessary.

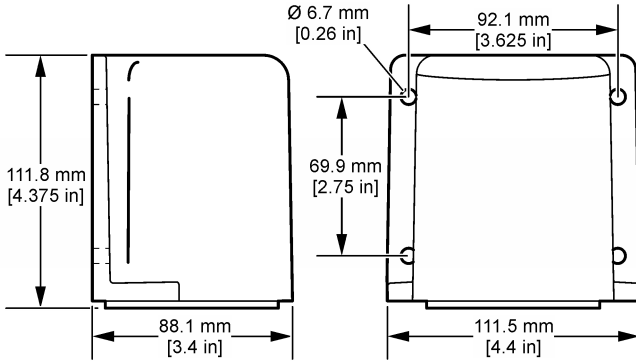
### 3.1.2.8 Optional extended range sensor installation

The extended range sensor ([Figure 15](#)) can be used when the pipe or channel depth is more than the standard level specifications. Refer to [Specifications](#) on page 3.

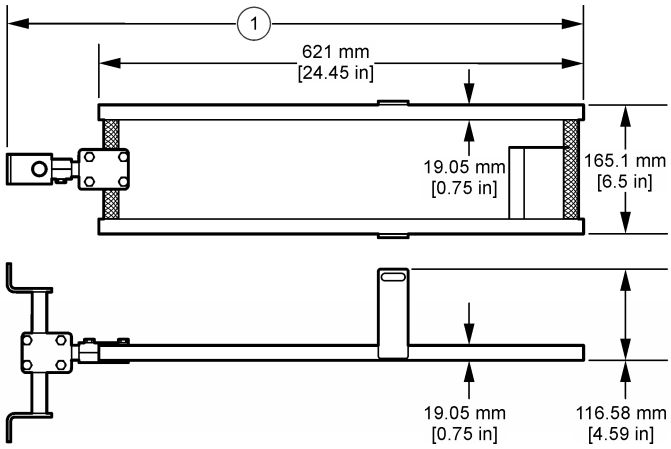
Use the extended frame ([Figure 16](#)) instead of the standard frame, or mount the extended range sensor on the wall.

The extended range sensor must be installed at least 457.2 mm (18 in.) above the crown of the pipe for correct measurements. The extended range sensor has a deadband zone of 431.8 mm (17 in.) where the sensor is not active.

**Figure 15 Extended range sensor dimensions**

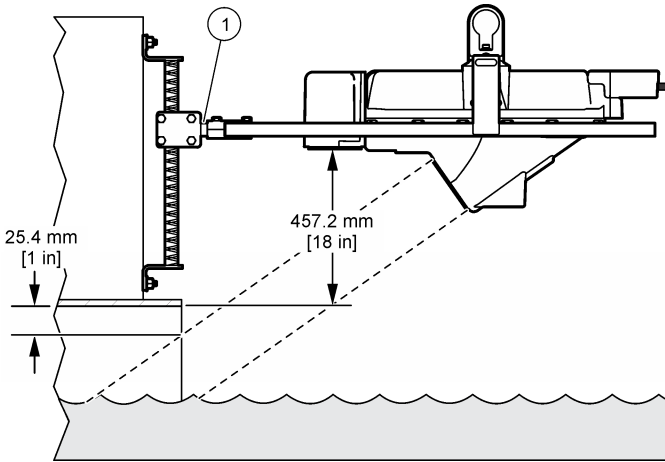


**Figure 16 Extended frame dimensions**



1 739.14 mm (29.1 in.) with 2¼ in. spacer; 985.52 mm (38.8 in.) with 12 in. spacer

**Figure 17 Vertical alignment with extended range sensor**



1 Spacer

### 3.1.3 Measure the sensor offset

The sensor offset is the distance from the top of the frame to the bottom of the pipe or channel. This distance will be entered into the software and is necessary for accurate flow calculations.

If the optional extended range sensor is installed on the wall without the extended frame, the sensor offset is the distance from the surface of the extended range sensor to the bottom of the pipe or channel.

