

# TIENet<sup>®</sup> 360 LaserFlow<sup>®</sup> Velocity Sensor

## Installation and Operation Guide



Part #69-4363-043

Revision H, December 2024

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## Foreword - Water and Wastewater Products

This instruction manual is designed to help you gain a thorough understanding of the operation of the equipment. Teledyne ISCO recommends that you read this manual completely before placing the equipment in service.

Although Teledyne ISCO designs reliability into all equipment, there is always the possibility of a malfunction. This manual may help in diagnosing and repairing the malfunction.

If a problem persists, call or e-mail Teledyne ISCO technical support for assistance. Simple difficulties can often be diagnosed over the phone. For faster service, please have your serial number ready.

If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by technical support, including the use of the Return Merchandise Authorization (RMA) specified. Be sure to include a note describing the malfunction. This will aid in the prompt repair and return of the equipment. **No item may be returned for service without a Return Merchandise Authorization (RMA) number issued by Teledyne.**

Teledyne ISCO welcomes suggestions that would improve the information presented in this manual or enhance the operation of the equipment itself.

**Teledyne ISCO is continually improving its products and reserves the right to change product specifications, replacement parts, schematics, and instructions without notice.**

### Contact Information

#### *Customer Service*

Phone: (800) 228-4373 (USA, Canada, Mexico)  
(402) 464-0231 (Outside North America)

Fax: (402) 465-3022

Email: [isco.orders@teledyne.com](mailto:isco.orders@teledyne.com)

#### *Technical Support*

Phone: Toll Free (866) 298-6174 (Samplers and flowmeters)

Email: [iscowatersupport@Teledyne.com](mailto:iscowatersupport@Teledyne.com)

Return equipment to: 4700 Superior Street, Lincoln, NE 68504-1398

#### *Other Correspondence*

Mail to: P.O. Box 82531, Lincoln, NE 68501-2531

**Warranty and Operation Manuals can be found on our website:**

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



General Warnings

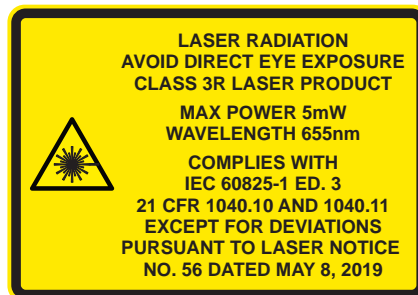
 **WARNING**

**Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.**

Wavelength: 655 nm

Maximum Power: 5 mW

Before installing, operating, or maintaining this equipment, it is imperative that all hazards and preventive measures are fully understood. While specific hazards may vary according to location and application, heed the following general warnings:



 **WARNING**

**Avoid hazardous practices! If you use this instrument in any way not specified in this manual, the protection provided by the instrument may be impaired.**

*Hazard Severity Levels*

This manual applies *Hazard Severity Levels* to the safety alerts, These three levels are described in the sample alerts below.

 **CAUTION**

Cautions identify a potential hazard, which if not avoided, may result in minor or moderate injury. This category can also warn you of unsafe practices, or conditions that may cause property damage.

 **WARNING**









Warnings identify a potentially hazardous condition, which if not avoided, could result in death or serious injury.

 **DANGER**

**DANGER – limited to the most extreme situations to identify an imminent hazard, which if not avoided, will result in death or serious injury.**

*Hazard Symbols*

The equipment and this manual use symbols used to warn of hazards. The symbols are explained below.

<b>Hazard Symbols</b>	
<b>Warnings and Cautions</b>	
	The exclamation point within the triangle is a warning sign alerting you of important instructions in the instrument's technical reference manual.
	The lightning flash and arrowhead within the triangle is a warning sign alerting you of "dangerous voltage" inside the product.
<b>Symboles de sécurité</b>	
	Ce symbole signale l'existence d'instructions importantes relatives au produit dans ce manuel.
	Ce symbole signale la présence d'un danger d'électocution.
<b>Warnungen und Vorsichtshinweise</b>	
	Das Ausrufezeichen in Dreieck ist ein Warnzeichen, das Sie darauf aufmerksam macht, daß wichtige Anleitungen zu diesem Handbuch gehören.
	Der gepfeilte Blitz im Dreieck ist ein Warnzeichen, das Sie vor "gefährlichen Spannungen" im Inneren des Produkts warnt.
<b>Advertencias y Precauciones</b>	
	Esta señal le advierte sobre la importancia de las instrucciones del manual que acompañan a este producto.
	Esta señal alerta sobre la presencia de alto voltaje en el interior del producto.





# TIENet® 360 LaserFlow® Velocity Sensor

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# TIENet® 360 LaserFlow® Velocity Sensor

## Section 1 Introduction

### 1.1 Description

The TIENet 360 LaserFlow sensor is an Area Velocity flow measurement device that remotely measures flow in open channels with non-contact Laser Doppler Velocity Sensing and non-contact Ultrasonic Level Sensing technologies. The sensor uses advanced technology to measure velocity with a laser beam at single or multiple points below the surface of the wastewater stream.

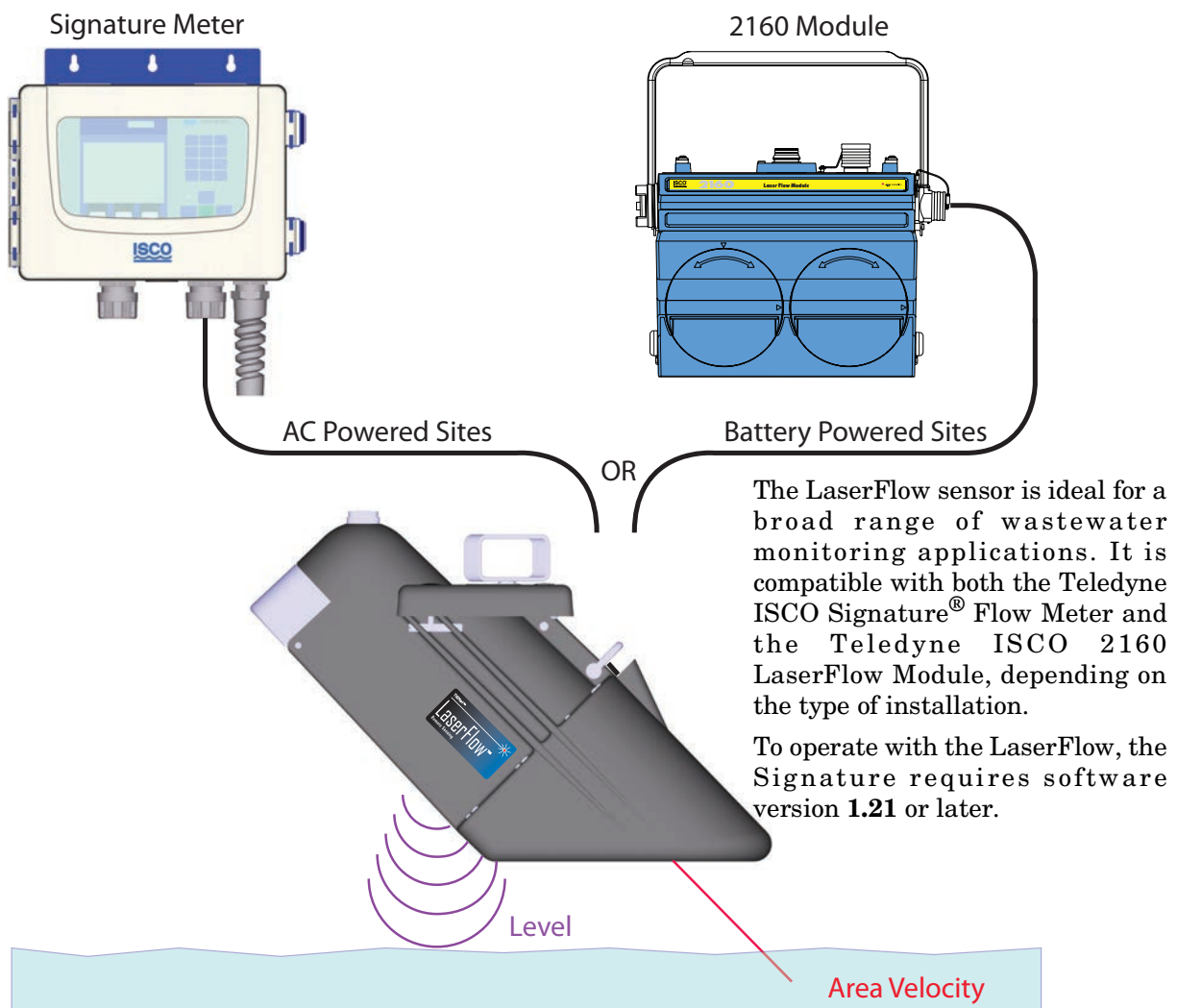


Figure 1-1 Basic LaserFlow system (showing both AC and battery-powered options)

## 1.2 Design

The LaserFlow sensor consists of a housing with two measurement technologies working together.

### 1.2.1 Measurement Technology

The **laser velocimeter** has a laser diode that serves as both transmitter and receiver of a laser light beam. The Doppler-shifted signal frequency is used to determine flow stream velocity.

The **ultrasonic level transducer** determines the stream's level by emitting an ultrasonic pulse and measuring the time it takes for the echo to return from the stream's surface. The transducer is both pulse transmitter and echo receiver.

### 1.2.2 Cabling

The LaserFlow sensor is available with a 10m or 23m standard length cable. Custom cable length is also available. For greater distances, external connection via conduit, and connection of additional TIENet devices, the TIENet Expansion Box is available.

Distance can be increased by installing the TIENet Expansion Box closer to the installed sensor and adding a custom-length TIENet cable between the box and the Signature® flow meter. The maximum recommended distance between the LaserFlow and the Signature® flow meter is 45.7 meters (150 feet). The maximum recommended distance between the LaserFlow and the 2160 LaserFlow module is 22.9 meters (75 feet).

## 1.3 Operation

The **laser velocimeter** uses a laser beam to generate a source frequency light, which is focused at points below the surface of the flow stream. The light is scattered back to the laser. The returned light is frequency shifted due to the Doppler effect and the motion of the flow. The lens that focused the laser light below the surface of the flow stream now focuses the returned light back into the laser. The source light and shifted light frequencies are mixed to determine a Doppler shift, which is then used to calculate flow stream velocity.

The LaserFlow is able to move the laser beam transverse to the flow in order to obtain readings at multiple points in the flow, with automatic compensation to maintain precise focus at all times.

The **ultrasonic level transducer** emits multiple ultrasonic pulses per second. Between pulses, the transducer switches from transmitter to receiver. When the transducer receives the echo from the water's surface, the sound energy is converted into an electrical signal. The signal is then amplified and processed by the flow meter into an "echo-received" signal. The time between the transmitted pulse and the echo-received signal is proportional to the distance between the transducer and the liquid surface, which is then translated into a level reading. Because the speed of the pulse through the air varies with temperature, compensation is built-in. A temperature sensor inside the LaserFlow measures ambient temperature. The microprocessor program automatically compensates for speed-of-sound changes caused by air-temperature changes.

The LaserFlow operates with no deadband from the measurement point for both level and velocity measurement.

#### 1.4 Optional Submerged Functionality

During submerged conditions, flow measurement continues without interruption with the optional TIENet 350 AV sensor, which combines continuous wave Doppler to measure area velocity with a differential pressure transducer to measure level.

The 350 AV sensor is factory-installed on the bottom of the LaserFlow sensor, and is also available as a kit for installation in an existing system. Refer to Section 5.7 for kit installation instructions.

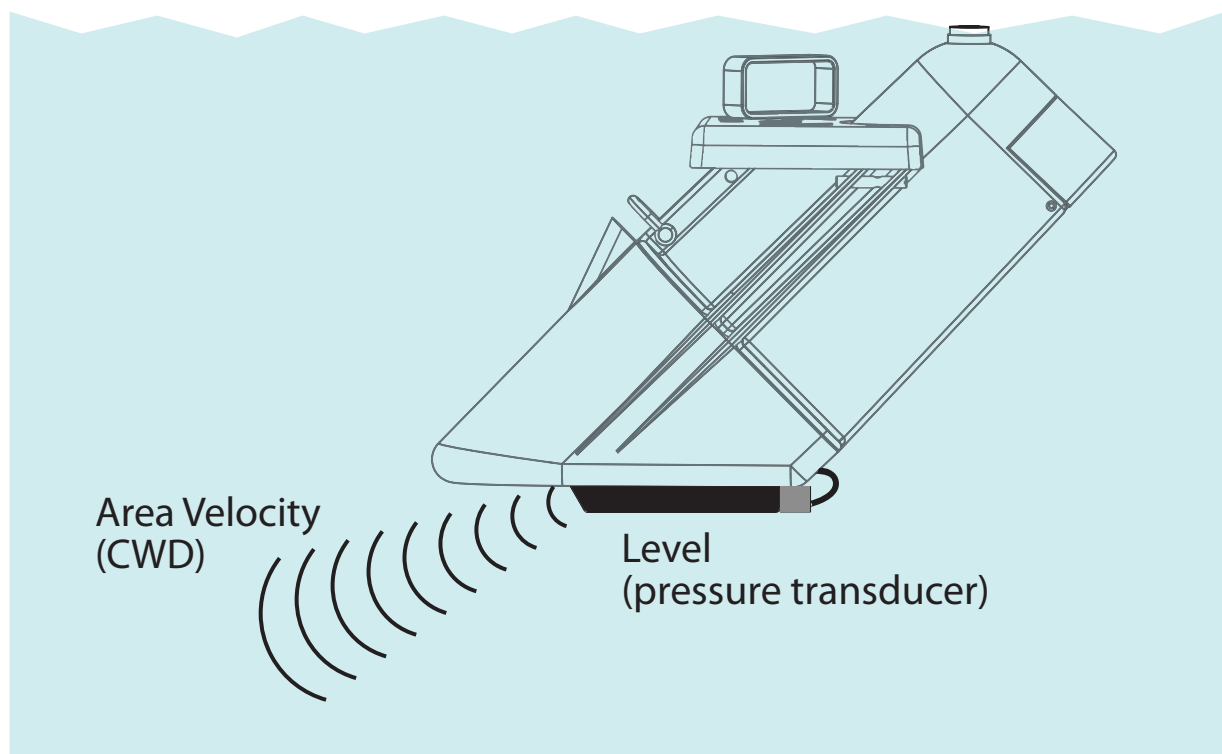


Figure 1-2 Optional submerged functionality

## 1.5 Technical Specifications

Table 1-1 provides technical specifications for the LaserFlow.

<b>Table 1-1 LaserFlow Sensor Specifications<sup>a</sup></b>		
Size (H x W x D)	38.01 x 26.21 x 56.7 cm	14.96 x 10.3 x 22.32 in
Cable Lengths <sup>b</sup>	10 or 23 m The maximum recommended distance between the LaserFlow and the Signature® flow meter is 45.7 meters (150 feet). The maximum recommended distance between the LaserFlow and the 2160 LaserFlow module is 23 meters (75.5 feet).	32.8 or 75.5 ft
Weight (LaserFlow w/ built-in sensor, 10 m cable)	8.7 kg	19.2 lbs
Sensor w/o built-in sensor, 10 m cable	8.25 kg	18.2 lbs
LaserFlow w/ built-in sensor, 350 AV Sensor	9 kg	20 lbs
Materials	Conductive Carbon Filled ABS Plastic, SST, Conductive Kynar <sup>®</sup> , Anodized Aluminum, UV Rated PVC	
Enclosure (self-certified)	IP68 (Submerged @ 2 m depth for 72 hrs)	
Certifications	CE EN61326; FDA CDRH 21CFR1040; IEC 60825-1	
Laser Class	Class 3R	
Laser Wavelength	655 nm	
Laser Exit Angle	45° ±3°	
Power (from connected flow meter/module)	Input voltage range: 8 to 26VDC; 12VDC Nominal	
Electrical Connections	Signature Flow Meter 2160 LaserFlow Module	Screw Terminal TIENet Plug
Temperature Range	Operating: -20 to 60 °C Storage: -40 to 60 °C	-4 to 140 °F -40 to 140 °F
Flow Accuracy	±4% of Reading (Typical under normal flow conditions)	
<b>Velocity Measurement</b>		
Technology	Non-Contact, Subsurface Laser Doppler Velocity (U.S. patent 8,339,584 and patents pending)	
Measurement Range	-4.6 to + 4.6 m/sec	-15 to +15 ft/sec
Number of velocity readings per measurement	1 to 15 (selectable measurement points)	
Maximum distance: liquid surface to bottom of sensor	3m (10 ft)	
Minimum depth for velocity measurement	0.01m (0.5 in)	
Direction	Selectable Bi-Directional Measurement <sup>d</sup>	
Minimum Velocity	0.15 m/s	0.5 ft/s
Deadband	Zero deadband from bottom of LaserFlow sensor <sup>d</sup>	
Accuracy	±0.5% of reading ±0.03 m/s (0.1 ft/s)	



**Table 1-1 LaserFlow Sensor Specifications<sup>a</sup>**

<b>Level Measurement</b>	
Technology	Non-Contact Ultrasonic Signal
Measurement Range	0 to 3 m (0 to 10 ft) from measurement point
Accuracy @ 22 °C	±0.006m (0.02 ft) at < 1ft level change; ±0.012m (0.04 ft) at > 1ft level change
Ultrasonic Temperature Coefficient	± 0.0002 x D (m) per °C (± 0.00011 x D (ft) per °F) (Where D is the distance from transducer to liquid surface)
Ultrasonic Beam Angle	10° (5° from center line)
Ultrasonic Signal	50KHz
Deadband	Zero deadband from bottom of LaserFlow sensor <sup>e</sup>

- a. All specifications are subject to change without notice.
- b. Custom cable lengths also available.
- c. Kynar® is a registered trademark of Arkema, Inc.
- d. Turbidity > 20 NTU. Distance < 48 inches.
- e. Deadband for 310 remote ultrasonic sensor varies due to the type of mounting hardware.

## 1.6 Accessories

Accessories used in sensor installation are briefly described below. Refer to the next section for ordering information.

### 1.6.1 Ordering Information

Options and accessories can be purchased by contacting Teledyne ISCO's Customer Service Department.

**Teledyne ISCO**  
 Customer Service Dept.  
 P.O. Box 82531  
 Lincoln, NE 68501 USA

Phone: 800 228-4373  
 402 464-0231  
 FAX: 402 465-3022

E-mail: [isco.orders@Teledyne.com](mailto:isco.orders@Teledyne.com)

TIENet Expansion Box .....	60-4307-023
Cord grip fitting, 3/4" NPT, for TIENet cable .....	209-0073-12
Integrated 350 AV Kit for surcharge functionality .....	60-4354-117
Signature Flow Meter Exterior desiccator <i>(required for use with 330 and 350 TIENet devices)</i> .....	60-4304-092
Silica gel desiccant, 1.5-lb container .....	60-2004-233

**Note**

Guidelines for Area Velocity reference line support and networking with the expansion box can be downloaded in the Teledyne ISCO application note [Signature Flow Meter Expansion Box](#), available at [www.teledyneisco.com](http://www.teledyneisco.com). Contact the factory for more information.

Permanent Wall Mounting Hardware Kit .....	60-4364-003
Refer to Section 2.6.1 <i>Wall Mount Installation</i> for additional information.	

Temp Mount Kit, 48-55" Variable Range .....	62-4360-032
Temp Mount Kit, 54-66" Variable Range .....	62-4360-034
Temp Mount Kit, 63-84" Variable Range .....	62-4360-035
Temp Mount Kit, 83-114" Variable Range .....	62-4360-036
Refer to Section 2.7.1 <i>Temporary Mounting Installation</i> for additional information.	

Horizontal Sensor Mount Bracket .....	60-4368-020
Sensor retrieval arm for sensor retrieval, replacement, and locking <i>(Maximum extension of 23 feet)</i> .....	60-4364-033
ProHanger SST Bracket for suspending equipment in manhole <i>(Up to 24 inches)</i> .....	69-2003-599

**Note**

Teledyne ISCO uses FreeRTOS version 5.4.2 in its TIENet devices. In accordance with the FreeRTOS license, FreeRTOS source code is available on request. For more information, visit [www.FreeRTOS.org](http://www.FreeRTOS.org).

## 1.7 Unpacking Instructions

When the system arrives, inspect the outside packing for any damage. Then carefully inspect the contents for damage. If there is damage, contact the delivery company and Teledyne ISCO (or its agent) immediately.

### **WARNING**

**If there is any evidence that any items may have been damaged in shipping, do not attempt to install the unit. Please contact Teledyne ISCO (or its agent) for assistance.**

When you unpack the system, check the items against the packing list. If any parts are missing, contact the delivery company and Teledyne ISCO's Customer Service Department. When you report missing part(s), please indicate them by part number. In addition to the main packing list, there may be other packing lists for various sub-components.

It is recommended that you retain the shipping cartons as they can be used to ship the unit in the event that it is necessary to transport the system. Please complete the registration card and return it to Teledyne ISCO.

### 1.7.1 Protective Window Cap

Leave the protective window cap in place until the sensor is ready to be installed.

Before installation, remove the cap. The sensor will not be able to measure velocity with the cap in place. Retain the cap for use during cleaning, storage, or shipment, to protect the laser window from damage.

### **CAUTION**

Be sure the protective window cap is installed during cleaning, storage, or shipment.



Figure 1-3 Remove protective window cap before installation



# TIENet® 360 LaserFlow® Velocity Sensor

## Section 2 Preparation and Installation

### 2.1 Safety

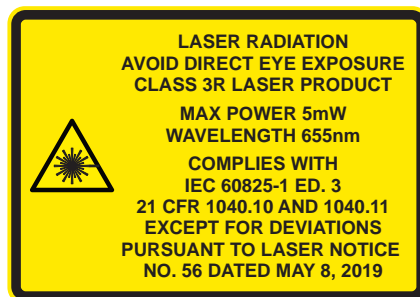
Before installing, operating, or maintaining this equipment, it is imperative that all hazards and preventive measures are fully understood.

#### 2.1.1 Site Conditions

Components are often installed in confined spaces. Some examples of confined spaces include manholes, pipelines, digesters, and storage tanks. These spaces may become hazardous environments that can prove fatal for those unprepared. These spaces are governed by OSHA 1910.146 and require a permit before entering.

#### **WARNING**

**The installation and use of this product may subject you to hazardous working conditions that can cause you serious or fatal injuries. Take any necessary precautions before entering a worksite. Install and operate this product in accordance with all applicable safety and health regulations, and local ordinances.**



## 2.2 Sensor Installation Considerations

Measurement accuracy can be affected by a number of site factors that should be taken into consideration when selecting the location for the sensor.

These factors may affect the laser velocity or the ultrasonic level, or both.

If the laser velocimeter or ultrasonic transducer cannot obtain a valid reading at any measurement point, an asterisk (\*) will appear next to the displayed reading, indicating there is an error.

### 2.2.1 Ultrasonic Beam Angle

The ultrasonic level transducer has a 10° beam angle (5° from center line), forming a cone in which the apex is the transducer. The transducer can only detect surfaces within this cone.

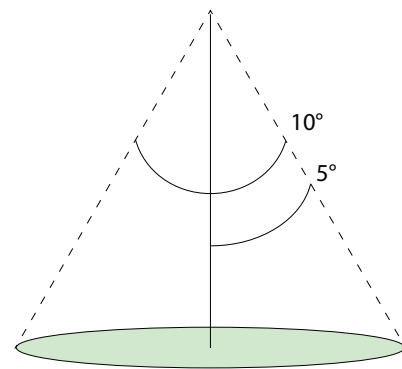


Figure 2-1 Ultrasonic level sensor beam angle

The ultrasonic beam narrows as elevation decreases, which can increase difficulty in detecting the return echo. Narrow channels can result in false echoes and incorrect level readings from the walls and sides of the channel.

The beam widens as elevation increases. If the beam is too wide, the sensor may pick up signals from unwanted surfaces, such as the walls of the channel.

### 2.2.2 High Water Levels

In most open channel installations where the level may exceed one-half of the full pipe, mount the sensor as near as possible to the midpoint between the entrance and exit to measure over the least turbulent flow.

### 2.2.3 Submersion and Fouling

Fouling by grease or solids can cause the LaserFlow sensor to malfunction. The LaserFlow is sealed, so unless it is exposed to corrosive substances, submersion of 2 meters, up to 72 hours will not harm it. Upon retrieval, ensure that the surfaces of the laser window and ultrasonic sensor are clean.

Cleaning instructions are provided in Section 5.

### 2.2.4 Humidity

Conditions of extremely high or low humidity can cause ultrasonic level detection to occur either earlier or later than normal conditions. A drop in water level, normally compensated for by the sensor's interval-based amplifier, may produce errors in echo detection.

**2.2.5 Surface** Solids, foam, oil, and turbulence can all absorb or weaken the ultrasonic and laser signals, causing errors in detection. Foam or oil on the surface of the stream can also produce false level readings.

**2.2.6 Temperature** Changes in ambient temperature significantly affect the velocity of sound. If ambient temperature changes rapidly, there may be a delay before the temperature sensor of the ultrasonic transducer can activate temperature compensation.

 **Note**

If the sensor will be installed outdoors in direct sunlight, use a sunshade to prevent heating of the sensor housing.

**2.2.7 Waves** Waves on the surface of the flow stream can deflect the ultrasonic signal, causing erroneous readings or total loss of signal. The flow meter software rejects occasional readings that deviate substantially from normal.

**2.2.8 Wind** Strong winds can significantly reduce the strength of the ultrasonic return echo. Narrow beams can result in the sound being blown away; likewise, greater distances to the flow stream surface are more subject to distortion in strong winds.

**2.3 Installation Checklist** Prior to installing the system, ensure that you have all supplies and site information readily available.  
To assist you in this preparation, this manual includes the *Installation Checklist*, page B-1. Teledyne ISCO recommends that you print this appendix and fill in the relevant information.

**2.4 Connecting the Cable** The LaserFlow cable will have one of two different connector types: Unterminated for the Signature® Flow Meter (Section 2.4.1), and TIENet plug for the 2160 LaserFlow Module (Section 2.4.3).

Distance can be increased by installing the TIENet Expansion Box closer to the installed sensor and adding a custom-length TIENet cable between the box and the Signature® flow meter. The maximum recommended distance between the LaserFlow and the Signature® flow meter is 45.7 meters (150 feet). The maximum recommended distance between the LaserFlow and the 2160 LaserFlow module is 23 meters (75.5 feet).

**2.4.1 Cable Connection: Signature Flow Meter** External TIENet devices such as the LaserFlow sensor are connected to the Signature flow meter in the same manner, usually using conduit or cord-grip cable fittings. Multiple external TIENet devices can be connected simultaneously.

Refer to the Signature flow meter manual for instructions on accessing the instrument's interior components.

**⚠ WARNING**

Before proceeding, ensure that the flow meter has been disconnected from mains power.

**✓ Note**

The following steps include instructions for installing cord-grip fittings. Some applications may use user-supplied  $\frac{3}{4}$ " ID conduit for cable routing.

1. Remove one of the 6-position plug-in terminal strip connectors from the case board.

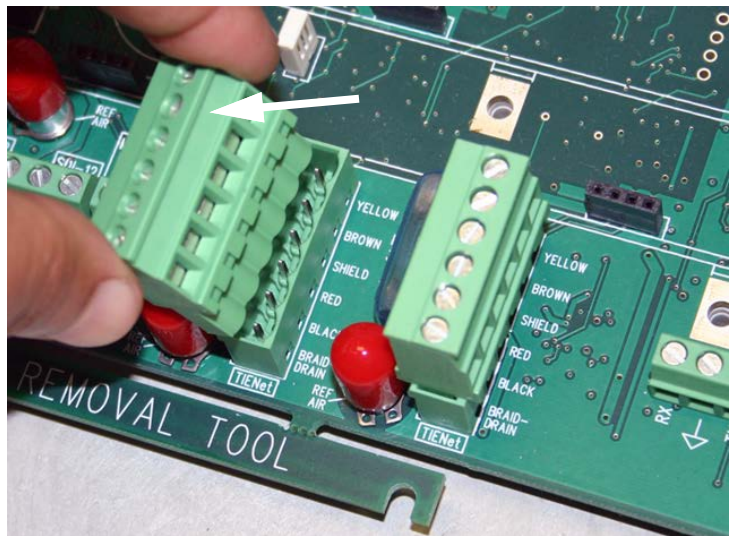


Figure 2-2 TIENet device terminal strips

2. If using a cord-grip fitting, install the cable nut in the appropriate opening on the bottom of the Signature enclosure, securing it to the wall with the lock nut (concave side facing wall).

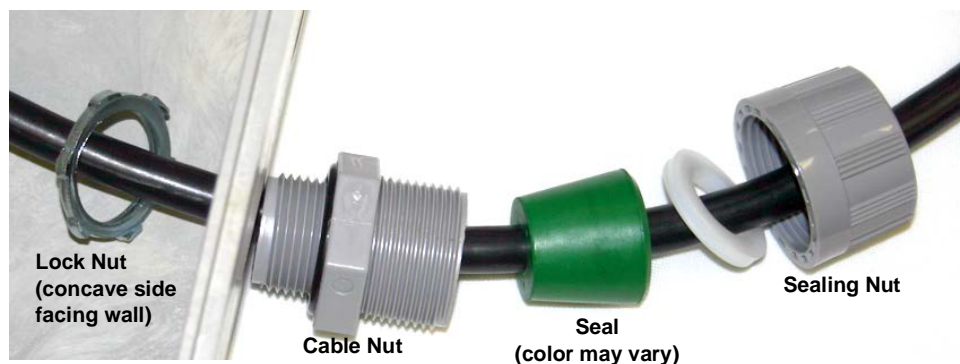


Figure 2-3 Installing cable with a cord-grip fitting



3. Feed the TIENet device cable end through the sealing nut and seal and through the cable nut. Lightly tighten the sealing nut, just enough to hold the cable in place while installing the connector.
4. Attach the wire ends to the terminal strip as shown in Figure 2-4), then press the terminal strip back down into its socket on the case board, as shown in Figure 2-5, ensuring no wire connections are strained. Gently tug each wire when finished, to verify secure connection to the screw terminals.

**Note**

The SHIELD wire is the bare drain emerging from the foil shield around the YELLOW and BROWN wires. The BRAID-DRAIN wire is the bare drain emerging from the surrounding braided shield inside the cable jacket. It is not necessary to prevent the two braids from coming into contact with each other.

