TIENet® 310 Ex Ultrasonic Level Sensor

Installation and Operation Guide

TELEDYNE ISCO
Everywhereyoulook™

Manual Body #69-4313-010

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Foreword

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 Material Authorization (RMA) specified. Be sure to include a note describing the malfunction. This will aid in the prompt repair and return of the equipment.

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 (402) 464-0231 (USA, Canada, Mexico)

(402) 465-3022 (Outside North America)

Fax: isco.orders@teledyne.com

Email:

TechnicalSupport

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

Email: iscoEPS@teledyne.com

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

Other Correspondence

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

Email: IscoInfo@teledyne.com

Safety

General Warnings

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, take heed of 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.

AVERTISSEMENT

Éviter les usages périlleux! Si vous utilisez cet instrument d'une manière autre que celles qui sont specifiées dans ce manuel, la protection fournie de l'instrument peut être affaiblie; cela augmentera votre risque de blessure.

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.

Hazard Symbols	
Warnings and Cautions	
	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.
Symboles de sécurité	
	Ce symbole signale l'existence d'instructions importantes relatives au produit dans ce manuel.
	Ce symbole signale la présence d'un danger d'électocution.
Warnungen und Vorsichtshinweise	
	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 Sei vor "gefährlichen Spannungen" im Inneren des Produkts warnt.
Advertencias y Precauciones	
	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™ Model 310 Ex Ultrasonic Level Sensor

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TIENet® Model 310 Ex Ultrasonic Level Sensor

Section 1Introduction

1.1 Description

The Signature® Flow Meter uses the TIENet 310 Ex Device to provide non-contact liquid level measurement. The flow meter has built-in level-to-flow conversions that cover the majority of open channel flow measurement situations.

The ultrasonic sensor is mounted over the flow stream. The flow meter measures the time interval between transmission of a sound pulse from the sensor, and receiving its echo off the surface of the liquid, to determine the level of the stream.

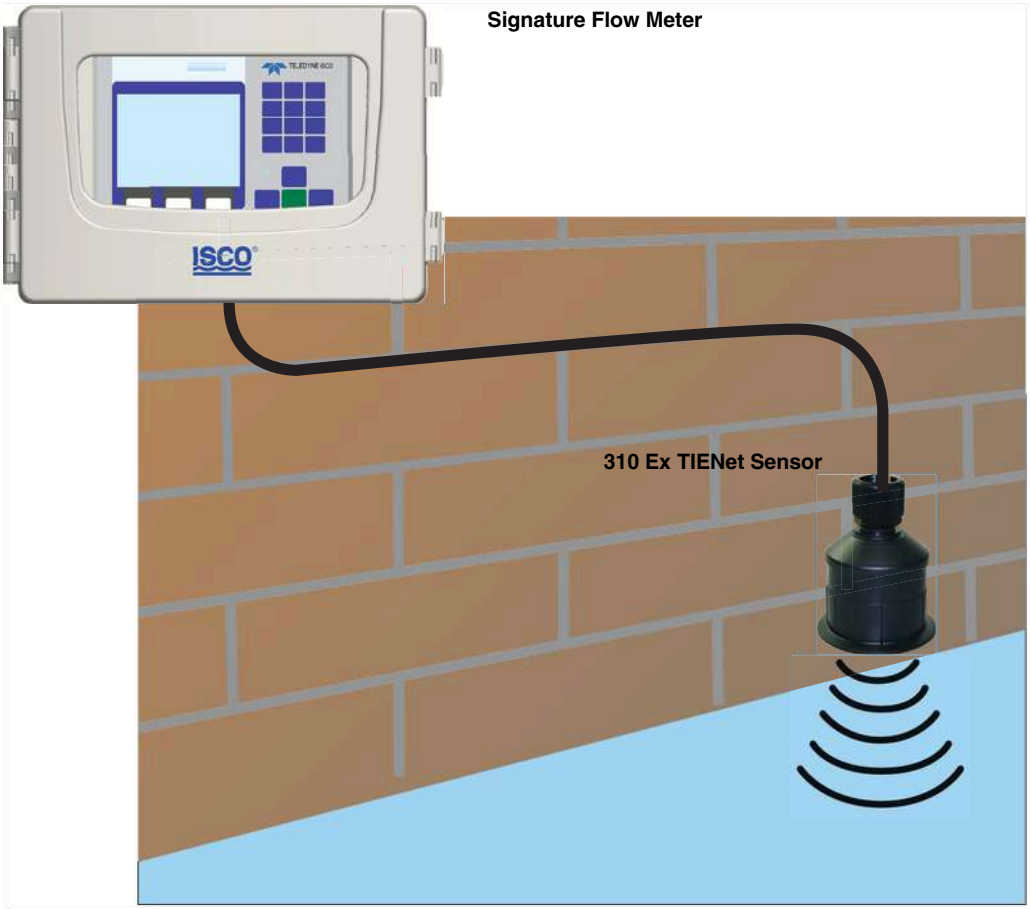


Figure 1-1Basic Signature monitoring system with 310 Ex (mounting hardware not shown)

This non-contact measurement method reduces the frequency of maintenance, and is ideal for applications where the flow may contain chemicals, grease, silt, or suspended solids.

1.2310 Ex Sensor Design

The ultrasonic level sensor consists of a housing with a single transducer that is both pulse transmitter and echo receiver. A temperature sensor within the housing measures the ambient temperature, and a microprocessor automatically compensates for speed-of-sound changes due to any changes in air temperature.

The 310 Ex is available with a 10m, 23m, and special order to 150m or less cable lengths with or without connectors. For greater distances, external connection via conduit, and connection of additional TIENet devices, the TIENet Expansion Box is available. Bulk TIENet cable may also be used for greater distances.

Figure 1-2310 Ex Ultrasonic TIENet Sensor with unterminated leads (l) or TIENet plug (r)

1.3 Operation

The sensor 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 Signature flow meter into an "echo-received" signal. The time between the trans- mitted pulse and the echo-received signal is proportional to the distance between the transducer and the liquid surface. This dis- tance in turn determines the liquid level used to calculate flow.

1.4Technical Specifications

Table 1-1310 Ex TIENet Device Specificationsa

Sensor Dimensions	3.63" □ x 4" tall (9.1cm □ x 10.2cm tall)
Cable Length	10 or 23 meters standard (32.8 or 75.5ft) standard
Mounting Attachment	3/4" NPT Pipe thread nipple w/ Conduit lock nut
Weight	4 lbs (1.8 kg)
Body Material	PVDF
Enclosure	IP68 when connected and properly sealed with cord-grip fitting.
Temperature Range Operating (compensated) Storage Hazardous Locations	 -22 to 140°F (-30 to 60°C) -40 to 158°F (-40 to 70°C) -40 to 140°F (-40 to 60°C)
Measurement Range	Minimum: 1 ft (0.3m) from sensor to liquid surface Maximum: 11 ft (3.3m) from sensor to liquid at minimum level
Measurement Accuracy at 72 °F (22 °C)	±0.02ft (0.006m) at 1ft level change or less; ±0.03ft (0.009m) at greater than 1ft level change
Temperature Coefficient within compensated range	± 0.0002 x D (m) per degree C ± 0.00011 x D (ft) per degree F (Where D is the distance from the transducer to the liquid surface)
Beam Angle	10° 5° From center line
Ultrasonic Signal	50KHz
Cer tifications	Group II Category 1G (zone 0), T4, [ATEX and IECEx] Class I Division 1 (and Zone 0), T4

a. All specifications are subject to change without notice.

1.5 Accessories

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

> ☑ ***Note***
>
> Only the Wall Mount Bracket is approved for use in classified hazardous locations. Other accessories must undergo a hazardous location evaluation in order to fulfill safe installation requirements.

Spreader Bar–The Spreader Bar is an expandable pipe for suspending equipment inside a manhole. Outward spring pressure secures it against the manhole walls, like a shower curtain rod. Depending on your application, you can then suspend the 310 Ex TIENet Device, or the Signature Flow Meter itself, from the bar.

Cable Straightener–The cable straightener is designed for use in installations where the transducer is suspended by its cable only, such as from the Spreader Bar. The straightener helps hold the transducer vertically plumb, thereby stabilizing alignment.

Cable Clamp–The cable clamp is used with the Spreader Bar to secure the mounting of the sensor.

Wall Mount Bracket–This device lets you install the ultrasonic level sensor on a convenient nearby wall over a flow stream, such as the side of a bridge, or other structure.

Floor Mount–The Ultrasonic Floor Mount is a collapsible metal stand attached to the floor, for extending the sensor out over a flow stream.

Ultrasonic Calibration Target–This option is designed to make calibration of the level sensor more accurate during the installation process by letting you calibrate the level sensor from outside the manhole.

