ADS® Intrinsically-Safe FlowShark® Triton Installation, Operation, and Maintenance Manual

April 2015   **QR 775013 A6**

ADS ENVIRONMENTAL SERVICES®

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C H A P T E R 1

Introduction

The *ADS®* Intrinsically-Safe *FlowShark® Triton* flow monitor measures open channel flow in sanitary sewers, storm sewers, combined sewers, and other environments to assist municipalities and other industry in addressing the following issues:

- Planning sewer systems (sizing and rehabilitation)

- Reducing infiltration and inflow (I/I)

- Monitoring combined sewer overflows (CSOs)

- Detecting and monitoring surcharges

- Managing inter-agency billing

- Monitoring sewage handling facilities (wastewater treatment plants and pump stations)

The battery- or externally-powered FlowShark Triton monitor provides exceptional accuracy and reliability in measuring open-channel flow depth and velocity to determine flow rate (quantity) in pipes. This flow data is the essential element required to successfully perform investigative, analytical, and reporting activities.

This manual offers detailed instructions on installing, maintaining, and troubleshooting the FlowShark Triton flow monitor, sensors, and communication hardware.

Intrinsic Safety

Intrinsic safety is an electronic hardware protection concept that ensures there are no conditions under which the equipment can operate that could cause a release of energy sufficient to ignite a hazardous gas or dust mixture. Devices that meet the low power, current-limited design criteria are deemed Intrinsically Safe (IS). Special design, testing, quality, and inspection rules apply to manufacturers and users of IS equipment due to the critical nature of their deployment in hazardous areas. Areas where hazardous conditions can be expected to be present on a constant basis are classified (rated) as Class I, Division 1 or Zone 0.

The FlowShark Triton flow monitor (Models 8000-FST and 8000-FST-60C) is certified for use in North America in areas where the Class/Division system is observed. The FlowShark Triton has been tested to worldwide IECEx (International Electrotechnical Commission Explosive) standards and is certified for use in areas requiring Class I, Division 1, equipment. The IECEx scheme allows demonstrated compliance for use in Class I, Division 1, Group C & D or Zone 0, areas in the following countries.

United States	Germany	Poland
Australia	Hungary	Romania
Brazil	India	Russia
Canada	Italy	Singapore
China	Japan	Slovenia
Croatia	Korea	South Africa
Czech Republic	Malaysia	Sweden
Denmark	Netherlands	Switzerland
Finland	New Zealand	Turkey
France	Norway	United Kingdom

The FlowShark Triton has also been certified for use in Zone 0 via testing to ATEX standards.

The FlowShark Triton flow monitor has been tested to CSA (Canadian Standards Association) standards and certified for use in Canada in Intrinsically Safe and Non-Incendive Systems – For Hazardous Locations. The CSA certification allows demonstrated compliance for use in Ex ia IIB T4 Ga areas in Canada.

It is the customer's responsibility to ensure that the certification(s) provided for the ADS equipment meets the applicable regulatory requirements.

> **Note:** FlowShark Triton models include only the 8000-FST and 8000-FST-60C.

FlowShark Triton System Certification

The FlowShark Triton unit and associated telemetry equipment are certified for use only with approved ADS sensors, communication cables, and telemetry equipment. Connection of any non-approved devices could result in unsafe operation and will immediately void the warranty and IS certification.

> **Note:** Connecting the Telog® Ru-33 to the ADS FlowShark Triton is an approved application and, therefore, will not void the FlowShark Triton warranty. However, because the Telog unit is not IS certified, the installation will *not* be considered intrinsically safe if the Ru-33 is installed in the manhole with the monitor.

Sensors

The FlowShark Triton monitor supports several approved IS sensors that vary in measurement methodology, redundancy, and other features. The monitor is approved for accommodating up to two of the same or different types of IS sensors. Following are the approved IS sensors:

- **Peak Combo Sensor** Performs upward ultrasonic depth, pressure depth, and peak velocity measurement and mounts at

or near the bottom of the pipe under the flow surface (ADS p/n
-CS4-05-35, 8K-CS4-15-35, *or* 8K-CS4-30-1H).

● **Surface Combo Sensor** Performs downward ultrasonic
depth, surcharge pressure depth, surcharge peak velocity, and
surface velocity measurement and mounts at the top (or crown)
of the pipe above the flow (ADS p/n 8K-CS5-V2-05-30 *or* 8K-
CS5-V2-15-30).

● **Ultrasonic Depth Sensor (*ultrasonic and optional
pressure depth only*)** Performs downward ultrasonic depth
and pressure depth (*optional*) measurement alone and mounts
at the top (or crown) of the pipe above the flow (ADS p/n 8K-
CS3-V0-00-30, 8K-CS3-V0-05-30, *or* 8K-CS3-V0-15-30).

● **Slimline Peak Combo Sensor** Performs upward ultrasonic
depth and peak velocity measurement and mounts at or near the
bottom of the pipe under the flow surface (ADS p/n 8K-CS4-
35).

Extension cables are available for these sensors in lengths up to
maximum of 300 feet (91 m).

> **Note:** Detailed descriptions and specifications for the
> sensors are available in *Chapter 2*, *System Overview*, and
> *Appendix A*, *Specifications*.

Power

The FlowShark Triton flow monitor can be powered by an internal
12-volt IS battery pack (ADS p/n 8000-0043) or an external DC
power source through an external modem unit (EMU, ADS p/n
3800-0148) or EMU/multiplexer (EMUX, ADS p/n 106226E)).

Telemetry

Wireless communication is available to the FlowShark Triton
monitor via connection to an IS quad-band GSM/GPRS module
(ADS p/n 8000-0052), an EMU (ADS p/n 3800-0148), or an
EMUX (ADS p/n 106226E). Connecting the FlowShark Triton to
the Telog RTU (Model Ru-33) also supports wireless
communication via the Telog "passthrough" mode.

The GSM module is certified for installation and operation in the hazardous area and draws its power from the FlowShark Triton. The antenna may be located either inside or outside the manhole; however, ADS recommends installing the antenna outside the manhole to maximize signal strength. Several antenna models are available to mitigate signal strength issues.

The EMU is mounted outside the hazardous area and receives power from an external DC power source supplied by the user. It is delivered with the antenna installed on the inside of the EMU enclosure. However, the antenna may require installation outside the EMU if the material and/or construction of the enclosure and/or housing in which the EMU enclosure is installed impedes the signal from the wireless provider.

The EMUX is mounted outside the hazardous area and receives power from an external DC power source supplied by the user. It is delivered without an antenna; therefore, an antenna must be attached to the EMUX. However, it may require installation outside the enclosure in which the EMUX is installed if the material and construction of the enclosure impedes the signal from the wireless provider.

The Telog Ru-33 is mounted next to the FlowShark Triton in the hazardous area and connected to the monitor using the Triton-Telog Comm Cable (ADS p/n 8000-0054-01). *However, please note that, because the Telog unit does not possess IS certification, the installation will not be considered intrinsically safe if the Telog unit is installed in the manhole with the monitor.*

Installation and IS Considerations

When installing the FlowShark Triton flow monitor, carefully follow any local regulations for the installation of IS equipment. For example, many clients only allow the use of special *hazardous area* tools (flashlights, radios, etc.) in manholes. Some clients will not allow the use of an electric drill, either battery-powered or AC-powered, in a manhole. In this case, air (pneumatic) tools must be

used. When in doubt as to the applicable regulations, check with the client or the client's designated safety representative.