#### Items to collect:

- Rod
- Tape measure

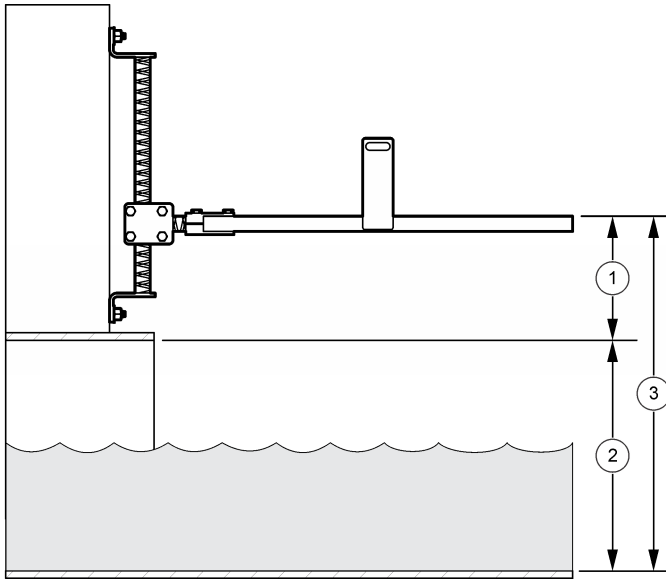
1. Put the rod in the bottom of the pipe or channel and align it vertically with the frame. Refer to [Figure 18](#).
2. Make a mark on the rod to identify the location of the top of the sensor frame.
3. Measure the distance from the bottom of the rod to the mark. This is the sensor offset.

**Note:** If it is not practical to measure to the bottom of the pipe, measure the distance from the crown of the pipe to the top of the frame. Refer to [Figure 18](#). Add this distance to the pipe diameter to get the sensor offset.

*Sensor offset = pipe diameter + distance from crown of the pipe to the top of the frame*



**Figure 18 Sensor offset**



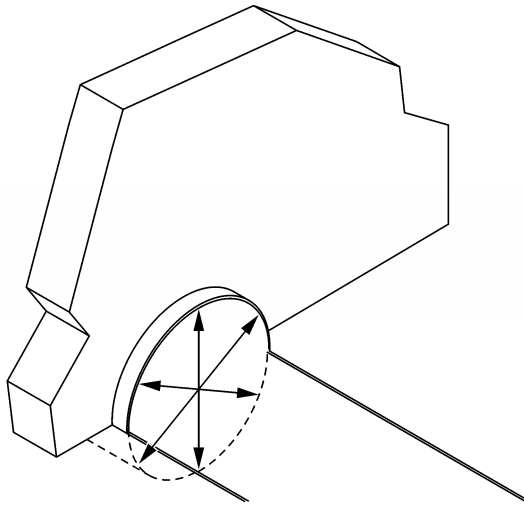
1 Distance from interior crown of pipe to top of frame	3 Sensor offset
2 Pipe diameter	

**3.1.4 Measure the pipe diameter**

The correct diameter of the pipe or channel is necessary for accurate flow calculations.

1. Measure the inside pipe diameter (ID) at three locations. Refer to [Figure 19](#). Make sure that the measurements are accurate.
2. Calculate the average of the three measurements. Record this number for use during the software setup for the site.

**Figure 19 Pipe diameter measurement**



## 3.2 Electrical installation

### 3.2.1 Wiring safety information

#### **⚠ DANGER**



Electrocution hazard. Always remove power to the instrument before making electrical connections.

### 3.2.2 Electrostatic discharge (ESD) considerations

#### **NOTICE**



Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Refer to the steps in this procedure to prevent ESD damage to the instrument:

- Touch an earth-grounded metal surface such as the chassis of an instrument, a metal conduit or pipe to discharge static electricity from the body.
- Avoid excessive movement. Transport static-sensitive components in anti-static containers or packages.
- Wear a wrist strap connected by a wire to earth ground.
- Work in a static-safe area with anti-static floor pads and work bench pads.

### 3.2.3 Connect the flow logger

Connect the Flo-Dar sensor to the flow logger.