Sunshade–The ultrasonic sunshade is a white plastic cap that fits over the top of the ultrasonic transducer. Its purpose is to keep sunlight from heating the body of the level transducer and introducing temperature errors to the internal temperature compensation.

1.5.1 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:IscoInfo@teledyne.com

1.5.2TIENet 310 Ex Ultrasonic Level Sensor

310 Ex Ultrasonic Level Sensor with unterminated leads. For use with barrier screw terminals orSignature 6 position plug-in (green) terminal strip.
Includes cord grip and sensor with cable. (See cable lengths below).

310 Ex Ultrasonic sensor w/ 10m cable.....60-4314-005 310 Ex Ultrasonic sensor w/ 23m cable.....60-4314-006 310 Ex Ultrasonic sensor Cut-to-length.....60-4314-014 Cut to length cable up to 999 ft*.....60-4304-050 *Cable lengths can go up to 150 m with an expansion box.

310 Ex Ultrasonic Level Sensor with Signature connection ending in TIENet plug. For use with portable Signature TIENet receptacle. *Includes cord grip and sensor with cable. (See cable lengths below).*

310 Ex Ultrasonic sensor w/ connector and 10m cable.....60-4314-009 310 Ex Ultrasonic sensor w/ connector and 23m cable.....60-4314-011 310 Ex Ultrasonic sensor w/ connector Cut-to-length*.....60-4314-013 Cable Assembly with TIENet Y w/ connector.....60-4304-066 *Cable lengths can go up to 150 m with an expansion box. Sunshade for ultrasonic sensor.....60-3004-142 Spreader bar for suspension of sensor or flow meter in manhole shaft.....60-3004-110 Cable clamp.....60-3004-129 Sensor Mounting Bracket U/S.....60-2003-615 Floor mount for horizontal surfaces.....60-2004-611

Cable straightener for suspension over stream.....60-4313-009

Ultrasonic calibration target.....60-3004-143
TIENet Expansion Box.....60-4307-023

Kit includes 10ft TIENet cable

Cord grip fitting, 3/4" NPT, for TIENet cable.....209-0073-12
Barrier for Signature (SPA 2060).....60-5324-060

1.5.31.5.3 TIENet Barrier for Hazardous Locations

TIENet Barrier (DIN-rail Mountable)

TIENet Barrier.....60-4364-112

TIENet Barrier with Enclosure

TIENet Barrier w/ enclosure and 10m cable.....60-4364-120
TIENet Barrier w/ enclosure and 23m cable.....60-4364-121
TIENet Barrier w/ enclosure and cut-to-length cable.....60-4364-122

> ☑ ***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.

TIENet® Model 310 Ex Ultrasonic Level Sensor

Section 2Installation and Setup for Signature

The Signature Flow Meter does not have to be mounted near the flow stream. You can install the flow meter itself at a convenient, protected location and route the sensor cable to the measurement point. Proper installation of the 310 Ex sensor is critical for accurate measurement.

2.1Sensor 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. If the sensor cannot obtain a valid reading, an asterisk (*) will appear next to the displayed level, indicating there is an error.

2.1.1Beam Angle

The 310 Ex sensor has a 10° beam angle, forming a cone whose apex is the ultrasonic transducer. The sensor can only detect surfaces within this cone. Narrow channels can result in false echoes and incorrect level readings off the walls and sides of the channel. For preventive measures, see Section2.5.2 *Measurement Setup*, and the programming steps in Figure2-15.

The beam becomes narrower at shorter distances, which can increase difficulty in detecting the return echo. If the beam is too wide, the sensor may pick up signals from unwanted surfaces, such as the walls of the channel.

2.1.2 Humidity

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

Additionally, water droplet condensation on the bottom surface of the sensor can cause measurement errors.

2.1.3 Surface

Solids, foam, oil, and turbulence can all absorb or weaken the ultrasonic pulses, causing errors in detection. Foam or oil on the surface of the stream can produce false level readings.

2.1.4 Temperature

Changes in ambient temperature significantly affect the velocity of sound. If ambient temperature changes rapidly, there may be a delay before the 310 Ex's temperature sensor can activate temperature compensation.

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

2.1.5 Waves

Waves on the surface of the flow stream can deflect the ultrasonic signal, causing erroneous readings or total loss of signal. The Signature Flow Meter software is able to reject occasional readings that deviate substantially from normal. Strong winds can significantly reduce the strength of the 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. Installation in classified hazardous locations must meet specific conditions in order to fulfill safety requirements. Installation must be performed only by trained, qualified personnel. Refer to Section2.4 *Installation in Hazardous Locations* for complete information.

2.1.6 Wind

2.1.7Hazardous Locations

2.2Connecting the Cable

External TIENet devices such as the 310 Ex are all connected to the Signature flow meter in the same manner. These connections usually use conduit or cord-grip cable fittings for permanent mounted meter or with TIENet receptacle for portable meters. Multiple external TIENet devices can be connected simultaneously.

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

> ☑ ***Note***
>
> The steps that follow include instructions for installing cord-grip fittings. Some applications will require cables to be routed through user-supplied conduit. Conduit with a minimum 3/4" ID is suggested for unterminated sensor cables and conduit with minimum 1-1/2" ID is suggested for straight runs for sensor cables with connectors.

2.2.1Permanent Meters

> ☑ ***Note***
>
> Before proceeding, ensure that the flow meter has been disconnected from mains power.

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

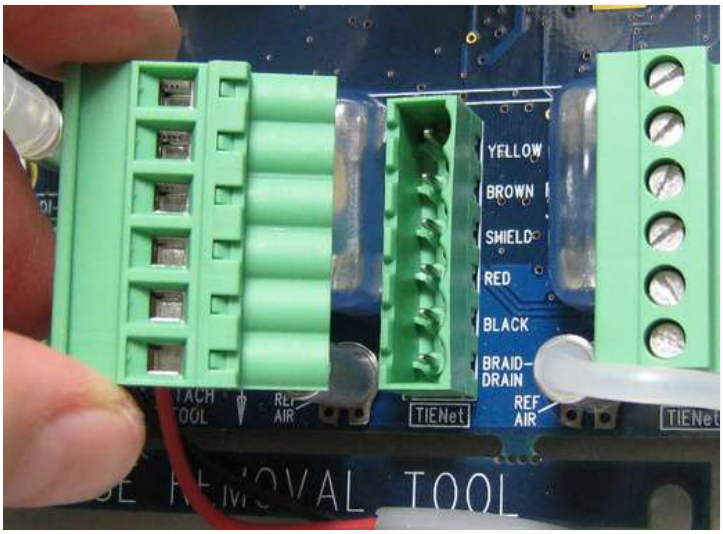


Figure 2-1TIENet Device terminal strips

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).

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.

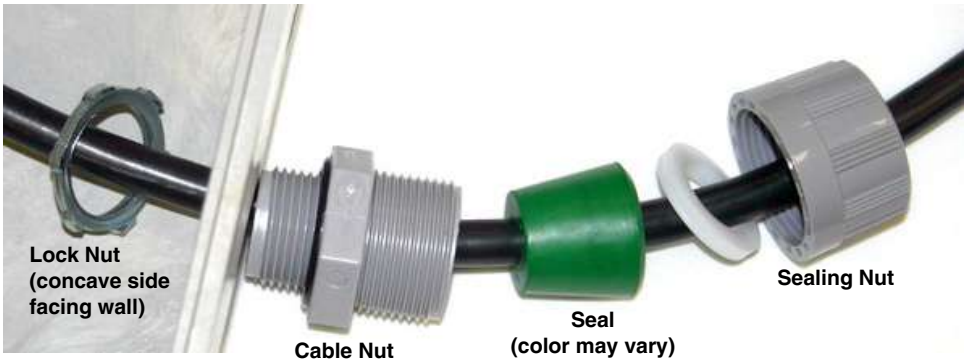


Figure 2-2Installing cable with a cord-grip fitting

4.Attach the wire ends to the terminal strip as shown in Figure2-3, then press the terminal strip back down into its socket on the case board, as shown in Figure2-4, taking care not to strain any wire connections. 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 sur- rounding braided shield inside the cable jacket. It is not neces- sary to prevent the two braids from coming into contact with each other.The drain wires need to be kept very short.