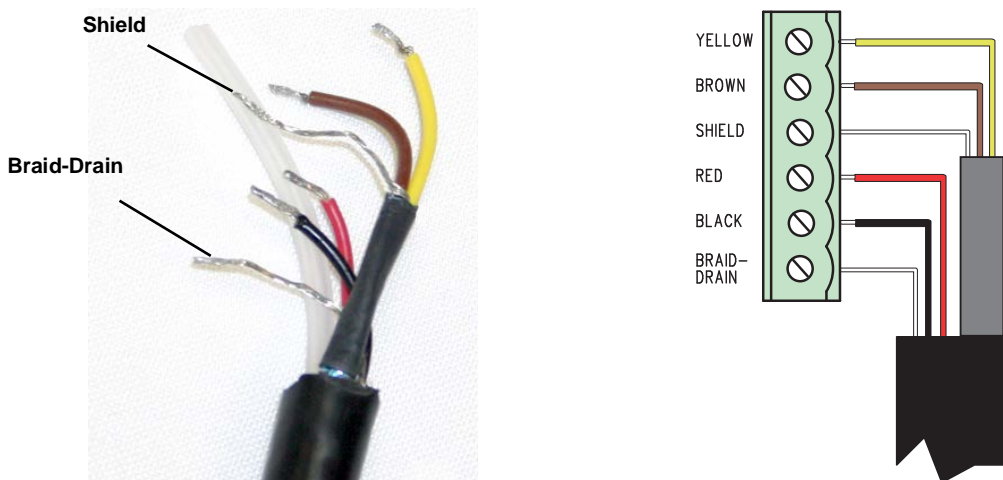


Figure 2-4 TIENet device terminal connections

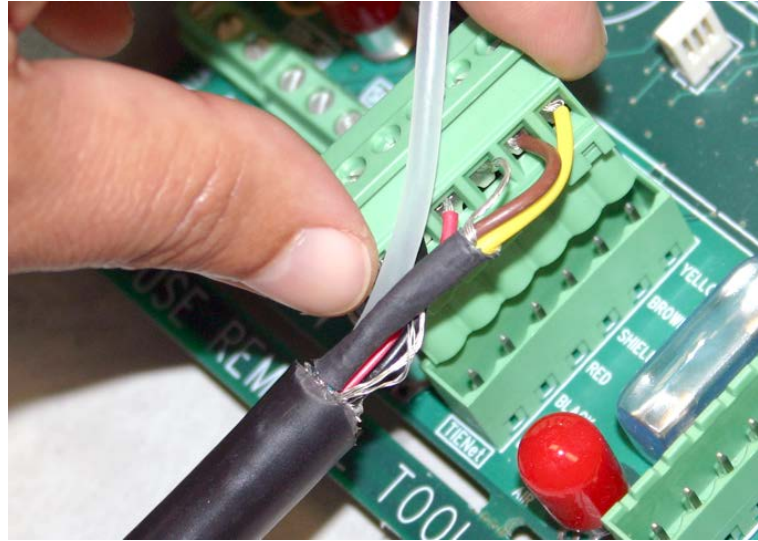


Figure 2-5 Attach wired terminal strip to case board socket

5. Insert the reference tubing into the REF AIR port on the case board, pushing it down inside the silicon tubing. **Take precaution not to bend or kink the reference tubing.**

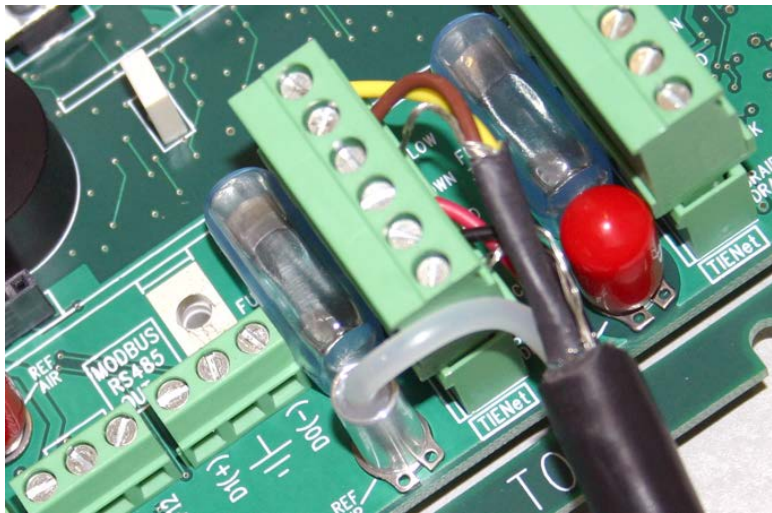


Figure 2-6 Insert the cable reference tubing into the case board reference port

6. Gently tug the cable downward to remove any slack within the enclosure, taking care not to put any stress on the connections.

7. Tighten the cord grip sealing nut (Figure 2-7).



*Figure 2-7 Position and secure the cable*

 **CAUTION**

If using conduit instead of the cord-grip fitting, the conduit must be sealed to prevent harmful gases and moisture from entering the Signature enclosure. Failure to seal the conduit may reduce equipment life.

8. Close the front panel and fasten with the two Phillips screws.

**2.4.2 Remote Ultrasonic  
Cable Connection:  
310 Ultrasonic Sensor**

1. Prepare the LaserFlow connector receptacle by removing the cap (press down on the spring clip and pull out the cap).



*Figure 2-8 Preparing the LaserFlow connector receptacle*

2. Remove the stainless steel cap from the 310 ultrasonic plug and push the protective caps from the LaserFlow module and ultrasonic together.
3. Aligning the pins on the 310 ultrasonic plug with those in the connector receptacle, push the ultrasonic plug into the receptacle until the spring release "clicks."



*Figure 2-9 Secure caps and connect 310 ultrasonic plug to  
LaserFlow*

To be certain that the connectors are locked, lightly pull on the cable connector; the cable should be held in place by the spring release clip.

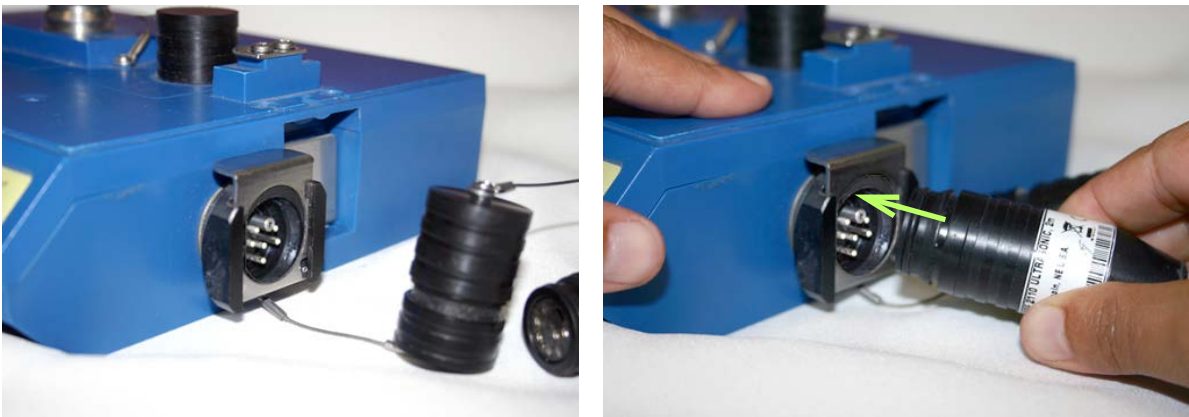
**2.4.3 Cable Connection:  
2160 LaserFlow  
Module**

1. Prepare the 2160 receptacle by removing the cap (press down on the spring clip and pull out the cap).



*Figure 2-10 Preparing the 2160 connector receptacle*

2. Remove the cap from the LaserFlow TIENet plug and push the protective caps on the module and sensor together.
3. Aligning the pins on the LaserFlow cable with those in the connector receptacle, push the sensor connector into the receptacle until the spring release "clicks."



*Figure 2-11 Secure caps and connect LaserFlow to 2160*

4. To be certain that the connectors are locked, lightly pull on the cable connector; the cable should be held in place by the spring release clip.

## **2.5 Sensor Installation Tools and Requirements**

The Signature flow meter or 2160 LaserFlow Module does not have to be mounted near the flow stream. The flow meter can be installed at a convenient, protected location and the sensor cable can be routed through user-provided conduit back to the flow meter.

Proper installation of the LaserFlow is critical for accurate measurement.

### **2.5.1 Tools Required**

See Appendix B.2 Equipment and Recommended Tools.

### **2.5.2 Sensor and Mounting Equipment Dimensions**

Complete mounting assembly dimensions are provided in Figures 2-12 through 2-15.

Refer to the appropriate drawing(s) when planning the installation and adjusting the mounting hardware.

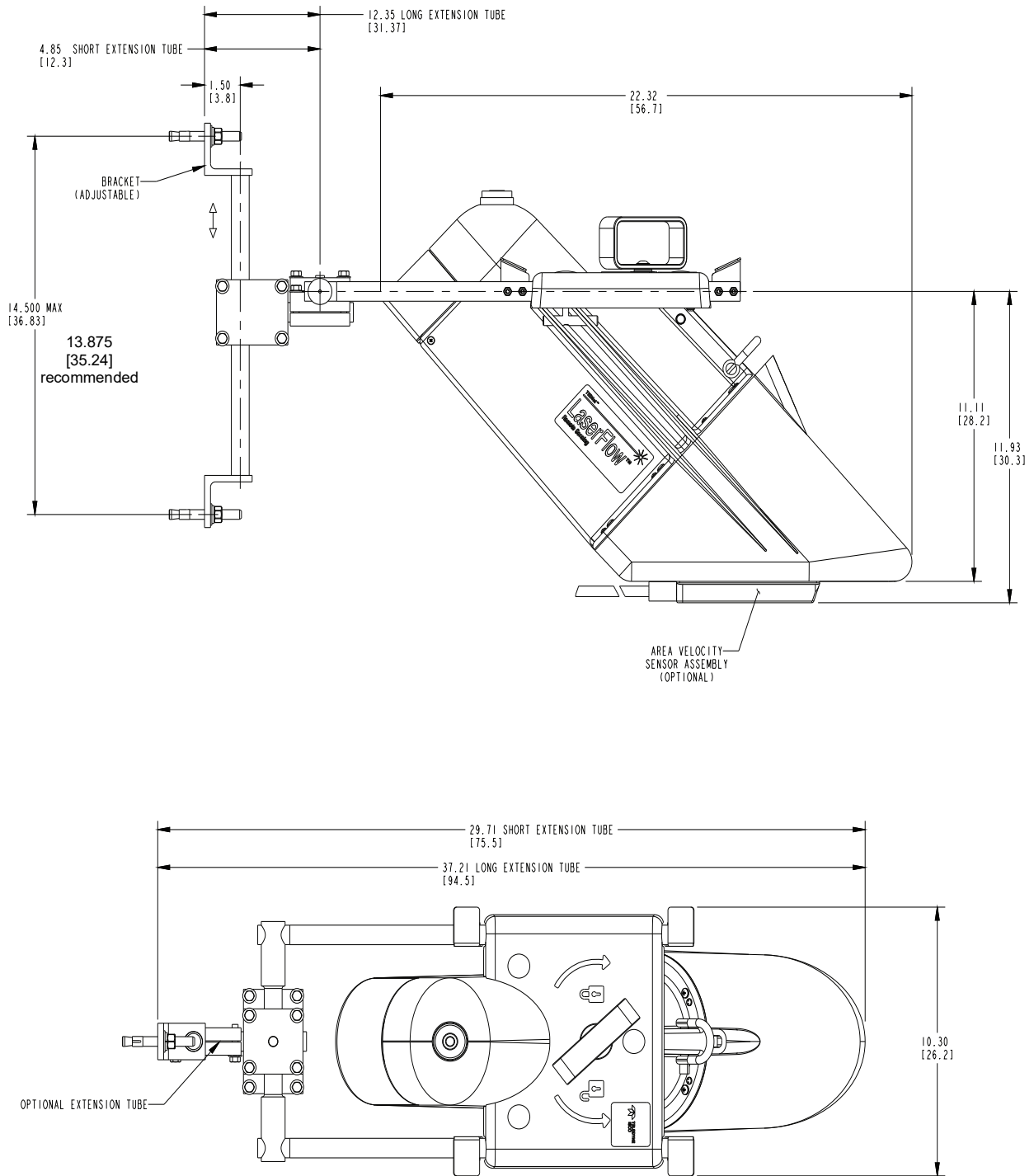
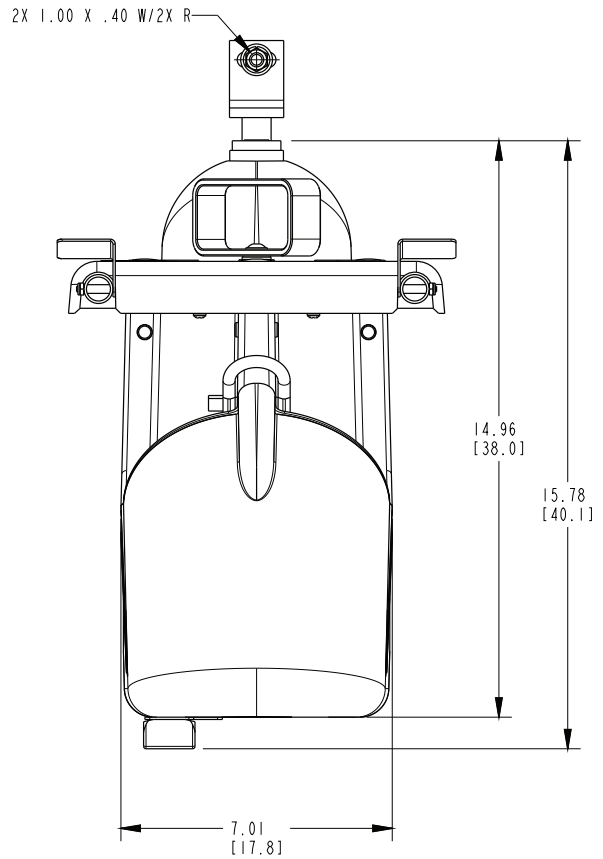


Figure 2-12 Overall dimensions including wall mounting hardware (part 1)

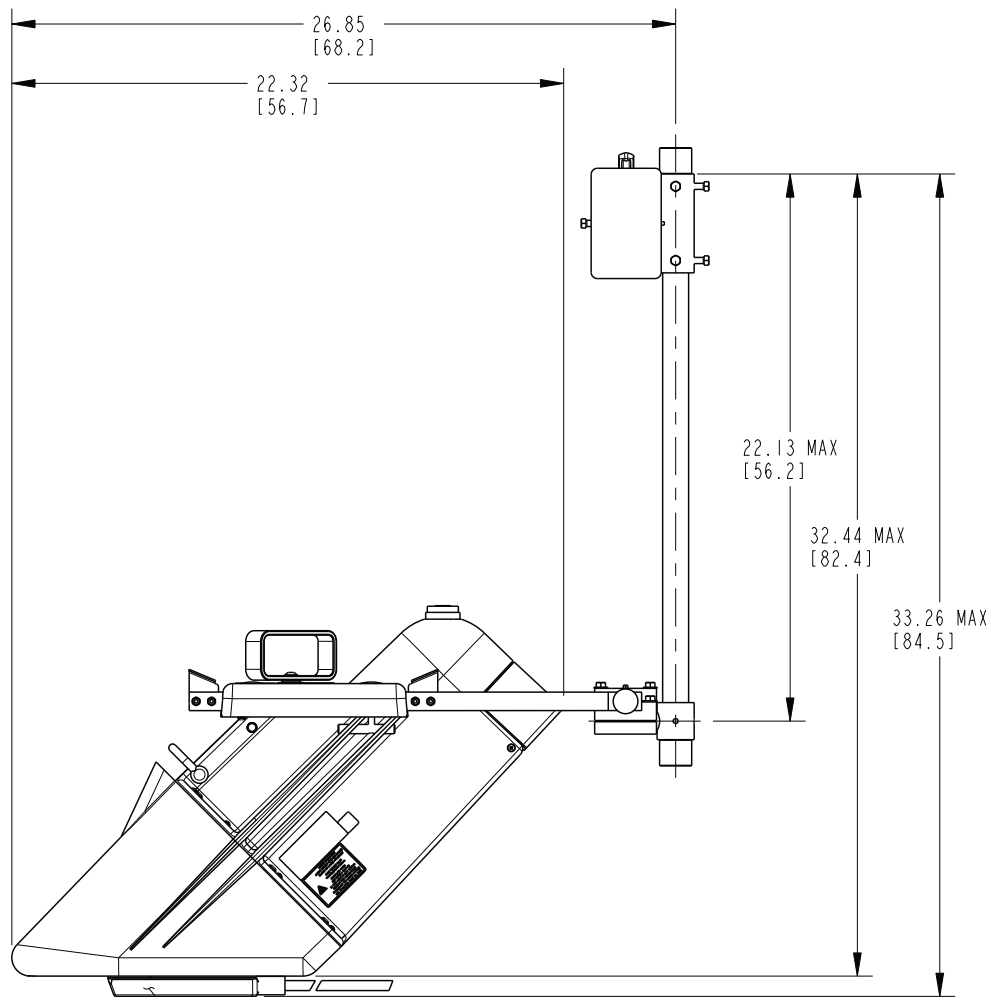
*TIENet® 360 LaserFlow® Velocity Sensor  
Section 2 Preparation and Installation*

<b>LaserFlow SENSOR SPECIFICATIONS</b>	
<b>WEIGHT</b>	
MOUNT	11.5 LBS [5.2 KG]
LaserFlow SENSOR 10M	19.2 LBS [8.7 KG]
LaserFlow SNSR + AREA VELOCITY	20 LBS [9 KG]
<b>ENCLOSURE MATERIAL</b>	
HOUSING LaserFlow	CONDUCTIVE CARBON FILLED ABS
HOUSING ULTRASONIC	ANNODIZED ALUMINUM 6061
ULTRASONIC SENSOR	Kynar 340 RESIN PVDF GRADE
MOUNTING HARDWARE	STAINLESS STEEL
ALL OTHER EXTERIOR METAL PARTS	STAINLESS STEEL
<b>ELECTRICAL</b>	
POWER SUPPLY	TIENet BUS POWERED 8-26 VDC
<b>ELECTRICAL CONNECTIONS</b>	
TIENet DEVICE	SREW TERMINAL CONNECTION OR TIENet PLUG
LASER CLASS	CLASS 3R



*Figure 2-13 Overall dimensions including wall mounting hardware (part 2)*





AREA VELOCITY  
 SENSOR ASSEMBLY  
 (OPTIONAL)

NOTES:  
 1. SECONDARY DIMENSIONS IN BRACKETS ARE IN CENTIMETERS (CM),  
 UNLESS OTHERWISE SPECIFIED.

LaserFlow SENSOR SPECIFICATIONS	
<b>WEIGHT</b>	
CARGO BAR 48"-55" [122-140]	6.0 LBS [2.7 KG]
CARGO BAR 54"-66" [137-168]	6.5 LBS [2.9 KG]
CARGO BAR 63"-84" [160-213]	7.4 LBS [3.4 KG]
CARGO BAR 83"-114" [211-290] (SHOWN)	9.0 LBS [4.1 KG]
MOUNT	11.7 LBS [5.3 KG]
LaserFlow SENSOR 10M	19.2 LBS [8.7 KG]
LaserFlow SNSR + AREA VELOCITY	20 LBS [9 KG]
<b>FORCES</b>	
TOTAL FORCE	350 LBS [158.8 KG]
MAX LOAD	45 LBS [20.4 KG]
<b>ENCLOSURE MATERIAL</b>	
CARGO BAR	ALUMINUM
HANDLE & HYDRAULIC HOUSING	NYLON
FOOT	RUBBER
HOUSING LaserFlow	CONDUCTIVE CARBON FILLED ABS
HOUSING ULTRASONIC	ANNOXIDIZED ALUMINUM 6061
ULTRASONIC SENSOR	Kynar 340 RESIN PVDF GRADE
MOUNTING HARDWARE	STAINLESS STEEL
ALL OTHER EXTERIOR METAL PARTS	STAINLESS STEEL

Figure 2-14 Overall dimensions including temporary  
 mounting hardware (part 1)

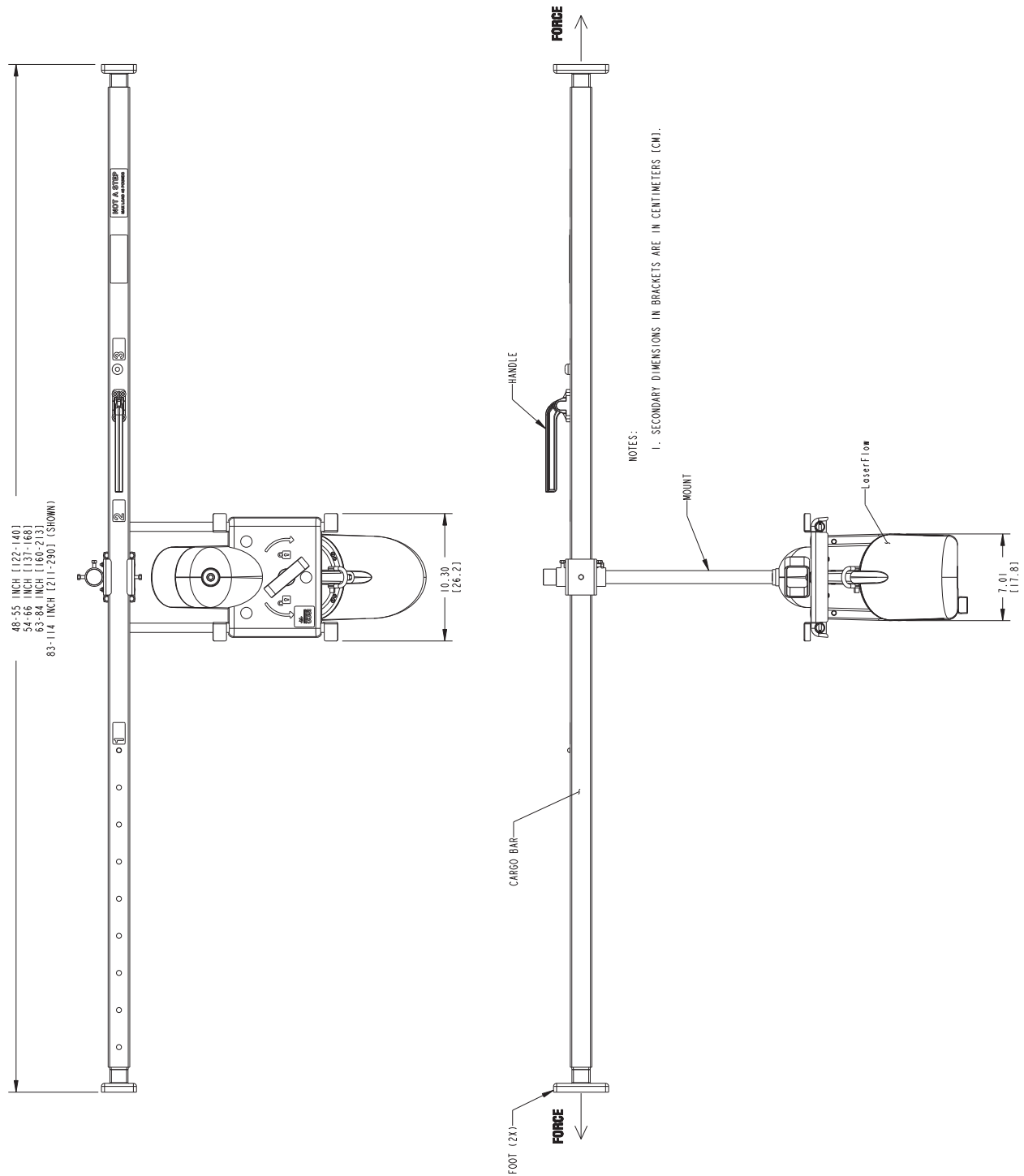


Figure 2-15 Overall dimensions including temporary mounting hardware (part 2)

### 2.5.3 Sensor Positioning and Requirements

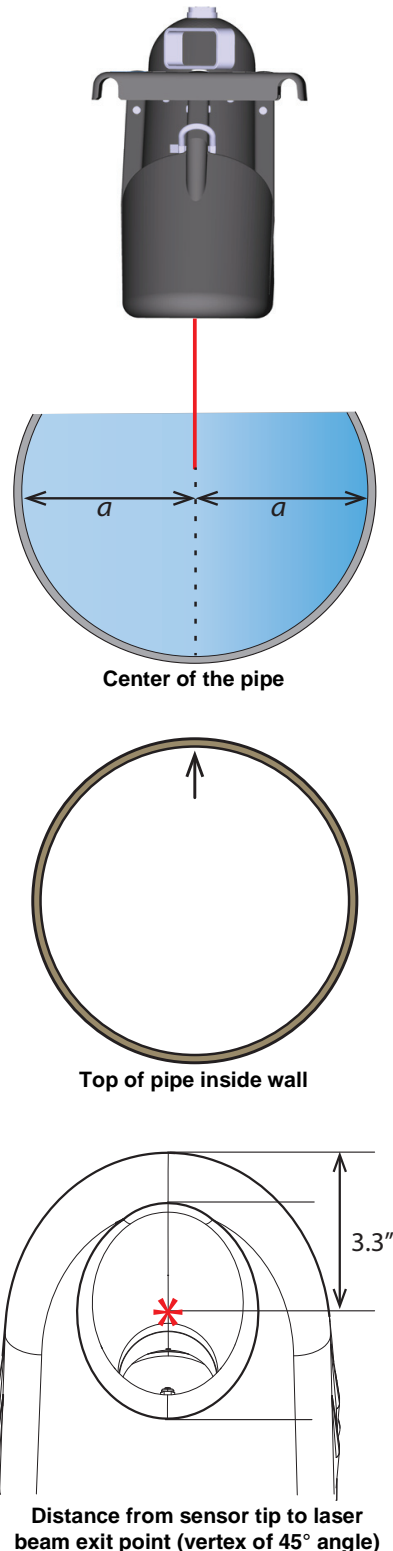


Figure 2-16, at left, shows constants that serve as reference points when planning the positioning of the sensor.

Figure 2-17, shows a typical LaserFlow manhole installation.

**CAUTION**

For proper function, the requirements listed here must be followed exactly.

**Requirements:**

- **Permanent Installation:** Install the wall bracket perpendicular to the x-axis.  
**Temporary Installation:** Install the cargo bar perpendicular to the y-axis.
- Always center the LaserFlow (and middle laser beam) relative to the pipe walls, and always use the attached circular bubble level for vertical alignment.
- Mount the LaserFlow sensor with the bottom parallel with the water surface.
- Align the bottom of the LaserFlow with the top of the inside wall of the inlet pipe, and as close as possible to the pipe mouth without obstructing the laser. To accomplish this, refer to Figure 2-16 at left, Figure 2-17 on the next page, and the following important figures:
  - The point at which the laser exits the sensor mouth is **3.3" (8.4 cm)** from the front tip of the sensor, or the center of the opening.
  - The distance from the bottom of the Laserflow sensor to the center of the coupling tube is **10.375" (26.35 cm)**.
  - The laser beam exits the sensor mouth at a **45° angle**.  
 (If the sensor bottom is parallel with the water surface, the laser beam will also strike the water surface at a 45° angle.)

Figure 2-16 Sensor installation constants

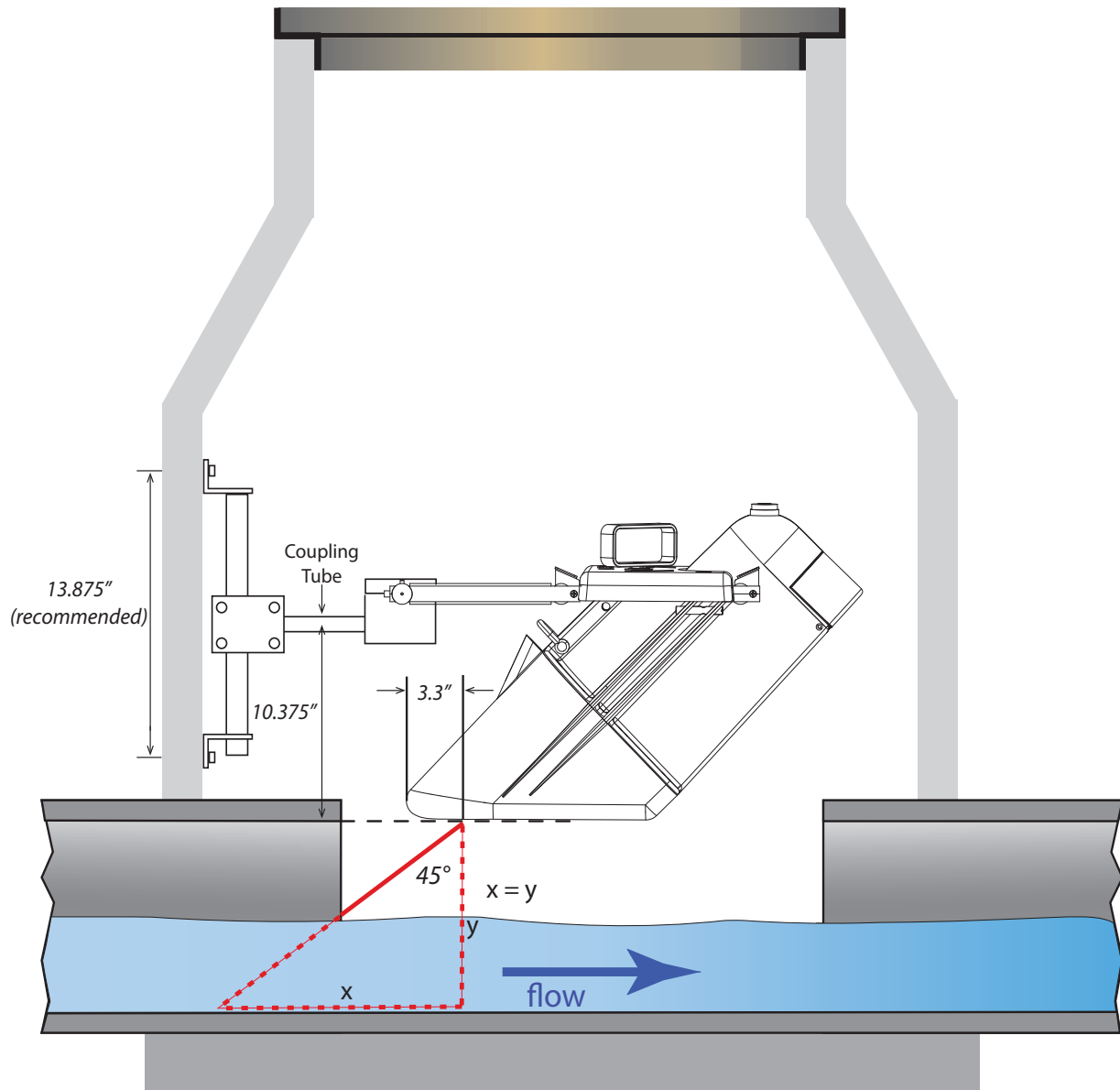


Figure 2-17 Typical manhole installation

## 2.6 Wall Mounting Kit

For wall mounting, identify the components listed in Figure 2-18 and Table 2-1, and perform the steps that follow. Order numbers for parts and fasteners are provided in Appendix A.

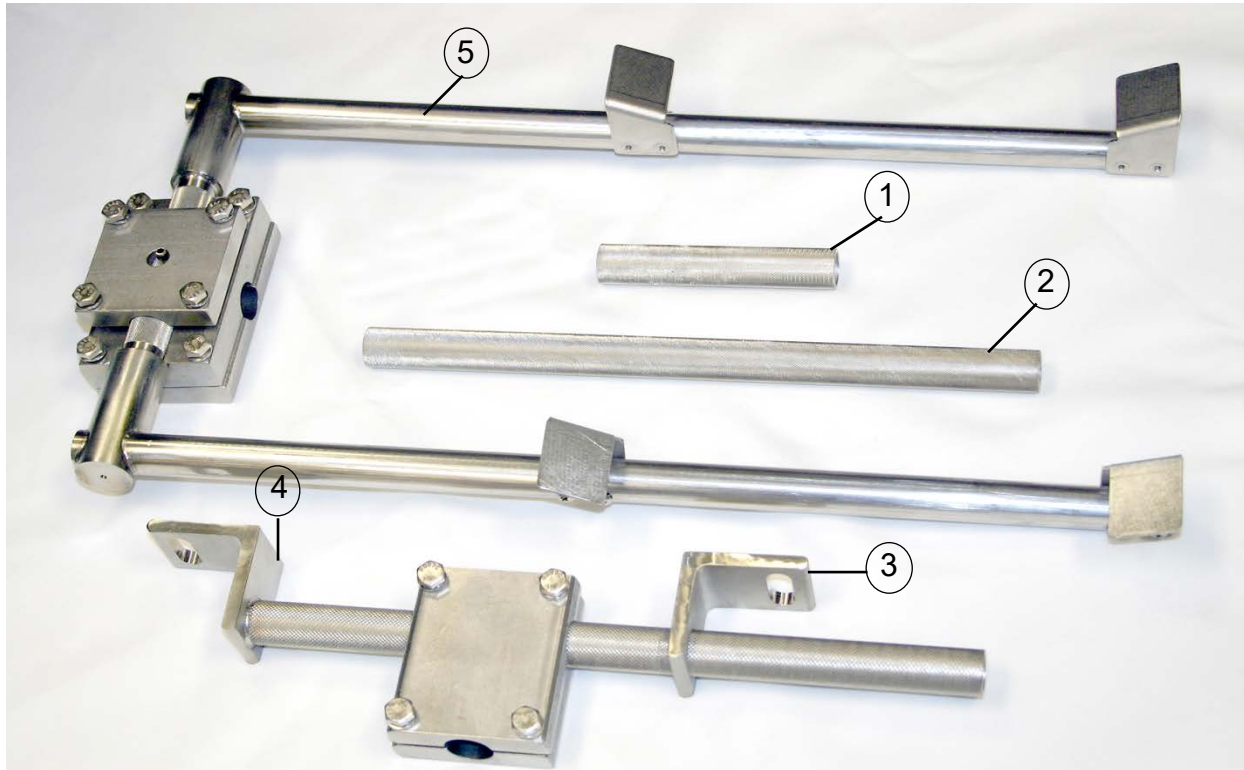


Figure 2-18 Wall mounting kit (Numbers correspond with Table 2-1)

Table 2-1 Wall Mounting Kit	
Item (Callout #)	Description
1	Tube Coupler (short)
2	Tube Coupler (long)
3	Bottom Wall Mount Angle Bracket (adjustable)
4	Mounting Shaft
5	Sensor Carrier
	SST Anchor Stud Assembly & Spring Lock Washers (for fastening brackets to wall)

### 2.6.1 Wall Mount Installation

Refer to the dimensions and requirements in Figure 2-17 while performing the following steps.