Special Conditions for Safe Use

During the ATEX/IECEx/CSA approval process, certain conditions are set forth that must be observed when using the certified equipment. These *Special Conditions for Safe Use* can be found in the body of each certification (referenced in this manual). Following is a summary of these Safe Use Instructions:

- Parts of the enclosure may be non-conducting and may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, do not install this equipment in a location where it may be subject to external conditions (such as high-pressure steam or dust) that may cause a buildup of electrostatic charge on non-conducting surfaces.

- As aluminum is used at the accessible surface of this unit, in the event of rare incidents, ignition sources due to impact and friction sparks may occur. This shall be considered when it is being installed, particularly in locations that require equipment with a Group II Ga level of protection.

- The equipment (ADS Models 8000-FST and 8000-FST-60C) shall be used in the hazardous area only when fully assembled. Do not perform any maintenance of internal parts, replacement of battery packs, or replacement of fuses unless the unit is located in a safe area.

- (*applicable to the USB Serial Interface*) Measures shall be taken to limit transient over voltages to the USB Serial Interface to an appropriately low level in accordance with Overvoltage Category 1 (IEC 60664-1)

- The equipment shall be installed as per installation drawing 8000BK0009.

- The external modem unit (EMU) or EMU/multiplexer (EMUX) may only be mounted in a non-hazardous location.

Other Conditions for Safe Use

- The ADS Models 8000-FST and 8000-FST-60C shall use only the 12-volt IS Battery Pack (ADS p/n 8000-0043) for internal power.

- Only ADS-approved sensors shall be connected to the ADS Models 8000-FST and 8000-FST-60C: ADS sensor types 8K-CS1, 8K-CS3, 8K-CS4, and 8K-CS5.

  Note: The 8K-CS1 is no longer available; however, ADS will continue to provide support for this sensor.

- The only communication devices that may be connected to the **COMM** connector on the FlowShark Triton are the GSM Wireless Module (ADS p/n 8000-0052), the External 3G Cell Modem (ADS p/n 8000-0430), the EMU/EMUX Communication Cable (ADS p/n 106227B), the Direct Connect Interface (ADS p/n 8000-0054), and the USB Serial Interface (ADS p/n 8000-0337).

Maintenance Restrictions

As mentioned earlier, all ADS FlowShark Triton flow monitors are manufactured to meet IS standards. ***The monitor's IS certification can be voided instantly if proper maintenance and service procedures are not followed.*** ADS must restrict certain maintenance tasks to ADS IS-certified technicians.

ADS-certified technicians carefully inspect and document their repairs of IS monitors. This inspection and documentation process provides legal protection should the monitor's performance or safety be in question.

If you experience trouble with this equipment, please refer to this manual for troubleshooting guidelines. The following maintenance procedures may be performed in the field, but they must be performed as described in this manual:

- Install and swap monitor

- Install and swap sensors

- Install and swap battery pack

- Swap fuses in power regulator in monitor

- Install and swap GSM wireless module

- Install and swap EMU and modem in EMU

- Install and swap EMUX

- Install and swap SIM cards (EMU, EMUX, and GSM module)

- Replace pressure depth sensor dryer tube and desiccant beads

- Replace desiccant pack (GSM module)

- Clean sensors

- Confirm sensors

    Note: Please note that, in all applications, only ADS IS-certified Service Technicians are authorized to perform component-level service on the FlowShark Triton.

If you have any questions about the procedures, warranty information, or the level of service you are allowed to perform on a monitor, contact ADS through the contact information listed at the end of this chapter.

Warnings, Certifications, GSM/GPRS Compliance, and Conformity

Manhole and sewer system work involves confined space entry and is inherently dangerous. Therefore, installers and technicians should comply with all federal, state, and municipal regulations concerning confined space entry.

In addition, personnel installing and maintaining this equipment should follow all guidelines presented in this manual concerning monitor installation and maintenance. Failure to strictly adhere to these guidelines can result in personal injury and/or damage to the monitor.

Changes or Modifications

Changes or modifications to the FlowShark Triton flow monitor not expressly approved by the party responsible for compliance will void the IS certification.

Personnel performing installation of the FlowShark Triton flow monitor should carefully follow the guidelines contained in this manual when installing and maintaining the monitor. Failure to strictly adhere to these guidelines can result in personal injury and can cause damage to the monitor, which would invalidate its warranty.

The FlowShark Triton flow monitor is designed to be installed in combined and sanitary sewer lines and manholes. This installation work is inherently dangerous. All applicable safety guidelines should be followed and carried out by at least two fully trained and qualified persons.

Control Drawing

This drawing depicts the allowed interconnections for the FlowShark Triton. It is intended for use by inspection professionals for audit certificate compliance; however, it is a good tool to understand the FlowShark Triton flow monitoring system structure. This drawing is divided in two sections with a match point indicated.
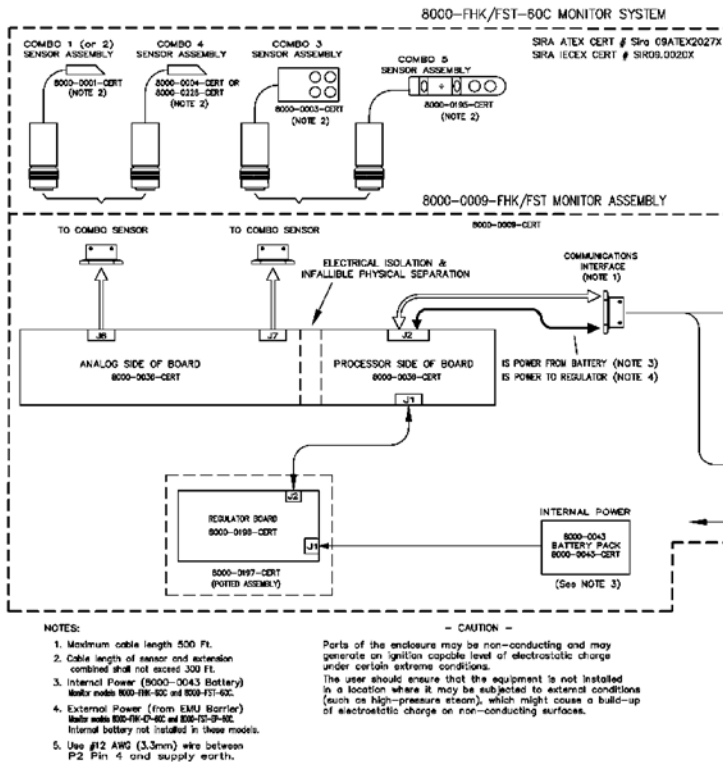
Control Drawing – Part 1 (right side from part 1 continues on part 2)
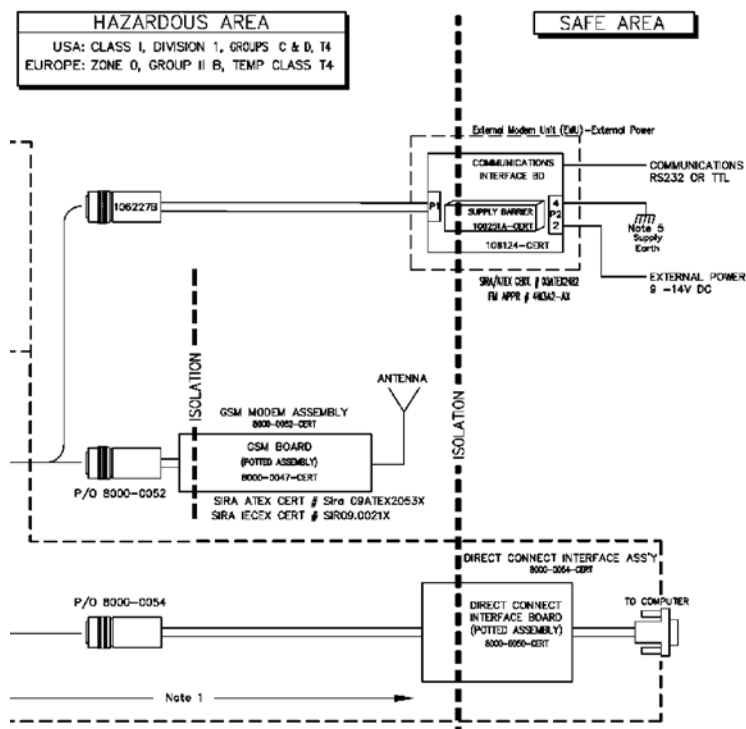
Control Drawing – Part 2 (left side on 2 continues from drawing 1)

Note: These are excerpts from an agency-controlled document for illustration purposes only. Changes to the base controlled document require agency approval. For a full-size copy of this drawing, please contact ADS and request drawing number *8000BK0009-CERT*.