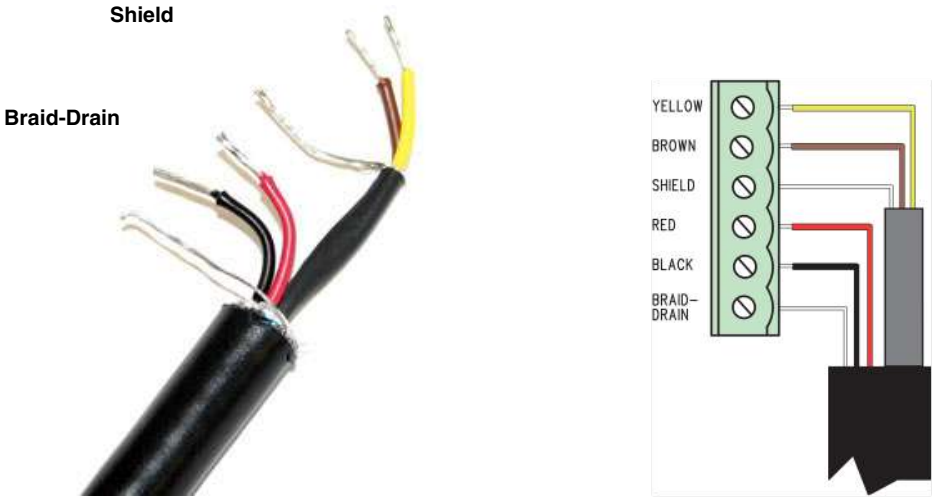


Figure 2-3TIENet Device terminal connections

5.Press the terminal strip back down into its socket on the case board, as shown in Figure2-5, taking care not to strain any wire connections. The 310 Ex sensor cable does not include a reference air connection (Figure 2-4).

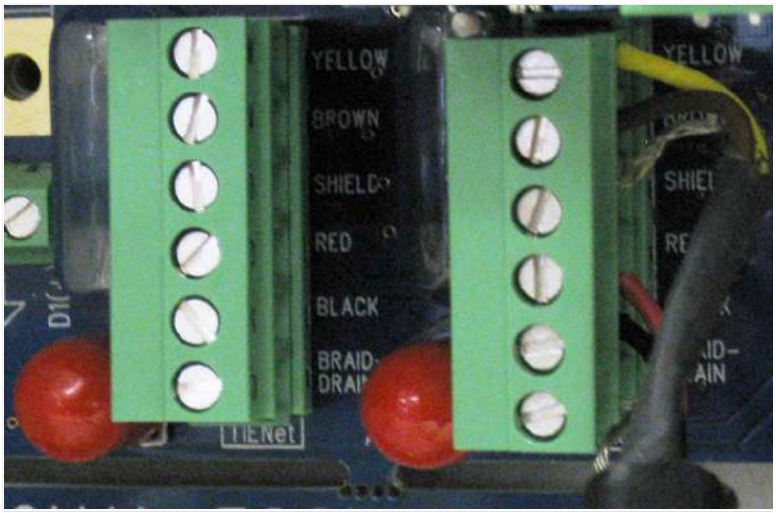


Figure 2-4 Attach wired terminal strip to case board socket

6. Gently tug the cable downward, to remove any slack within the enclosure, taking care not to put any stress on the connection.
7. Tighten the cord grip sealing nut.

⚠ CAUTION

If you are 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 conduit could reduce equipment life.

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

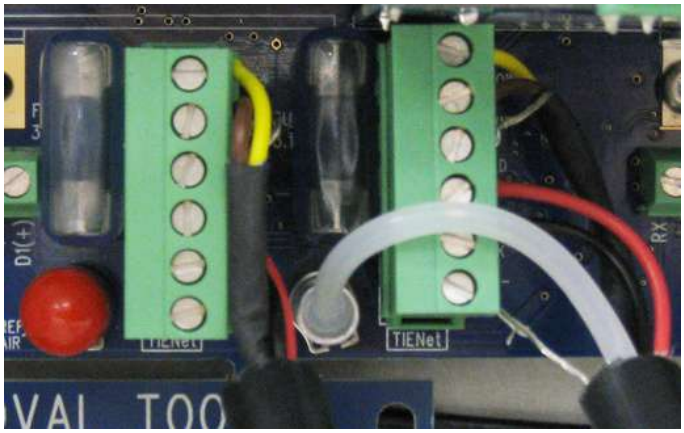


Figure 2-5 Position and secure the cable

2.2.2 Connecting to Signature Portable via a TIENet Receptacle

The optional external TIENet devices compatible with the Signature Portable (and Signature) all scan into the hardware in the same manner. A scan is required anytime a new TIENet device is added. Multiple TIENet devices can be connected simultaneously to the same Signature Portable Flow Meter. The following TIENet devices will attach to the TIENet receptacle:

- Ultrasonic Level Sensor

- Area Velocity Sensor
- 301 pH Interface
- LaserFlow
- 306 Sampler Interface

Connecting a TIENet plug to the Signature Portable

To connect the TIENet plug from the sensor to the TIENet Receptacle:

1. Align the connectors and push together (Figure 2-6).
2. After the physical connection is made, a scan must be performed for the device to be recognized.

For additional TIENet connections, use the TIENet Y-cable or alternately an Expansion Box.

O-Ring and Lubrication for the TIENet receptacle

1. Coat the O-ring's sealing surface with a silicone lubricant.

⚠ CAUTION

Do not use petroleum-based lubricants. Petroleum-based lubricants will cause the O-ring to swell and eventually deterio- rate. Aerosol silicone lubricant sprays often use petro- leum-based propellents. If you are using an aerosol spray, allow a few minutes for the propellent to evaporate before pro- ceeding.

2. Align and insert the connector. The sensor release will "click" when the sensor connector is fully seated.
3. Connect the two caps together.

Figure 2-6How to connect a TIENet plug to the Signature Portable

2.2.3 Connecting to TIENet Barr ier

1. Refer to the TIENet Barrier Installation Guide section 2 for connecting the 310 Ex TIENet cable to the "hazardous" side of the barrier.
2. If the installation utilizes a Signature flow meter refer to section 2.2.1 *Permanent Meters* for the installation of the TIENet cable on the "safe" side of the barrier to the meter.
3. Refer to section 2.4 *Installation in Hazardous Locations* for installation requirements.

2.3 Sensor Installation

The mounting location of the ultrasonic level sensor depends on the type of primary measuring device (such as a weir or flume), and on the method of level-to-flow conversion used. Refer to the *Isco Open Channel Flow Measurement Handbook* included with your Signature flow meter, or to instructions provided by the manufacturer of the primary device, for detailed information about locating the measuring point.

If you intend to measure flow by some other means, such as a gravity flow equation (Manning) or by calibrating a section of the flow channel, you must locate the measuring point based on the hydraulic characteristics of the channel, as well as the level-to-flow conversion method.

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

2.3.1 Dead Band

Mount the sensor as close as possible to **one foot** (0.3 m) above maximum expected level. The sensor cannot measure within the foot of space directly below it, called the *dead band*.

2.3.2 Submersion and Fouling

Fouling by grease or solids can cause the sensor to malfunction.

The sensor is sealed, so unless it was exposed to corrosive substances, temporary accidental submersion should not harm it. Upon retrieval, ensure that the sensor's surface is clean. Clean the bottom surface very gently with running water and a soft cloth.

2.3.3 Mounting Options

The 310 Ex sensor can be mounted over the flow stream in various ways, depending on which method best fits the application.

Optional equipment is available from Teledyne Isco for wall, floor, suspension, and horizontal mounting (see Section1.5 *Accessories*). The sensor has a 3/4" NPT male pipe thread with a conduit lock nut to connect it to a mounting bracket or cable stiffener. The sensor cable can be routed through user-provided conduit back to the Signature Flow Meter.

Regardless of the mounting method you select, always place the sensor over the center of the stream, and always use a circular bubble level for vertical alignment.