**✓ Note**

Stud anchors for concrete are provided in the mounting kit. It is recommended to drill a hole 2" (5.08 cm) deep, leaving 1" (2.54 cm) of the stud exposed.

1. Bolt or anchor the bottom angle bracket to the wall.
2. Slide the mounting shaft into the bottom angle bracket and bolt or anchor the mounting shaft to the wall.
3. Insert either the long or short tube coupler into the hole formed by the vertical clamp. Adjust the clamps to the desired height and cross-tighten the four bolts evenly until the clamp and tube coupler are firmly attached.

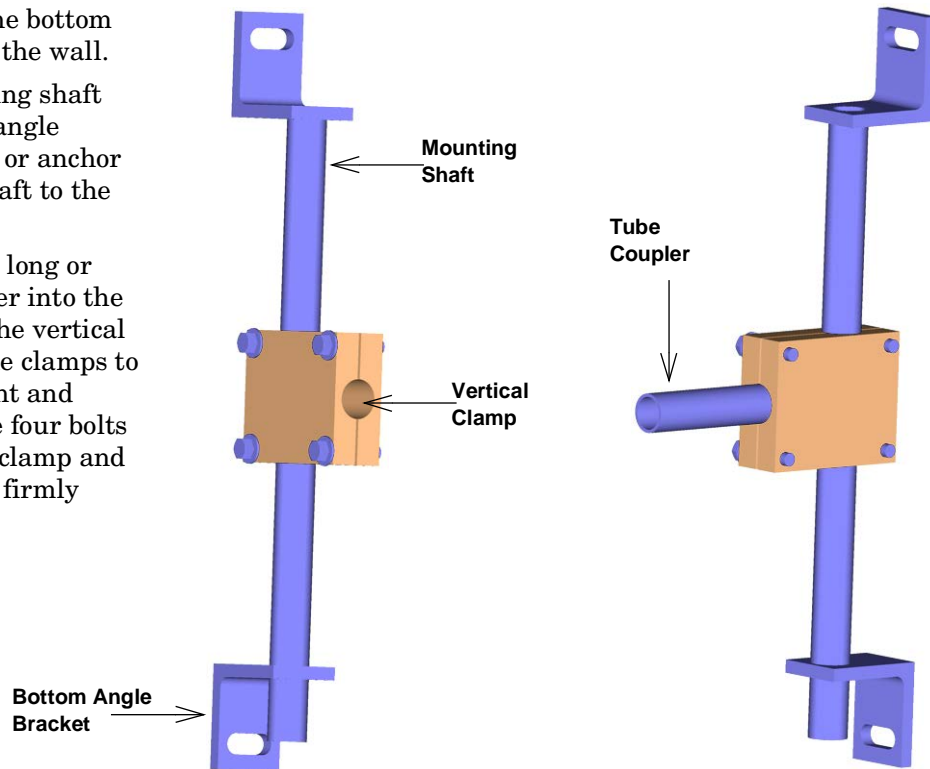


Figure 2-19 Wall Mount: Vertical clamp and vertical clamp with tube coupler inserted

4. Push the sensor carrier clamp onto the tube coupler until the coupler appears on the other side of the clamp. Align the carrier with both arms parallel to the flow surface and cross-tighten the bolts so the carrier is held firmly in position. Ensure the alignment tabs are facing up (see Figure 2-20).

Note that some realignment will be necessary following installation of the LaserFlow sensor; ensure that all hardware is tightened following final alignment.

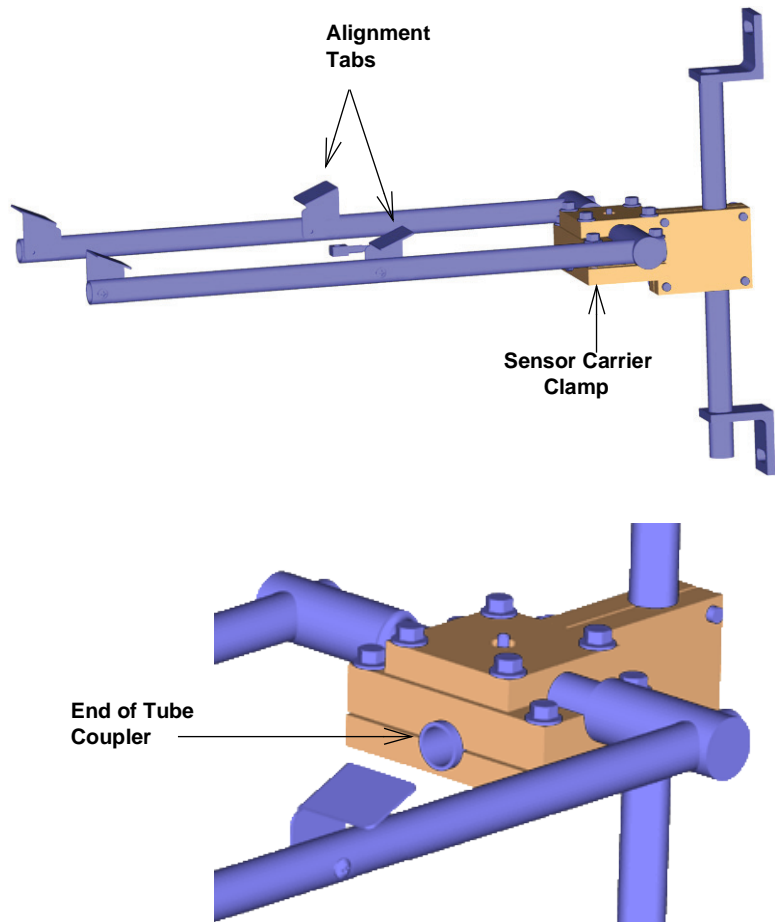


Figure 2-20 Wall Mount: Sensor carrier installed on tube coupler

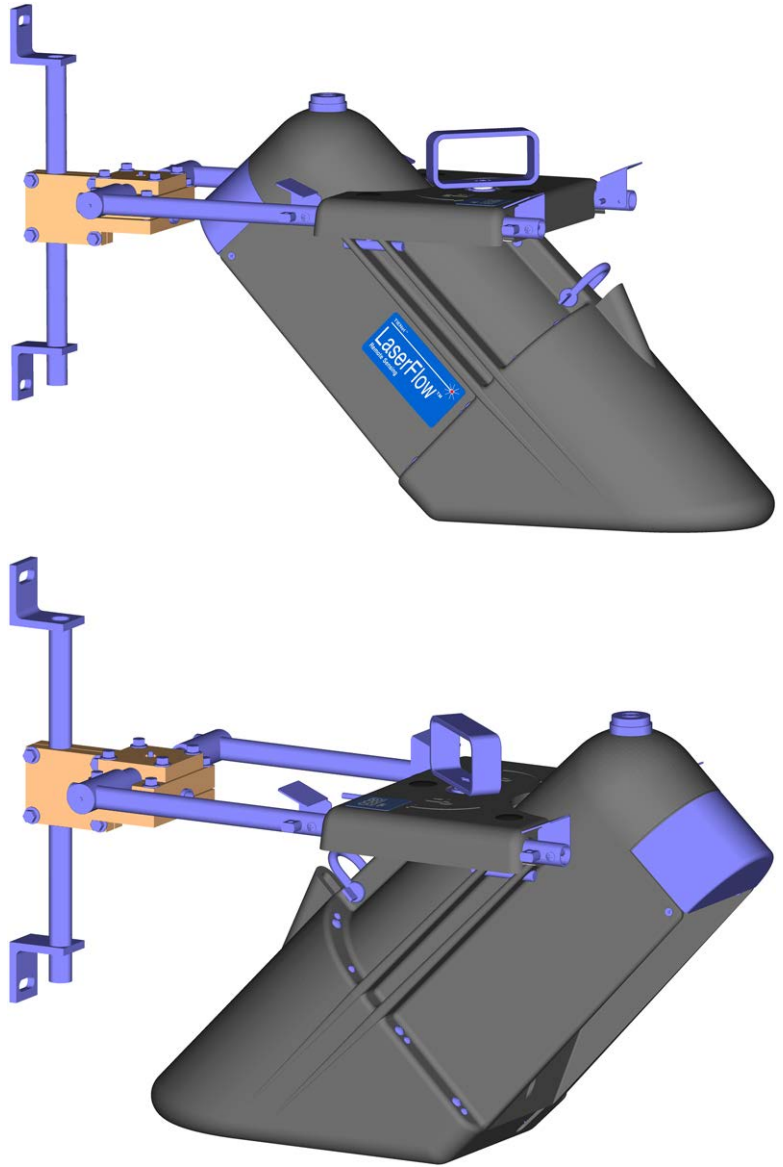
**Note**

After initial installation and sensor alignment, the remaining steps are often possible to perform from above ground, with the optional sensor retrieval arm.

 **WARNING**

If lowering the LaserFlow from above ground, ensure that it does not become dislodged while being lowered, possibly endangering any personnel who may still be below ground.

5. Lower the LaserFlow sensor onto the mounting bracket between the front and rear alignment tabs, with the two mounting block grooves resting on the two carrier arms. The sensor can be installed on the carrier facing inward or outward, depending on installation requirements.



*Figure 2-21 Wall Mount: Place the sensor on the carrier*



6. Turn the locking handle clockwise until it locks the sensor in place.



*Figure 2-22 Turn the locking handle clockwise until sensor is locked into place (shown with optional sensor retrieval arm, described in Section 2.8)*

7. Using the bubble level on top of the sensor as a guide, adjust the carrier by loosening the appropriate bolts in the sensor carrier clamp so that the bubble in the level falls within the concentric rings.
8. Turn the laser on to make final adjustments so that the laser beam hits the flow stream at the exact center of the pipe (refer to Section 3.4 for Signature or Section 4.3 for 2160).

**Note**

Additional assistance in adjusting the sensor's position may be obtained by activating and observing the 360 X-Axis (roll) and 360 Y-Axis (pitch) parameters.

9. Following final adjustments, ensure that all mounting bracket fasteners are tightened.

**2.7 Temporary Mounting Kit**

For temporary applications, refer to the components listed in Figure 2-23 and Table 2-2, and perform the steps that follow. Parts can be ordered separately or as a kit. Order numbers for parts and fasteners are provided in Appendix A.

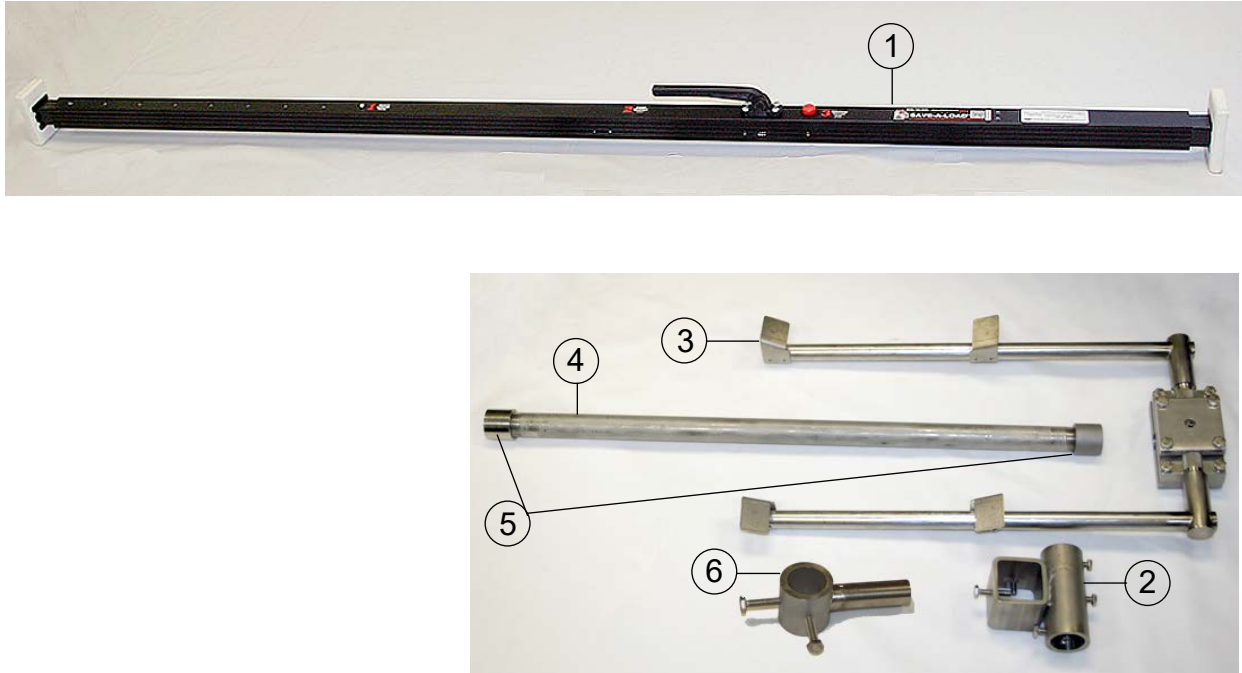


Figure 2-23 Temporary mounting kit (Numbers correspond with Table 2-2)

Table 2-2 Temporary Mounting Kit	
Item (Callout #)	Description
1	Cargo Bar
2	Coupler Assembly
3	Sensor Carrier
4	24" Pipe
5	Cap (2)
6	Knuckle Assembly

### 2.7.1 Temporary Mounting Installation

The temporary mounting kit is rated for up to 45 lbs (20.5 kg).

When installing the sensor with the temporary mounting kit, ensure that the sensor carrier is positioned for easy installation and removal of the sensor.

1. Slide the foot out of the stationary end of the cargo bar.

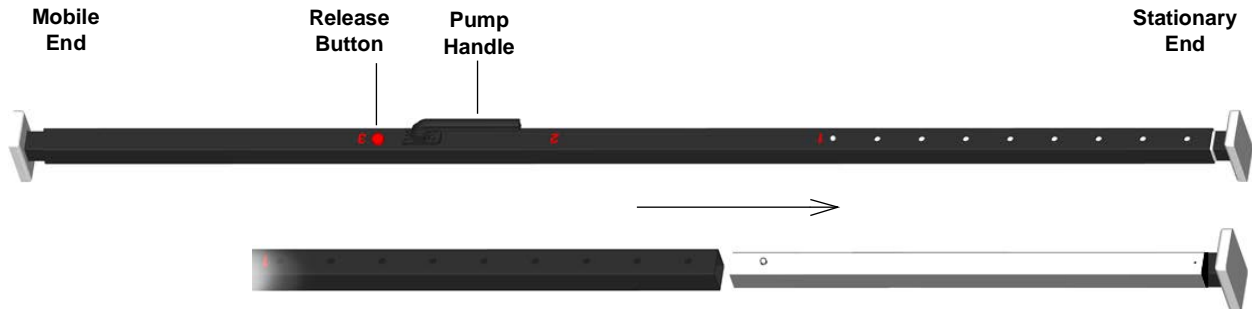


Figure 2-24 Temporary Mount: Remove stationary foot

2. Slide the coupler onto the bar, tightening the two coupler bolts (see Figure 2-26) enough to prevent it from sliding around during the rest of the installation.
3. Reinsert the foot in the stationary end of the cargo bar.

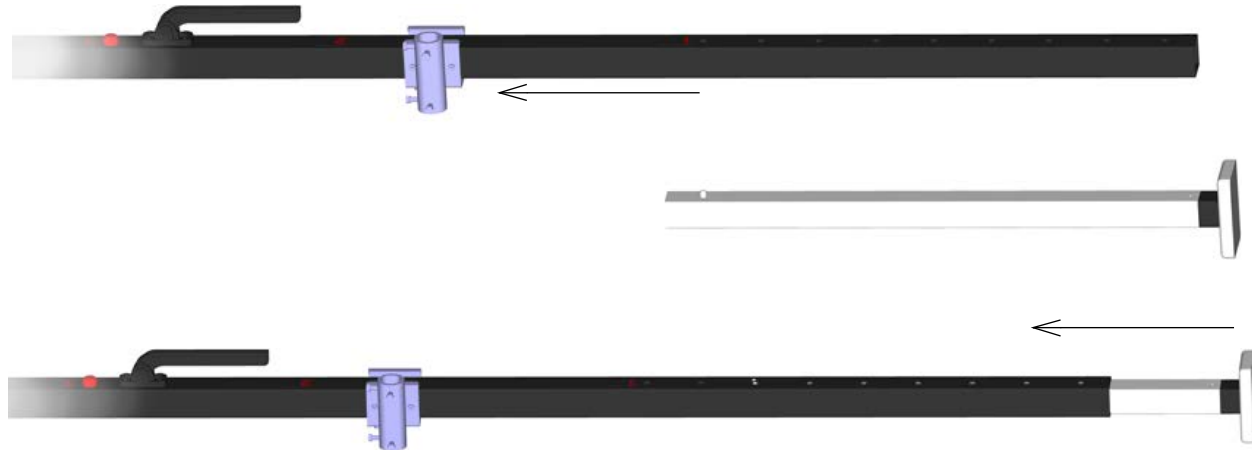


Figure 2-25 Temporary Mount: Install coupler, replace stationary foot

4. In the manhole or vault, position the cargo bar for installation. Place the mobile end against the wall, and extend the stationary end as far as possible.
5. Pump the handle fully up and down approximately 10 times, until the hydraulic tension presses the stationary foot firmly against the opposite wall.

**Note**

To release the hydraulic pressure, press the red rubber button next to the pump handle.

6. Position the coupler over the center of the flow stream and tighten the coupler bolts on the back and bottom.

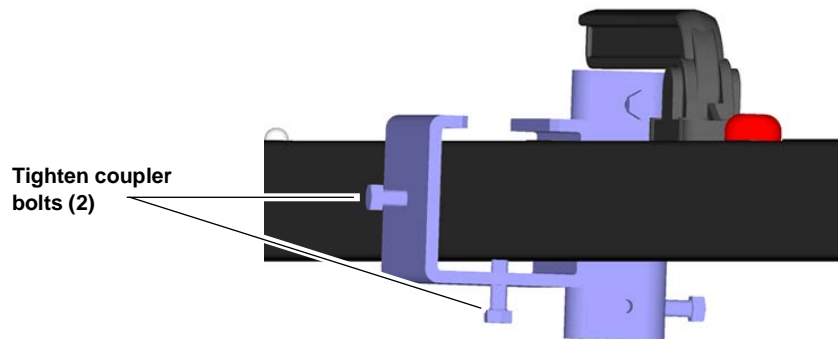


Figure 2-26 Temp Mount: Securing the coupler

7. Remove the end caps from the 24" pipe and slide one end through the knuckle on the sensor carrier.
8. Reinstall the cap on the bottom end. Turn the assembly top-side up and slide the knuckle down to rest on the bottom cap.

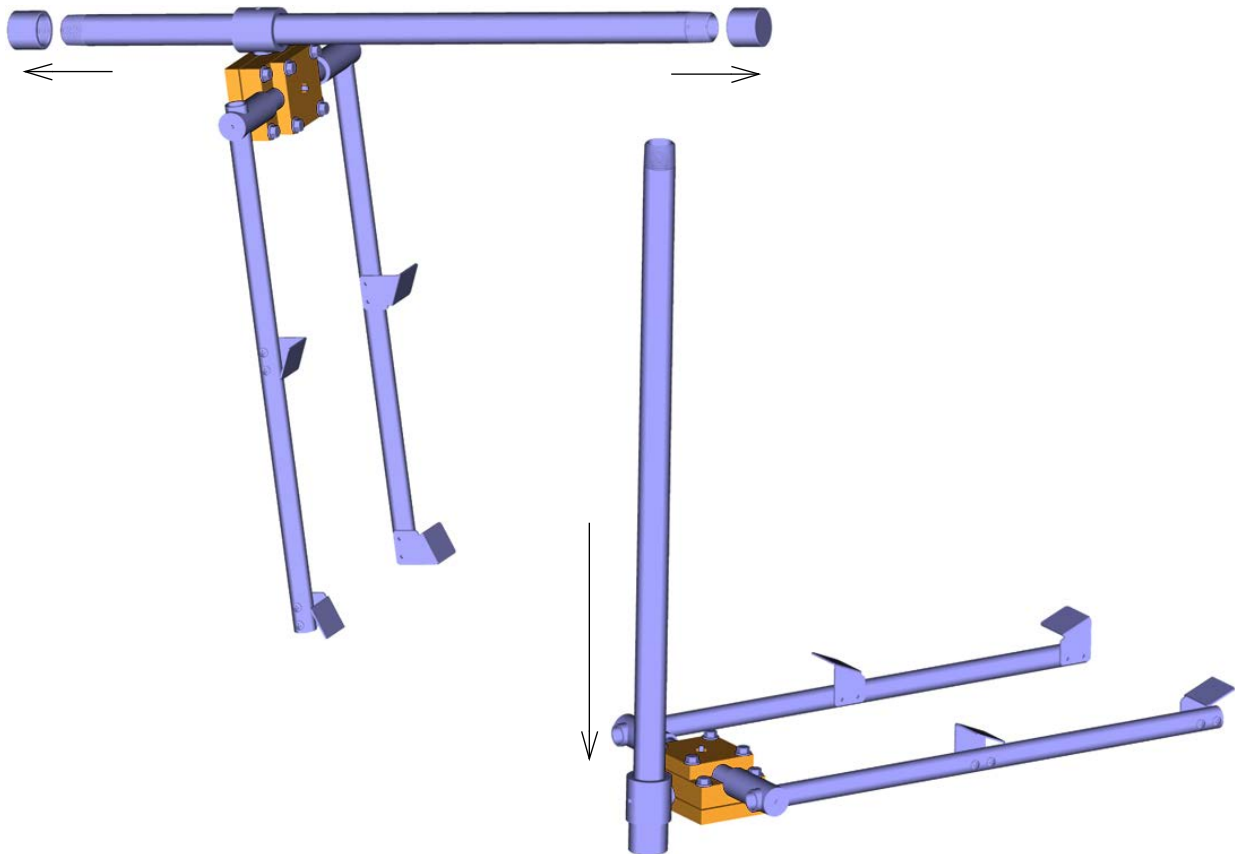


Figure 2-27 Temporary Mount: Install sensor carrier/knuckle onto 24" pipe

9. Slide the pipe up through the coupler tube. Replace the other pipe cap.
10. Rotate the carrier to proper orientation and tighten the 4 bolts on the coupler tube.
11. Fine-tune the carrier orientation and tighten the 2 bolts on the carrier knuckle.

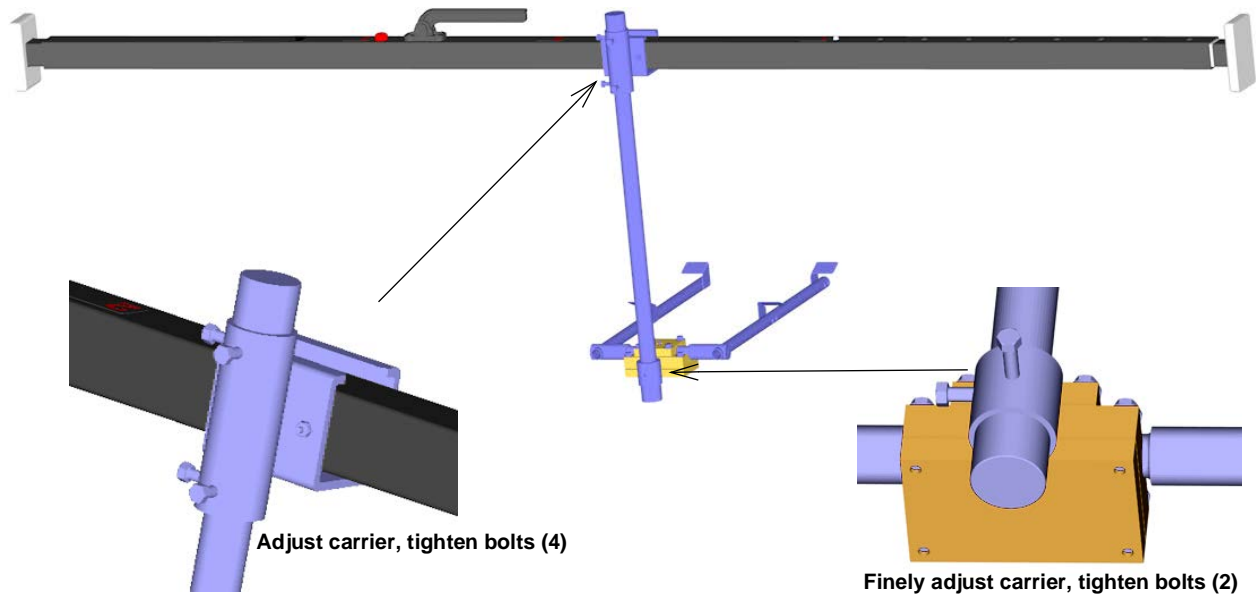


Figure 2-28 Installing the sensor carrier

**Note**

After initial installation and sensor alignment, the remaining steps are often possible to perform from above ground with the optional sensor retrieval arm.

 **WARNING**

If lowering the LaserFlow from above ground, ensure that it does not become dislodged while being lowered, possibly endangering any personnel who may still be below ground.

12. Lower the LaserFlow sensor onto the mounting bracket between the front and rear alignment tabs, with the two mounting block grooves resting on the two carrier arms. The sensor can be installed on the carrier facing inward or outward, depending on installation requirements.

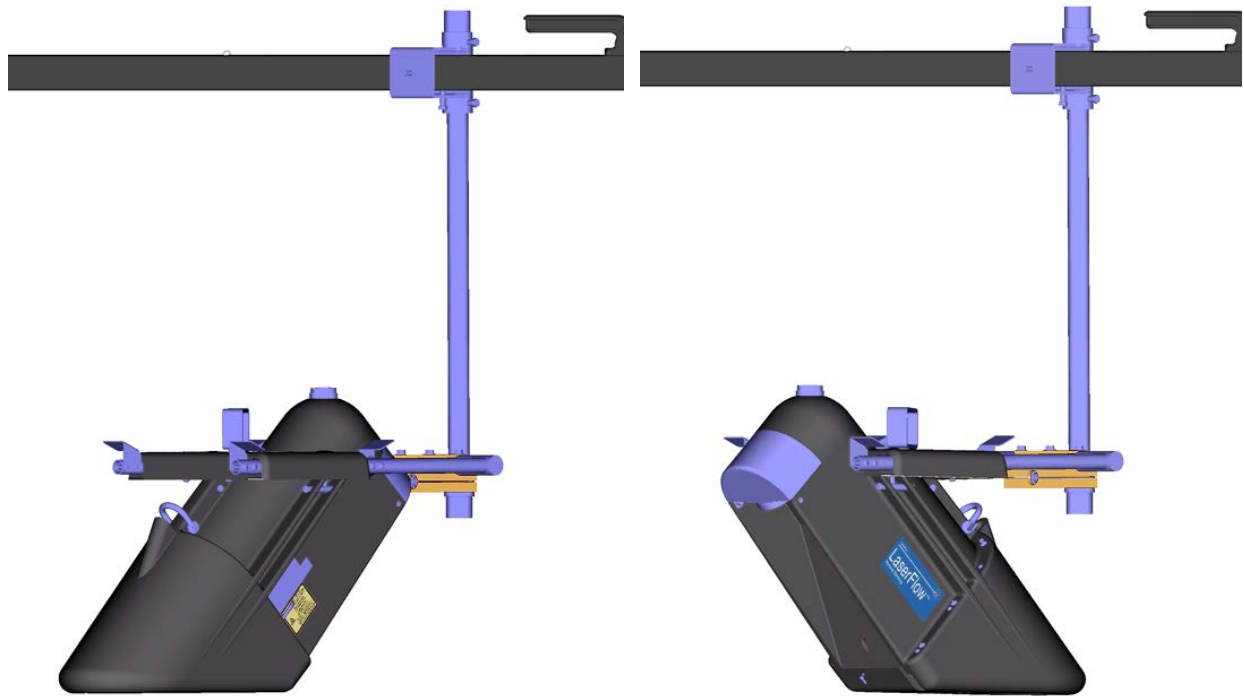


Figure 2-29 Temporary Mount: Place the sensor on the carrier

13. Turn the locking handle clockwise until it locks the sensor in place.



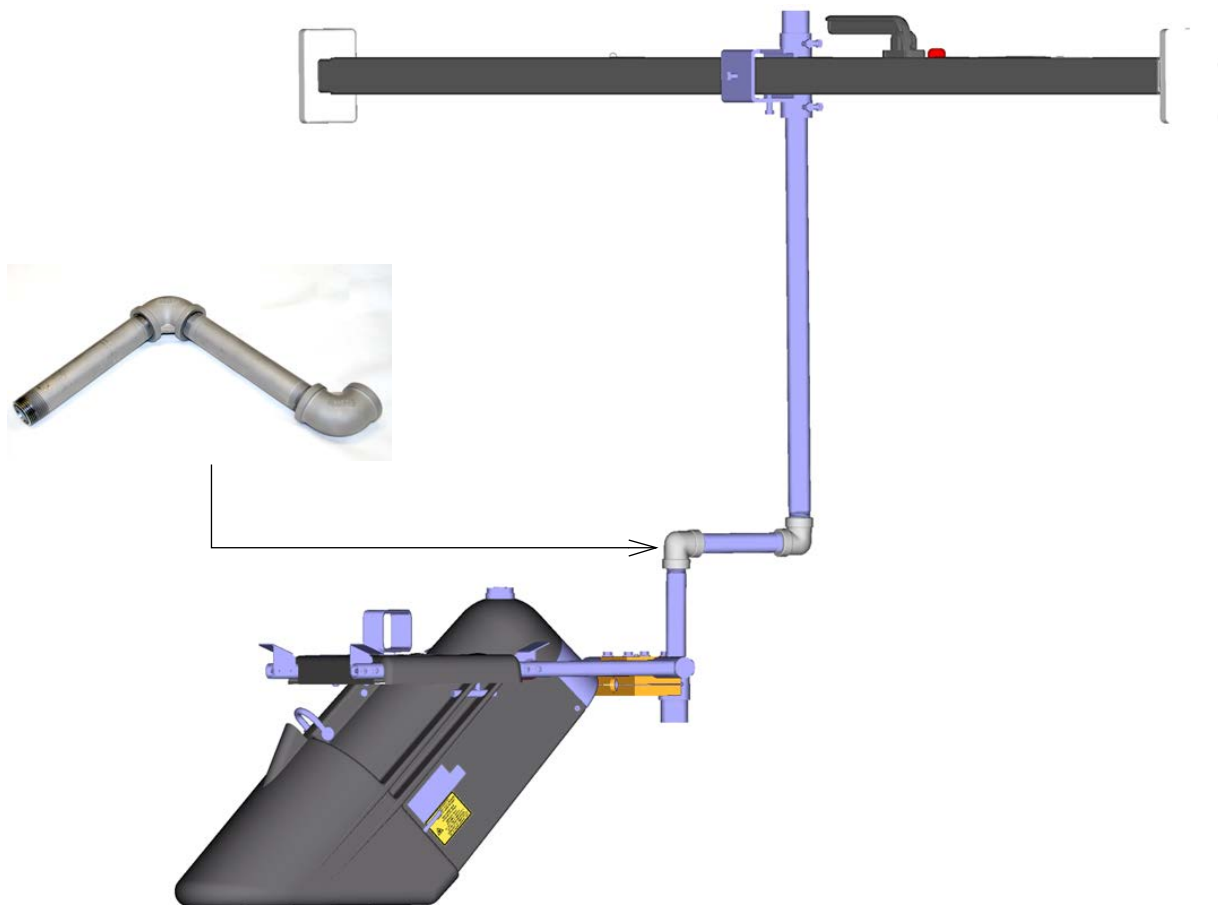
Figure 2-30 Turn the locking handle clockwise until sensor is locked into place (shown with the optional sensor retrieval arm, described in Section 2.8)

14. Using the bubble level on top of the sensor as a guide, adjust the carrier by loosening the appropriate bolts in the sensor carrier clamp such that the bubble in the level falls within the concentric rings.
15. Turn the laser on to make final adjustments so that the laser beam hits the flow stream at the exact center of the pipe (refer to Section 3.4 for Signature or Section 4.3 for 2160).
16. Following final adjustments, ensure that all mounting bracket fasteners are tightened.