Note: The Telog Ru-33 can be connected to the **COMM** port on the FlowShark Triton monitor using the Telog-Triton Comm Cable (ADS p/n 8000-0054-01). However, this configuration has not been included on this drawing because the Telog unit is not certified for IS operation. Therefore, an installation involving this configuration will not be considered intrinsically safe, unless the Ru-33 is installed outside the hazardous area.

GSM/GPRS Modem Information

Wireless telemetry is provided via attachment of the ADS GSM Module to the FlowShark Triton monitor. The GSM Module contains a third-party, FCC-approved, commercial GSM/GPRS modem. Integration of the modem into the GSM Module was performed in accordance with guidelines set forth in the third party's Integration Manual in order to maintain the FCC approval.

Use of the modem, as installed in the ADS Module, is considered a fixed Mobile wireless application, meaning the module is capable of being moved between locations. However, it is NOT considered a Portable device, which indicates it is used in close proximity to a user's body (like a handset). Users of the ADS GSM Module must maintain a distance from the antenna of at least 7.87 inches (200 mm) when the unit is operational.

Users cannot provide their own antennas due to strict limitations on antenna gains and other variables that may produce a dangerous RF condition and violate IS and FCC requirements. Only antennas provided by ADS for use with the GSM Module may be used.

European ATEX Hazardous Area Compliance

The following instructions apply to equipment covered by certificates numbered Sira 09ATEX2027X (FlowShark Triton, Direct Connect Interface, and Combo Sensors CSX Series), 09ATEX2053X (IS GSM modem), and 03ATEX2482 (IS Comm Interface). Reference European ATEX Directive 94/9/EC, Annex II, 1.0.6:

- The equipment may be used with flammable gases and vapors with apparatus groups IIA and IIB and with temperature classes T3 (152°C), T4, T5, and T6.

- The equipment is only certified for use in ambient temperatures in the range of -20°C to +60°C and should not be used outside this range.

- The certificate number has an 'X' suffix, which indicates that special conditions apply to installation and use. Those installing or inspecting this equipment must have access to the contents of the certificate.

- Installation shall be carried out in accordance with the applicable code of practice by suitably-trained personnel.

- Repair of this equipment shall be carried out in accordance with the applicable code of practice.

- If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

  ❑ Aggressive substances such as acidic liquids or gases that may attack metals, or solvents that may affect polymeric materials

  ❑ Suitable precautions such as regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals

- There are no special inspections or maintenance conditions other than a periodic check.

- FlowShark Triton monitors and GSM modem modules delivered outside the U.S. must bear the following label to substantiate conformance to ATEX standards as certified through Sira Certification Services:
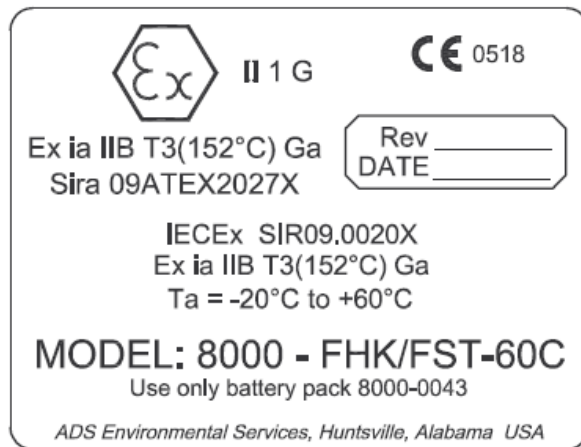
Sira FlowShark Triton Certification Label

Sira Combo Sensor CSX Series Certification Label
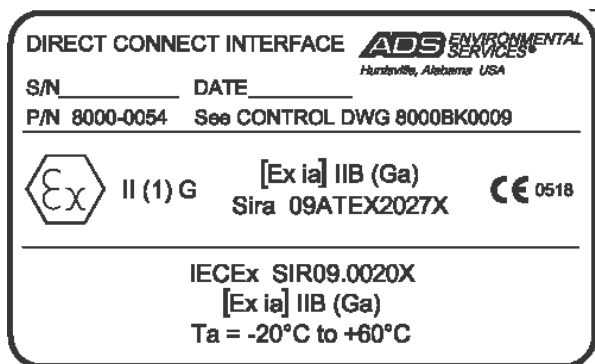
Sira Direct Connect Interface Certification Label
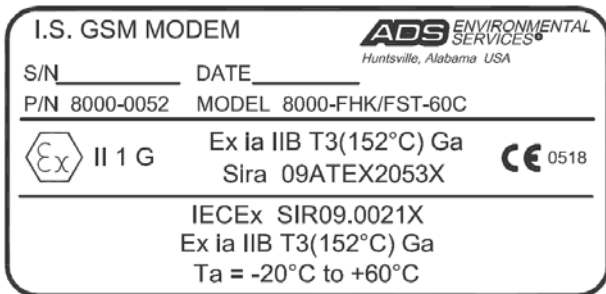
Sira GSM Certification Label
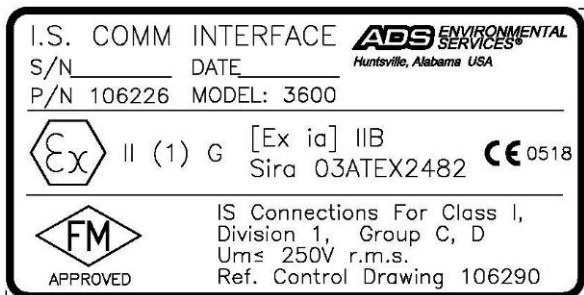
Sira Communication Interface (EMU/EMUX) Certification Label

EC Type Examination Certificates Sira 09ATEX2027X, Sira 09ATEX2053X, and Sira 03ATEX2482 can also be used to substantiate conformance to applicable EU laws for IS equipment.

The following pages provide a copy of the first page of each certificate.

> **Note:** These copies were current at the time of publication of this manual. To access the latest version and entire content of each certificate, please contact ADS.

sira
CERTIFICATION

1	**EC TYPE-EXAMINATION CERTIFICATE**
2	Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC
3	Certificate No: **Sira 09ATEX2027X** Issue: **7**
4	Equipment: **8000-FHK/FST Monitor System**
	(aka Flowshark Triton (Model No. 8000-FST) or Flowhawk (Model No. 8000-FHK)
5	Applicant: **ADS LLC**
6	Address: 1300 Meridian Street
	Suite 3000
	Huntsville
	Alabama 35801
	USA

7   This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8   Sira Certification Service, notified body number 0518 in accordance with Article 9 of Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential reports listed in Section 14.2.