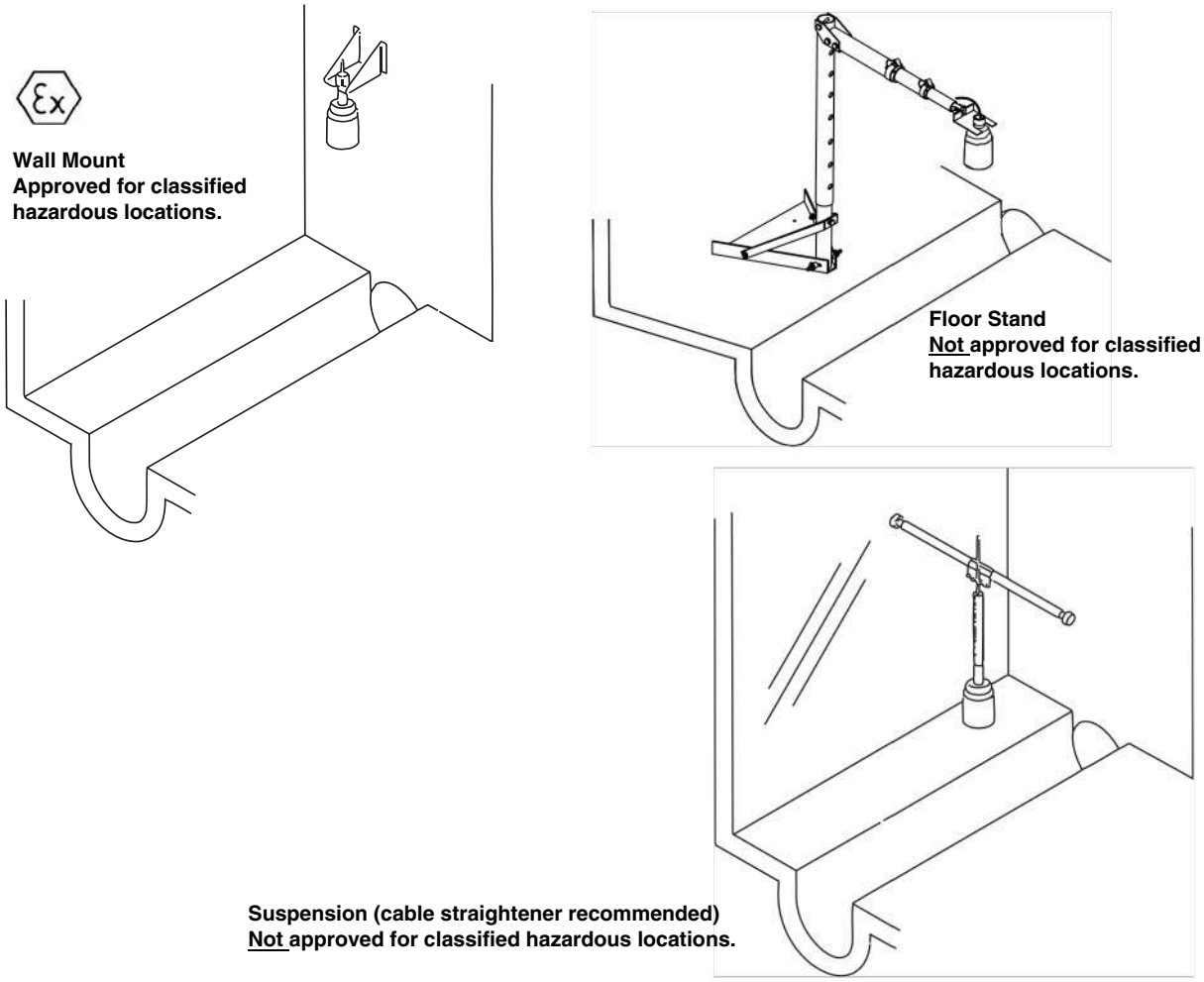


Figure 2-7Sensor mounting options

2.4Installation in Hazardous Locations

Read all labels carefully before installing the equipment! The TIENet Model 310 Ex device is IECEx and ATEX-approved for use in potentially explosive atmospheres when specific conditions are met, as described in this section in reference to "X" Marking.

The 310 Ex is Group II, Category 1G equipment for use in gas hazard zones 0, 1, and 2 (IECEx and European standards), or Class I Division 1 (North American standards).

The braid-drain lead depicted in Figure 2-8 *Sensor labeling regarding hazloc installations* is normally bonded to earth through the Signature connector case terminals or conduit; it is also electrically connected to the anti-static conductive housing of the 310 Ex sensor.

Installation must be performed only by trained, qualified personnel.

Barriers or isolators required for certifiable safe installation are the responsibility of the user. Refer to the control drawings provided in Figures2-9 and2-10.

☑ *Note*

There is a TIENet barrier (a weatherproof box with terminals and power supply) available for hazardous locations. Refer to

section 1.5.3.

☑ *Note*

Only the Wall Mount Bracket is approved for use in classified hazardous locations. Non-Isco hardware must undergo a hazardous location evaluation in order to fulfill safe installation requirements.

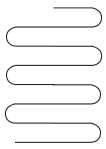
⚠ WARNING

The mounting bracket is a potential isolated charge carrier. For classified hazardous locations, your installation MUST satisfy earthing requirements. Refer to IEC 60079-14 section 12.2.4 and IEC 60079-11.

⚠ WARNING

Do not coil the sensor cable; this will form an inductor and create a hazard. The cable should be kept as short as is practical. If necessary, use a serpentine loop (see figure at left) instead.

Serpentine loop



2.4.1Important Information Regarding “X” Marking

The ATEX labeling on the serial tag of the 310 Ex device includes a number ending in “X.” The X marking indicates that there are specific conditions that must be met in order for the equipment to comply with intrinsic safety requirements. Refer to Figure2-8 on the following page.

These specific conditions are as follows for ATEX and IECEx:

- The integral cable must be terminated in a manner suitable for the zone of installation and providing at least degree of protection IP20.
- Any extension to the integral 310 Ex sensor cable must utilize a cable with parameters <108pF/m, <1µH/m, <19µH/Ω. The total length of cable must not exceed 150m.
- A maximum of three 310 Ultrasonic sensors may be connected together in parallel.
- The Li and Ci of the associated apparatus must be negligible.

2.4.2 Electrical Requirements

Always refer to the electrical values listed at the bottom of the 310 Ex serial tag when connecting associated apparatus (i.e., power supply, network interface, etc.).

This labeling indicates the maximum input voltage (Ui), maximum input current (Ii), and maximum power (Pi) that can be present at the specified terminals without invalidating intrinsic safety.

The power supply parameter allowances *must exceed* maximum internal capacitance (Ci) and either the maximum internal inductance (Li), or the maximum internal inductance-to-resistance ratio (Li/Ri) of the 310 Ex device and integral cable. These parameters are established on the third party certification report and are available by contacting Teledyne Isco.

2.4.3Ambient Environment

Installation in designated hazardous areas must fall within the temperature range of -40 to +60°C, as specified on the serial tag labeling.