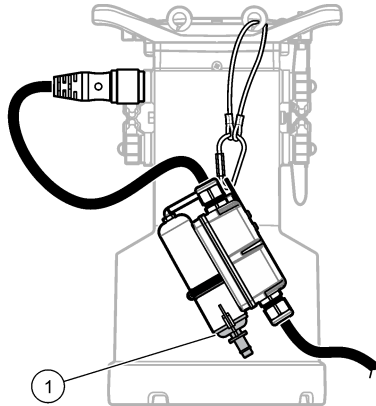
- **FL900 flow logger**—Connect the cable from the Flo-Dar sensor to a sensor connector on the flow logger. If the optional surcharge velocity sensor (SVS) is installed, connect the cable from the SVS to a sensor connector on the logger.
- **FL1500 flow logger**—Connect the cable from the Flo-Dar sensor to the correct terminal in the flow logger. If the optional surcharge velocity sensor (SVS) is installed, connect the cable from the SVS to the correct terminal in the controller. Refer to the FL1500 flow logger documentation for the correct terminal locations.

### 3.2.4 Attach the desiccant hub (FL900)

Attach the optional desiccant hub to the FL900 flow logger to give strain relief to the sensor cable and the connector. Refer to [Figure 20](#).

For the best performance, make sure to install the desiccant container vertically with the end cap pointed down. Refer to [Figure 20](#).

**Figure 20 Attach the desiccant hub**



1 End cap

## Section 4 Operation

For sensors connected to an FL900 flow logger, connect a computer with FSDATA Desktop software to the flow logger to configure, calibrate and collect data from the sensors. Refer to the FSDATA Desktop documentation to configure, calibrate and collect data from the sensor.

For sensors connected to an FL1500 flow logger, refer to the FL1500 flow logger documentation to configure, calibrate and collect data from the sensors. As an alternative, connect a computer with FSDATA Desktop software to the flow logger to configure, calibrate and collect data from the sensors. Refer to the FSDATA Desktop documentation to configure, calibrate and collect data from the sensor.

### 4.1 Install the software

Make sure that the latest version of the FSDATA Desktop software is installed on the computer. Download the software from <http://www.hachflow.com>. Click Support, then select Software Downloads>Hach FL Series Flow Logger.

## Section 5 Maintenance

### ▲ DANGER



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

### ▲ DANGER



Explosion hazard. When using the retrieval pole, make sure to connect the grounding strap to the ground lug on the barrier. The sensor must also be connected to the barrier during maintenance activities. This is to prevent ignition of explosive gases due to static discharge.

## ⚠ CAUTION



Radar RF exposure hazard. Avoid putting the head and other vital organ areas within the microwave beam (within 1 meter (3.3 ft) of the microwave aperture). Although the Flo-Dar microwave power level is very small (approximately 15 mW) and is well below government stated exposure limits for uncontrolled environments, users of this product should obey proper safety protocols for the handling of devices with radar frequency transmitters.

## NOTICE

Handle the sensor with care to prevent damage to the microwave transmitter. Damaged transmitters can result in higher signal power levels, which can interfere with essential terrestrial microwave links.

The safety of the transmitter may be impaired if any of the following conditions have occurred:

- Visible damage
- Storage above 70 °C for prolonged periods
- Exposure to severe transport stresses
- Previous installation
- Failure to operate properly

If any of these conditions have occurred, return the device to the manufacturer for recertification.

### 5.1 Look for corrosion and damage

Look for corrosion and damage once a year.

**Note:** *The only parts of the Flo-Dar system that can be replaced by the user are the bail assembly and the cable. If the sensor becomes defective, it must be replaced as a complete unit.*

1. Look for corrosion or damage that can let environmental gases into the interior of the sensor.
2. Make sure that no swelling, blistering, pitting or loss of material has occurred on the upper and lower portions of the main plastic enclosure, the depth module or the radome.
3. If the extended range sensor is used, examine the enclosure and the four ¼-20 stainless steel bolts.
4. If the surcharge velocity sensor (SVS) is used:
  - a. Make sure that the unit is not corroded and the labels can be read.
  - b. Examine the connectors for any damage or corrosion. Tighten all the connectors in the system.
5. Examine the connectors for any damage or corrosion. Tighten all the connectors in the system.
6. If corrosion is found on the connectors, clean and dry the connectors to make sure that no moisture is on the connector pins. If corrosion is severe, replace the cables. Refer to [Replace a cable](#) on page 27.

### 5.2 Clean the instrument

## ⚠ DANGER



Explosion hazard. Never attempt to wipe or clean the Flo-Dar or SVS sensor while in a hazardous location. Do not use abrasives or high-pressure hoses or washers to clean the sensors. Do not disturb the pressure port on the bottom of the sensor.