### 2.7.2 Offset Carrier from Cargo Bar

For installations where the temporary mount assembly alone cannot suspend the sensor directly over the center of the flow; an optional elbow pipe is available to create an offset of 6" from the cargo arm.

Simply install it between the 24" pipe and the knuckle, as shown below.



*Figure 2-31 Temporary Mount: Optional elbow pipe for offset*

## 2.8 Optional Sensor Retrieval Arm

Following initial installation and adjustment, the sensor can be installed or removed as needed without manhole entry in most situations, using the optional retrieval arm to grasp the handle. See Figure 2-33.

The sensor retrieval arm can extend to a maximum of 23 ft.

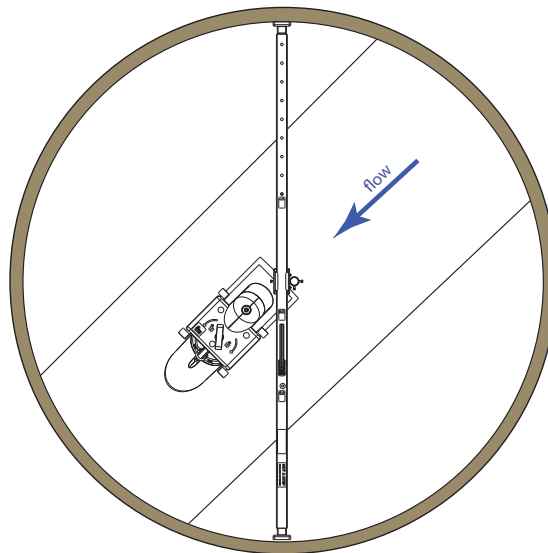
When using temporary mounting hardware with the sensor retrieval arm, Teledyne ISCO recommends mounting the LaserFlow module at a 45° angle to lessen the effective rotational torque applied to the mounting feet of the cargo bar. See Figure 2-32.

 **DANGER**

**Explosion hazard. The retrieval arm is not intrinsically safe. Do not use in hazardous locations.**

 **DANGER**

**Electrocution hazard. Maintain a minimum of 10 feet from power lines.**



*Figure 2-32 Suggested placement of LaserFlow sensor when using temporary mounting hardware and the sensor retrieval bar*





*Figure 2-33 Optional Sensor Retrieval Arm*

## 2.9 Optional Sunshade

The sunshade is an optional accessory for use when the Laserflow sensor is installed in an outdoor location in direct sunlight. The purpose of the sunshade is to prevent sunlight from striking the case of the sensor directly and heating it to a higher temperature than that of the surrounding air.

This heating, caused by the absorption of sunlight, should be avoided, as it introduces an error factor into the flow meter's level calculations.

1. Loosen the four tee knobs (two on each side of the sunshade) and slide the two adjustable mounting blocks to the rear of the slots on each side of the sunshade.
2. Position the sunshade on top of the Laserflow sensor mount and slide the sunshade toward the rear until the four stationary mounting blocks (two on each side of the sunshade) fit under the two front alignment tabs of the Laserflow sensor carrier. See Figure 2-34.

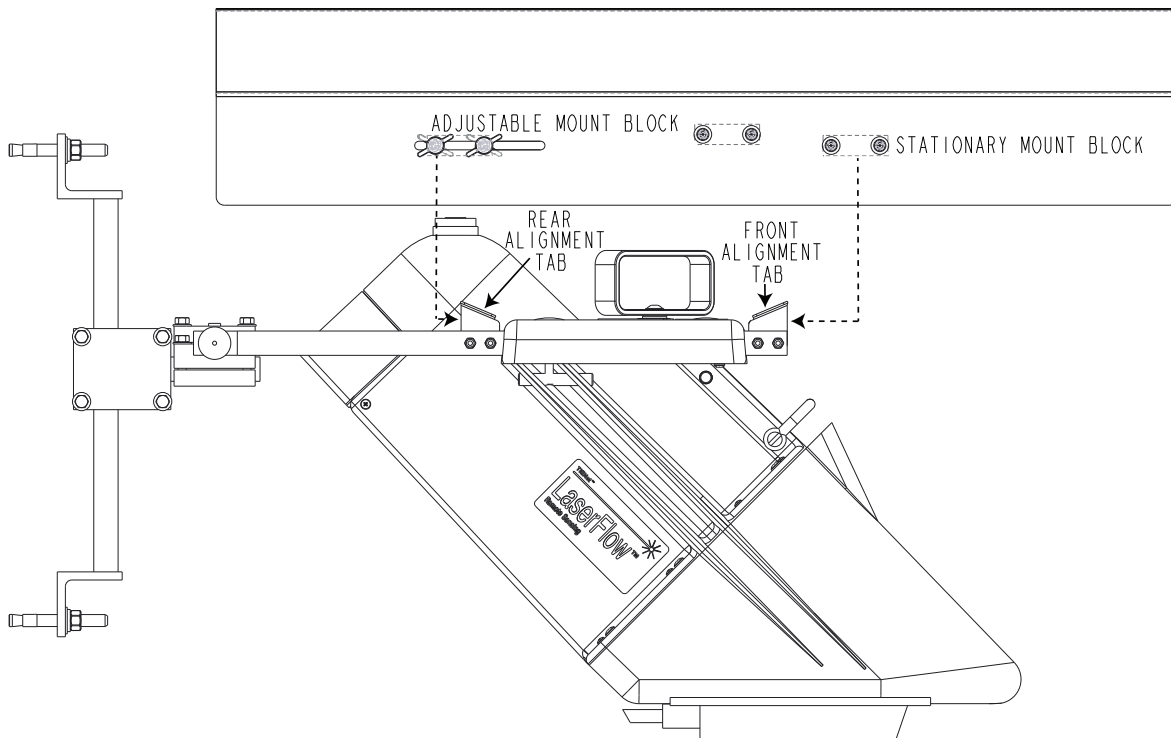


Figure 2-34 Mounting the sunshade

3. Slide the two adjustable mounting blocks (connected to the tee knobs) until they fit under the rear alignment tabs of the Laserflow sensor carrier. See Figure 2-34.

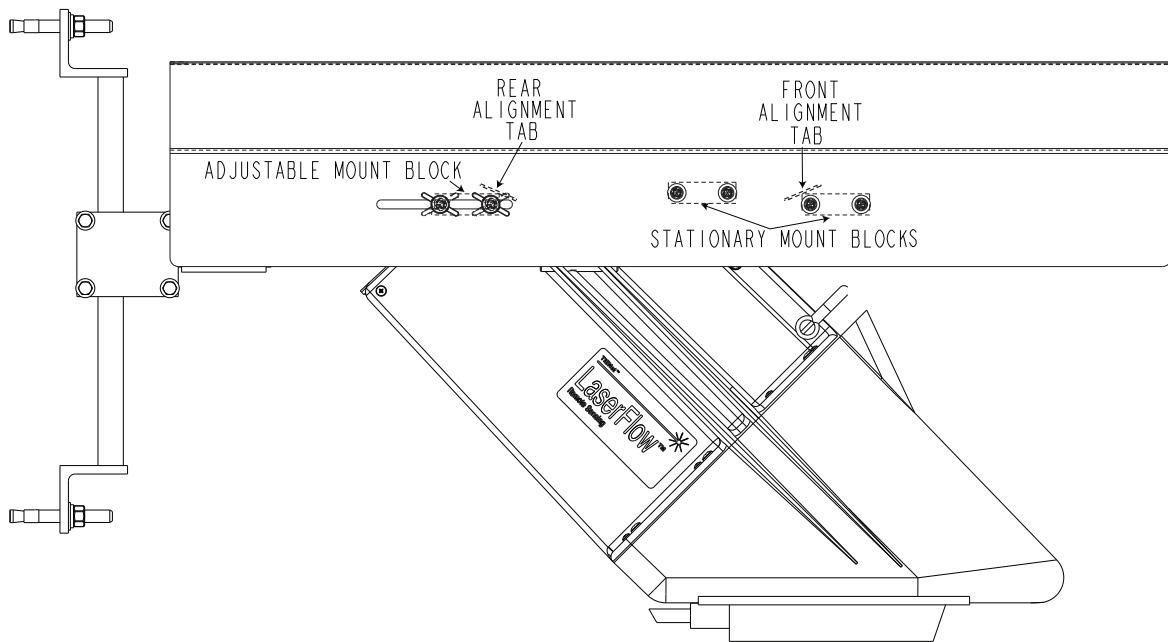


Figure 2-35 Mounted sunshade

4. Tighten the four tee knobs.

## 2.10 Remote TIENet Model 310 Ultrasonic Level Sensor

Refer to the TIENet 310 Ultrasonic Level Sensor Installation and Operation Guide for details.




# TIENet® 360 LaserFlow® Velocity Sensor

## Section 3 Setup with Signature® Flow Meter

The LaserFlow velocity sensor is compatible with both the Teledyne ISCO Signature Flow Meter and the Teledyne ISCO 2160 LaserFlow Module. For 2160 setup instructions, refer to Section 4. For complete information about the Signature Flow Meter, refer to the Signature Flow Meter user manual.

### 3.1 Configuring the System

To configure the Signature flow meter for operation with the

LaserFlow sensor, press the “Menu” button (  ) to access the top menu, and then select “Hardware Setup”. For all TIENet devices including the LaserFlow sensor, select “Smart Sensor Setup (TIENet)”.

#### 3.1.1 Updating the Device List

When the LaserFlow sensor has been physically added to the system, select “Perform Scan” so that the flow meter detects it. When the scan is complete, the LaserFlow sensor (model number 360) appears in the list of connected devices, ready to be configured with the steps shown in Figure 3-2.

#### Note

From the Hardware Setup menu, “Configure Measurements” refers to defining and selecting the parameters for each connected device.

The LaserFlow sensor parameters are:

**360 Distance** – Distance between the bottom of the sensor and the surface of the flow stream (refer to Section 3.2.2).

**360 Velocity** – Average velocity of the flow stream

**360 Laser Temperature** – Temperature of the laser assembly

**360 Y-Axis** – Tilt about the ‘y’ axis (pitch)

**360 Ultrasonic Signal** – Strength of the ultrasonic return echo

**360 Sense Voltage** – Measurement of window clarity (under 100 mV) –

**360 Doppler Power** – Strength of the laser Doppler signal for velocity

**360 Level** – Level of the flow stream surface

**360 Case Temperature** – Internal temperature of the LaserFlow sensor housing

**360 X-Axis** – Tilt about the ‘x’ axis (roll)




**360 Laser Diode Current** – Current draw of the laser diode

**360 Temperature** – Temperature of the window

**360 Air Temperature** – Temperature of surrounding (ambient) air

**360 Window Temp** – Temperature of the window

If your system includes the optional submerged functionality for redundant measurement, the TIENet 350 Area Velocity sensor is also displayed in the list of connected devices, with its own list of parameters.

The name of any parameter can be customized by highlighting it and pressing the “Enter” button (  ) to display the character grid (  ). Navigate the grid using the arrow keys. Select characters by pressing the “Enter” button and clear characters by pressing the “Delete” button (  ).

360 Distance														
Done		Cancel												
A	B	C	D	E	F	G	H	I	J	K	L	M	N	↑
O	P	Q	R	S	T	U	V	W	X	Y	Z	a	b	
c	d	e	f	g	h	i	j	k	l	m	n	o	p	
q	r	s	t	u	v	w	x	y	z		/	:	!	
@	#	\$	%	^	&	*	(	)	-	_	+	=	<	
>	?	,	.											↓

Figure 3-1 Character grid

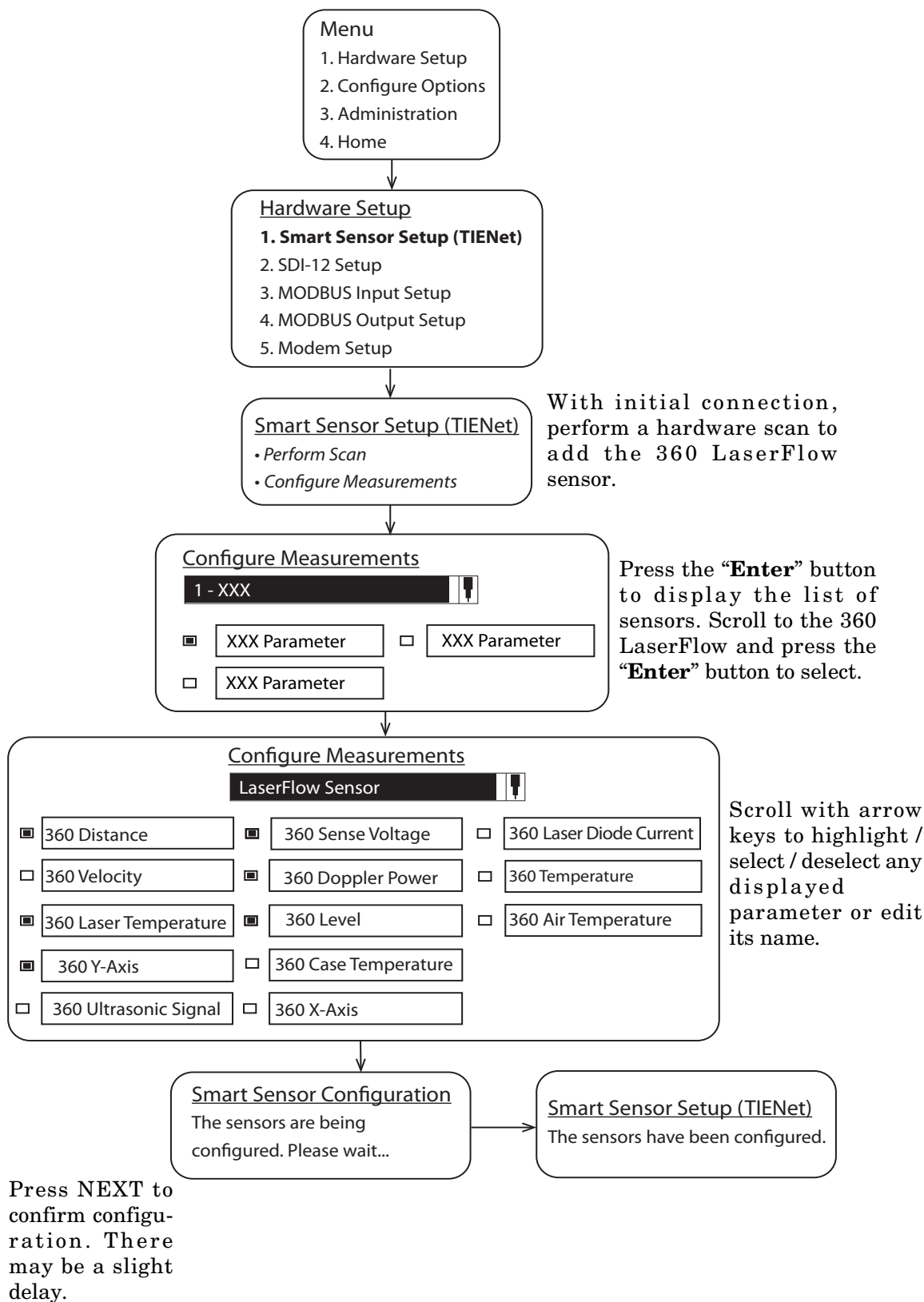


Figure 3-2 Menu Tree: LaserFlow Configuration

### 3.2 Measurement Setup

From Measurement Setup (Figure 3-3), select Level Input Setup to define the blanking distances and Velocity Input Setup to set velocity direction and access advanced settings.

**✓ Note**

Refer to the Signature user manual for information about Flow Rate Input Setup and Volume Input Setup.

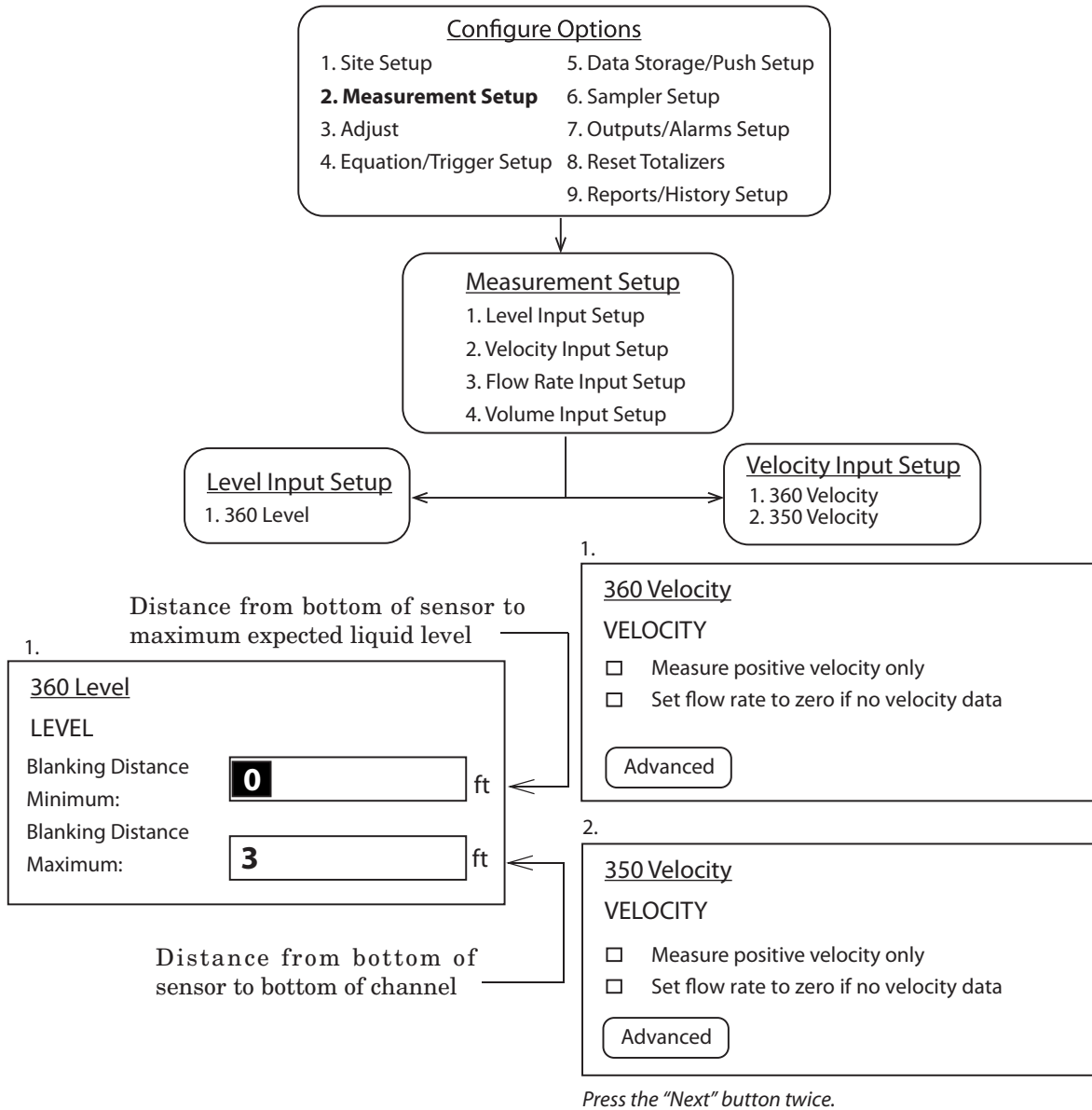


Figure 3-3 Measurement Setup: Sensor input settings (optional 350 AV Sensor also shown)



### 3.2.1 360 Level

The **Minimum Blanking Distance** is the distance from the bottom of the sensor to the liquid surface at the highest expected level. Depending on the elevation of your sensor, this value may be increased to help ensure that echoes read by the flow meter come only from the surface of the flow stream, and not off the walls or sides of the channel.

The **Maximum Blanking Distance** is the distance between the bottom of the sensor and the bottom of the channel (i.e., zero level). A larger value than calculated can be entered.

If using the LaserFlow module with the 310 remote ultrasonic sensor and horizontal sensor mounting bracket, the maximum blanking distance is the distance between the bottom of the mounting bracket and the bottom of the channel.

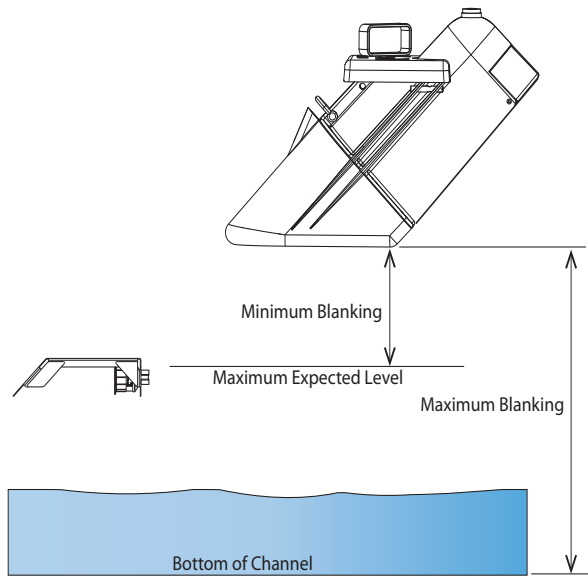


Figure 3-4 Blanking distance for LaserFlow with built-in sensor or with remote ultrasonic sensor

### 3.2.2 360 Velocity

When the **Measure Positive Velocity only** option is selected, the LaserFlow will not attempt to determine flow direction and negative readings are discarded in the average velocity calculation. Selecting this setting will save power. By default, this option is selected.

When the Positive Velocity option is deselected, a second velocity measurement is taken to determine the direction of the flow.

### 3.2.3 LaserFlow Velocity Advanced Settings

The LaserFlow **Advanced Settings** are pre-programmed into the sensor. However, if your application requires any custom configuration, the Advanced button opens the Advanced settings window (refer to Figure 3-5).

**Input Velocity Coefficients** – The relationship of the three Input Velocity Coefficients A, B and C can be expressed as:

$$\bar{V} = A (\text{offset}) + B * (\text{Measured Velocity}) + C * (\text{Measured Velocity})^2$$

Coefficient A is an additive offset value to correct the Measured Velocity for any additive bias. The value for A must be expressed in units of meters/second. The default is “0”.

Coefficient B is a multiplicative scalar for correcting the Measured Velocity for any linear multiplicative bias. The value for B is unitless. The default is “0.9”.

Coefficient C is another scalar to correct the Measured Velocity for any nonlinear bias. The value for C must be expressed in units of seconds/meter, so that the resulting value for the Reported Velocity Reading will be in units of meters/second. The default is “0”.

**Spectral Averages** – The value for Spectral Averages may be used to reduce noise and improve signal strength. The default is “5000”. If persistent low signal strength or velocity dropouts are indicated, enter a high value, such as 10000. If signal quality and measurement improve, try entering a lower value, such as 7500, observing the signal quality. The lower the value for Spectral Average, the less time required for each complete measurement, reducing power usage. Adjust the value to determine a number that balances power usage with satisfactory signal quality and readings.

**Re-home Count** – For testing purposes only. For more information, contact Environmental Products Support.

**Peak Detect** – The Peak Detect function scans across the user-defined row to locate the peak velocity. To enable Peak Detect functionality, select the “**Peak Detect**” box.

**Adaptive Focus** – Adaptive Focus enables the LaserFlow module to scan above and below the standard focus point, then adjust the focus to the point with the best signal strength. To enable Adaptive Focus functionality, select the “**Adaptive Focus**” box.

**Positive Downstream** – Select the “**Positive Downstream**” box when the LaserFlow sensor is pointed downstream.

**Maximum Distance** – The Maximum Distance is the greatest distance (e.g., inches) the LaserFlow sensor will take a directional velocity reading. The default is “48”. Units of measurement are based on user settings.

**Maximum Velocity** – The Maximum Velocity is the greatest velocity (e.g., ft/s) the LaserFlow sensor will take a directional velocity reading. The default is “1”. Units of measurement are based on user settings.

**Steep Slope LaserFlow Focusing** – If the pipe is on a slope greater than 1%, select the “**Enable Slope Setting**” box. By default, this option is disabled.

**Parallel to Channel Slope** – If the sensor is parallel to the channel slope, select “**Parallel to Channel Slope**”. Measure from the front of the sensor carrier to the bottom of the channel. Then measure from the back of the sensor carrier to the bottom of the channel. Ensure the distance is equal. Adjust the sensor

carrier as necessary. By default, this option is enabled when the “Enable Slope Setting” box is selected. See Figure 4-11 in Section 4.

**Slope Percentage** – If the slope of the pipe is known, mount the sensor level with the Earth, using the bubble level mounted on the top of the sensor and then enter the Slope Percentage in the field. By default, this option is disabled when the “Enable Slope Setting” box is selected. See Figure 4-12 in Section 4.

**Optical Clarity** – Sense voltage detects fog on the window of the LaserFlow sensor. When the sense voltage is greater than 100 mV, the defogger is activated. The defogger is enabled from 1 to 5 minutes, depending on the severity of the fog.

**Note**

In locations with severe fogging potential, Teledyne ISCO recommends increasing battery capacity or monitoring the site more frequently.

To enable Optical Clarity, select “**Active**”. To disable Optical Clarity, select “**Passive**”. The default is “Active”.

Advanced

Warning: Any changes to the following data can adversely affect the performance of this Instrument!  
 Select BACK to cancel or NEXT to continue.

---

A + (B \* v) + (C \* v<sup>2</sup>)  
 Input Velocity Coefficients

A (default=0):  m/s

B (default=0.9):

C (default=0):  s/m

Spectral Averages (default=5000):

Re-home Count (default=100):

Start Bin:

Maximum Focus Depth:  ft

Focus Learning Algorithm

Peak Detect

Adaptive Focus

Remote Distance Measurement

US Distance to Bottom  in

LaserFlow Distance to Bottom  in

Horizontal Mount

LaserFlow Directional Velocity

Focus Downstream

Maximum Distance:  ft

Maximum Velocity:  ft/s

Steep Slope LaserFlow Focusing

Enable Slope Setting

Parallel to Channel Slope

Slope Percentage:  %

Optical Clarity

Active

Passive

For use with the remote 360 ultrasonic level sensor.

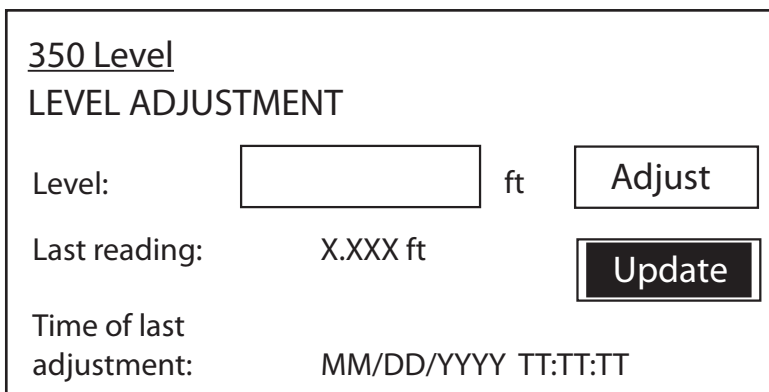
Figure 3-5 Measurement setup: Advanced settings for LaserFlow sensor

### 3.2.4 Adjust 350 Level (Optional)

If your system includes the optional surcharge sensor, it is also capable of measuring level with a pressure differential transducer.

The Level Adjustment screen is accessed via the Shortcuts menu on the Signature. From this screen, you can also update the display to show the current level of the stream.

Press SHORTCUTS (  ) and select Adjust Level.



350 Level  
LEVEL ADJUSTMENT

Level:  ft

Last reading: X.XXX ft

Time of last adjustment: MM/DD/YYYY TT:TT:TT

Figure 3-6 350 Level adjustment screen

To set an initial or new level, enter the value in the field next to **Level**, and select **Adjust**. To update the current reading, select **Update**.

Following installation, measure the distance between the bottom of the channel and the bottom of the LaserFlow to obtain the initial value for 350 Level (Figure 3-7).

It is recommended that the variable data storage rate function be used to trigger 350 velocity and level measurement based on a Level threshold.

Alarm setup and activation are explained in the Signature user manual under Outputs/Alarms Setup.

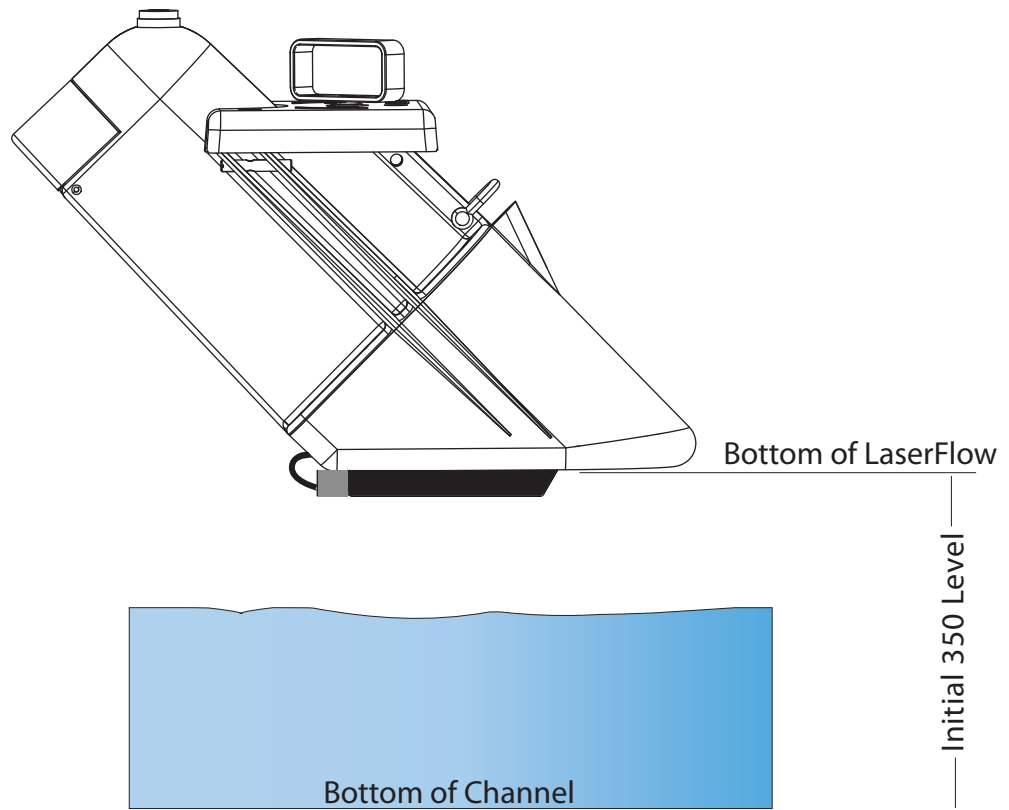


Figure 3-7 Submerged functionality: Initial 350 Level setting

**3.2.5 350 Velocity (Optional)** If your system includes the optional submerged functionality or redundant measurement, it is also capable of measuring velocity with a continuous wave Doppler sensor.