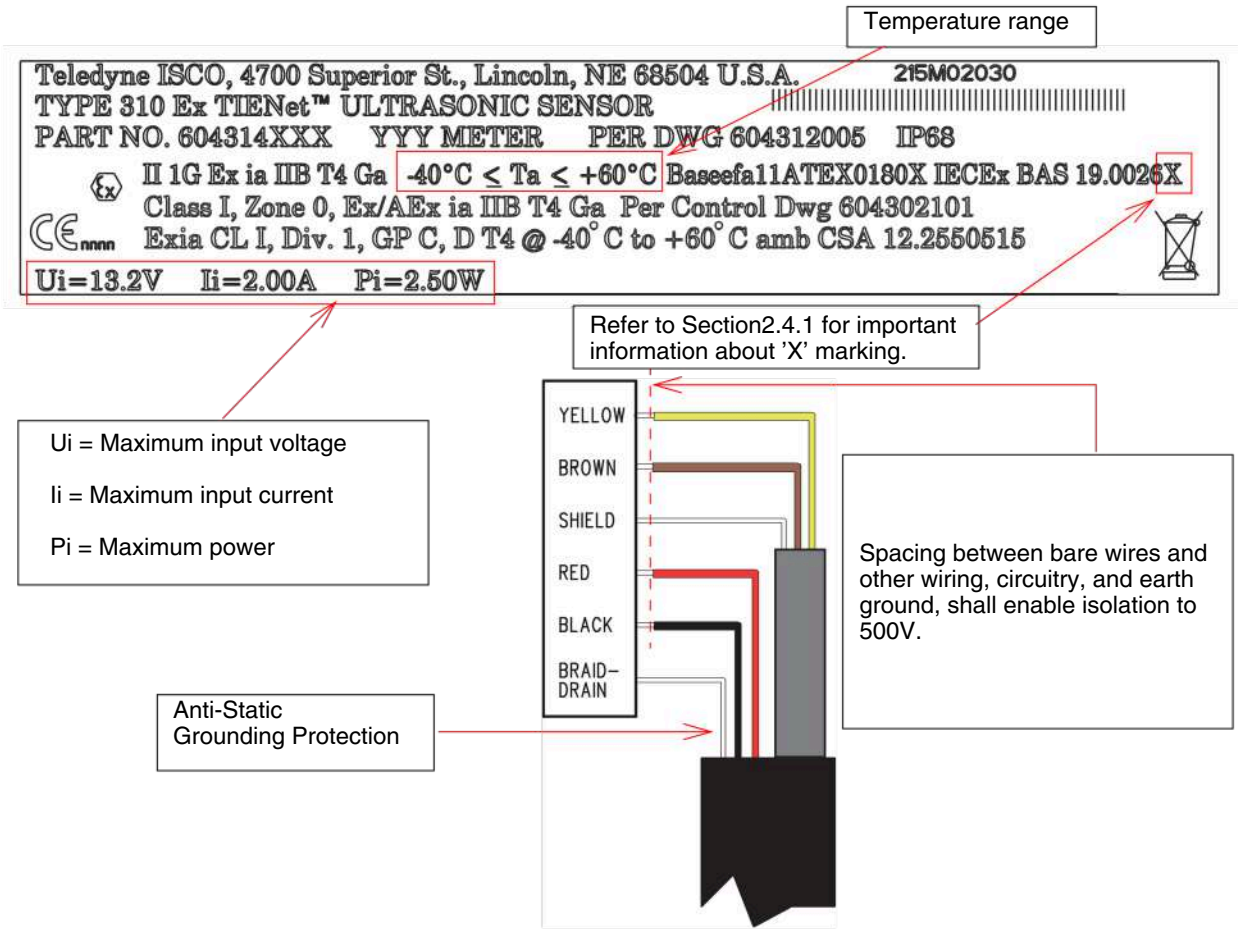


Figure 2-8 Sensor labeling regarding hazloc installations

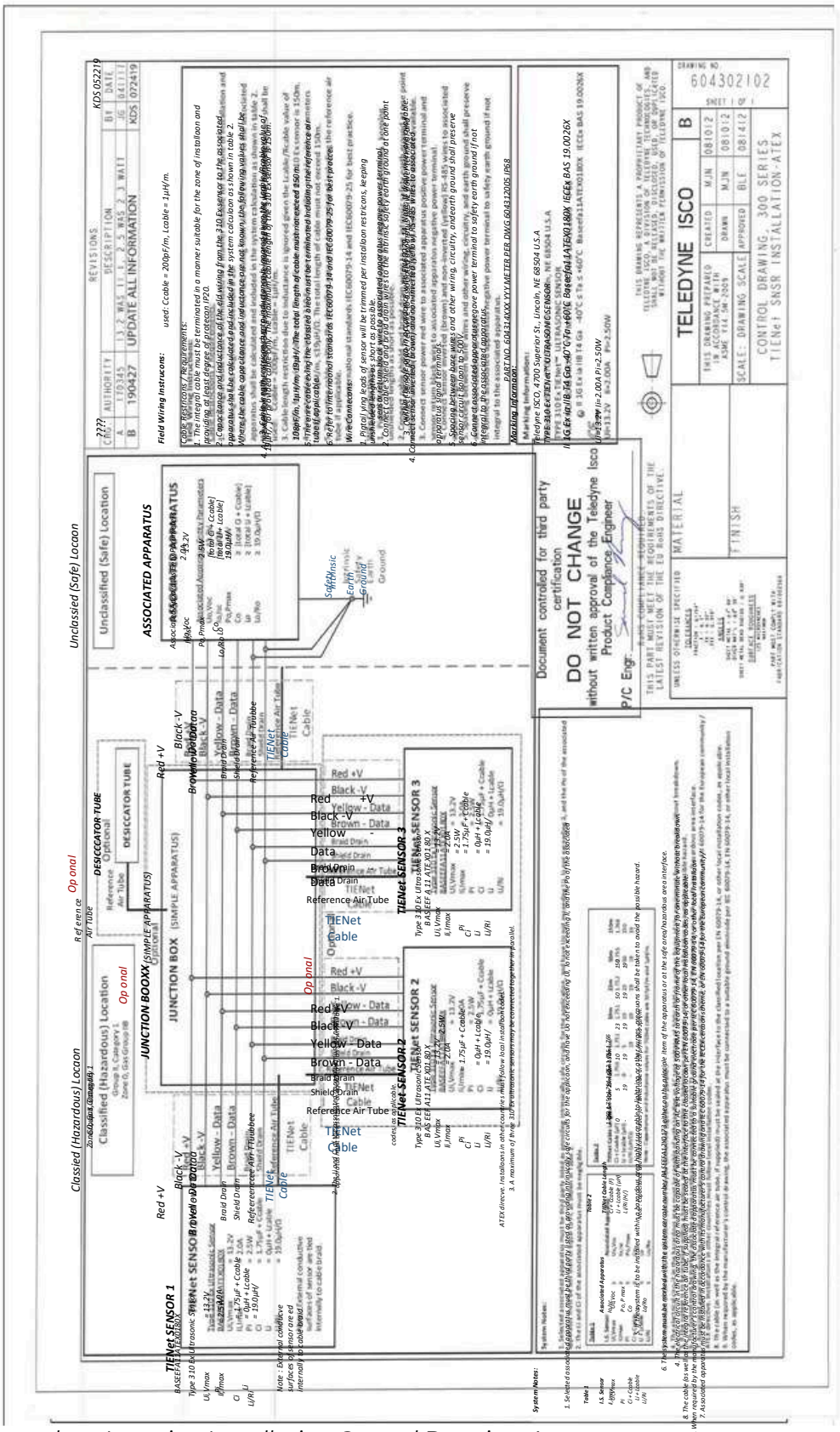


Figure 2-9Hazardous Location Installation Control Drawing-Atex

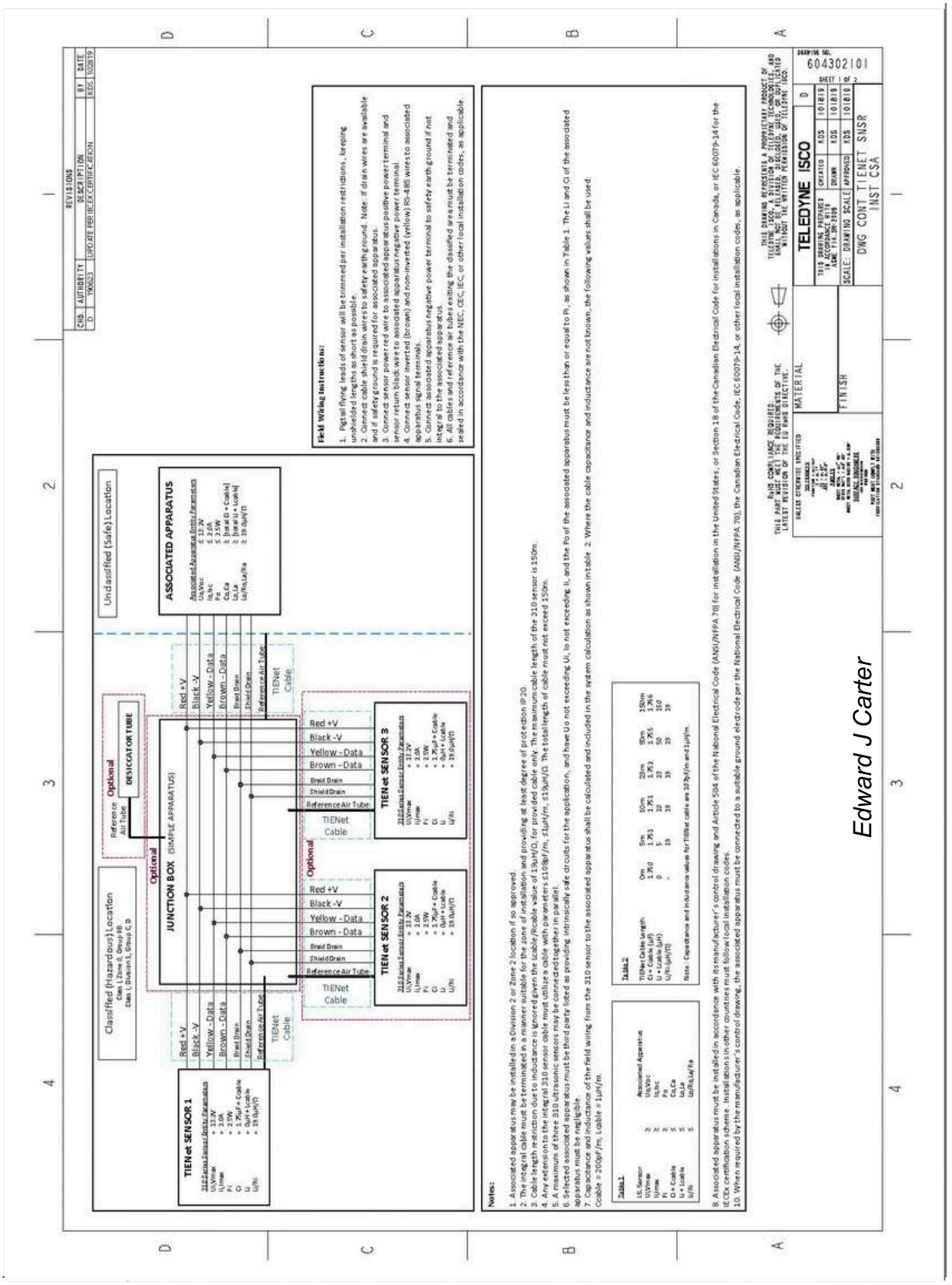
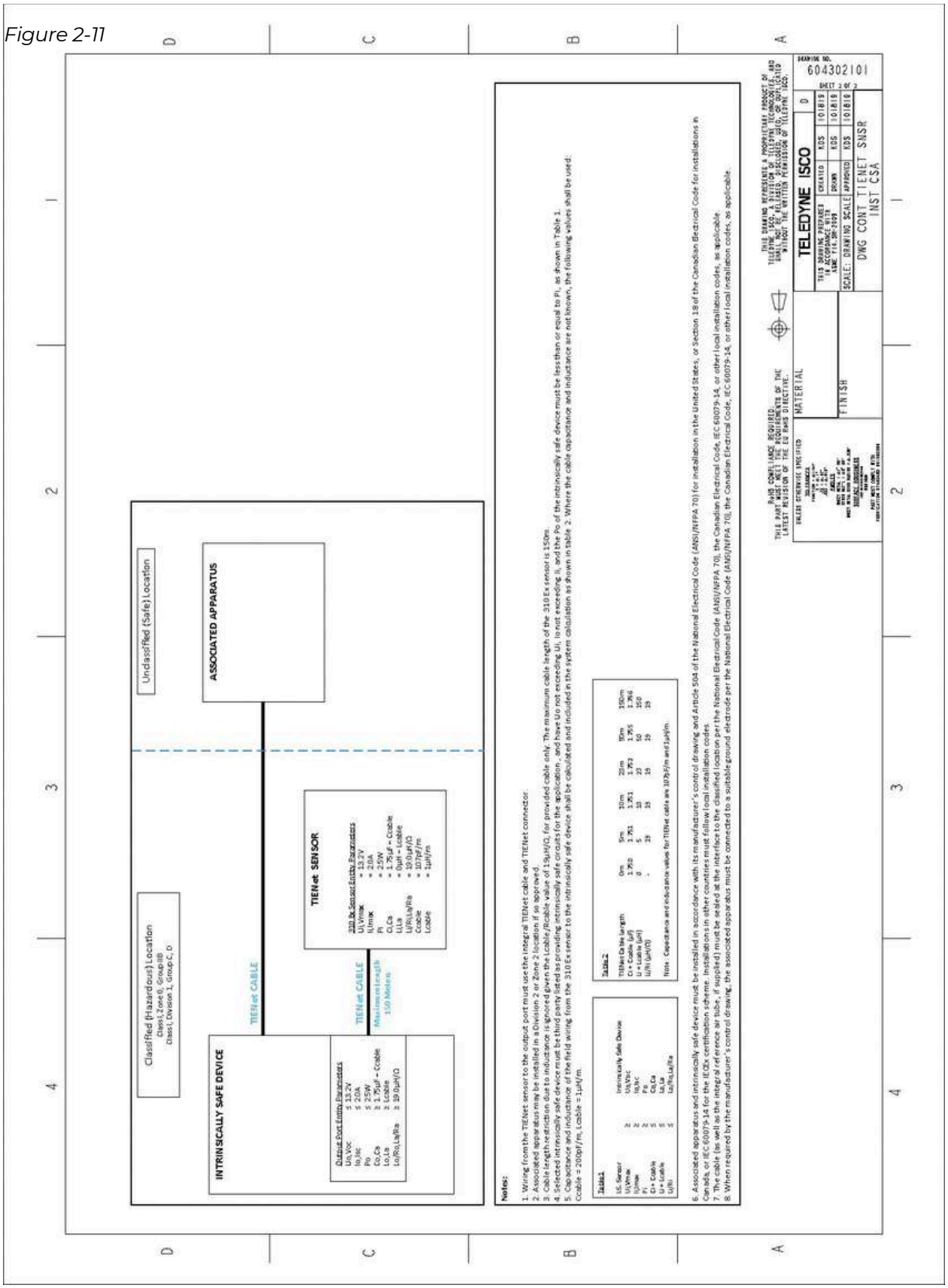