9   Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:

EN 60079-0:2006   EN 60079-11:2007   EN 60079-26: 2007

10   If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

11   This EC type-examination certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.

12   The marking of the equipment shall include the following:

Either: 〈Ex〉   II 1 G   Or: 〈Ex〉   II (1) G
                 Ex ia IIB T4 Ga   [Ex ia] IIB (Ga)

C. Ellaby

Project Number   26270

C Ellaby
Deputy Certification Manager

This certificate and its schedules may only be
reproduced in its entirety and without change.

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Form 9400 Issue 1

Sira Certification Service

Rake Lane, Eccleston, Chester, CH4 9JN, England

Tel: +44 (0) 1244 670900
Fax: +44 (0) 1244 681330
Email: info@siracertification.com
Web: www.siracertification.com

First page of the FlowShark Triton ATEX Certificate

sira
CERTIFICATION

1 **EC TYPE-EXAMINATION CERTIFICATE**

2 Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

3 Certificate Number: **Sira 09ATEX2053X**   Issue: **3**

4 Equipment: **IS GSM Modem**

5 Applicant: **ADS Environmental Services**

6 Address: 4940 Research Drive
                         Huntsville
                         Alabama 35805
                         United States of America

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Sira Certification Service, notified body number 0518 in accordance with Article 9 of Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

   The examination and test results are recorded in the confidential reports listed in Section 14.2.

9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:

   EN 60079-0:2006   EN 60079-11:2007   EN60079-26: 2007

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

11 This EC type-examination certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.

12 The marking of the equipment shall include the following:

   ⟨Ex⟩ II 1 G
        Ex ia IIB T4 Ga

Project Number   22062   D R Stubbings
C. Index   15   Certification Manager

This certificate and its schedules may only be
reproduced in its entirety and without change.

                                                Sira Certification Service
                                                Rake Lane, Eccleston, Chester, CH4 9JN, England

                    Page 1 of 3
Form 9400 Issue 1   Tel: +44 (0) 1244 670900
                                                Fax: +44 (0) 1244 681330
                                                Email: info@siracertification.com
                                                Web: www.siracertification.com

First page of the GSM Module ATEX Certificate

sira
CERTIFICATION

1	**EC TYPE-EXAMINATION CERTIFICATE**
2	Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC
3	Certificate Number: **Sira 03ATEX2482** Issue: **3**
4	Equipment: **106124 Communications Interface Unit**
5	Applicant: **ADS Environmental Services**
6	Address: **4940 Research Drive** **Huntsville** **Alabama 35805** **USA**
7	This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
8	Sira Certification Service, notified body number 0518 in accordance with Article 9 of Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.
	The examination and test results are recorded in the confidential reports listed in Section 14.2.
9	Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:
	EN 60079-0:2006 EN 60079-11:2007
10	If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.
11	This EC type-examination certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.
12	The marking of the equipment shall include the following:

II (1) G
[Ex ia] IIB

Project Number   52B20981
C. Index   12

D R Stubbings BA MIET
Certification Manager

This certificate and its schedules may only be
reproduced in its entirety and without change.

Page 1 of 3

Form 9400 Issue 1
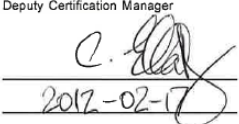
Sira Certification Service
Rake Lane, Eccleston, Chester, CH4 9JN, England
Tel: +44 (0) 1244 670900
Fax: +44 (0) 1244 681330
Email: info@siracertification.com
Web: www.siracertification.com

First page of the Communications Interface Unit (from the EMU/EMUX)
ATEX Certificate

IECEx (International Electrotechnical Commission Explosive) Hazardous Area Compliance

The FlowShark Triton is covered by certificates IECEx SIR 09.0020X (FlowShark Triton) and IECEx SIR 09.0021X (IS GSM modem). Reference IECEx standards IEC 60079-0 : 2004; IEC 60079-11 : 2006; and IEC 60079-26 : 2006. These IECEx certificates can also be used to substantiate conformance to applicable international standards for IS equipment. The following pages provide a copy of the first page of each certificate.

Note: The copies were current at the time of publication of this manual. To access the latest version and entire content of each certificate, please contact ADS.

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	IECEx SIR 09.0020X	issue No.:7
Status:	Current	
Date of Issue:	2012-02-17	Page 1 of 4

Certificate history:
Issue No. 7 (2012-2-17)
Issue No. 6 (2011-11-24)
Issue No. 5 (2010-7-13)
Issue No. 4 (2010-3-26)
Issue No. 3 (2010-1-15)
Issue No. 2 (2009-9-23)
Issue No. 1 (2009-9-15)
Issue No. 0 (2009-9-10)

Applicant:
ADS LLC
1300 Meridian Street
Suite 3000
Huntsville
Alabama 35801
United States of America

Electrical Apparatus: **Flowshark Triton (Model Number 8000-FST) or Flowhawk (Model Number 8000-FHK)**
Optional accessory:

Type of Protection: **Intrinsic Safety**

Marking: Either: Ex ia IIB T4 Ga
Or: [Ex ia] IIB (Ga)

Approved for issue on behalf of the IECEx
Certification Body: C Ellaby

Position: Deputy Certification Manager

Signature:
(for printed version)

Date: 2012-02-17

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:
SIRA Certification Service
Rake Lane
Eccleston
Chester
CH4 9JN
United Kingdom

sira
CERTIFICATION

First page of the FlowShark Triton IECEx Certificate of Conformity

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	IECEx SIR 09.0021X		Issue No.:2	Certificate history: Issue No. 2 (2010-7-5) Issue No. 1 (2010-1-15) Issue No. 0 (2009-9-10)
Status:	Current			
Date of Issue:	2010-07-05		Page 1 of 5	
Applicant:	**ADS Environmental Services** 4940 Research Drive Huntsville Alabama 35805 **United States of America**			
Electrical Apparatus: *Optional accessory:*	**IS GSM Modem**			
Type of Protection:	**Intrinsic Safety**			
Marking:	**Ex ia IIB T4 Ga**			

Approved for issue on behalf of the IECEx *Certification Body:*	D R Stubbings BA MIET
Position:	Certification Manager
Signature: *(for printed version)*	
Date:	2010-07-05

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

SIRA Certification Service
Rake Lane
Eccleston
Chester
CH4 9JN
United Kingdom

sira
CERTIFICATION

First page of the GSM Module IECEx Certificate of Conformity

CSA Hazardous Area Compliance

The FlowShark Triton is covered by certificate CSA 2517095 (FlowShark Triton and Combo Sensors, IS GSM modem, and Direct Connect Interface). Reference CSA requirements C22.2 No. 0-10; CAN/CSA-C22.2 No. 60079-0:11; and CAN/CSA-C22.2 No. 60079-11:11.

The following CSA certificate can also be used to substantiate conformance to applicable Canadian standards for IS equipment:

Note: The certificate displayed on the following page was current at the time of publication of this manual. To access the latest certificates, please contact ADS.

Certificate of Compliance

CSA Group

Certificate:	2517095	Master Contract:	255567
Project:	2517095	Date Issued:	June 22, 2012

Issued to: **ADS LLC**
1300 Meridian Street,
Suite 3000
Huntsville, AL 35801
US
Attention: Jos Dominguez

The products listed below are eligible to bear the CSA Mark shown

Ron Wildish

Issued by: Ron Wildish

PRODUCTS

CLASS 2258 03   - PROCESS CONTROL EQUIPMENT - Intrinsically Safe and Non -
Incendive Systems - For Hazardous Locations

Ex ia IIB T4 Ga:

Flowshark Triton, Model 8000-FST and Flowhawk, Model 8000-FHK Monitors; battery operated, powered by field-replaceable Battery Pack P/N 8000-0043; with accessory, P/N 8000-0052 IS GSM Modem; with optional accessory, P/N 8000-0054 "Direct Connect Interface"; intrinsically safe and providing intrinsically safe circuits to Combo Sensor, P/N 8K-CS1, 8K-CS2, 8K-CS3, 8K-CS4 or 8K-CS5 when installed per Installation Drawing 8000BK0009; Temperature Code T4; Ambient: –20 ℃ to +40℃.