The *Measure positive velocity only* setting causes any negative readings to be discarded in the average velocity calculation. If this is set to false, both positive and negative readings are used.

### 3.2.6 350 Advanced Settings (Optional)

The LaserFlow **Advanced Settings** are pre-programmed into the sensor. However, if your application requires any custom configuration, the Advanced button opens the Advanced settings window (refer to Figure 3-5).

**Input Velocity Coefficients** – The relationship of the three Input Velocity Coefficients A, B and C can be expressed as:

$$\bar{V} = A (\text{offset}) + B * (\text{Measured Velocity}) + C * (\text{Measured Velocity})^2$$

Coefficient A is an additive offset value to correct the Measured Velocity for any additive bias. The value for A must be expressed in units of meters/second. The default is “0”.

Coefficient B is a multiplicative scalar for correcting the Measured Velocity for any linear multiplicative bias. The value for B is unitless. The default is “0.9”.

Coefficient C is another scalar to correct the Measured Velocity for any nonlinear bias. The value for C must be expressed in units of seconds/meter, so that the resulting value for the Reported Velocity Reading will be in units of meters/second. The default is “0”.

The sensor is pre-programmed at the factory with the **Advanced Settings** for your application. Should your application require the addition of any correction factors, the Advanced button opens the Advanced settings window (Figure 3-8).

Input velocity coefficients can be adjusted for A, B, and C, where:

$$\bar{V} = A (\text{offset}) + BV (\text{slope}) + CV^2 (\text{second-order parameter}).$$

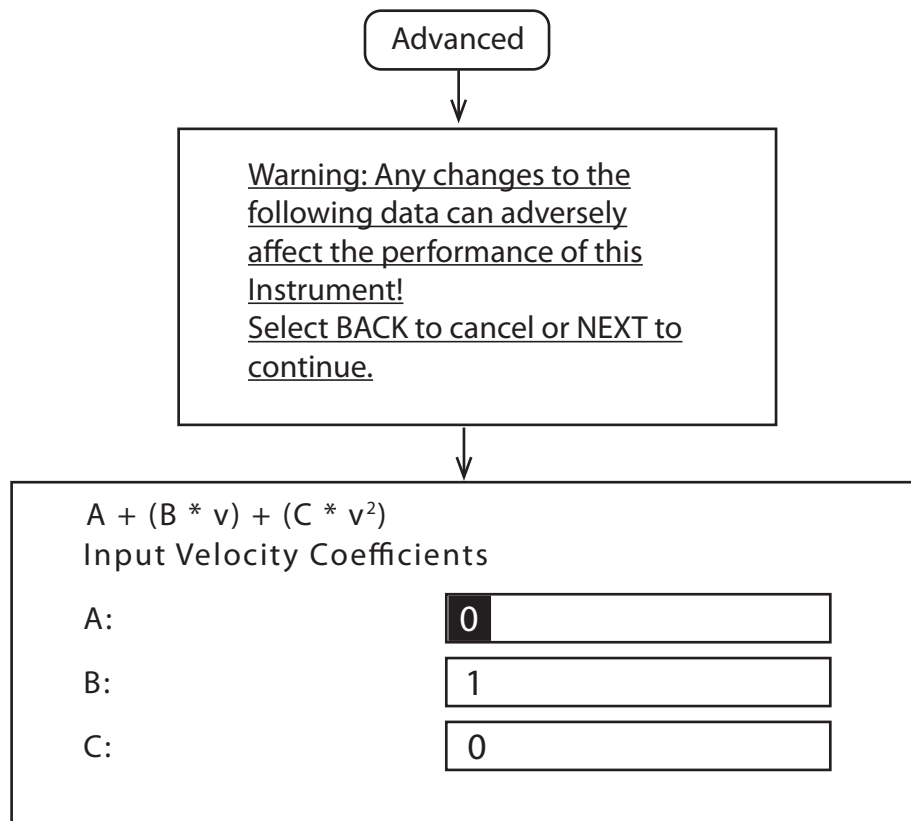


Figure 3-8 Measurement setup: Advanced settings for 350 AV sensor



### 3.3 360 Velocity Grid

The 360 Velocity screen has a grid containing 15 possible measurement points. Use the Shortcuts > Adjust function to navigate to this screen (refer to Figure 3-9).

The measurement points are activated and deactivated with the arrow and Enter keys. To save the measurement settings, highlight Update and press Enter.

As the LaserFlow begins to take readings, the grid becomes populated with a velocity reading and time stamp for each active measurement point (points where a valid reading could not be obtained will display the word “invalid”).

Prior to operation, the LaserFlow sensor must be set up for measurement using the 360 Velocity grid. Refer to Section 3.4.

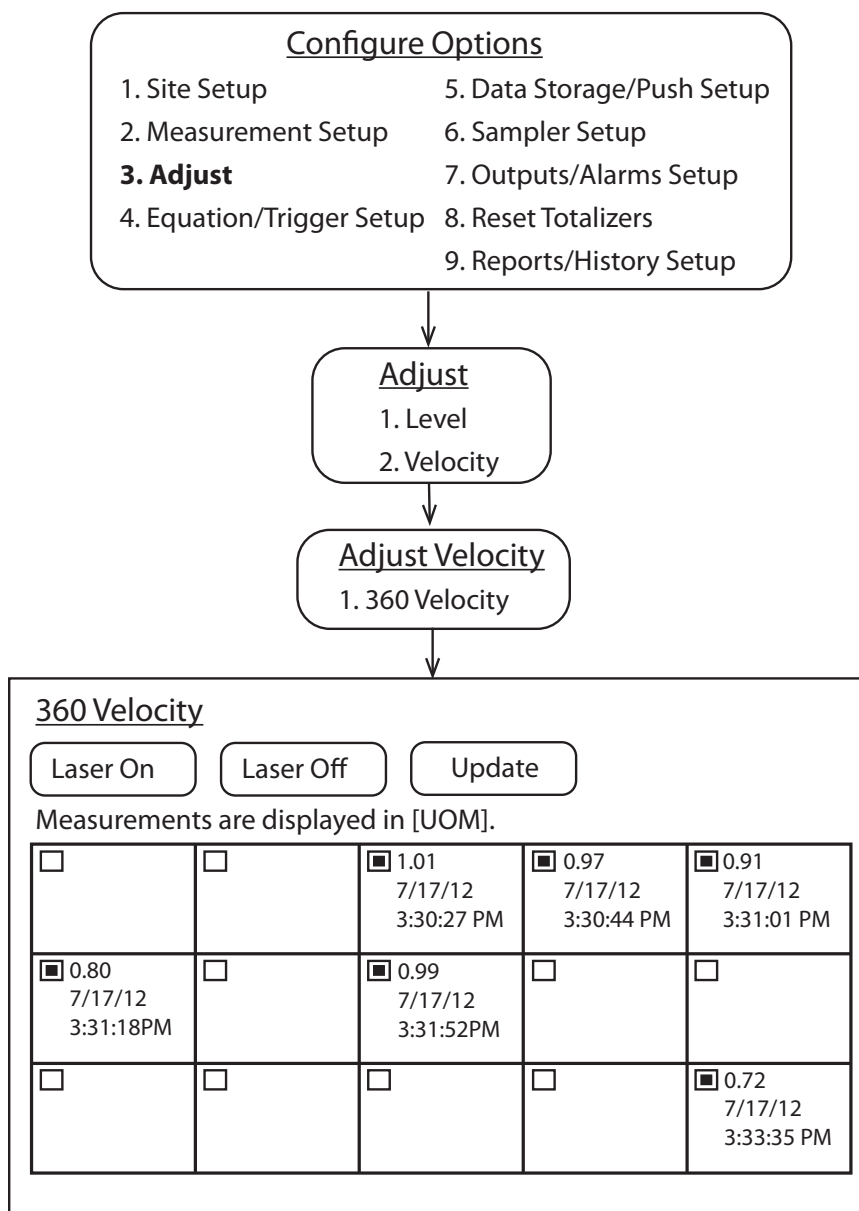
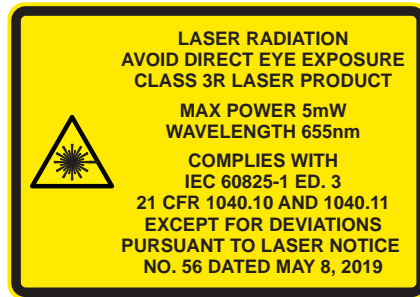


Figure 3-9 360 Velocity grid

### 3.4 Sensor Positioning and Adjustment



#### 3.4.1 Centering the LaserFlow Sensor

*Laser On*

Proper positioning of the LaserFlow sensor is critical for optimal velocity measurement. In center position, the laser beam must strike the flow stream precisely in the center.

The beam automatically moves to the top center position.

Select Laser On and press Enter. This will keep the laser beam on continuously for 10 minutes or until Laser Off is selected, allowing the beam to be used for fine-tuning the sensor's position.

**Note**

When sensor positioning is completed, securely tighten all mounting hardware.

#### 3.4.2 Laser Velocity Measurement Point Selection

Once the LaserFlow sensor is installed over the flow stream, some installations may only require the center laser position for velocity measurement.

For installations requiring multiple measurement points, the next step is to determine which points will be used. To do so, activate all 15 points and wait for all of them to display their readings. This process may take up to 15 minutes.

Each point will display a velocity reading and time stamp, or "Invalid." Deselect "Invalid" and undesired points. The fewer points selected, the less time required to complete one velocity measurement.

Select all 15 measurement points and Update.

### 360 Velocity

Laser On Laser Off Update

Measurements are displayed in [UOM].

<input checked="" type="checkbox"/> Invalid	<input checked="" type="checkbox"/> Invalid	<input checked="" type="checkbox"/> 1.01 7/17/12 3:30:27 PM	<input checked="" type="checkbox"/> 0.97 7/17/12 3:30:44 PM	<input checked="" type="checkbox"/> 0.91 7/17/12 3:31:01 PM
<input checked="" type="checkbox"/> 0.80 7/17/12 3:31:18PM	<input checked="" type="checkbox"/> Invalid	<input checked="" type="checkbox"/> 0.99 7/17/12 3:31:52PM	<input checked="" type="checkbox"/> Invalid	<input checked="" type="checkbox"/> Invalid
<input checked="" type="checkbox"/> Invalid	<input checked="" type="checkbox"/> Invalid	<input checked="" type="checkbox"/> Invalid	<input checked="" type="checkbox"/> Invalid	<input checked="" type="checkbox"/> 0.72 7/17/12 3:33:35 PM

### 360 Velocity

Laser On Laser Off Update

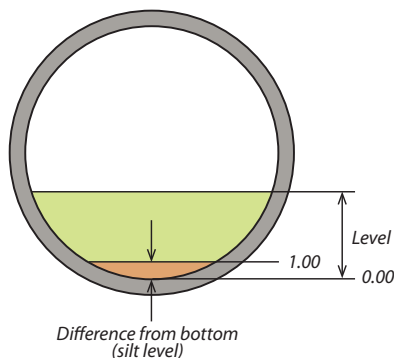
Measurements are displayed in [UOM].

Deselect invalid (and undesired) points and Update.

<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> 1.01 7/17/12 3:30:27 PM	<input checked="" type="checkbox"/> 0.97 7/17/12 3:30:44 PM	<input checked="" type="checkbox"/> 0.91 7/17/12 3:31:01 PM
<input checked="" type="checkbox"/> 0.80 7/17/12 3:31:18PM	<input type="checkbox"/>	<input checked="" type="checkbox"/> 0.99 7/17/12 3:31:52PM	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> 0.72 7/17/12 3:33:35 PM

Figure 3-10 Selection of velocity measurement points

### 3.4.3 Ultrasonic Level Adjustment



Once the LaserFlow sensor is installed over the flow stream, measure the present liquid level from the bottom of the channel (if there is a difference between the bottom of the channel and zero level, save this value for reference in flow calculation) and enter this value for Level, under Adjust options. Then highlight **Adjust** and press Enter to confirm.

From this screen, you can also update the display to show the current level of the stream.

**Note**

Level adjustment of a newly installed and activated sensor should be performed only after the sensor is allowed to stabilize under site conditions (allow approximately one hour per 10 °F difference between storage and operating environments).

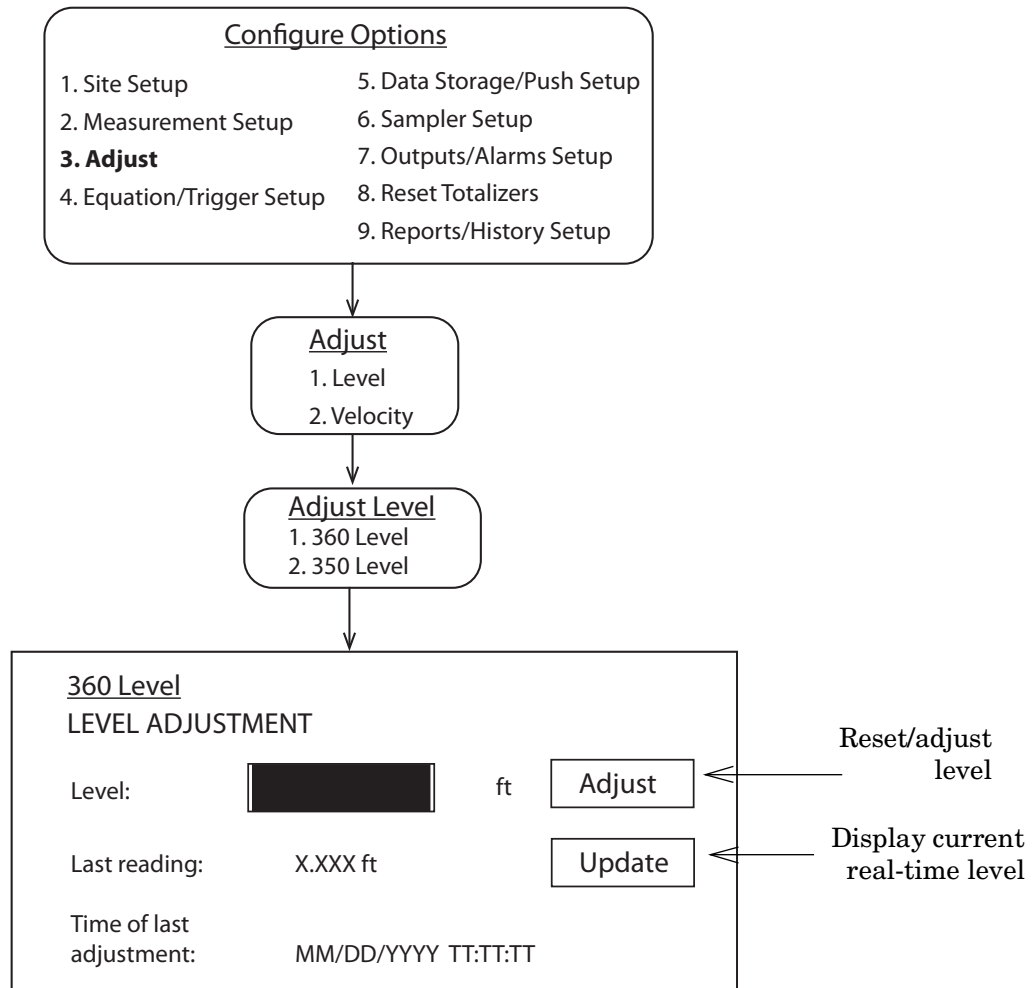


Figure 3-11 Ultrasonic level adjustment

### 3.5 Contact Teledyne ISCO

If you have further questions about the installation, operation, and maintenance of your TIENet device, contact Environmental Product Support at:

Teledyne ISCO  
 4700 Superior St.  
 Lincoln, NE 68504  
 Phone: 866 298-6174 or 402 464-0231  
 Fax: 402 465-3022  
 E-mail: [iscowatersupport@Teledyne.com](mailto:iscowatersupport@Teledyne.com)

# TIENet® 360 LaserFlow® Velocity Sensor

## Section 4 Setup with 2160 LaserFlow Module

The LaserFlow sensor is compatible with both the Teledyne ISCO 2160 LaserFlow Module and the Teledyne ISCO Signature Flow Meter. For Signature setup instructions, refer to Section 3.

The 2160 module is programmed and set up using Teledyne ISCO Flowlink® software. This section of the manual describes activation of connected sensors, and basic LaserFlow and optional TIENet 350 level and velocity measurement setup.

This section of the manual assumes the 2160 site is already configured in Flowlink, and the 2160 module is connected to Flowlink. Detailed Flowlink instructions are available in the Flowlink Windows Help and also in the Flowlink software user manual. For complete information about the 2160 LaserFlow Module, refer to the 2160 LaserFlow Module Installation and Operation Guide.

### 4.1 Activating Connected Sensors

To add an available (connected) LaserFlow sensor or optional 350 AV sensor and to activate in Flowlink, select the **TIENet** tab (Figure 4-1), then highlight the appropriate LaserFlow module 2160 module, and click the “**Configure**” button.

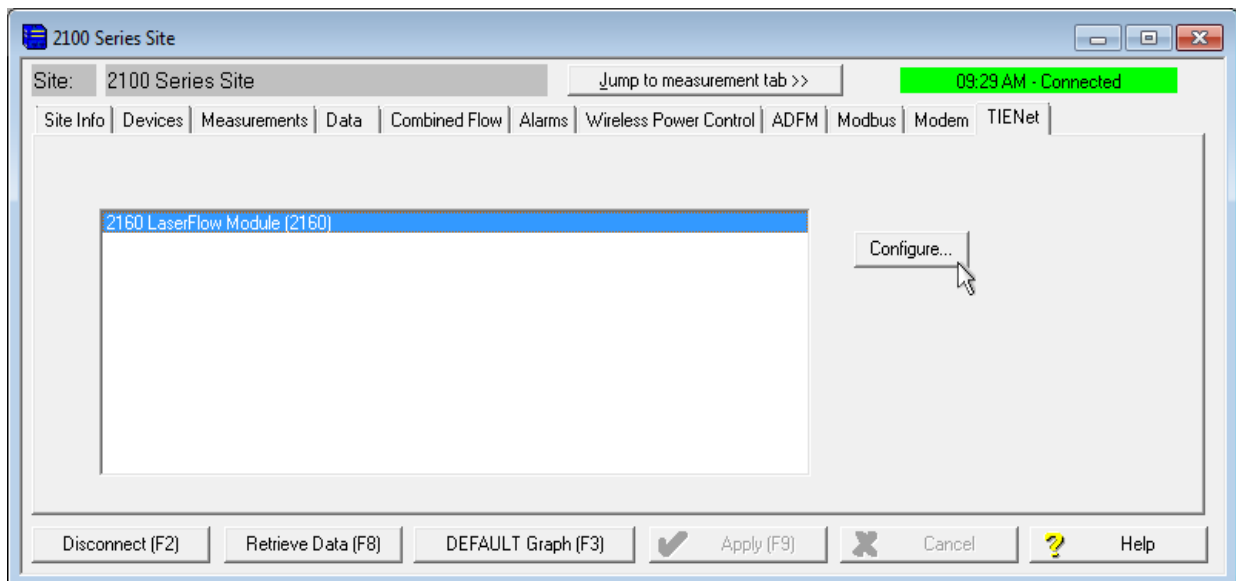


Figure 4-1 Activate connected sensors in Flowlink

A box is displayed, listing active and available TIENet Devices. Click the “**Scan**” button to detect any newly connected LaserFlow or 350 Area Velocity sensors. Devices will appear in the Available TIENet Devices pane.

Highlight the appropriate device(s) and click the “**Add**” button to activate. Active TIENet devices will appear in the Active TIENet Devices pane. Click the “**OK**” button.

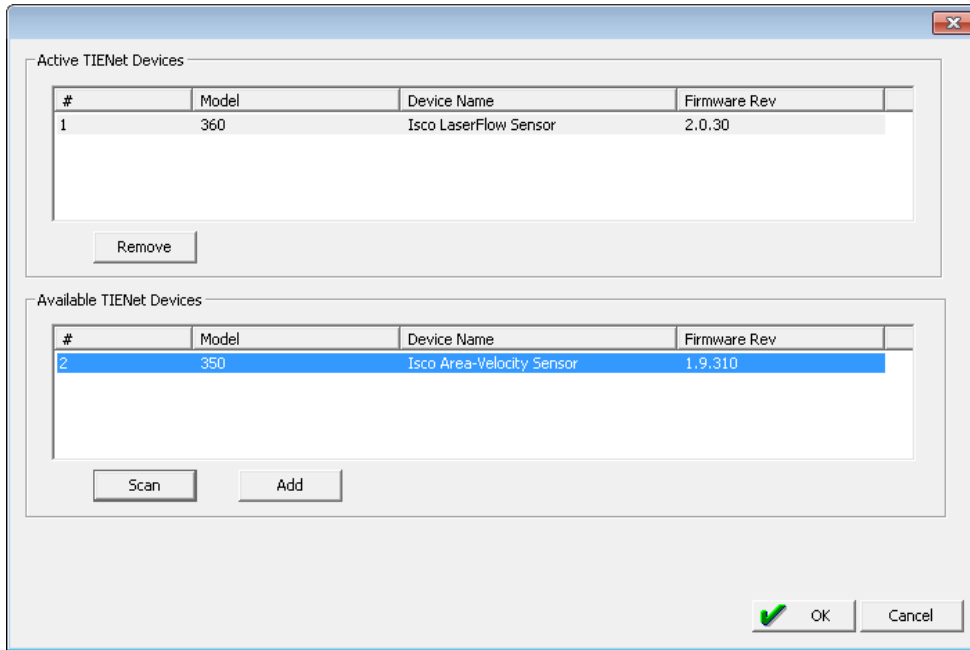


Figure 4-2 Activating connected sensors in Flowlink

## 4.2 Measurement Display and Settings

The **Measurements** tab in the Site window lists the data types being measured by the 2160 module and displays real-time measurements.

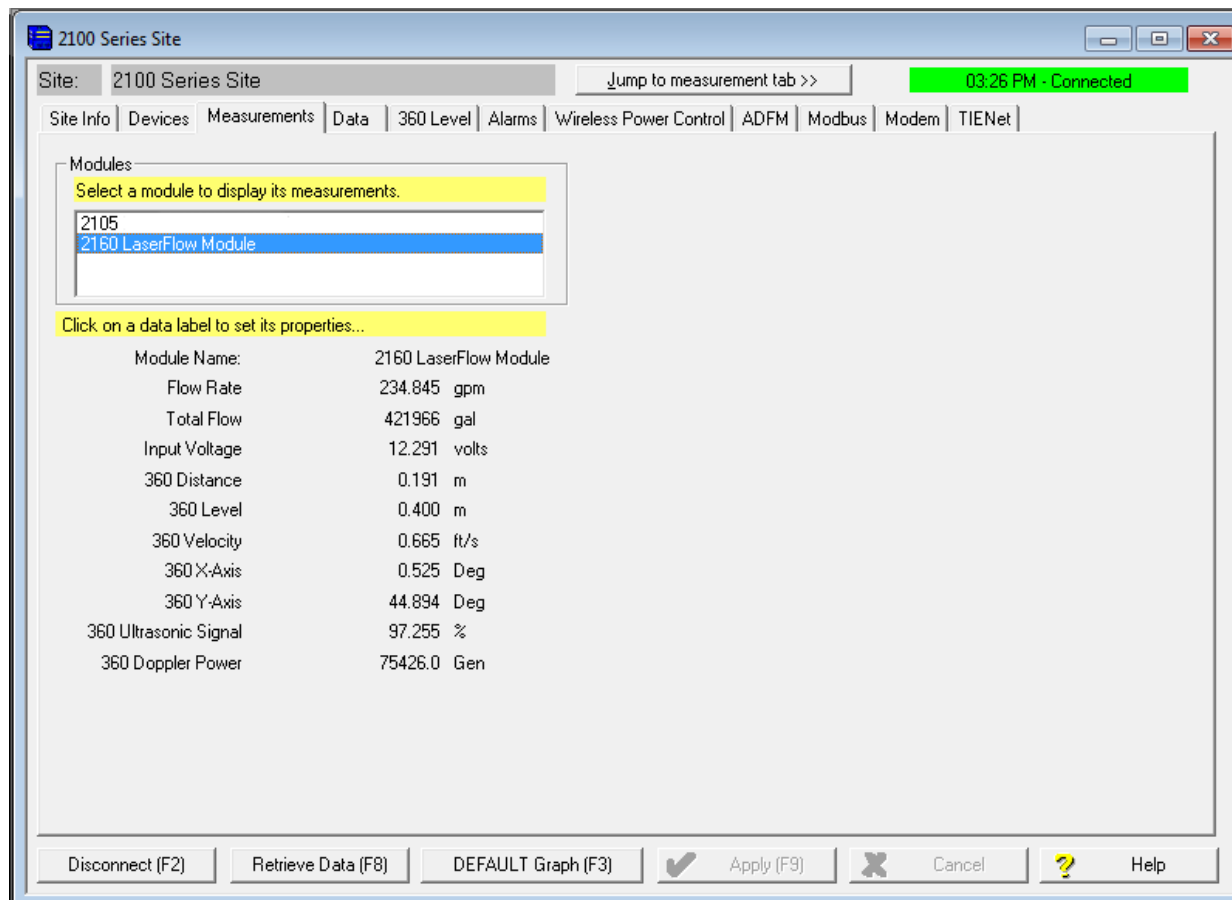


Figure 4-3 Measurements tab: Displays real-time measurements

To select and configure any parameter for your connected devices, click the “**Jump to measurement tab**” button at the top of the Site window and hover over the 2160 LaserFlow Module. If your system includes the optional submerged functionality for redundant measurement, additional parameters may appear for the connected TIENet 350 Area Velocity sensor. Explanations for the listed measurements are provided in Figure 4-4.

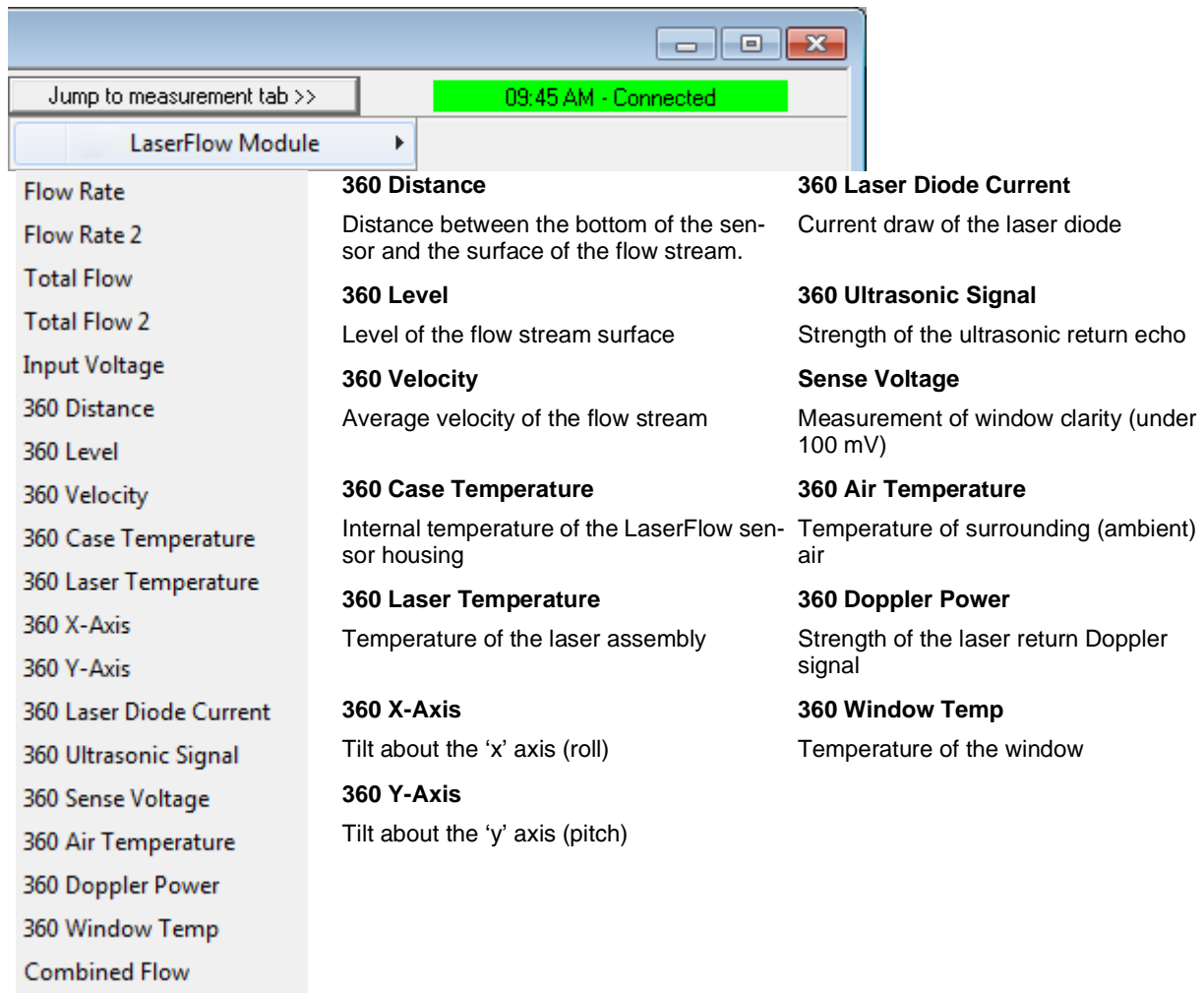


Figure 4-4 Drop down list of measurements for 2160 Module

Click on any parameter on the Measurements tab or in the Jump to Measurements tab list to open a dedicated tab to view details or set up data storage.

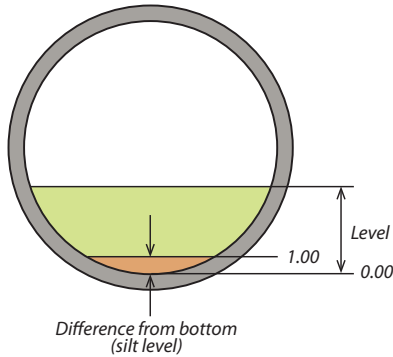
To prevent a parameter from being displayed on the Measurements tab, select the **Hide in Measurements** box.

The settings for level and velocity input are defined on their respective tabs in Flowlink. To save any changes made to the settings, click the “**Apply**” button.



#### 4.2.1 360 Level

##### *Ultrasonic Level Adjustment*



The **Measurement** field displays the most recent level reading. Once the LaserFlow sensor is installed over the flow stream, measure the present liquid level from the bottom of the channel (if there is a difference between the bottom of the channel and zero level, save this value for reference in flow calculation). Enter this value in the Adjust level field. After the “**Apply**” button is clicked, the level you entered will appear in the Measurement field.