Edward J Carter

Figure 2-10Hazardous Location Installation Control Drawing-CSA

Figure 2-11



2.5 Configuring the System

To configure the Signature flow meter for operation with the TIENet 310 Ex device, press MENU (B) to access the top menu, and select Hardware Setup. For all TIENet devices including the 310 Ex, select Smart Sensor Setup (TIENet).

2.5.1 Updating the Device List

When the 310 Ex is physically added to the system, select Perform Scan so that the flow meter detects it. When the scan is complete, the 310 Ex appears in the list of connected devices, ready to be configured with the steps shown in Figure 2-13 on the following page.

> **Note**
> From the Hardware Setup menu, "Configure" refers to defining and selecting the parameters for each connected device.

The four parameters that will appear for the 310 Ex device are:

310 Distance – Distance between the bottom of the sensor and the surface of the flow stream.

310 Air Temperature – Temperature of surrounding (ambient) air

310 Level – Level of the flow stream surface

310 Signal – Strength of the return echo

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

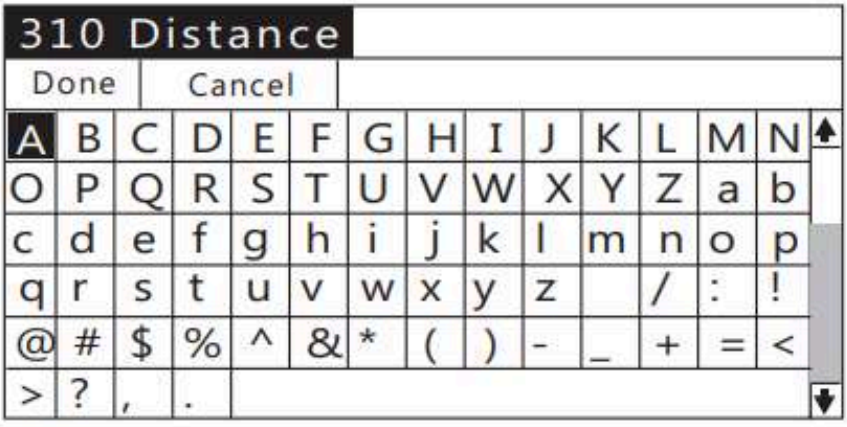


Figure 2-12 Character grid

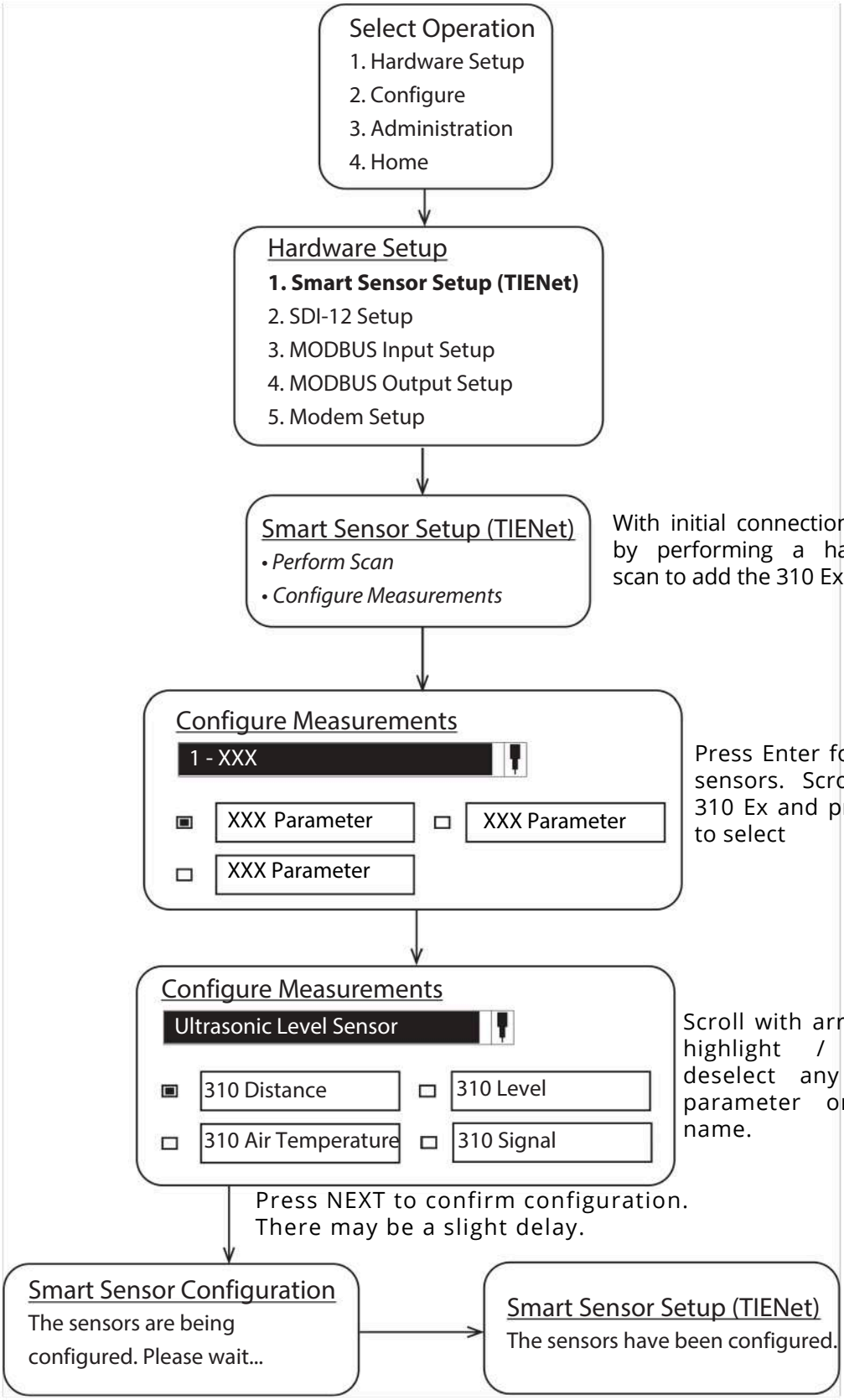


Figure 2-13Menu Tree: 310 Ex Configuration

2.5.2Measurement Setup

From Measurement Setup (Figure2-14 below), select Level Input Setup to define the measurement range.