Regular cleaning is not necessary because the sensor does not contact the flow unless a surcharge condition occurs. Examine the sensor after a surcharge to see if cleaning is necessary.

**Item to collect:** Retrieval pole with hook (optional)

1. Remove power to the sensor.
2. Put the hook on the retrieval pole to remove the sensor without manhole entry. Make sure the grounding strap is on the pole.


3. Hook the bail on the sensor and turn the pole counter-clockwise to unlock the sensor from the frame. Remove the sensor.
4. Remove any debris from the bottom of the sensor. Clean the external surface of the sensor with mild soap and rinse with water.
5. If the surcharge velocity sensor (SVS) is used, use 600 grit sand paper on the electrodes (small black dots). Use only light pressure or the electrodes will become damaged.
6. Lower the sensor on the frame. Make sure that the cable points toward the center of the manhole.
7. Turn the retrieval pole clockwise to engage the locking bars into the frame.
8. Apply power to the sensor.


### 5.3 Replace a cable

If corrosion is severe on a connector(s) or a cable has damage, replace the cable.

1. Disconnect power to the sensor at the logger or controller.
2. Put the hook on the retrieval pole to remove the sensor without manhole entry. Make sure that the grounding strap is on the pole.
3. Hook the bail on the sensor and turn the pole counter-clockwise to unlock the sensor from the frame. Remove the sensor.
4. Remove the two Phillips screws on the sensor handle to remove the cable clamp. Remove the cable.
5. Install the new cable. Make sure that the connector is aligned correctly and that no debris or water gets into the connector.
6. Install the cable clamp.
7. Lower the sensor on the frame. Make sure that the cable points toward the center of the manhole.
8. Turn the retrieval pole clockwise to engage the locking bars into the frame.
9. Apply power to the sensor through the logger or controller.

### 5.4 Replace the desiccant

<b>▲ CAUTION</b>	
	Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

<b>▲ CAUTION</b>	
	Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

<b>NOTICE</b>	
Do not operate the sensor without desiccant beads or with green desiccant beads. Permanent damage to the sensor can occur.	

Immediately replace the desiccant when it changes to green. Refer to [Figure 21](#).

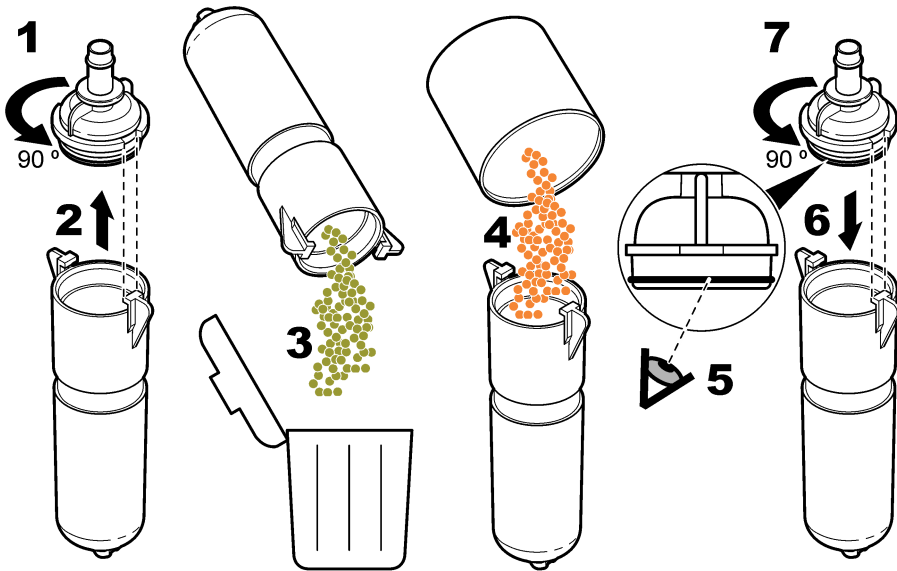
**Note:** *It is not necessary to remove the desiccant container from the desiccant hub to install new desiccant.*

At step 5 of [Figure 21](#), make sure that the O-ring is clean and has no dirt or debris. Examine the O-ring for cracking, pits or sign of damage. Replace the O-ring if it has damage. Apply grease to dry or new O-rings to make installation easier, to get a better seal and to increase the life of the O-ring.