#### **Note**

Level adjustment of a newly installed and activated sensor should be performed only after the sensor is allowed to stabilize under site conditions (allow approximately one hour per 10 °F difference between storage and operating environments).

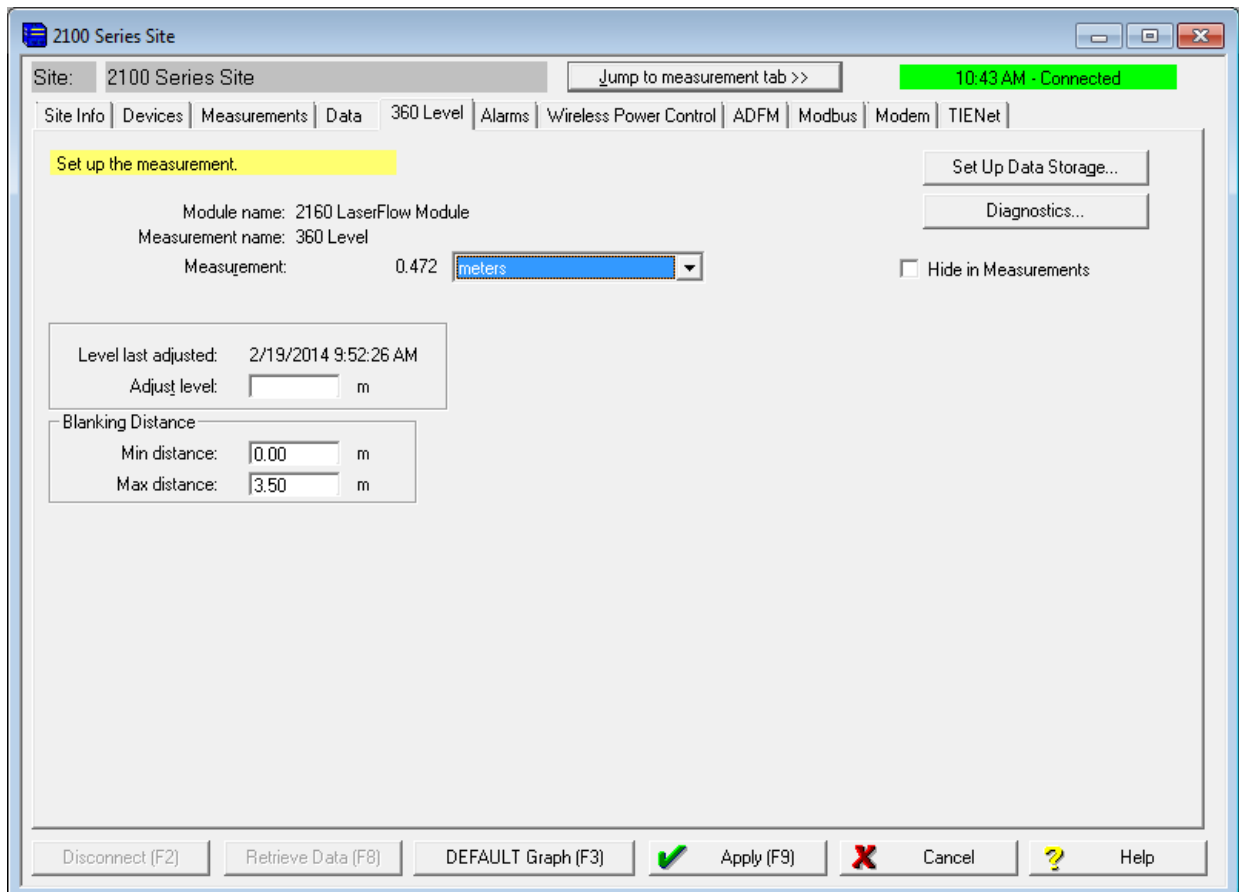


Figure 4-5 360 Level Measurement tab in Flowlink

The **Minimum Blanking Distance** is the distance from the bottom of the sensor to the liquid surface at the highest expected level. Depending on the elevation of the sensor, this value may be increased to help ensure that echoes read by the flow meter come only from the surface of the flow stream, and not off the walls or sides of the channel.

The **Maximum Blanking Distance** is the distance between the bottom of the sensor and the bottom of the channel (i.e., zero level). A larger value than calculated can be entered.

If using the LaserFlow module with the 310 remote ultrasonic sensor and horizontal sensor mounting bracket, the maximum blanking distance is the distance between the bottom of the mounting bracket and the bottom of the channel.

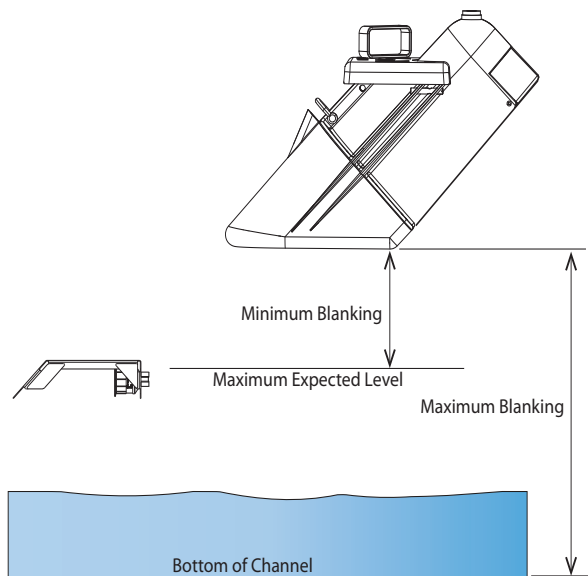


Figure 4-6 Blanking distance for LaserFlow with built-in sensor or 310 remote ultrasonic sensor

#### 4.2.2 360 Velocity

The 360 Velocity measurement tab has a grid containing 15 possible measurement points. The measurement points are activated and deactivated by selecting or deselecting the appropriate check box. To save the measurement settings, click the “**Apply**” button (F9).

As the LaserFlow begins to take readings, the grid becomes populated with a velocity reading and time stamp for each active measurement point (points where a valid reading could not be obtained will display the word “invalid”).

Prior to operation, the LaserFlow sensor must be set up for measurement using the 360 Velocity grid. Refer to Section 4.3 *Sensor Positioning and Adjustment*

When the **Positive Velocity** option is “true”, the LaserFlow will not attempt to determine flow direction and negative readings are discarded in the average velocity calculation. Selecting this setting will save power. The default is “true”.

When the Positive Velocity option is “false”, a second velocity measurement is taken to determine the direction of the flow.

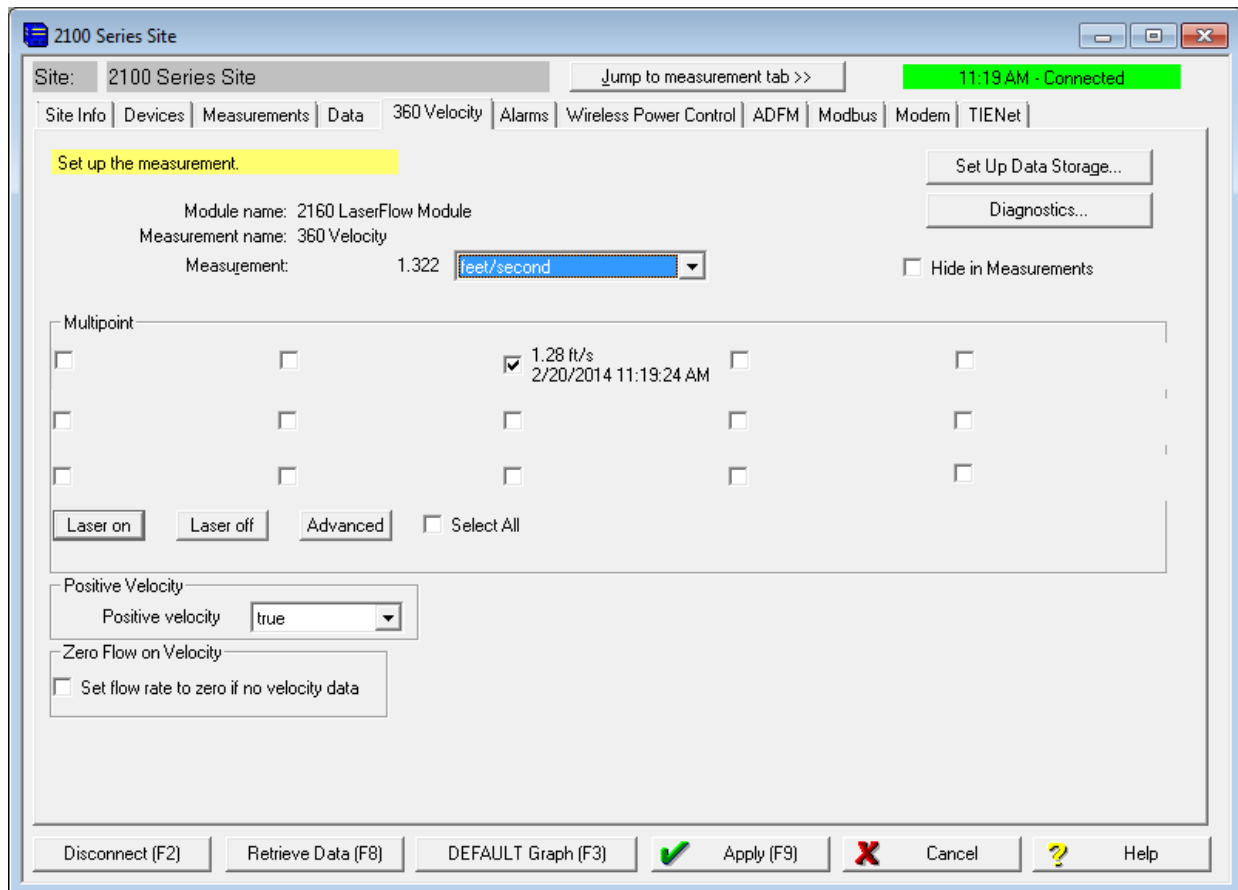


Figure 4-7 360 Velocity Measurement tab in Flowlink

### 4.2.3 Advanced Settings

The LaserFlow Advanced Settings are pre-programmed into the sensor. However, if your application requires the any custom configuration, the “**Advanced**” button opens the Velocity Coefficients window (refer to Figure 4-8).

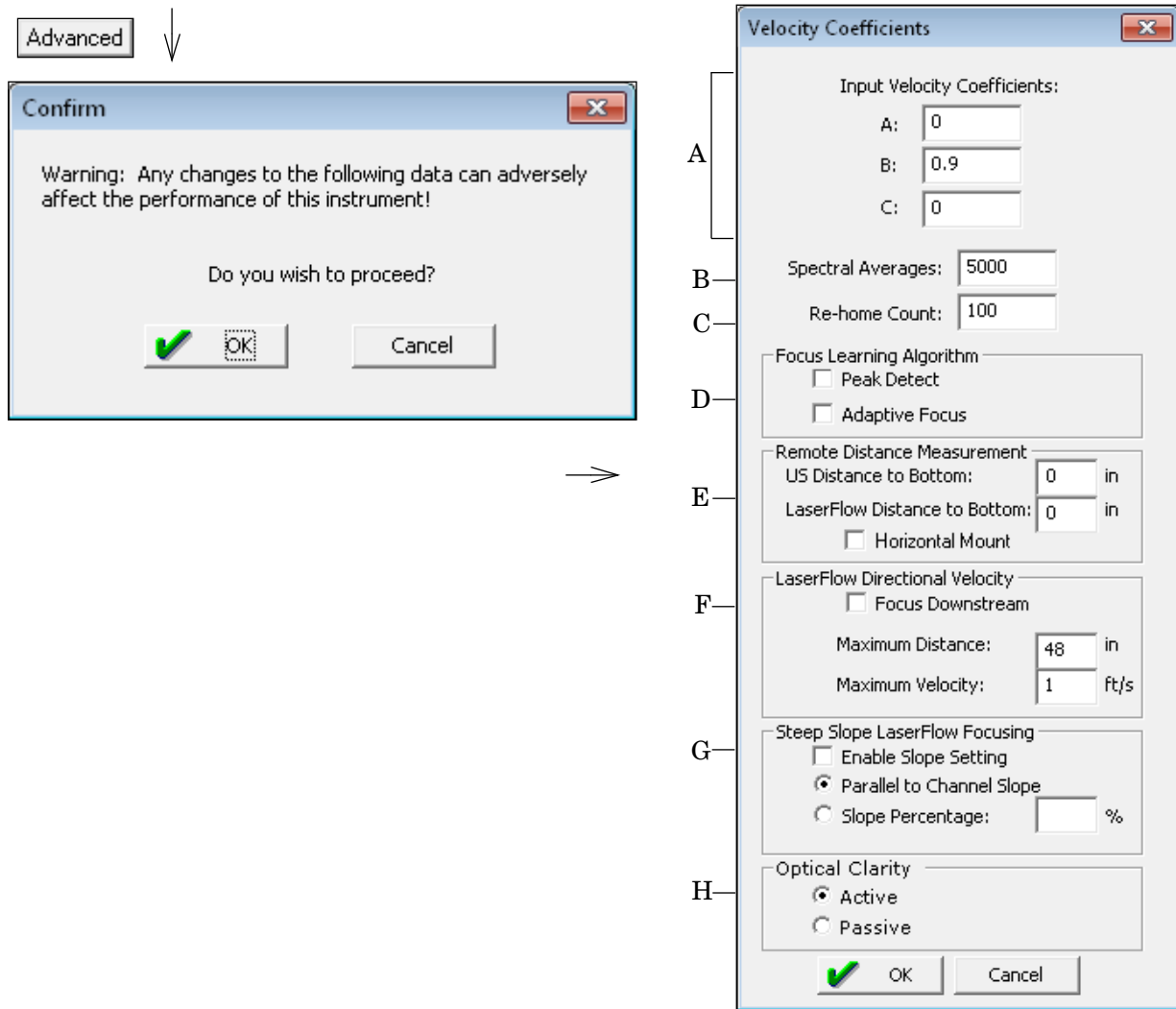
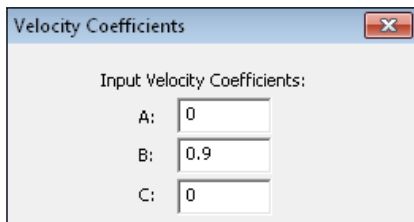


Figure 4-8 360 Velocity Tab: Advanced settings



A - Input Velocity Coefficients

**Input Velocity Coefficients** – The relationship of the three Input Velocity Coefficients A, B and C can be expressed as:

$$\bar{V} = A (\text{offset}) + B * (\text{Measured Velocity}) + C * (\text{Measured Velocity})^2$$

Coefficient A is an additive offset value to correct the Measured Velocity for any additive bias. The value for A must be expressed in units of meters/second. The default is “0”.

Coefficient B is a multiplicative scalar for correcting the Measured Velocity for any linear multiplicative bias. The value for B is unitless. The default is “0.9”.

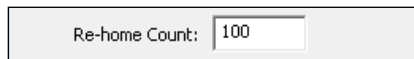
Coefficient C is another scalar to correct the Measured Velocity for any nonlinear bias. The value for C must be expressed in units of seconds/meter, so that the resulting value for the Reported Velocity Reading will be in units of meters/second. The default is “0”.



Spectral Averages: 5000

*B - Spectral Averages*

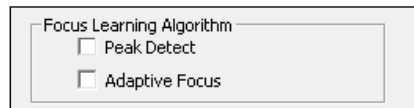
**Spectral Averages** – The value for Spectral Averages may be used to reduce noise and improve signal strength. The default is “5000”. If persistent low signal strength or velocity dropouts are indicated, enter a high value, such as 10000. If signal quality and measurement improve, try entering a lower value, such as 7500, observing the signal quality. The lower the value for Spectral Average, the less time required for each complete measurement, reducing power usage. Adjust the value to determine a number that balances power usage with satisfactory signal quality and readings.



Re-home Count: 100

*C - Re-home Count*

**Re-home Count** – For testing purposes only. For more information, contact Environmental Products Support.

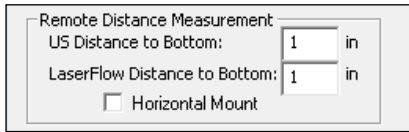


Focus Learning Algorithm  
 Peak Detect  
 Adaptive Focus

*D - Focus Learning Algorithm*

**Focus Learning Algorithm** – The Peak Detect function scans across the user-defined row to locate the peak velocity. To enable Peak Detect functionality, select the “**Peak Detect**” check box.

Adaptive Focus enables the LaserFlow module to scan above and below the standard focus point, then adjust the focus to the point with the best signal strength. To enable Adaptive Focus functionality, select the “**Adaptive Focus**” check box.



*E - Remote Distance Measurement*

**Remote Distance Measurement** – The Remote Distance Measurement options are active only when the LaserFlow module is connected to the TIENet 310 remote ultrasonic sensor.

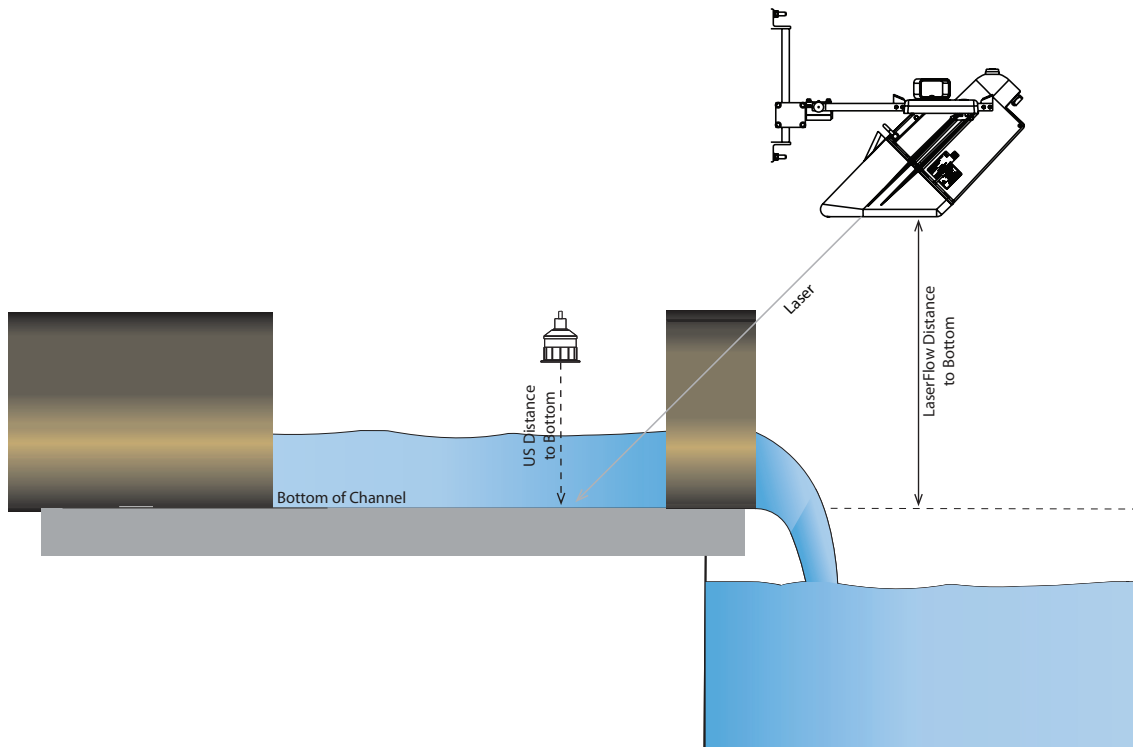
The **US Distance to Bottom** is the distance (e.g., inches) from the 310 remote ultrasonic sensor to the bottom of the channel. See Figure 4-9. Units of measurement are based on user settings.

**Note**

When using the horizontal sensor mount bracket, the US Distance to Bottom is measured from the bottom of the horizontal sensor mount bracket to the bottom of the channel. See Figure 4-10.

The **LaserFlow Distance to Bottom** is the distance (e.g., inches) from the bottom of the LaserFlow sensor the bottom of the channel. Units of measurement are based on user settings.

Select the “**Horizontal Mount**” check box if using the optional horizontal sensor mount bracket. See Figure 4-10.



*Figure 4-9 . Remote distance measurement with the 310 remote ultrasonic sensor*

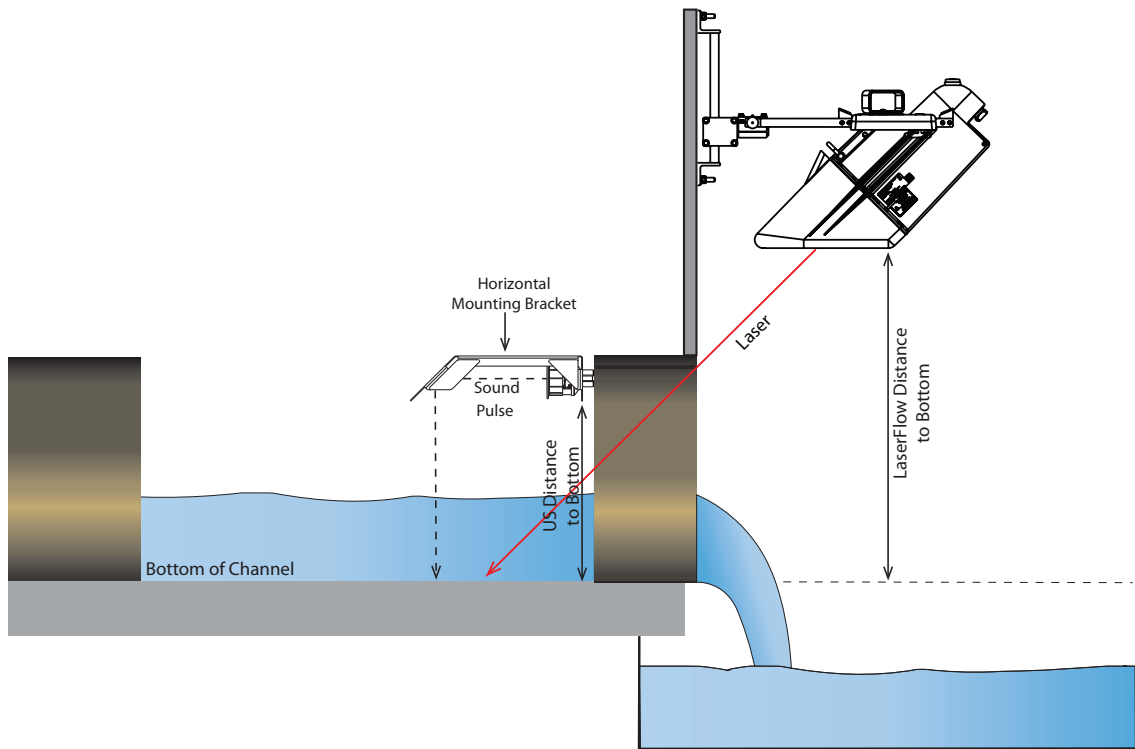
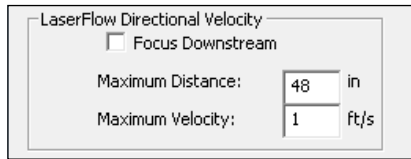
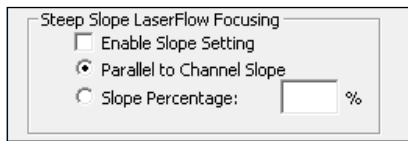


Figure 4-10 Remote distance measurement with the 310 remote ultrasonic sensor and horizontal sensor mount bracket



*F - LaserFlow Directional Velocity*



*G - Steep Slope LaserFlow Focusing*

**LaserFlow Directional Velocity** – The LaserFlow Directional Velocity options are active only when the Positive Velocity option is “false”.

Select the “**Focus Downstream**” check box when the LaserFlow sensor is pointed downstream.

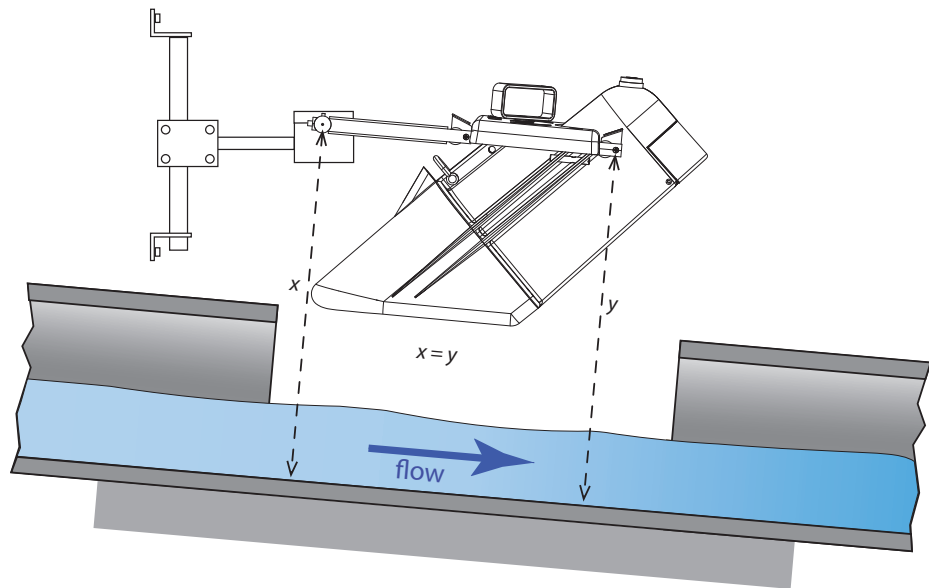
The **Maximum Distance** is the greatest distance (e.g., inches) the LaserFlow sensor will take a directional velocity reading. The default is “48”. Units of measurement are based on user settings.

The **Maximum Velocity** is the greatest velocity (e.g., ft/s) the LaserFlow sensor will take a directional velocity reading. The default is “1”. Units of measurement are based on user settings.

**Steep Slope LaserFlow Focusing** – If the sensor is on a slope greater than 1%, select the “**Enable Slope Setting**” check box. By default, this option is disabled.

If the sensor is parallel to the channel slope, select “**Parallel to Channel Slope**”. Measure from the front of the sensor carrier to the bottom of the channel. Then measure from the back of the sensor carrier to the bottom of the channel. Ensure the distance is equal. Adjust the sensor carrier as necessary. See Figure 4-11. By default, this option is enabled.

If the slope of the pipe is known, mount the sensor level with the Earth, using the bubble level mounted on the top of the sensor and then enter the **Slope Percentage** in the field. See Figure 4-12. By default, this option is disabled.



*Figure 4-11 LaserFlow placement using Parallel to Channel Slope option*



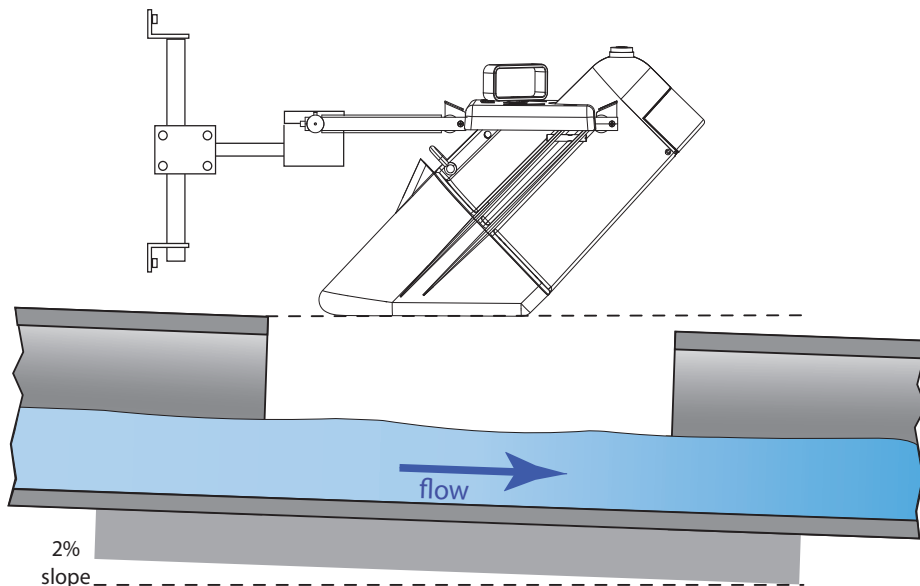
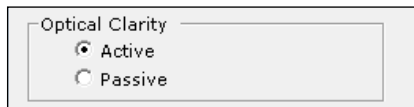


Figure 4-12 LaserFlow placement using Slope Percentage option



H - Optical Clarity

**Optical Clarity** – Sense voltage detects fog on the window of the LaserFlow sensor. When the sense voltage is greater than 100 mV, the defogger is activated. The defogger is enabled from 1 to 5 minutes, depending on the severity of the fog.

**Note**

In locations with severe fogging potential, Teledyne ISCO recommends increasing battery capacity or monitoring the site more frequently.

To enable Optical Clarity, click “**Active**”. To disable Optical Clarity, click “**Passive**”. The default is “Active”.

**Table 4-1 Default Advanced Settings**

<b>LaserFlow Hardware Revisions</b>				
	<b>A2</b>	<b>C2</b>	<b>C6</b>	<b>X0</b>
<b>Input Velocity Coefficients:</b>				
A:	0.0	0.0	0.0	0.0
B:	0.9	0.9	0.9	0.9
C:	0.0	0.0	0.0	0.0
Spectral Averages:	5,000	5,000	5,000	5,000
Re-home Count:	100	100	100	100
Start Bin:	15	7	7	7
Stop Bin:	1,020	1,020	1,020	1,020
Max Focus Depth:	0.1524 m	0.1524 m	0.1524 m	0.1524 m
Min Doppler Power:	1,000	1,000	1,000	1,000
<b>Focus Learning Algorithm</b>				
Peak Detect	Un-checked	Un-checked	Un-checked	Un-checked
Adaptive Focus	Un-checked	Un-checked	Un-checked	Un-checked
<b>Remote Distance Measurement</b>				
US Distance to Bottom	N/A	N/A	0.0 m	0.29765 m <sup>note 1</sup>
LaserFlow Distance to Bottom	N/A	N/A	0.0 m	0.0 m
Horizontal Mount	N/A	N/A	Un-checked	Un-checked
<b>LaserFlow Directional Velocity</b>				
Focus Downstream	Un-checked	Un-checked	Un-checked	Un-checked
Maximum Distance	1.2192 m	1.2192 m	1.2192 m	1.2192 m
Maximum Velocity	0.3048 m/s	0.3048 m/s	0.3048 m/s	0.3048 m/s
<b>Steep Slope LaserFlow Focusing</b>				
Enable Slope Setting	Un-checked	Un-checked	Un-checked	Un-checked
Parallel to Channel Slope	Checked	Checked	Checked	Checked
Slope Percentage	Un-checked	Un-checked	Un-checked	Un-checked
<b>Optical Clarity</b>				
Active	Checked	Checked	Checked	Checked
Passive	Un-checked	Un-checked	Un-checked	Un-checked

*Note 1 –If the LaserFlow Ex was used in a remote ultrasonic configuration and now will be used in the built in configuration, set the US Distance to Bottom value to 0.29765 m and the LaserFlow Distance to Bottom to zero.*

#### 4.2.4 350 Level (Optional)

If your system includes the optional surcharge sensor, it is also capable of measuring level with a pressure differential transducer. To set an initial or new level, enter the value in the **Adjust level** field. After you click Apply, the level you entered will appear in the Measurement field.

During setup for the optional surcharge functionality, measure the distance from the bottom of the channel to the bottom of the LaserFlow to set the initial level reading. Refer to Figure 4-14.