APPLICABLE REQUIREMENTS

C22.2 No. 0-10 - General Requirements – Canadian Electrical Code, Part II

CAN/CSA-C22.2 No. 60079-0:11 - Explosive Atmospheres - Part 0: Equipment - General requirements

CAN/CSA-C22.2 No. 60079-11:11 - Explosive Atmospheres – Part 1: Equipment protection by intrinsic safety "i"

DQD 507 Rev. 2012-05-22   Page: 1

CSA Certificate of Compliance

Installation and Configuration

Following is the general procedure for installing and configuring a FlowShark Triton monitor. *Refer to Chapters 3 through 7 for more details.*

❑ **Investigate Site Characteristics**

- Flow Hydraulics

- Pipe and Manhole Characteristics

❑ **Prepare Monitor and Sensors for Installation**

- Assemble Ring (when applicable)

- Mount Sensors to Ring or Special Bands

- Secure Sensor Cables to Ring or Special Bands

❑ **Install the Sensors in the Pipe**

- Install Ring or Band in Pipe

- Secure Sensor Cables Along Pipe and Up Manhole

❑ **Install Monitor in Manhole**

- Connect Sensors to Monitor

❑ **Establish Wireless or On-Site Communication with Monitor**

Note: This manual provides instructions on performing the remaining activities through the ADS **Profile®** Software. However, ADS also offers another software utility, **Q*start*™**, through which these tasks may be accomplished. **Q*start*** primarily serves as a streamlined configuration, activation, and diagnostic tool for setting up monitors quickly in the field. It also provides several other powerful and useful functions, such as data collection, archival, and display. Although this manual does not include instructions on completing these remaining procedures using **Q*start***, the application's integrated

online help provides comprehensive information on
successfully conducting these tasks.

❑ **Configure Monitor (*Profile software*)**

- Create Monitor Location

- Create Installation Table

- Select and Edit Devices

❑ **Set Communication Parameters (*Profile software*)**

❑ **Activate Monitor (*Profile software*)**

❑ **Run Diagnostics and Perform Confirmations (*Profile software*)**

Product Warranty

This section includes the warranty information for the ADS®
FlowShark Triton flow monitor.

New Product Warranty

All new products manufactured by ADS will be free from defects in
material and workmanship for up to one (1) year following the
delivery date to the customer. During this warranty period, upon
satisfactory proof of a defect, the product may be returned for repair
or replacement, at ADS's sole option. No returns will be accepted
unless the Owner has prepaid shipping and has received a prior
authorization return number from ADS. Please contact ADS to
obtain an authorization return number. Warranty repairs and
replacements will be performed only by ADS. Any unauthorized
repair or replacement will void this product warranty. Any repair or
replacement will be covered by this new product warranty for ninety
(90) days from the date that such repaired or replaced product is
shipped from ADS. This warranty is available only if the product
has been installed and operated in accordance with the procedures
outlined in the ADS Operations and Maintenance Manual. This
warranty does not apply to damage by catastrophes of nature, fire,
explosion, acts of God (including, but not limited to, lightning
damage and power surges), accidents, improper use or service,
damage during transportation, or other similar causes beyond
ADS's control.

Out-of-Warranty Product Repairs

After the new product warranty expires, a product may be returned,
at the owner's prepaid expense, to ADS for repair. The owner will
pay for all parts and labor associated with the repair. Any repair part

will be covered by the new product warranty for 90 days from the date of shipment from ADS.

Troubleshooting Fee

ADS will charge a troubleshooting fee if the reported product defect cannot be found and/or the reported defect is not due to a defect in materials or workmanship.

Shipping

All repaired products will be returned via transportation prepaid by ADS. Import duties, fees, taxes, and other related charges are the responsibility of the owner.

THIS IS THE ONLY WARRANTY FOR ADS PRODUCTS. NO OTHER WARRANTY IS EXPRESSED OR IMPLIED, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. PRODUCT REPAIR OR REPLACEMENT IS THE ONLY REMEDY. IN NO EVENT WILL ADS BE RESPONSIBLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, OR SPECIAL DAMAGES.

Warranty Return Information for International Customers

Please use **U.S. Harmonized Schedule Number 9801.00.1012** on your shipping documents and customs forms to indicate **"U.S. made goods being returned for repair"**.

North American Service

Contact ADS customer service by telephone at 1-877-237-9585 or email at <u>adssupportcenter@idexcorp.com</u>.

C H A P T E R 2

System Overview

The ADS® FlowShark® Triton flow monitor supports four flow measurement devices for gathering flow data:

- **Peak Combo Sensor** This sensor, which mounts at or near the bottom of the pipe, contains an upward-looking ultrasonic depth sensor, Doppler peak velocity sensor, and pressure depth sensor.

- **Surface Combo Sensor** This sensor, which mounts at the top of the pipe, contains an ultrasonic depth sensor, a surface velocity sensor, a surcharge peak velocity sensor, and surcharge pressure depth sensor.

- **Ultrasonic Depth Sensor** This sensor, which mounts at the top of the pipe, contains only a quadredundant ultrasonic depth sensor and an *optional* pressure depth sensor.

- **Slimline Peak Combo Sensor** This sensor, which mounts at or near the bottom of the pipe, contains an upward-looking ultrasonic depth sensor and a Doppler peak velocity sensor.

The monitor receives the raw flow depth and velocity data from the sensors based on a defined time interval and then processes the data, which may involve calculating the flow rate. The monitor memory can store up to 150 days of data based on logging 6 entities at a 15-minute sample rate. The storage capacity varies according to the number of sensors attached to the monitor, the number of entities stored, the rate at which the entity data is logged, and the functions activated for the sensors. This data is available to the user

for collection, further processing, analysis, and reporting. These reports include critical information that can assist municipalities and other industries in planning improvements and additions to sewer systems, improving the accuracy of billing information, and providing overall management of sewer systems.

The FlowShark Triton monitor and sensors are primarily designed for monitoring flow in sanitary and storm sewers. The monitor mounts to the manhole rim or wall slightly below the manhole cover or to a rung on the ladder; the sensors typically attach to a ring or band installed in the sewer pipe a short distance upstream from the manhole invert. The FlowShark Triton monitor can support up to two sensors at one or two separate locations in the pipe. These sensors display exceptional durability and accuracy, even under harsh and turbulent flow monitoring conditions.
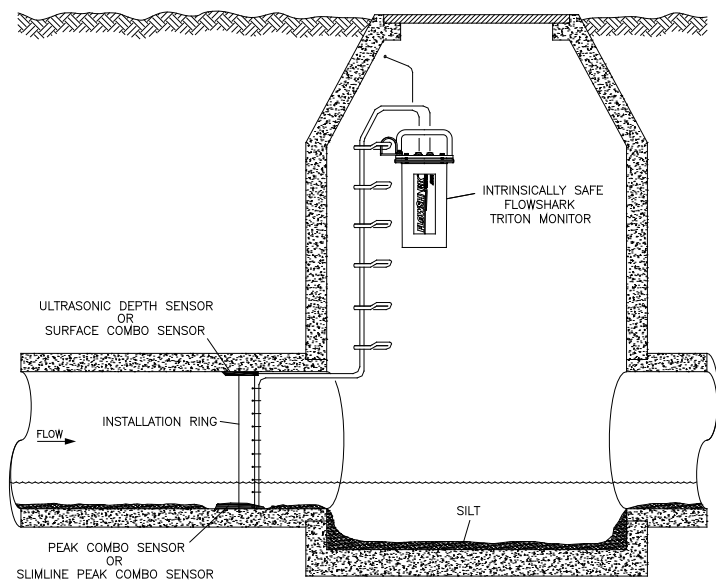
Typical FlowShark Triton flow monitoring system installation

Communication between the monitor and the user's office or field computer can occur over TCP/IP (remote, wireless communication) or a direct connect interface cable (on-site communication).