The **Minimum Blanking Distance** is the shortest distance from the sensor face (highest expected liquid level). Because of the dead band, this value can never be less than one foot. 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 sensor face and the bottom of the channel, or zero level. You can enter a slightly larger value than calculated, if you prefer.

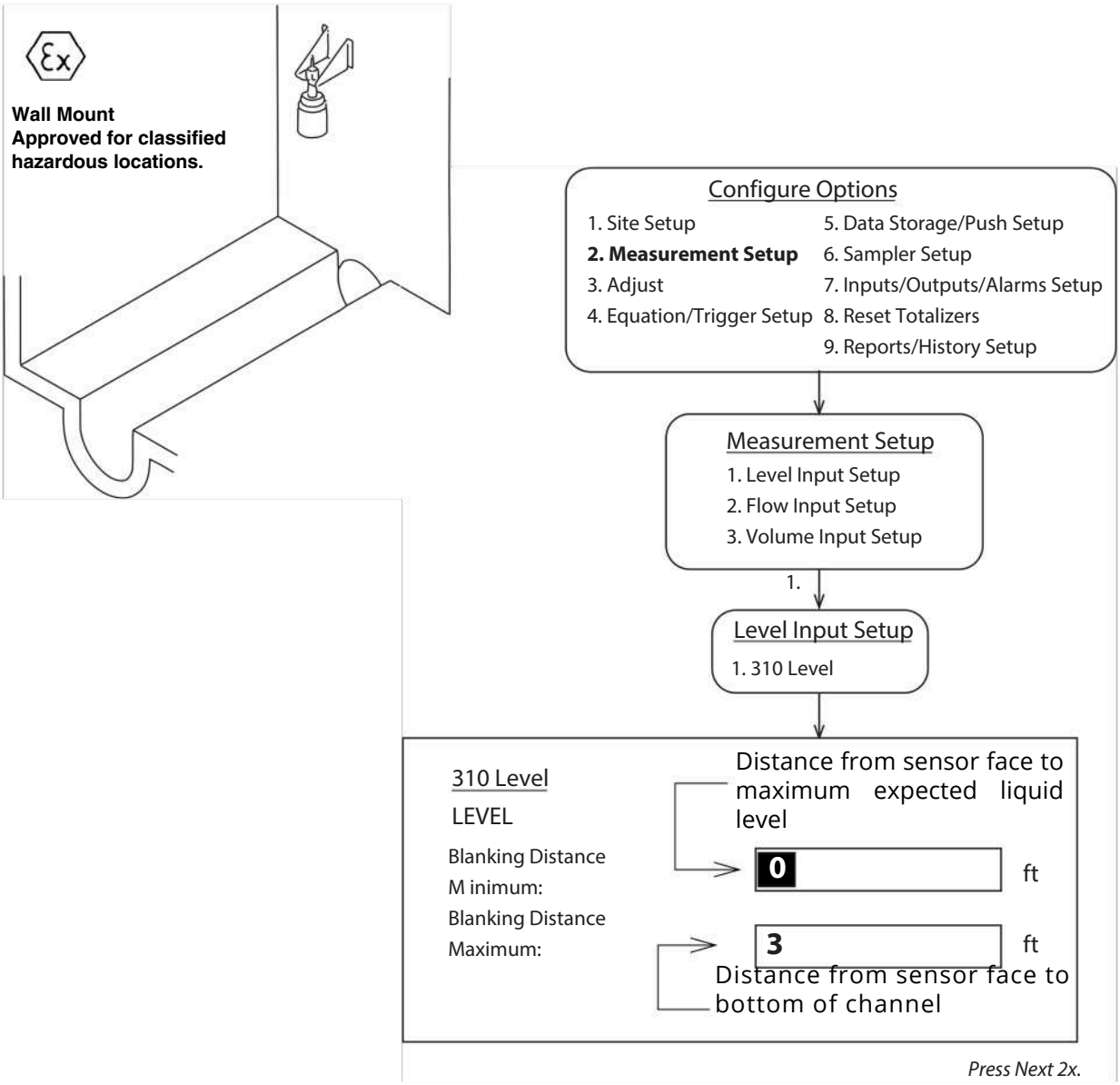
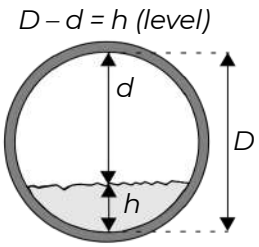


Figure 2-14Configuring ultrasonic level measurement

2.6Level Calibration



Although all other programming steps can be performed off-site, level must be set at the measurement site following installation, at ambient temperature.

Once the sensor is installed over the flow stream, measure the present liquid level (see figure at left) 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.

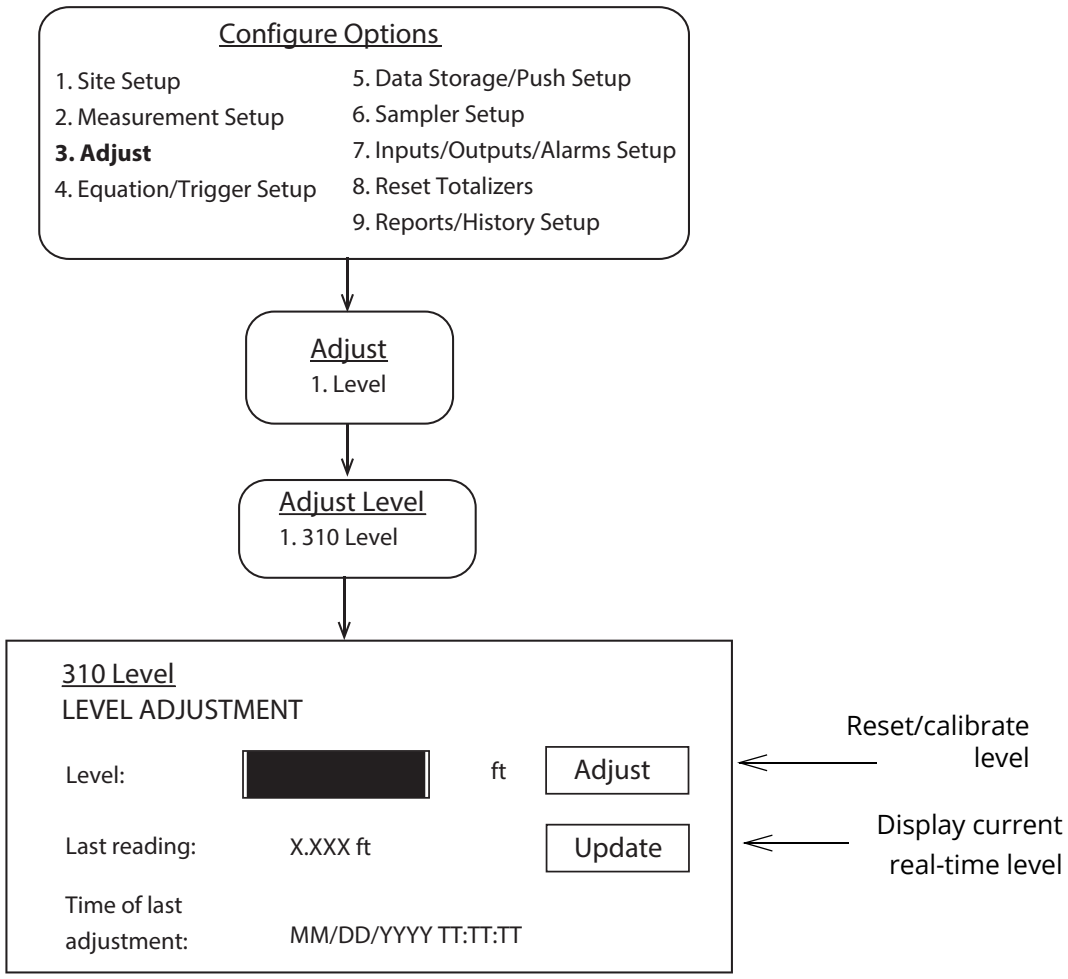


Figure 2-15Ultrasonic level adjustment and calibration

2.7Firmware Updates

The TIENet device's firmware is updated via the USB port on the front panel of the Signature Flow Meter. Step-by-step instruc- tions for updating the firmware can be found in Section2 of the Signature user manual.