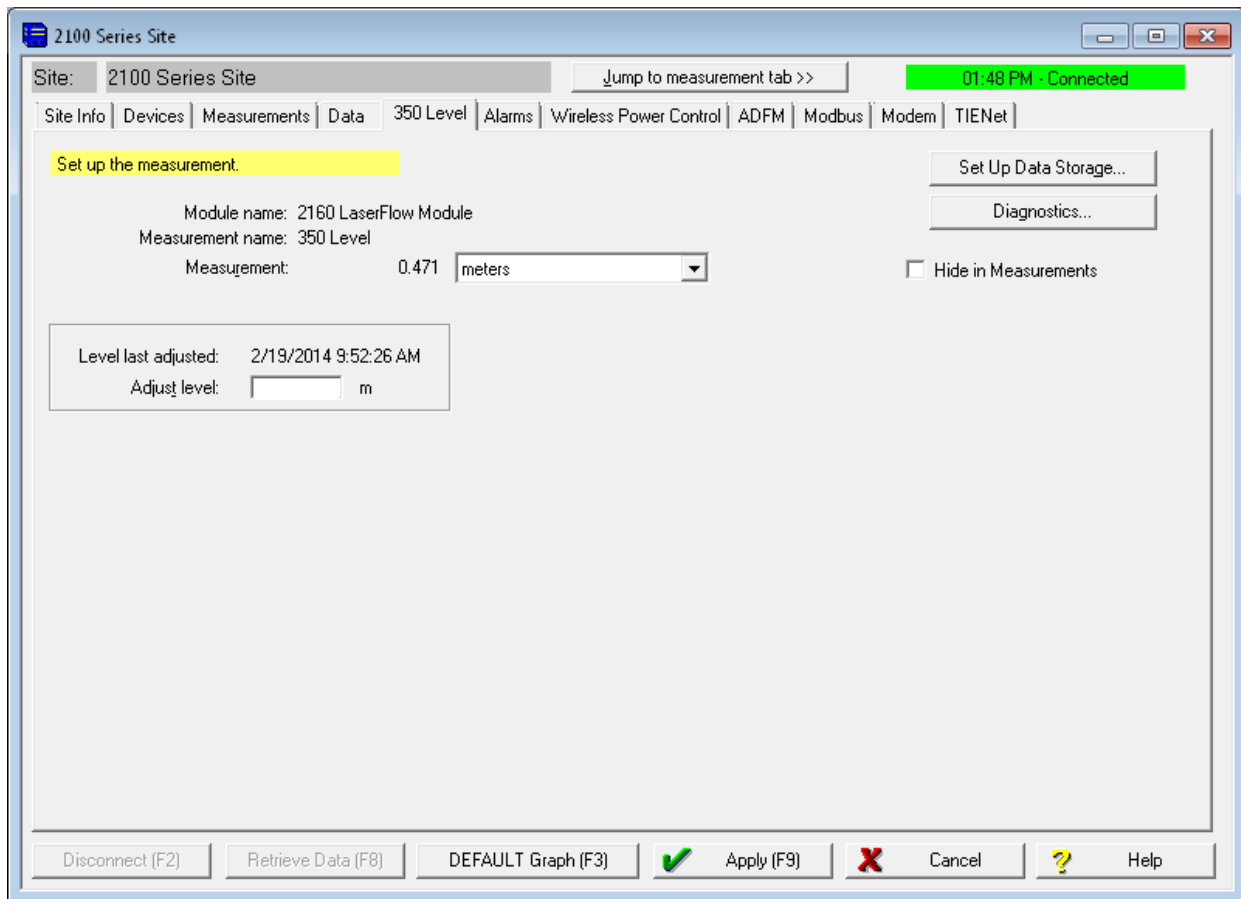


Figure 4-13 350 Level Measurement tab in Flowlink

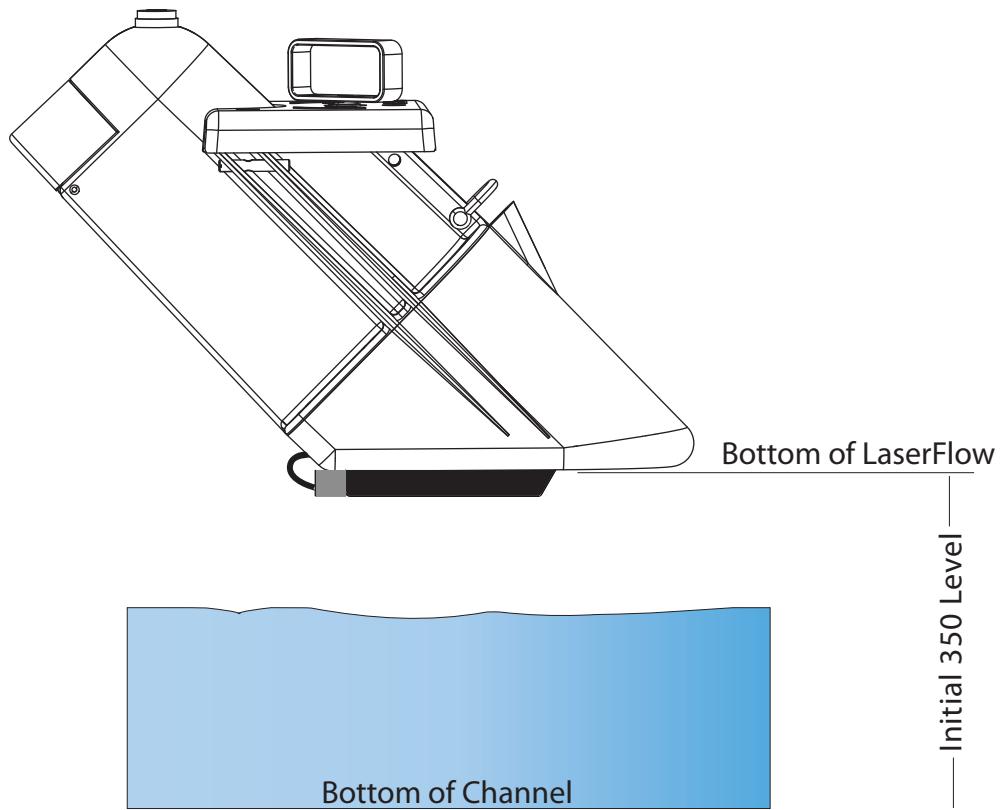


Figure 4-14 Submerged functionality: Initial 350 Level setting

*Surcharge alarming*

It is recommended that the variable data storage rate function be used to trigger 350 velocity and level measurement based on a Level threshold.

Alarm setup and activation are explained in the Flowlink software user manual and help windows, under Equation Builder, Condition Builder, and Threshold.

**4.2.5 350 Velocity (Optional)** If your system includes the optional submerged functionality or redundant measurement, it is also capable of measuring velocity with a continuous wave Doppler sensor.

In the case of the submerged functionality, measure the distance between the bottom of the channel and the face of the pressure transducer (bottom of the LaserFlow) to obtain the initial value for 350 Level.

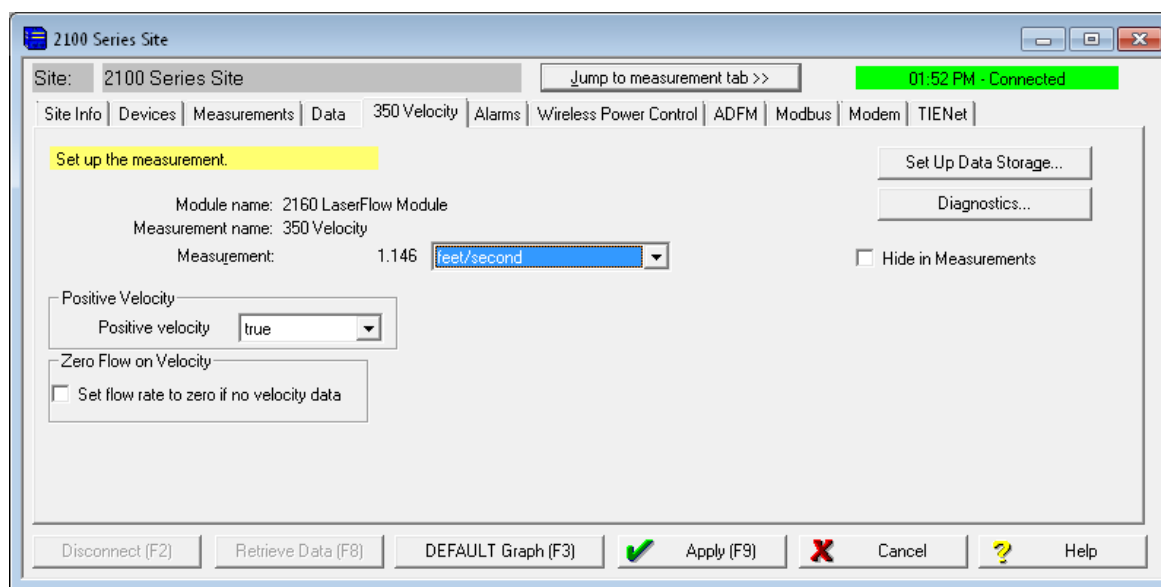


Figure 4-15 350 Velocity Measurement tab in Flowlink

The **Positive Velocity** setting, when set to “true”, the LaserFlow will not attempt to determine flow direction and negative readings are discarded in the average velocity calculation. Selecting this setting will save power. This setting is set to “true” by default.

The **350 Advanced Settings** are pre-programmed into the sensor. However, if your application requires the addition of any correction factors, the Advanced button opens the Advanced settings window (refer to Figure 4-16).

Input velocity coefficients can be adjusted for A, B, and C, where:

$$\bar{V} = A (\text{offset}) + B * (\text{Measured Velocity}) + C * (\text{Measured Velocity})^2$$

Coefficient A is an additive offset value to correct the Measured Velocity for any additive bias. The value for A must be expressed in units of meters/second.

Coefficient B is a multiplicative scalar for correcting the Measured Velocity for any linear multiplicative bias. The value for B is unitless.

Coefficient C is another scalar to correct the Measured Velocity for any nonlinear bias. The value for C must be expressed in units of seconds/meter, so that the resulting value for the Reported Velocity Reading will be in units of meters/second.

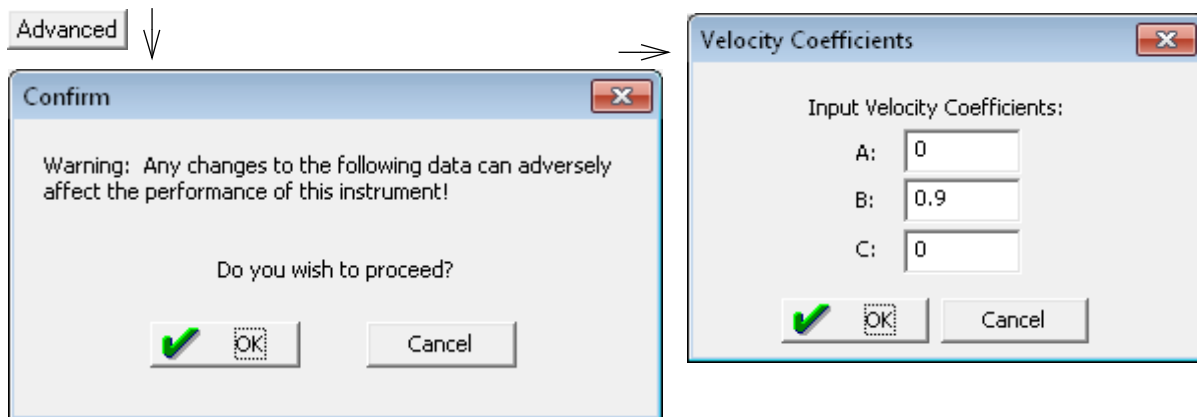
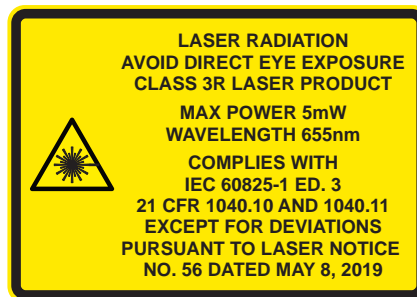


Figure 4-16 350 Velocity tab: Advanced settings for optional TIENet 350 AV sensor

### 4.3 Sensor Positioning and Adjustment

To set the initial level values, refer to Sections 4.2.1 (LaserFlow) and 4.2.4 (optional 350).



#### 4.3.1 Centering the LaserFlow Sensor

*Laser on*

Proper positioning of the LaserFlow sensor is critical for optimal velocity measurement. In center position, the laser beam must strike the flow stream precisely in the center.

The beam automatically moves to the top center position.

Select the “**Laser on**” button and click the “**Apply**” button. This will keep the laser beam on continuously for 10 minutes or until the “**Laser off**” button is clicked, allowing the beam to be used for fine-tuning the sensor’s position.

**Note**

When sensor positioning is completed, securely tighten all mounting hardware.

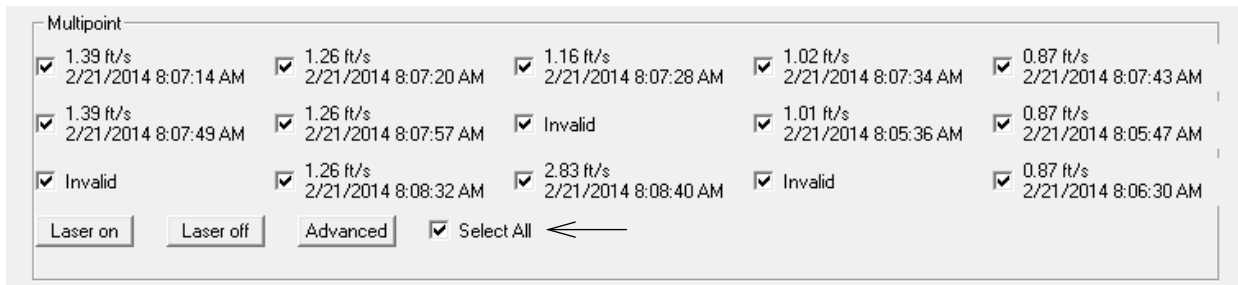
### 4.3.2 Laser Velocity Measurement Point Selection

Once the LaserFlow sensor is installed over the flow stream, some installations may only require the center laser position for velocity measurement.

For installations requiring multiple measurement points, determine which points will be used. To do so, activate all 15 points and wait for all of them to display their readings. This process may take up to 15 minutes.

Each point will display a velocity reading and time stamp, or “Invalid.” Deselect “Invalid” and undesired points. The fewer points selected, the less time required to complete one velocity measurement.

Select the “**Select All**” check box to activate all 15 points, then click the “**Apply**” button.



Deselect “Invalid” and undesired points, then click the “**Apply**” button.

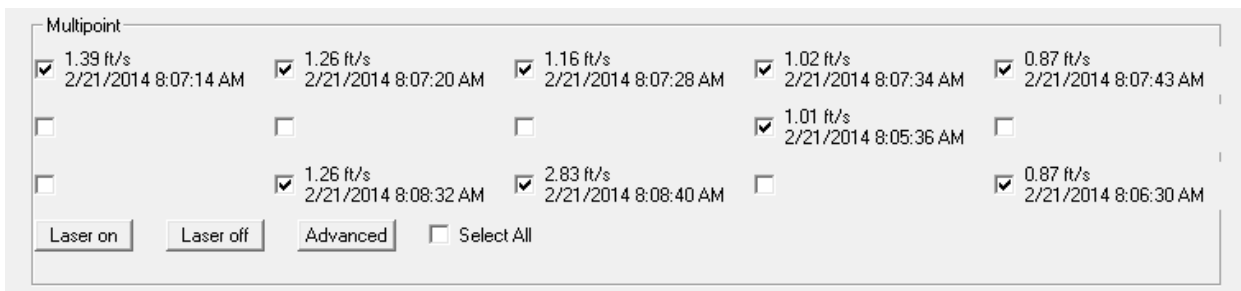


Figure 4-17 Selection of velocity measurement points





# TIENet® 360 LaserFlow® Velocity Sensor

## Section 5 Maintenance and Optional Kits

### 5.1 Maintenance

The following tables are recommended maintenance checks to ensure proper operation. As site conditions may vary, increase the frequency of inspections as needed.

**Table 5-1 Recommended Maintenance (Accessible Locations)**

Action	Recommended Frequency	Location
Check Ultrasonic level sensor (built-in or remote) for obstructions (e.g., spider webs, debris)	Monthly	On-site
Check Horn for obstructions (e.g., spider webs, debris)	Monthly	On-site
Check 350 Area Velocity sensor (if applicable) for debris	Monthly or following surcharge event	On-site
Ensure suitable alignment - check x-axis (roll) and y-axis (pitch)	Weekly	Via Flowlink application or Signature flow meter
Check Doppler Power and assess historical trend	Weekly	Via Flowlink application or Signature flow meter
Check Ultrasonic Signal and assess historical trend	Weekly	Via Flowlink application or Signature flow meter

**Table 5-2 Recommended Maintenance (Difficult-to-Access Locations)**

Action	Recommended Frequency	Location
Check Ultrasonic level sensor (built-in or remote) for obstructions (e.g., spider webs, debris)	Every 6 months or following surcharge event	On-site
Check Horn for obstructions (e.g., spider webs, debris)	Every 6 months or following surcharge event	On-site
Check 350 Area Velocity sensor (if applicable) for debris	Every 6 months or following surcharge event	On-site
Ensure suitable alignment - check x-axis (roll) and y-axis (pitch)	Weekly	Via Flowlink application or Signature flow meter
Check Doppler Power and assess historical trend	Weekly	Via Flowlink application or Signature flow meter
Check Ultrasonic Signal and assess historical trend	Weekly	Via Flowlink application or Signature flow meter

## 5.2 Firmware Updates

When firmware updates become available, they can be downloaded from [www.teledyneisco.com](http://www.teledyneisco.com) or via email from the factory.

### 5.2.1 With Signature Flow Meter

The TIENet device's firmware is updated via the USB port on the front panel of the Signature Flow Meter. Step-by-step instructions for updating the firmware can be found in Section 2 of the Signature user manual.

### 5.2.2 With 2160 LaserFlow Module

The TIENet device's firmware is updated via the "Update ISCO Instrument Software" tool from Flowlink for the 2160 module. Step-by-step instructions for updating the firmware can be found in the Help text of the update application.

## 5.3 Cleaning the Sensor Housing

The LaserFlow sensor's outer housing and ultrasonic transducer can be cleaned with warm water, mild soap, and a soft, lint-free cloth. Do not spray water on the laser window; install the protective window cap prior to cleaning.

 **CAUTION**

Never use ordinary cloth or abrasives to clean the LaserFlow.

 **CAUTION**

Be sure the protective window cap is installed during cleaning, storage, or shipment (refer to Section 1.7.1).

## 5.4 Accessing the LaserFlow's Nose Piece

Several procedures for maintenance and options require accessing the interior of the sensor by separating the nose piece from the body, and subsequent reassembly. Refer back to this section when performing these procedures.

 **WARNING**

**Disconnect power from the LaserFlow sensor before opening the sensor housing.**

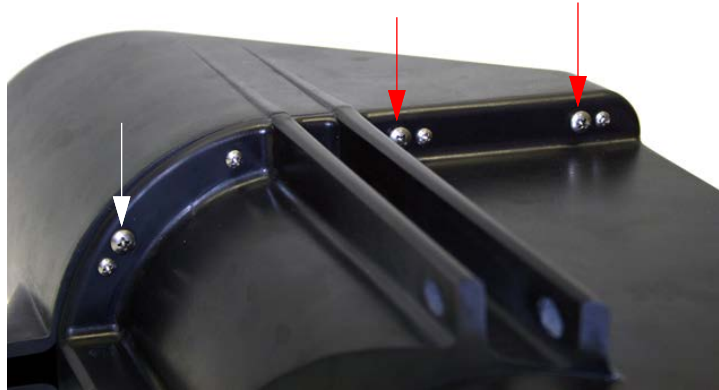
### *Tools required*

- #2 Phillips straight screwdriver less than 4" (right-angled if available)

#### 5.4.1 Removing the Nose Piece

The screws that attach the nose piece to the body are difficult to access with a straight screwdriver, being somewhat obstructed by the mounting block.

1. Remove the 6 large Phillips screws on the LaserFlow nose piece, and separate the nose from the body. **Do not remove any other screws.**



*Figure 5-1 Remove large screws and nose piece (3 on each side)*

#### 5.4.2 Replacing the Nose Piece

1. Fasten the sensor back together by cross-tightening the 6 large Phillips screws in diagonal order until the two sections are flush against each other.

 **CAUTION**

When reinstalling all self-tapping screws, avoid destroying the plastic threads. First seat each screw in its hole and, without pressing down, rotate the screw counter-clockwise until it falls into its thread groove with a "click". Then tighten the screw.

2. If applicable, reinstall the mounting block, ensuring that both flat and split washers are included.

Side cross-pin  
(1 of 2)



Center cross-pin



Figure 5-2 Location and orientation of cross-pins for mounting block installation

## 5.5 Velocity Readings and the Laser Window

Invalid or inconsistent velocity readings may indicate debris or moisture condensation on the window protecting the laser.

The laser window is crucial for focusing and should never be touched. Smudging or scratches can degrade the performance of the sensor. **For these reasons, cleaning the window is NOT recommended unless absolutely necessary.**

If cleaning must be performed, follow the instructions provided in Section 5.6 exactly.

## 5.6 Cleaning the Laser Window

The laser window is crucial for focusing and should never be touched. Smudging or scratches can degrade the performance of the sensor. **For these reasons, cleaning the window is NOT recommended unless absolutely necessary.**

### CAUTION

Never touch the laser window. Never use ordinary cloth or water to clean the surface of the laser window.

#### *Items required for cleaning*

- Pre-packaged, pre-IPA-moistened, single-use, lint-free tissue, such as Zeiss Lens Cleaning Wipes or Bausch & Lomb Sight Savers®<sup>1</sup> Pre-Moistened Lens Cleaning Tissues.
- Kimwipes®<sup>2</sup> dry tissues
- Rain-X®<sup>3</sup> Original Glass Treatment

### CAUTION

Never moisten the tissue with IPA or other solution *after* removing it from its package.

#### *Procedure*

You must access the LaserFlow's interior to clean the window. Instructions for opening and reassembling the LaserFlow are provided in Section 5.4 *Accessing the LaserFlow's Nose Piece*.

### WARNING

**Disconnect power from the LaserFlow sensor before opening the sensor housing.**

### CAUTION

Do not attempt to clean the laser window without opening the sensor housing. Serious damage can result.

1. Sight Savers® is a registered trademark of Bausch & Lomb, Inc.
2. Kimwipes® is a registered trademark of Kimberly-Clark Corporation.
3. Rain-X® is a registered trademark of Illinois Tool Works, Inc.

1. Remove the folded tissue from its package and use the corners to lightly brush any abrasive material from the surface.
2. Unfold the tissue and gently clean the surface with downward strokes only, **keeping the tissue between your finger and the glass at all times.**
3. Examine the window closely under good lighting from all directions to ensure there are no smudges, streaks, or film on the surface.  
If the window is smudged, streaked, or still dirty, get a fresh pre-packaged tissue and repeat.
4. Next, fold a clean, dry Kimwipe tissue four times to reinforce its thickness, and gently clean the window surface with downward strokes only, **keeping the tissue between your finger and the glass at all times.**
5. Examine the window closely under good lighting from all directions to ensure there are no smudges, streaks, or film on the surface.  
If the window is smudged, streaked, or still dirty, get a fresh pre-packaged tissue and repeat.
6. Fold a fresh Kimwipe tissue as previously described and spray the closed end of it with Rain-X.

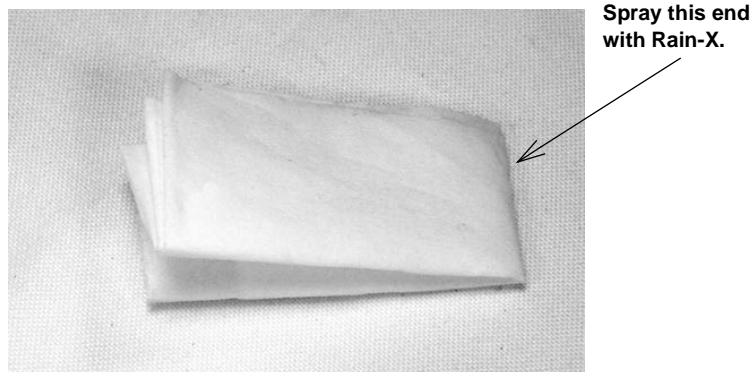


Figure 5-3 Cleaning the laser window: Moisten Kimwipe tissue w/ Rain-X

7. Apply the Rain-X to the entire window surface using downward strokes only.
8. After allowing 30 minutes for the Rain-X treatment to dry, wipe the window with another dry Kimwipe tissue, as described in step 4.
9. Carefully examine the window as previously described, and continue polishing the surface with fresh dry tissues until no streaks or film are visible.

Reassemble the sensor, following the steps provided in Section 5.4.2 *Replacing the Nose Piece.*

## 5.7 Installing the Optional Submerged Measurement Kit

The submerged functionality consists of a TIENet 350 Area Velocity sensor mounted on the bottom of the LaserFlow sensor. This option is normally pre-assembled and installed at the factory before shipment. However, it can also be installed by the user in existing systems.

### *Tools Required*

To install the submerged measurement kit, you will need:

- Integrated 350 Kit from Teledyne ISCO
  - TIENet 350 AV Sensor with 28" cable
  - Sensor mounting plate
  - 2 Flathead screws
  - 2 Lock nuts
  - 2 Flat washers
- 1/4" Nut driver or open wrench

### 5.7.1 Installation Procedure

You must access the LaserFlow's interior to install this option. Instructions for opening and reassembling the LaserFlow are provided in Section 5.4 *Accessing the LaserFlow's Nose Piece*.

 **WARNING**

Disconnect power from the LaserFlow sensor before opening the sensor housing.

 **CAUTION**

NEVER touch the window or get it dirty.



Figure 5-4 350 AV sensor with mounting plate

1. Using the flat washers and lock nuts, attach the mounting plate to the rectangular mounting holes in the bottom of the LaserFlow interior, with the tip of the 350 sensor facing front.



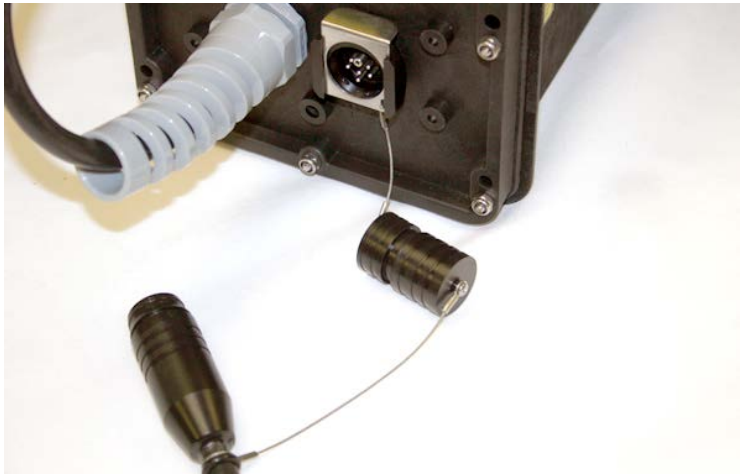
*Figure 5-5 Mounting the integrated 350 AV sensor on the LaserFlow*



2. Prepare the LaserFlow receptacle by removing the cap (press down on the spring release and pull out the cap).



3. Remove the cap from the 350 TIENet plug and push the protective caps of the two sensors together.



4. Aligning the pins on the LaserFlow cable with those in the connector receptacle, push the 350 connector into the receptacle on the inner wall of the LaserFlow until the spring release clicks.



*Figure 5-6 Connecting the 350 AV sensor to the LaserFlow*

5. Route the 350 sensor cable through the slot in the bottom of the nose piece. Route the LaserFlow cable through its slot in the top of the nose piece.  
Taking care not to pinch or bind the cables, bring the two sections of the sensor housing back together.



Figure 5-7 Reassembling the LaserFlow w/ AV sensor installed

6. Reassemble the LaserFlow housing, following the steps provided in Section 5.4.2 *Replacing the Nose Piece*.

 **CAUTION**

When reinstalling all self-tapping screws, avoid destroying the plastic threads. First seat each screw in its hole and, without pressing down, rotate the screw counter-clockwise until it falls into its thread groove with a "click." Then tighten the screw.

### 5.8 Installing the Remote TIENet 310 Ultrasonic Level Sensor

Refer to the TIENet 310 Ultrasonic Level Sensor Installation and Operation Guide for details.

# TIENet® 360 LaserFlow® Velocity Sensor

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## *Appendix A Replacement Parts*

### **A.1 Replacement Parts**

Replacement parts are called out in illustrations in this section. Replacement parts can be purchased by contacting Teledyne ISCO's Customer Service Department.

**Teledyne ISCO**  
Customer Service Department  
P.O. Box 82531  
Lincoln, NE 68501 USA

Phone: (800) 228-4373  
(402) 464-0231  
FAX:(402) 465-3022

E-mail: [isco.orders@Teledyne.com](mailto:isco.orders@Teledyne.com)

## A.2 LaserFlow Sensor

### 360 LaserFlow Sensor Replacement Parts



604367123  
Replacement LaserFlow Mounting  
Handle Kit



609004470  
Replacement Small Parts Package Kit  
for LaserFlow

### Vertical Mounting Bracket Kit



609004471  
Replacement LaserFlow Vertical  
Mounting Components Kit for  
Permanent Wall Mounting



604363104  
Horn used on LaserFlow Sensor (blue)



202100669  
O-Ring (0.699 I.D., 0.079 Cross Section)

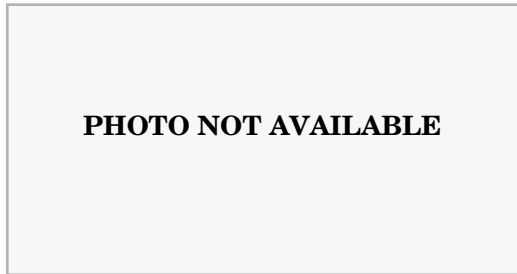


231115921  
Hex Machine Screw  
(1/4-20 x 1-1/4 inch long)

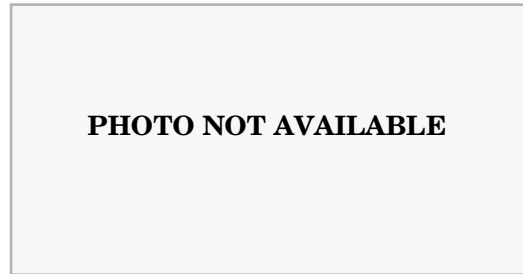


604364037  
Anchor Studs with Lock Washers used on  
LaserFlow Mounting Bracket

### Horizontal Tube Coupler Parts



604363026  
Coupling Tube used on LaserFlow  
Mounting Bracket



604363036  
Extended Coupling Tube used on  
LaserFlow Mounting Bracket

### Horizontal Mount Bracket Parts Kit



609004472  
Replacement LaserFlow Horizontal  
Mounting Components Kit for Permanent  
Wall Mount



231115921  
Hex Machine Screw  
(1/4-20 x 1-1/4 inch long)

### U Tube Mounting Bracket Parts



604364044  
Mounting Alignment Tabs with Hardware  
Kit

**A.3 A.3 Wall Mounting  
Hardware**

**360 LaserFlow Sensor Temporary Mounting Kits**



609004473  
Replacement LaserFlow Temporary  
Mount Cargo Bar Clamp Kit



60-9004-474  
Replacement LaserFlow Temporary  
Mount Kit For U Tube Clamp

## A.4 Temporary Mounting Hardware

### TIENet 360 LaserFlow Sensor with Built-in Ultrasonic

LaserFlow Sensor, 10m Cable w/ TIENet Plug .....	Call Factory
LaserFlow Sensor, 23m Cable w/ TIENet Plug .....	Call Factory
LaserFlow Sensor, 10m Cable w/ TIENet Plug, 350 Surcharge Kit.....	Call Factory
LaserFlow Sensor, 23m Cable w/ TIENet Plug, 350 Surcharge Kit.....	Call Factory
LaserFlow Sensor, 10m Unterminated Cable.....	Call Factory
LaserFlow Sensor, 23m Unterminated Cable.....	Call Factory
LaserFlow Sensor, 10m Unterminated Cable, 350 Surcharge Kit .....	Call Factory
LaserFlow Sensor, 23m Unterminated Cable, 350 Surcharge Kit .....	Call Factory

### Includes TIENet 310 Ultrasonic Level Sensor

LaserFlow Sensor with Remote 310 Ultrasonic, 10m Cable w/ TIENet Plug.....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 23m Cable w/ TIENet Plug.....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 10m Cable w/ TIENet Plug, 350 Surcharge Kit .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 23m Cable w/ TIENet Plug, 350 Surcharge Kit .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 10m Unterminated Cable .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 23m Unterminated Cable .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 10m Unterminated Cable, 350 Surcharge Kit .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 23m Unterminated Cable, 350 Surcharge Kit .....	Call Factory

### Excludes TIENet 310 Ultrasonic Level Sensor

LaserFlow Sensor with Remote 310 Ultrasonic, 10m Cable w/ TIENet Plug .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 23m Cable w/ TIENet Plug .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 10m Cable w/ TIENet Plug, 350 Surcharge Kit .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 23m Cable w/ TIENet Plug, 350 Surcharge Kit .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 10m Unterminated Cable .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 23m Unterminated Cable .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 10m Unterminated Cable, 350 Surcharge Kit .....	Call Factory
LaserFlow Sensor with Remote 310 Ultrasonic, 23m Unterminated Cable, 350 Surcharge Kit .....	Call Factory

## A.5 Sensor Accessories

LaserFlow Sunshade .....	60-4364-080
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# TIENet® 360 LaserFlow® Velocity Sensor

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## *Appendix B Installation Checklist*

### **B.1 Introduction**

This special appendix is to assist you in ensuring that you have all equipment, supplies, and site information readily available prior to going to site for installation.