The FlowShark Triton is powered either by a 12-volt IS battery pack or through external power. Externally-powered units receive power from an independent source through an intermediate EMU (external modem unit) or EMUX (EMU/Multiplexer) and support wireless communication.

The EMUX also serves as a Modbus interface to provide real-time data from the monitor to a SCADA (supervisory control and data acquisition) or other process control system through an RTU (remote terminal unit) or another comparable instrument.

The ADS **Profile**® and **Q***start*™ software applications enable the user to configure and communicate with the monitor for activation, data collection, and diagnostic purposes. Configuration involves defining the Location Information File (LIF) for storage in the user's local directory and building the necessary code and variables for the site. The LIF contains information such as pipe characteristics, monitor identification, active sensors, sensor offsets, data log rate, and other parameters necessary for measuring the flow both accurately and efficiently.

Activation involves downloading the site-specific information from the LIF (stored in the user's local directory or network drive) to the monitor. It also includes initiating monitor activities such as taking sensor readings, logging flow data, and managing event notification.

Profile also enables the user to process the flow data, generate graphical and tabular reports, organize data in the user's local directory, and maintain logs of communication between the monitor and the user's PC.

> **Note:** Refer to the *Profile User's Guide* #950015 (version B4 or greater) or the **Profile** or **Q***start* online help for more information.

ADS FlowShark Triton Flow Monitor

The FlowShark Triton flow monitor is contained in a waterproof, airtight, cylindrical, high-impact ABS plastic canister housing. It contains a single processor board attached to the inside of the aluminum monitor top, a power regulator built into a protective dome, and a replaceable battery pack.

> **Note:** The FlowShark Triton also can receive power from an external DC source when used in conjunction with an ADS *EMU* (External Modem Unit) or *EMUX* (EMU/ Multiplexer).

MONITOR TOP & REGULATOR DOME   EXTERNAL HOUSING

IS 12 VOLT BATTERY
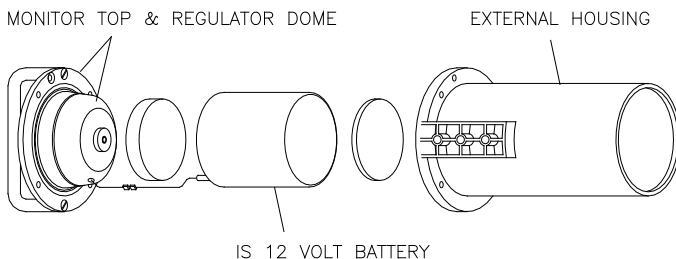
Exploded view of FlowShark Triton (processor board resides between the monitor top and protective regulator dome)

Communications

ADS offers both remote (*wireless*) and on-site (*direct*) communication options for the FlowShark Triton monitor.

Wireless Communication

Wireless communication occurs over the GSM/GPRS cellular network using *TCP/IP* (Transmission Control Protocol/Internet Protocol). GPRS TCP/IP facilitates high-speed, low-cost, efficient digital communication in areas with GSM/GPRS coverage using static IP address services.

Remote communication with the monitor occurs over the network through one of three kinds of modems:

● **ADS GSM Module** The GSM module (ADS p/n 8000-0052) is typically installed in the manhole at the monitor location.

GSM Module

- **ADS External Modem Unit (EMU)** The EMU (ADS p/n 3800-0148) is installed outside the manhole near an external power source.

EMU

- **ADS EMUX (External Modem Unit/Multiplexer)** The EMUX (ADS p/n 106226E) is installed outside the manhole in a weatherproof enclosure or indoors near an RTU (remote terminal unit) and/or external power source. The EMUX serves as both a conduit through which the monitor can receive operating power from an external DC source and a communication interface through which the monitor can provide flow data serially to the SCADA RTU (real-time) and wirelessly to the ADS **Profile** or **IntelliServe**® software.

EMUX

Direct Communication

On-site (or *direct*) communication with all monitors is available through an IS PC communication direct connect cable (ADS p/n 8000-0054).

Modbus

Modbus is a protocol that allows for communication to occur among multiple devices connected to the same network. It often is used to connect a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition (SCADA) systems. ADS uses the Modbus protocol to enable a SCADA RTU

to interface with a FlowShark Triton directly through an EMUX (ADS p/n 106226E) to obtain current data. The multiplexer in the EMUX facilitates both serial communication between a flow monitor and the RTU *and* wireless communication between a flow monitor and the ADS **Profile** or **IntelliServe®** software application.

ADS also uses Modbus protocol to allow a Telog® Ru-33 to request data from a FlowShark Triton directly through a Triton – Telog Comm Cable (ADS p/n 8000-0054-01). Refer to *Appendix E, System Configuration and Setup to Support the Telog Ru-33*, for more information.

Processor Board

FlowShark Triton top with processor board attached

The processor board is the source of all monitor activity. The board is responsible for all of the monitor's high-level functions, including the following:

- Managing user communication with the monitor

- Controlling the timing at which the sensors fire (i.e., take readings)

- Retrieving and storing sensor data

- Maintaining the monitor time and date

- Performing power management

- Storing the parameters required to accomplish the associated system operations

- Transmitting the stored and current data to the user's PC

- Initiating event notification through alarms

The board allocates portions of memory to firmware (embedded software in the monitor that can be upgraded remotely) and data storage. The board also includes the monitor clock, random access memory (RAM), and Flash. The monitor uses RAM while taking readings and processing the flow data. The RAM then downloads the data to NVRAM *or non-volatile memory*, which is backed up by an on-board battery. Firmware programs concerning operation are stored in Flash.

Connector Ports
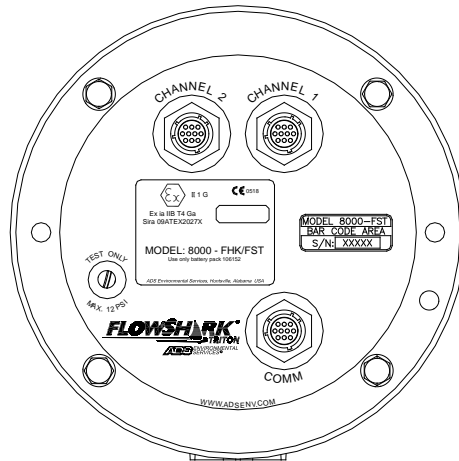
Monitor top with sensor and communication connector ports

The connector ports located on top of the monitor can receive up to two sensors and one communication device:

● **Channel 1 and Channel 2 Ports** These ports can receive up to two of the following sensors:

❑ Peak Combo Sensor

❑ Surface Combo Sensor

❑ Ultrasonic Depth Sensor

❑ Slimline Peak Combo Sensor

Note: The channel ports on the FlowShark Triton receive any combination of two sensors, including two of the same sensor type. However, the sensors attached to the channel ports must accurately reflect the channel assignments for the sensor devices in **Profile** or **Q***start*. In addition, two sensors of the same type may not be assigned to the same monitoring point. Refer to *Connecting Sensors to the*

Monitor in *Chapter 3*, *Sensor Installation and Connection*, for more information.