2.8Troubleshooting TIENet 310 Ex USLS

Table 2-1Troubleshooting: TIENet 310 Ex Ultrasonic Level Sensor

Symptom	Cause	Action
Invalid level, display has asterisk (*) by level reading	Not scanned	Perform a smart sensor scan
	Not able to achieve signal lock (misalignment, loose mounting, turbulence, foam, or debris in the water)	Adjust mounting or place over a solid surface
	Level outside of the Blanking distances	Adjust min/max blanking distances
	Not wired correctly	Check/repair wiring
	Open fuse	Replace fuse FU-T 3.15A and rescan. Part #411-0212-70. Refer to Figure 3-2 Item K.
	Failed sensor	Replace with known good sensor
No level reading on the dis- play	Parameter not selected to be displayed on Home Display	Add the parameter to the Home Dis- play. Refer to Section2.7.1 ***Site Setup***.
Incorrect level reading	Level not adjusted properly	Readjust level
	Sensor misaligned	Realign sensor
	Objects in the path of the signal	Adjust min/max blanking distances and/or reposition sensor.
	Sensor exposed to direct sunlight	Install sunshade. Refer to AppendixAppendix B ***Options and Accessor ies***.

2.9Contact Teledyne Isco

If you have further questions about the installation, operation, and maintenance of your TIENet device, please contact our service department at:

Teledyne Isco
4700 Superior St.
Lincoln, NE 68504

Phone: 866 298-6174 or 402 464-0231
Fax: 402 465-3022
E-mail: IscoService@teledyne.com

TIENet® Model 310 Ex Ultrasonic Level Sensor

Appendix A Replacement Parts

A.1Replacement Parts

Replacement parts are called out in the following illustrations. Refer to the call-out in the adjacent table to determine the part number for the item.

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:IscoInfo@teledyne.com

A.1.1 TIENet 310 Ex Ultrasonic Level Sensor Replacement Parts

Split mounting Nut.....60-4313-007 Cap Sensor Connector.....60-4314-011 310 Ex Ultrasonic sensor w/ 10m cable.....60-4314-005 310 Ex Ultrasonic sensor w/ 23m cable.....60-4314-006 310 Ex Ultrasonic sensor w/ Cut-to-length .....60-4314-014 310 Ex Ultrasonic sensor w/ connector and 10m cable.....60-4314-009 310 Ex Ultrasonic sensor w/ connector and 23m cable.....60-4314-011 310 Ex Ultrasonic sensor w/ connector and Cut-to-length .....60-4314-013 O-Ring Sensor Connector .....20-2100-669 Screw Connector Cap #4-40 X1/4.....23-1014-304

Name and amount of Hazardous Substances or Elements in the product

Component Name	Hazardous Substances or Elements					
	(Pb)	(Hg)	(Cd)	(Cr(VI))	(PBB)	(PBDE)
Circuit Boards	O	O	O	O	O	O
Display	O	O	O	O	O	O
Wiring	O	O	O	O	O	O
Internal Cables	O	O	O	O	O	O
DC Motor	O	O	O	O	O	O
Connectors	O	O	O	O	O	O
Battery	X	X	X	O	O	O
Solenoid valve	O	O	O	O	O	O

Name and amount of Hazardous Substances or Elements in the product

O: ST/

O: Represent the concentration of the hazardous substance in this component's any homogeneous pieces is lower than the ST/ standard limitation.

X ST/

("X")

X: Represent the concentration of the hazardous substance in this component's at least one homogeneous piece is higher than the ST/ standard limitation.

(Manufacturer may give technical reasons to the "X"marks)

The Environmentally Friendly Use Period (EFUP) was determined through experience.

(207 2007)

A B

The date of Manufacture is in code within the serial number. The first three numbers are the year of manufacture (207 is year 2007) followed by a letter for the month. "A" is January, "B" is February and so on.

DECLARATION OF CONFORMITY

CE 1180

ISM1-A

Application of Council Directive:	2014/30/EU -The EMC Directive 2014/35/EU - The Low Voltage Directive 2014/34/EU - The ATEX Directive 2011/65/EU –The RoHS Directive
Manufacturer's Name:	Teledyne Isco, Inc.
Manufacturer's Address:	4700 Superior, Lincoln, Nebraska 68504 USA Mailing Address: P.O. Box 82531, Lincoln, NE 68501
Equipment Type/Environment:	Laboratory Equipment for Light Industrial/Commercial Environments: The devices are communication cables connecting to a water flow monitoring instrument. The devices are intended for indoor/outdoor operation in ambient temperature range of -40 to +60 C.
Trade Name/Model No:	**310 Ultrasonic Sensor**
Year of Issue:	2011
Review of Harmonized Standards:	2017
Provisions of the Directive fulfilled by the Equipment:	II 1G Ex ia IIB T4 Ga (-40C < Ta < +60C) IP68 (self-certified; submerged 9 meters for 72 hours)
Notified Body for EC-Type Examination:	SGS Baseefa 1180 Buxton UK
EC-type Examination Certificate:	Model Type 310 Ultrasonic Sensor: Baseffa11ATEX0180X Issued December 8, 2011
Notified Body for Production:	SGS Baseefa 1180 Buxton UK
Harmonized Safety Standards:	EN60079-0:2012/A11:2013, EN60079-11:2012
Other Standards and Specifications used:	EN 61326-1:2013 — EMC Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use EN60529:1992/A2:2013 — Degrees of Protection Provided by Enclosure; Self Certified as IP-68 by submersion in water at 3meters for 72Hrs.

I, the undersigned, hereby declare that the design of the equipment specified above conforms to the above Directive(s) and Standards as of July 17, 2017.

USA Representative:

Edward J. Carter
Director of Engineering
TELEDYNE ISCO
A Teledyne Technologies Company
Teledyne Isco
4700 Superior Street
Lincoln, Nebraska 68504
Phone: (402)-464-0231
FAX: (402)-465-3799

60-4312-011
Rev A

Teledyne Isco One Year Limited Factory ServiceWarranty*

This warranty exclusively covers Teledyne Isco instruments, providing a one-year limited warranty covering parts andlabor.

Any instrument that fails during the warranty period dueto faulty parts or workmanship will be repaired at thefactory at no charge to the customer. Teledyne Isco'sexclusive liability is limited to repair or replacement ofdefective instruments. Teledyne Isco is not liable forconsequential damages.

Teledyne Iscowill pay surface transportation chargesboth ways within the 48 contiguous United States if the instrument proves to be defective within 30 daysof shipment. Throughout the remainder of the warranty period, the customer will pay to return the instrument toTeledyne Isco and Teledyne Isco will pay surface transportationto return the repaired instrument to the customer. Teledyne Isco will not pay air freight or customer's packingand crating charges. This warranty does not cover loss,damage, or defects resulting from transportation between the customer's facility and the repairfacility.

The warranty for any instrument is the one in effect ondate of shipment. The warranty period begins on the shipping date, unless Teledyne Isco agrees in writing to adifferent date. Excluded from this warranty are normal wear;expendable items such as desiccant, pH sensors, charts, ribbon, lamps, tubing,and glassware; fittings and wetted parts of valves; check valves, pistons,piston seals, wash seals, cylinders, pulse damper diaphragms, inlet lines and filter elements; anddamagedue to corrosion, misuse, accident, or lack of properinstallation ormaintenance. This warranty does not

cover products not sold under the Teledyne trademarkorforwhichanyother warranty is specifically stated.

No item may be returned for warranty service without a return authorization number(RMA)issued by Teledyne Isco.

This warranty is expressly in lieu of all otherwarranties and obligations and Teledyne Isco specificallydisclaims any warranty of merchantability or fitness fora particular purpose.

The warrantor is Teledyne Isco, 4700 Superior, Lincoln, NE 68504, U.S.A.

*This warranty applies to the USA and countries where Teledyne Isco does not have an authorizeddealer. CustomersincountriesoutsidetheUSA,whereTeledyneIscohasanauthorizeddealer,shouldcontact their Teledyne Isco dealer for warrantyservice.