For the best performance, make sure to install the desiccant container vertically with the end cap pointed down. Refer to [Attach the desiccant hub \(FL900\)](#) on page 25.

**Note:** When the beads just begin to turn green, it may be possible to rejuvenate them by heating. Remove the beads from the canister and heat them at 100-180 °C (212-350 °F) until they turn orange. Do not heat the canister. If the beads do not turn orange, they must be replaced with new desiccant.

**Figure 21 Replace the desiccant**



## 5.5 Replace the hydrophobic membrane

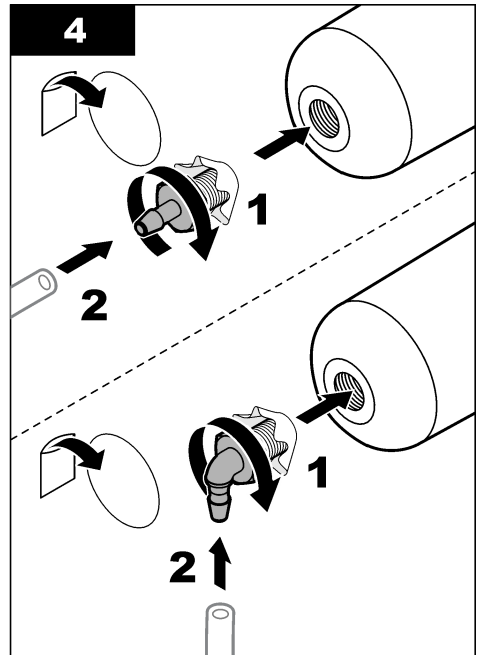
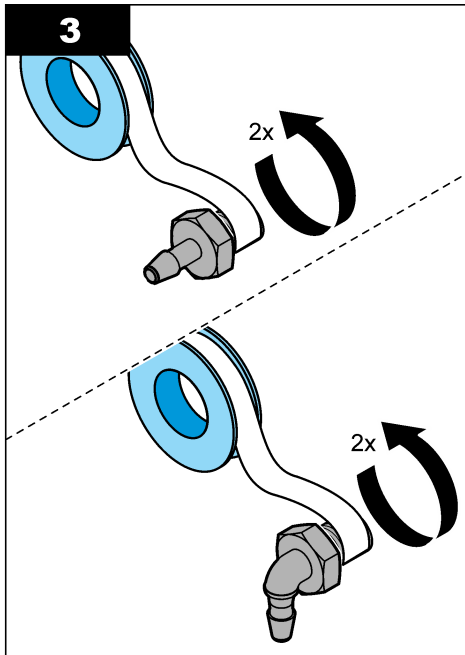
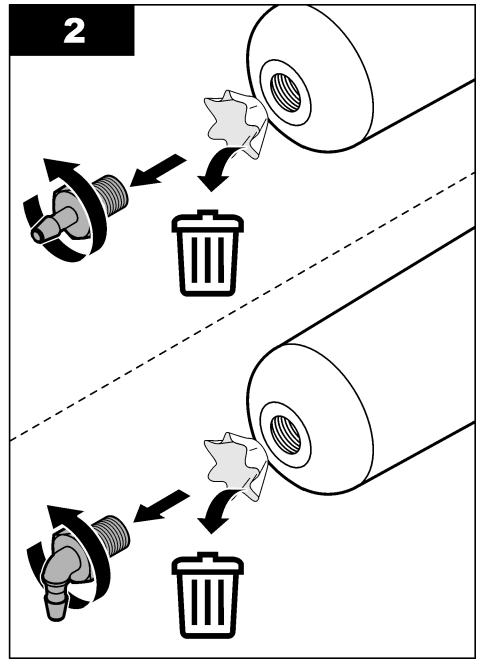
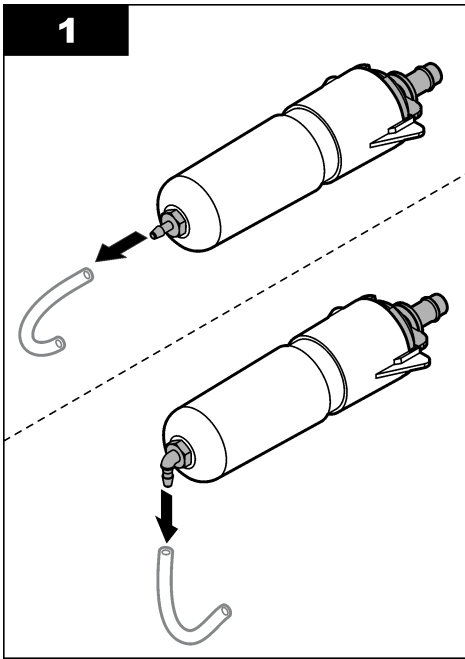
Replace the hydrophobic membrane when:

- Unexpected increases or decreases in level trends occur.
- Level data is missing or incorrect, but the velocity data is valid.
- The membrane is torn or has become saturated with water or grease.

Refer to the illustrated steps that follow to replace the membrane. At step 4, make sure that the following occurs:

- The smooth side of the hydrophobic membrane is against the inner surface of the desiccant container.
- The hydrophobic membrane bends up and goes fully into the thread until it is not seen.
- The hydrophobic membrane turns with the nipple when the nipple in the desiccant container turns. If the membrane does not turn, it has damage. Start the procedure again with a new membrane.

For the best performance, make sure to install the desiccant container vertically with the end cap pointed down. Refer to [Attach the desiccant hub \(FL900\)](#) on page 25.



## Section 6 Replacement parts and accessories

### ⚠ WARNING



Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

**Note:** Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

#### Replacement parts

**Note:** Contact customer service for additional cable length options.

Description	Item no.
Bail assembly	800014901
Cable assembly, 9.14 m (30 ft), connector on one end (includes a junction box, desiccant, and a potting kit)	FDJCTBOXCBL-030
Cable assembly, 9.14 m (30 ft), connector on both ends	FD9000CBL-030
Cable assembly, 18.29 m (60 ft), connector on one end (includes a junction box, desiccant, and a potting kit)	FDJCTBOXCBL-060
Cable assembly, 18.29 m (60 ft), connector on both ends	FD9000CBL-060
Cable assembly, 30.48 m (100 ft), connector on one end (includes a junction box, desiccant, and a potting kit)	FDJCTBOXCBL-100
Cable assembly, 30.48 m (100 ft), connector on both ends	FD9000CBL-100
Desiccant beads, bulk, 1.5 pound canister	8755500
Desiccant container	8542000
Hydrophobic membrane	3390
O-ring, desiccant container end cap, 1.176 ID x 0.070 OD	5252
SVS sensor, 9.14 m (30 ft) cable, replacement only	600006203
Wall mount assembly, standard frame (includes hardware)	800016701
Wall mount assembly, extended frame (includes hardware)	800016201
Wall mount hardware (refer to <a href="#">Figure 3</a> on page 9)	800015401

#### Accessories

Description	Item no.
Sensor retrieval pole, hook	510012701
Sensor retrieval pole, 2.4–7.3 m (8–24 ft)	245000501
Jack-bar (temporary mount assembly), standard frame, 86.36–132.10 cm (34–52 in.) manhole	800016401
Jack-bar (temporary mount assembly), standard frame, 132.10–177.80 cm (52–70 in.) manhole	800016402
Jack-bar (temporary mount assembly), standard frame, 177.80–223.52 cm (70–88 in.) manhole	800016403
Jack-bar (temporary mount assembly), extended frame, 86.36–132.10 cm (34–52 in.) manhole	800016301



**Accessories (continued)**

Description	Item no.
Jack-bar (temporary mount assembly), extended frame, 132.10–177.8 cm (52–70 in.) manhole	800016302
Jack-bar (temporary mount assembly), extended frame, 177.80–223.52 cm (70–88 in.) manhole	800016303
Jack-bar (temporary mount assembly), extended frame, 226.06–271.78 cm (89–107 in.) manhole	800016304







**McCrometer, Inc.**

3255 West Stetson Avenue

Hemet, CA 92545 USA

Tel: 951-652-6811

800-220-2279

Fax: 951-652-3078

[hachflowtechsupport@mccrometer.com](mailto:hachflowtechsupport@mccrometer.com)

[www.mccrometer.com](http://www.mccrometer.com)

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