● **COMM (Communication) Port** This port supports the following communication options:

❑ Wireless communications with the FlowShark Triton monitor through a GSM/GPRS modem typically installed in the manhole, an EMU installed outside the manhole adjacent to an external power source, or an EMUX installed outside the manhole adjacent to an RTU and/or external power source

❑ Direct on-site communications with the FlowShark Triton monitor through the **Profile** or **Q***start* software installed on a field computer using a direct connect cable

The connector ports are keyed to receive only the proper sensor or communication cables.

The FlowShark Triton also has an air pressure valve that exists only for factory and maintenance testing.
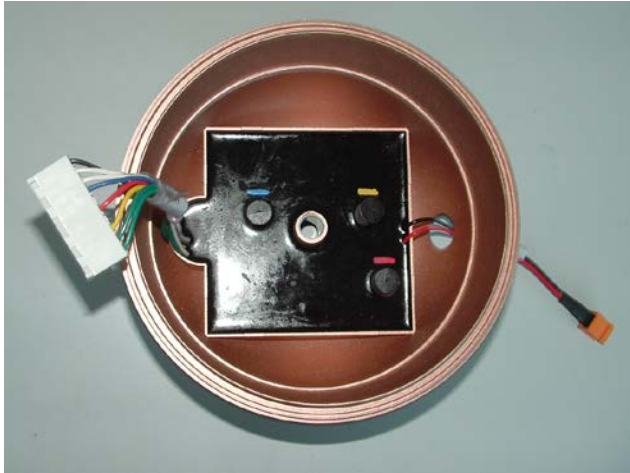
Power

Internal Power

Internal power is supplied to the FlowShark Triton flow monitor by an internal 12-volt IS battery pack (ADS p/n 8000-0043). The battery pack resides within the FlowShark Triton enclosure and powers monitor operations. An on-board backup battery sustains the monitor memory (RAM).

FlowShark Triton 12-volt battery

The power regulator, built into the dome assembly that covers and protects the processor board, is critical to intrinsically safe operation. It regulates the voltage supplied from the internal IS battery pack to the FlowShark Triton, ensuring that the monitor always operates within its IS certification requirements. It also includes replaceable fuses and current-limiting components that will limit and/or interrupt power if a fault condition occurs.

Power regulator dome with IS regulator board

The user receives a warning when the internal 12-volt IS battery pack drops below a specified threshold (*ADS recommends 7.5 volts*).

External Power

The FlowShark Triton flow monitor also can receive power from an external DC source through an *external modem unit* (EMU, ADS p/n 3800-0148) or *external modem unit/multiplexer* (EMUX, ADS p/n 106226E) located outside the manhole near the power source. These units regulate the power coming to the monitor and provide the communication interface between the user and the monitor. The EMU houses the GSM/GPRS modem, wireless antenna, and communication interface/barrier box. The EMUX, serving as the communication interface/barrier box, houses the modem. The wireless antenna mounts to a port on top of the EMUX.

> **Note:** The standard FlowShark Triton flow monitor (ADS p/n 8000-FST-60C includes an internal 12-volt IS battery pack that must be disconnected or completely removed from the monitor before connecting the external DC power source to the monitor. However, ADS offers another version of the FlowShark Triton flow monitor (ADS p/n

8000-FST-EP-60C) specifically designed for receiving external DC power that does not include the battery pack.

Powering the monitor through an external source is particularly advantageous at a location that requires logging an extensive amount of data at a short interval and eliminates the periodic need for battery replacement and disposal.

Sensors

The FlowShark Triton flow monitor can support up to 2 of the 4 sensor types available (3 combination sensors and a stand-alone ultrasonic depth sensor) at one time to gather raw flow data. It also can support 2 of the same sensor type at one time. Using independent measurement techniques, ultrasonic and pressure depth sensors collect information used to determine the depth of the flow. Velocity sensors use Doppler technology to determine the average or peak velocity of the flow. This variety of sensor options provides the versatility of measuring the depth and velocity of the flow from the top or bottom of the pipe and/or from within or outside of the flow.

A sewer system's hydraulics are much more stable and uniform in the incoming pipe than in the manhole invert or outgoing pipe. Therefore, the sensors mount to a stainless steel expandable ring or stainless steel bands installed in the pipe upstream from the manhole. Installing them upstream minimizes the hydraulic effects and erroneous data readings caused by foamy waters, flow waves, sewer noise, non-laminar flow, and obstructions in the manhole.
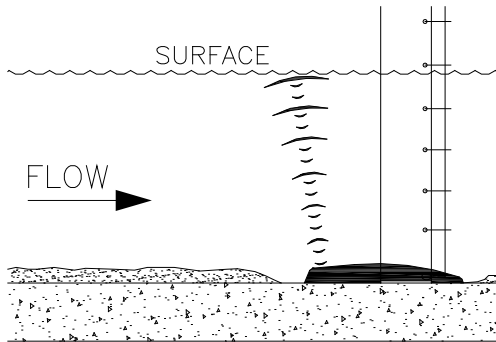
Peak Combo Sensor

The Peak Combo Sensor with a standard 35-foot (10.6-m) or 100-foot (30.5-m) cable (ADS p/n 8K-CS4-XX-35/1H) typically mounts at the bottom of the pipe and measures ultrasonic depth, pressure depth, and peak velocity using three independent sensors.

Peak Combo Sensor

Ultrasonic Depth Sensor

To provide the depth of the flow, the sensor sends an ultrasonic signal upward that bounces off the water surface – air interface. The travel time from the sensor to the flow surface and back is converted to distance, which translates into the depth of the flow.

Upward ultrasonic depth signals bouncing off water surface

Pressure Depth Sensor

A pressure transducer in the Peak Combo Sensor also measures the depth of the flow over the sensor. The monitor can use this data for comparison with other depth measurement devices in less than full-pipe conditions. The pressure depth sensor also can measure depths

greater than full pipe that may extend up into the manhole during surcharge conditions.

Water pressure impacts a diaphragm in the transducer that varies an electrical current. This current is digitized by a sensor processor board and the value is sent to the monitor processor board. A vent tube on the back of the diaphragm equalizes for atmospheric pressure. Three versions of pressure transducers are available with this combo sensor: 0 - 5 PSI (0 - 0.34 Bar), 0 - 15 PSI (0 - 1.03 Bar), and 0 - 30 PSI (0 - 2.07 Bar).

Peak Velocity Sensor

To obtain peak velocity, this sensor sends an ultrasonic signal at an angle up through the velocity layers in the oncoming flow. It emits a wide, omni-directional sound wave at a specific frequency upward into the flow. The sound wave bounces off particles in the flow and returns to the sensor. The velocity sensor measures the change in the sound wave's frequency from transmission to reception. This change is used to determine the peak velocity of the flow based on the *Doppler* effect.
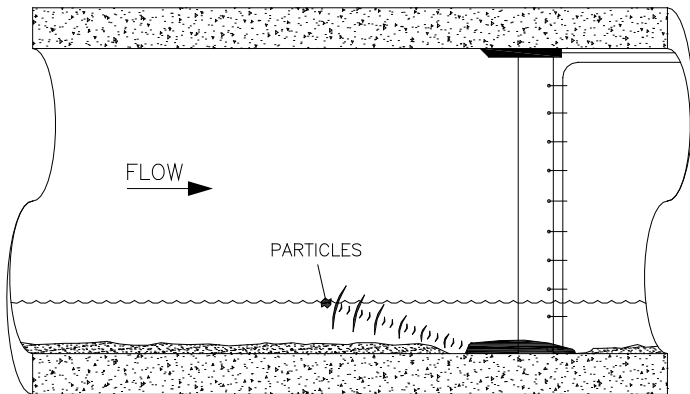
Peak Combo Sensor peak velocity transducer

The Doppler effect describes the shift in frequency of a sound wave emitted by a moving object in relation to a stationary point. The moving objects represent particles in the flow, the stationary point is

the velocity sensor, and the signal received is the reflection of the sound wave (emitted by the velocity sensor) off the particles.