Print these pages and fill out all relevant information.

Once you have established that all of the items listed here are on hand, take this printout to the site to assist in installation and setup.

**B.2 Equipment and  
Recommended  
Tools**  
Laptop computer

- LaserFlow Sensor
- 2160 Module or Signature Flow Meter
- Flowlink 5.1 Software and Communication Cable
- Power source
- Tape Measure
- Level
- Wall Mount Kit, if mounting on wall
  - o 7/16" Open or Socket Wrench
  - o 9/16" Open or Socket Wrench
  - o Hammer Drill
  - o 3/8" Masonry Bit
  - o Hammer
- Temporary Mount Kit, if application is temporary
  - o 7/16" Open or Socket Wrench
- Optional Sensor Retrieval Tool

**B.3 Site Information**

1. Site Name: \_\_\_\_\_

2. Meter:

- 2160 Module (Serial Number: \_\_\_\_\_)
- Signature Flow Meter (Serial Number: \_\_\_\_\_)
- LaserFlow Sensor (Serial Number: \_\_\_\_\_)
- \_\_\_\_\_

3. Meter Location: \_\_\_\_\_

4. Channel Shape:

- Round
- U-Shaped
- Rectangular
- Trapezoidal
- Elliptical

5. Channel Dimensions:

6. Number of Velocity Points: \_\_\_\_\_

7. Expected Level (m or ft)

Minimum: \_\_\_\_\_

Maximum: \_\_\_\_\_

Average: \_\_\_\_\_

8. Expected Velocity (m/s or ft/s)

Minimum: \_\_\_\_\_

Maximum: \_\_\_\_\_

Average: \_\_\_\_\_

9. Distance between bottom of sensor &  
Maximum Level (m or ft) \_\_\_\_\_

10. Distance between bottom of  
sensor & channel bottom (m or ft): \_\_\_\_\_

11. Direction sensor is facing:

Upstream

Downstream

12. Site IP Address: \_\_\_\_\_

13. Call-In Window

Start: \_\_\_\_\_

Stop: \_\_\_\_\_

14. Server Push Address: \_\_\_\_\_

15. Software Revisions

Flowlink: \_\_\_\_\_ (*Help > About Flowlink*)

LaserFlow: \_\_\_\_\_ (*TIENet / Configure*)

2160: \_\_\_\_\_ (*Device Tab*)

Signature: \_\_\_\_\_ (*Menu > Admin > Display Signature Information*)

16. Data Storage Rate: \_\_\_\_\_

#### B.4 Recommended Essential Parameters

The following basic parameters are used in almost every measurement site.

In the 2160, parameters are activated in the Jump to Measurements tab.

In the Signature, parameters are activated by going to Hardware Setup > Configure Measurements.

360 Distance	360 Level
360 Velocity	360 X-Axis
360 Y-Axis	360 Ultrasonic Signal
360 Doppler Power	360 Case Temperature
360 Air Temperature	Flow Rate

After programming, Retrieve Data to download initial diagnostic data, to verify that this data will be available if/when needed.

#### B.5 Site Conditions

**LaserFlow with Built-in Sensor:** When using the LaserFlow module with the built-in sensor, never install the LaserFlow in a free-flowing outfall or in a drop manhole (see Figure B-1).



*Figure B-1 Do not install LaserFlow with built-in sensor in a free-flowing outfall or in a drop manhole.*

**LaserFlow with Remote Ultrasonic Sensor:** When using the LaserFlow module with the remote ultrasonic sensor, the LaserFlow sensor can be installed in a free-flowing outfall or in a drop manhole.

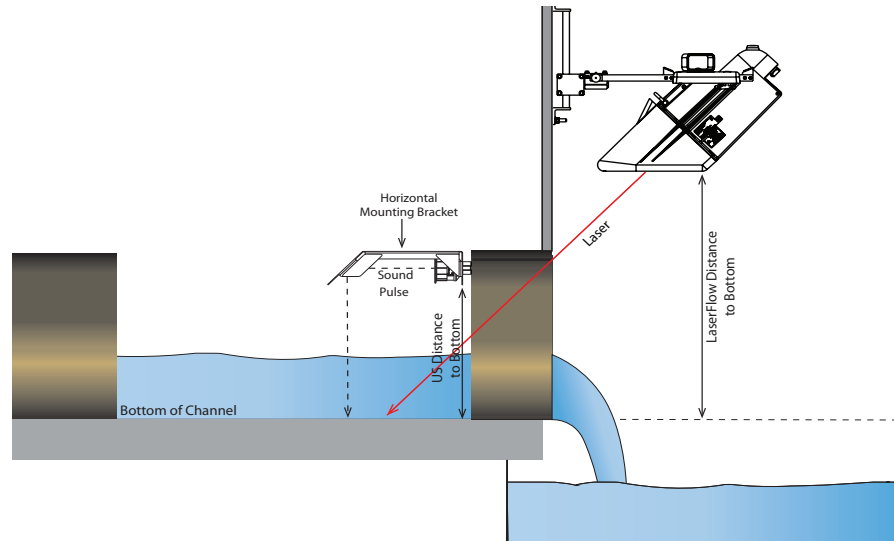


Figure B-2 Correct setup when using the LaserFlow module with remote ultrasonic sensor and horizontal mount bracket

**Stream Level –** The stream level should be the same at both the laser and ultrasonic measuring points.

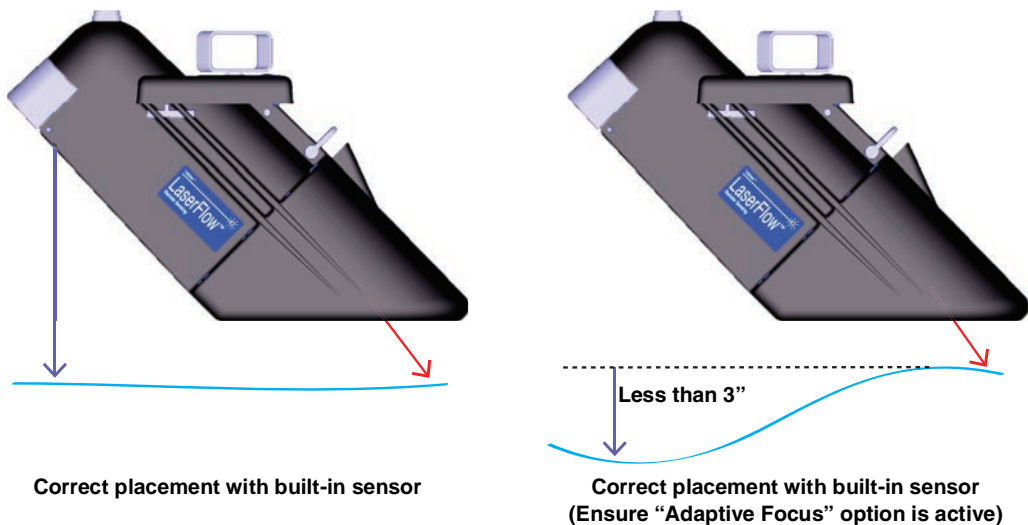


Figure B-3 Placement of LaserFlow with built-in sensor

**Note**

If the stream level is less than 3" (7.62 cm) when using the LaserFlow with built-in sensor, ensure the Adaptive Focus option is active. Refer to Section 4.2.3 for details.

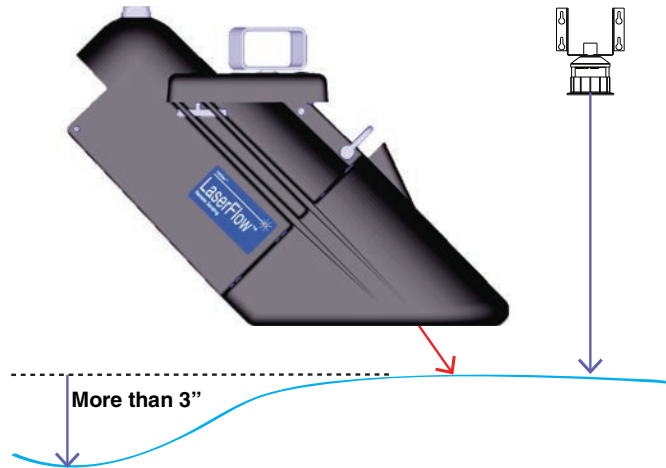


Figure B-4 Placement of LaserFlow with remote ultrasonic sensor

**Note**

If the laser and ultrasonic measuring points differ at the stream level by more than 3" (7.62 cm), the remote ultrasonic sensor must be used. Refer to Section 4.2.3 for details.

**Foam or Steam** – Never install the LaserFlow over foam or steam.

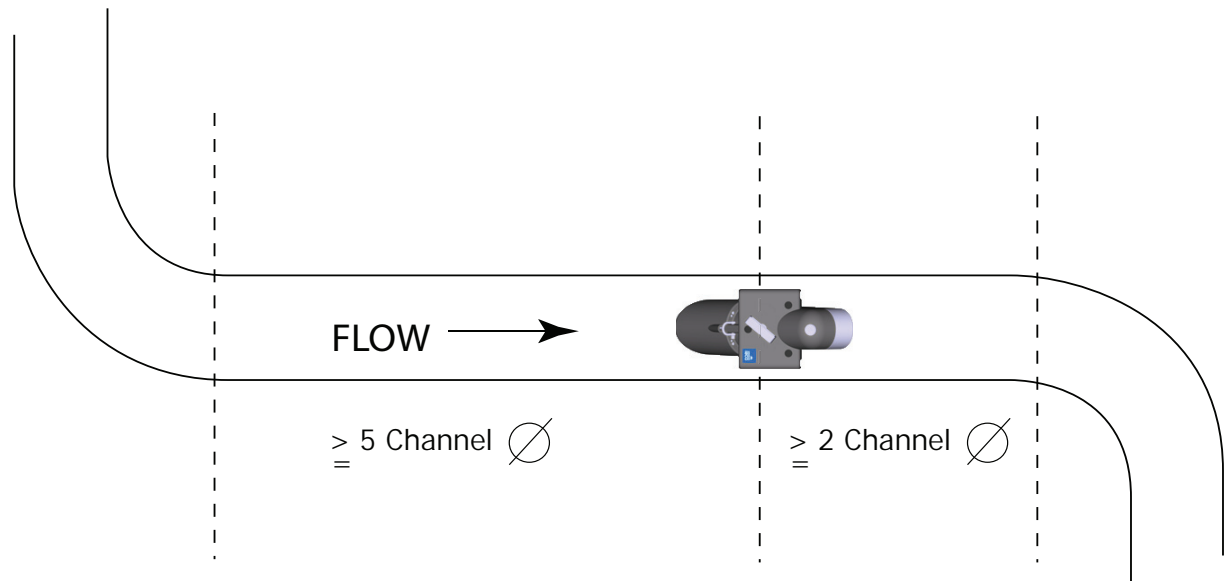


### B.6 Sensor Positioning

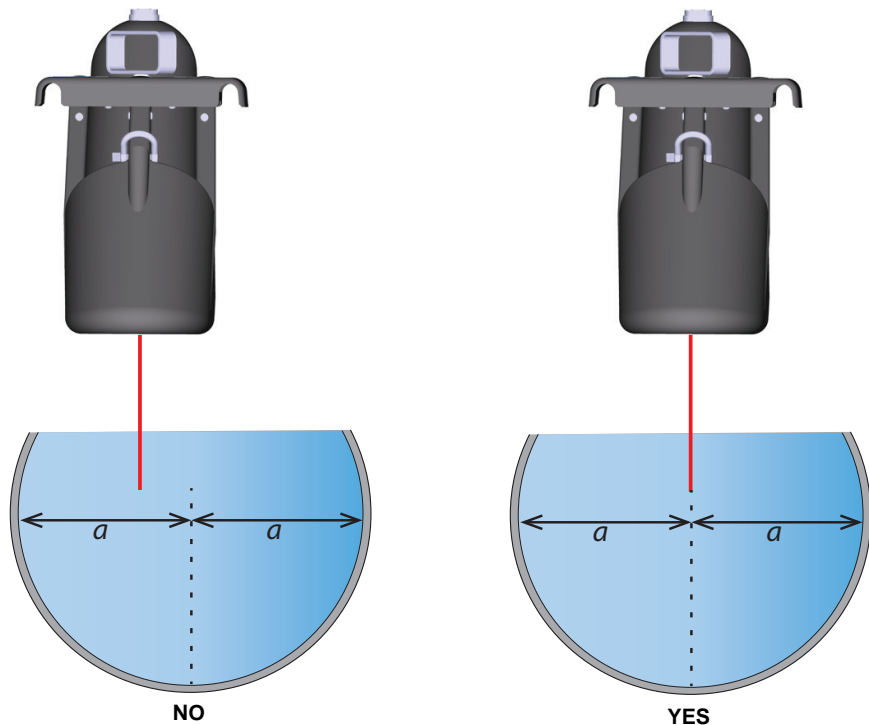
For complete installation requirements, refer to *Sensor Positioning*, page B-8.

**Straight Runs** – For best performance, place the sensor in the straightest possible run, at a minimum of 5 channel diameters downstream from a bend and 2 channel diameters upstream from a bend.

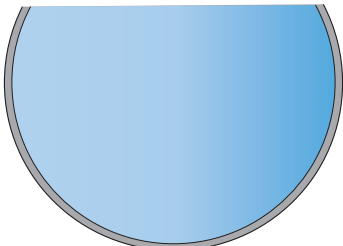
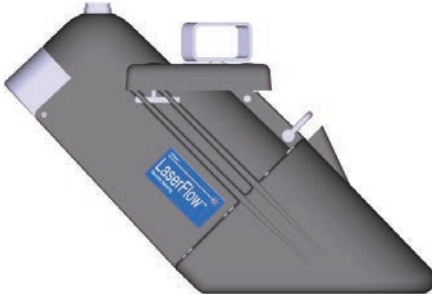
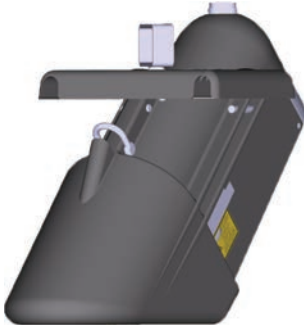




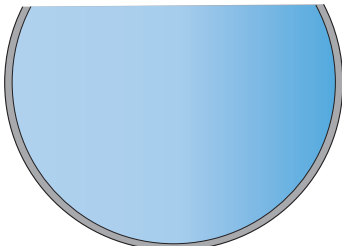
**Center of Pipe** – Center the LaserFlow (and middle laser beam) relative to the pipe walls.



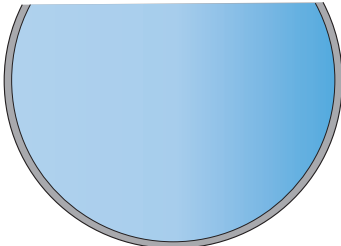
**Parallel w/ Flow** – Install the LaserFlow parallel with the flow. Never install it at an angle, or perpendicular, to the flow.



**Incorrect**



**Incorrect**



**Correct**

# TIENet® 360 LaserFlow® Velocity Sensor

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## *Appendix C Velocity Error Codes*

### **C.1 Introduction**

Erroneous flow data can result from a number of factors. The LaserFlow system provides numbered error codes associated with the 360 Velocity data to assist in troubleshooting.

If using the 2160 LaserFlow module, error codes are viewable using Teledyne ISCO Flowlink® software. If using the Signature flow meter, error codes are viewable in the bottom panel of the display. Definitions of the error codes are provided in Table C-1. For further assistance, contact the factory.

### **C.2 Importing Data Dump (.ddp) Files (Signature Only)**

Flow data can be downloaded from the Signature Flow Meter onto a USB flash drive in the form of a .ddp (Data Dump) file.

To download the data:

1. Connect a flash drive to the USB port on the front panel of the Signature flow meter. From the USB Options menu, select Retrieve Data.
2. Select “All data” or specify a start date or date range, and press NEXT. The data will be stored on the connected flash drive in the “ISCO” folder.
3. Connect the flash drive to a computer with Flowlink installed.
4. Launch the Flowlink application.
5. Copy the file using one of the methods below:
  - a. Select File > Import. When the import window appears, browse to the folder containing the desired .ddp file. Select the file and click Open.
  - b. Select “Signature Data Transfer” from the File menu and then browse to the appropriate folder.

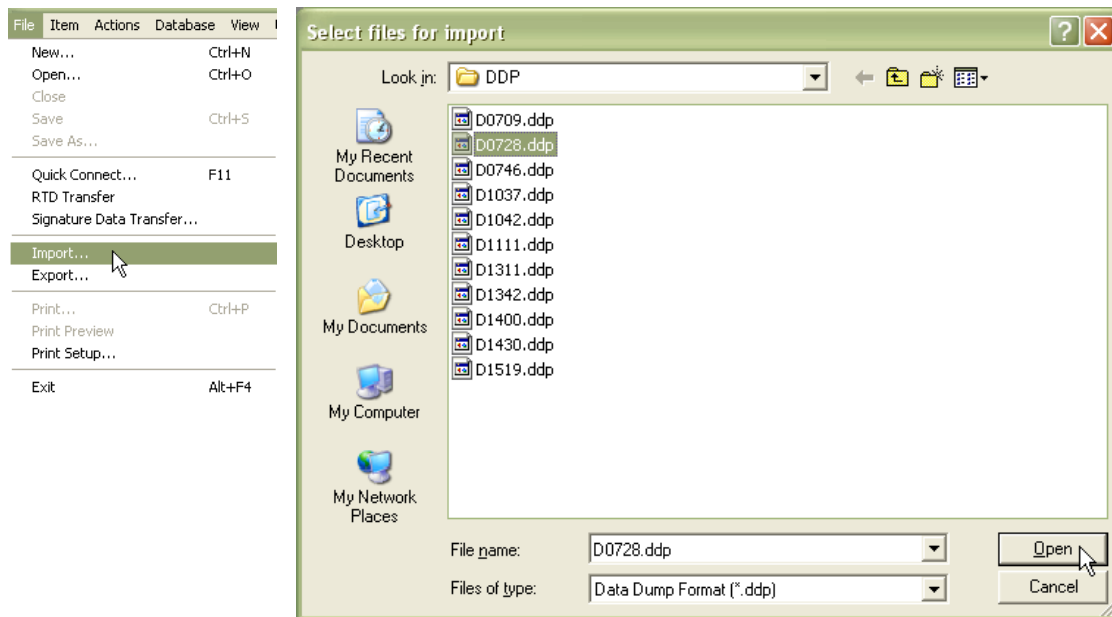


Figure C-1 Signature flow data: Selecting the .ddp file(s)

A progress window will appear, displaying the filename, site name, device type, number of data types in the site file, and progress of the download.

- When the two progress bars have completed, click Done to close the window.

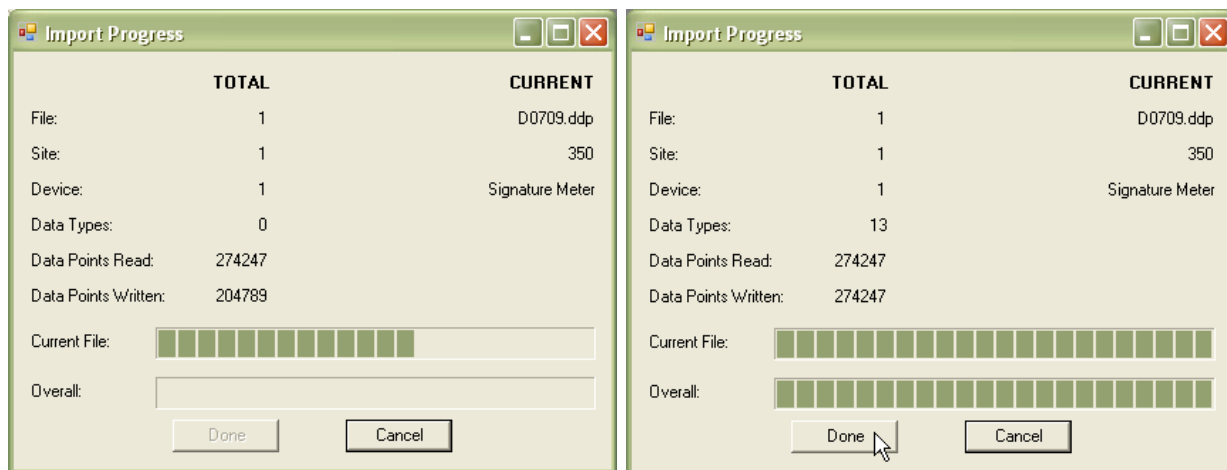


Figure C-2 Signature flow data: Importing the .ddp file

Upon completion, a new site file will appear in the Flowlink workspace.

### C.3 Viewing Velocity Error Codes in Flowlink

In order to view error codes for velocity readings:

1. In the Flowlink workspace, double-click the 360 Velocity data set. When the graph appears, click the Table View button.
2. When the table appears, click the Edit/View button.



Any error codes will appear in the 360 Velocity column following the words “No Data.” Definitions of the error codes are provided in Table C-1.

Date/Time	360 Velocity(m/s )	Edited 360 Velocity(m/s )
10/4/2012 1:45:00 PM	0.621	0.621
10/4/2012 2:00:00 PM	0.601	0.601
10/4/2012 2:15:00 PM	2.251	2.251
10/4/2012 2:30:00 PM	2.154	2.154
10/4/2012 2:45:00 PM	No Data: 1	2.154
10/4/2012 3:00:00 PM	1.897	1.897
10/4/2012 3:15:00 PM	No Data: 1	0.694
10/4/2012 3:30:00 PM	5.195	5.195
10/9/2012 10:00:00 AM	No Data: 7	0.000
10/9/2012 10:15:00 AM	No Data: 7	0.000

Error codes

Figure C-3 Identifying error codes in the 360 Velocity data set

Table C-1 Definitions of 360 Error Codes		
Error Code	Meaning	Possible Solutions
1: Low Signal Power Error	No laser Doppler signal peak or sufficient strength is found. Minimum is 1000.	Ensure the protective window cap is removed. Refer to Section 1.7.1 Protective Window Cap. Ensure the location of the laser is correct. Verify the distance is 0 to 10 ft from the bottom of the sensor. Ensure the input voltage is 10V (minimum). Ensure the Y-axis (pitch) is accurate (greater or equal to 45°).
2: Flow Direction Error	An error occurred while determining flow direction. This error displays only if the “Positive Velocity” option is set to “true” in the Flowlink application.	Call factory.

**Table C-1 Definitions of 360 Error Codes**

Error Code	Meaning	Possible Solutions
3: Ultrasonic Read Error	An error occurred during an ultrasonic reading. This includes communication errors with the ultrasonic sensor.	Ensure the blanking distance is correct. Refer to Section 3.2 Measurement Setup.  Ensure the placement of the sensor is accurate. Refer to Section 2.5.3 Sensor Positioning and Requirements.  Verify there is no foam or extreme turbulence.
4: Analog-to-Digital Converter (ADC) Error	An error occurred during an ADC reading.	Contact factory.
5: Focus Error	An error occurred while focusing the laser.	Ensure the input voltage is 10V (minimum).
6: Digital Signal Processor (DSP) Communication Error	An error occurred during communication with the DSP.	Contact factory.
7: Sensor not seen	Communication failed between flow meter and sensor. This could be due to the sensor being disconnected, losing power, etc.	Ensure the sensor is connected to the flow meter.  Ensure the input voltage is 10V (minimum).  Verify the battery is connected or charged.

**Table C-2 Definitions of 350 Error Codes**

Error Code	Meaning	Possible Solutions
1: Measurement Error	Unable to generate valid velocity data set.	Contact factory.
3: Velocity Filter Error	An error occurred while setting the filter clock.	Ensure there are uniform flow conditions at sensor location.
5: Velocity Gain Error	Unable to set gain after maximum attempts.	Ensure there is no debris on the sensor.
6: Level to Low error	The absolute level is too low to attempt velocity measurement.	Place sensor in flow with at least 1" deep.  Set storage of velocity to be secondary based on depth of 1".
7: Timeout/Quality Error	Measurement timed out or did not meet measurement quality requirements.	Contact factory.

# TIENet® 360 LaserFlow® Velocity Sensor

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## *Appendix D Material Safety Data Sheets*

This appendix provides Material Safety Data Sheets for the desiccant used by the TIENet 360 LaserFlow Sensor.

Teledyne ISCO cannot guarantee the accuracy of the data. Specific questions regarding the use and handling of the products should be directed to the manufacturer listed on the MSDS.

SORB-IT® is a registered trademark of N. T. Gates Company.

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[Belen, New Mexico 87002](#)  
[Phone: \(505\) 864-6691](#)  
[Fax: \(505\) 861-2355](#)

**SÜD-CHEMIE**  
 Performance Packaging



ISO 9002

MATERIAL SAFETY DATA SHEET -- September 28, 1998  
 SORB-IT®  
 Packaged Desiccant

**SECTION I -- PRODUCT IDENTIFICATION**

<b>Trade Name and Synonyms:</b>	Silica Gel, Synthetic Amorphous Silica, Silicon, Dioxide
<b>Chemical Family:</b>	Synthetic Amorphous Silica
<b>Formula:</b>	SiO <sub>2</sub> .x H <sub>2</sub> O

**SECTION II -- HAZARDOUS INGREDIENTS**

Components in the Solid Mixture

COMPONENT	CAS No	%	ACGIH/TLV (PPM)	OSHA-(PEL)
Amorphous Silica	63231-67-4	>99	PEL - 20 (RESPIRABLE), TLV - 5	LIMIT - NONE, HAZARD - IRRITANT "

Synthetic amorphous silica is not to be confused with crystalline silica such as quartz, cristobalite or tridymite or with diatomaceous earth or other naturally occurring forms of amorphous silica that frequently contain crystalline forms.

This product is in granular form and packed in bags for use as a desiccant. Therefore, no exposure to the product is anticipated under normal use of this product. Avoid inhaling desiccant dust.

**SECTION III -- PHYSICAL DATA**

<b>Appearance and Odor:</b>	White granules; odorless.
<b>Melting Point:</b>	>1600 Deg C; >2900 Deg F
<b>Solubility in Water:</b>	Insoluble.
<b>Bulk Density:</b>	>40 lbs./cu. ft.
<b>Percent Volatile by Weight @ 1750 Deg F:</b>	<10%.



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Packaged Desiccant

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#### SECTION IV -- FIRE EXPLOSION DATA

**Fire and Explosion Hazard** - Negligible fire and explosion hazard when exposed to heat or flame by reaction with incompatible substances.

**Flash Point** - Nonflammable.

**Firefighting Media** - Dry chemical, water spray, or foam. For larger fires, use water spray fog or foam.

**Firefighting** - Nonflammable solids, liquids, or gases: Cool containers that are exposed to flames with water from the side until well after fire is out. For massive fire in enclosed area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of the tank due to fire.

#### SECTION V -- HEALTH HAZARD DATA

Health hazards may arise from inhalation, ingestion, and/or contact with the skin and/or eyes. Ingestion may result in damage to throat and esophagus and/or gastrointestinal disorders. Inhalation may cause burning to the upper respiratory tract and/or temporary or permanent lung damage. Prolonged or repeated contact with the skin, in absence of proper hygiene, may cause dryness, irritation, and/or dermatitis. Contact with eye tissue may result in irritation, burns, or conjunctivitis.

**First Aid (Inhalation)** - Remove to fresh air immediately. If breathing has stopped, give artificial respiration. Keep affected person warm and at rest. Get medical attention immediately.

**First Aid (Ingestion)** - If large amounts have been ingested, give emetics to cause vomiting. Stomach siphon may be applied as well. Milk and fatty acids should be avoided. Get medical attention immediately.

**First Aid (Eyes)** - Wash eyes immediately and carefully for 30 minutes with running water.

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MATERIAL SAFETY DATA SHEET -- September 28, 1998  
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Packaged Desiccant

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**NOTE TO PHYSICIAN:** This product is a desiccant and generates heat as it adsorbs water. The used product can contain material of hazardous nature. Identify that material and treat accordingly.

#### SECTION VI -- REACTIVITY DATA

**Reactivity** - Silica gel is stable under normal temperatures and pressures in sealed containers. Moisture can cause a rise in temperature which may result in a burn.

#### SECTION VII -- SPILL OR LEAK PROCEDURES

Notify safety personnel of spills or leaks. Clean-up personnel need protection against inhalation of dusts or fumes. Eye protection is required. Vacuuming and/or wet methods of cleanup are preferred. Place in appropriate containers for disposal, keeping airborne particulates at a minimum.

#### SECTION VIII -- SPECIAL PROTECTION INFORMATION

**Respiratory Protection** - Provide a NIOSH/MSHA jointly approved respirator in the absence of proper environmental control. Contact your safety equipment supplier for proper mask type.

**Ventilation** - Provide general and/or local exhaust ventilation to keep exposures below the TLV. Ventilation used must be designed to prevent spots of dust accumulation or recycling of dusts.

**Protective Clothing** - Wear protective clothing, including long sleeves and gloves, to prevent repeated or prolonged skin contact.

**Eye Protection** - Chemical splash goggles designed in compliance with OSHA regulations are recommended. Consult your safety equipment supplier.

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Packaged Desiccant

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**SECTION IX -- SPECIAL PRECAUTIONS**

Avoid breathing dust and prolonged contact with skin. Silica gel dust causes eye irritation and breathing dust may be harmful.

\* No Information Available

HMIS (Hazardous Materials Identification System) for this product is as follows:

Health Hazard	0
Flammability	0
Reactivity	0
Personal Protection	HMIS assigns choice of personal protective equipment to the customer, as the raw material supplier is unfamiliar with the condition of use.

The information contained herein is based upon data considered true and accurate. However, United Desiccants makes no warranties expressed or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of United Desiccants, United Desiccants assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to United Desiccants' Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of the data and information is in accordance with applicable federal, state or local laws and regulations.



# TIENet® 360 LaserFlow® Velocity Sensor

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