Based on this information, the sensor determines the peak velocity of the oncoming flow. **Profile** calculates an average velocity from this peak by applying a user-defined average-to-peak ratio.

Ultrasonic Depth Sensor

The Ultrasonic Depth Sensor with a standard 30-foot (9.1-m) cable (ADS p/n 8K-CS3-V0-XX-30) mounts at the crown of the pipe and measures ultrasonic depth. This sensor also is available with a pressure depth capability.

Ultrasonic Depth Sensor

Ultrasonic Depth Sensor

This sensor first transmits sound waves from the sensor face to the surface of the flow, and then these sound waves return to the sensor. The monitor measures the time elapsed between transmission and reception of the reflected sound signal. Based on the elapsed time and the speed of sound, the monitor determines the range. The *range* represents the distance between the sensor face and flow surface. The monitor calculates the depth of the flow by subtracting the range from the pipe diameter. It compensates for the speed of

sound in the air using the temperature recorded by a temperature
sensor housed within the ultrasonic depth sensor.
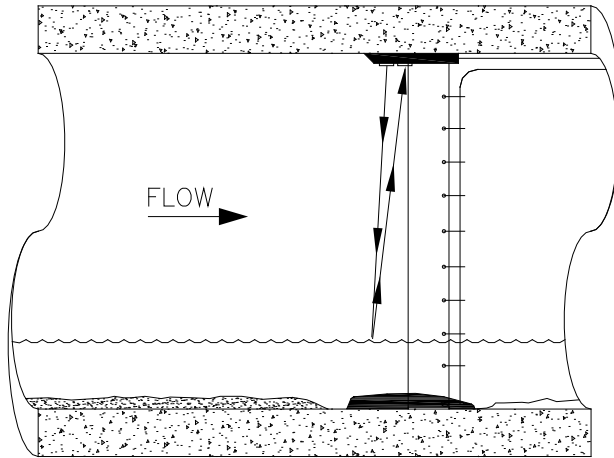
Ultrasonic depth sensor sending signals to flow surface to determine range

Quadredundancy

The sensor contains four ultrasonic transducers for taking readings
to give the sensor quadredundancy, which ensures greater sensor
reading reliability. To take a reading, one transducer transmits a
sound wave while a second transducer listens for the returning echo.
Each transducer has its own electronic circuitry and dedicated
wiring for true redundancy.

Depth Processing

The standard method for processing ultrasonic depth involves firing
the sensor once to take readings for predefined transducer pairs.
The return signals for all sensor pairs are converted to digital data
and referenced in time. When all sensor pairs are added together,
the results indicate that the strongest echoes off the water surface
increase in relative significance while noise and other random return
signals become relatively less significant. Finding the leading edge
of the return echo can be done with high confidence, and travel time
can be converted to a range.

This method of processing data in the monitor also replaces the need for a separate data-scrubbing process to eliminate random pops in the data. If not identified and discarded, these outliers—created by pipe and manhole noise, turbulent or wavy flow, a foamy flow surface, side connections, rungs, broken pipes, or drop connections—can make it more difficult to determine the true depth of the flow.

Pressure Depth Sensor

The *optional* pressure depth sensor in the Ultrasonic Depth Sensor measures pressure depth using the same technique as the other combo sensors, except from the top of the pipe. Since it can provide an accurate depth only when submerged, the data from this sensor is useful only under full-pipe or surcharge conditions. The Ultrasonic Depth Sensor offers two options for pressure measurement: 0 - 5 PSI (0 - 0.34 Bar) and 0 - 15 PSI (0 - 1.03 Bar).

Surface Combo Sensor

The Surface Combo Sensor with a standard 30-foot (9.1-m) cable (ADS p/n 8K-CS5-V2-XX-30) mounts at the top of the pipe and measures ultrasonic depth, surcharge pressure depth, surface velocity, and surcharge peak velocity using four independent sensors.

Surface Combo Sensor

Note: The new version of the Surface Combo Sensor (shown above) referenced here and throughout this manual is undergoing final testing and evaluation and will be available toward the end of 2012. However, the existing version of the Surface Combo Sensor (ADS p/n 8K-CS3-V2-XX-30) is currently available through ADS. Refer to the previous version of the *FlowShark Triton Installation, Operation, and Maintenance Manual* (QR 775013 A3) for detailed information and installation instructions concerning the current Surface Combo Sensor.

Ultrasonic Depth Sensor

This sensor first transmits an ultrasonic signal downward from one of the crystals on the sensor face that bounces off the flow surface and returns to the other crystal. The monitor measures the travel time elapsed between transmission and reception of the reflected sound signal. Based on the elapsed time and the speed of sound, the monitor determines the range. The range represents the distance between the sensor face and flow surface. The monitor calculates the depth of the flow by subtracting the range from the pipe diameter. It compensates for the speed of sound in the air using the temperature recorded by a temperature sensor housed within the ultrasonic depth sensor.

The ultrasonic depth sensor is located in the front, horizontal portion of the sensor and has two downward-facing ultrasonic crystals covered with a clear, moisture-shedding Teflon® coating.

Surface Velocity Sensor

This sensor measures the velocity of the flow also by bouncing signals off the flow surface using a method similar to the ultrasonic depth sensor, but the velocity signals are angled toward the oncoming flow surface.

The surface velocity sensor crystals reside in the two descended portions toward the rear end of the sensor.

ADS does not recommend using this sensor for measuring velocity at locations with smooth flow surfaces or velocities of less than 1 foot per second (0.3 m/s).
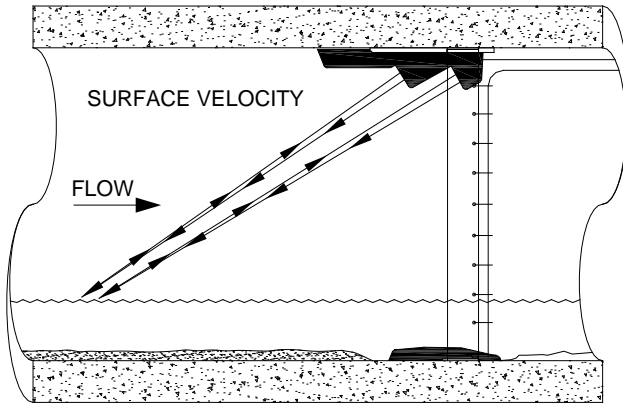
Measuring velocity using the surface velocity sensor

Surcharge Peak Velocity Sensor

This sensor measures the velocity of the flow during surcharge conditions using the same methodology as the Peak Combo Velocity Sensor. It will measure velocity *only* when the pipe is full.

The surcharge peak velocity sensor resides in the angled, front portion of the sensor in front of the ultrasonic depth crystals.

Surcharge Pressure Depth Sensor

The surcharge pressure depth sensor in the Surface Combo Sensor measures pressure depth using the same technique as the other combo sensors, except from the top of the pipe. Since it can provide an accurate depth only when submerged, the data from this sensor is useful only under full-pipe or surcharge conditions. The Surface Combo Sensor offers two options for pressure measurement: 0 - 5 PSI (0 - 0.34 Bar) and 0 - 15 PSI (0 - 1.03 Bar).

Slimline Peak Combo Sensor

The Slimline Peak Combo Sensor with a standard 35-foot (10.6-m) cable (ADS p/n 8K-CS4-35) typically mounts at the bottom of the pipe and measures ultrasonic depth and peak velocity using two independent sensors.

Slimline Peak Combo Sensor

Ultrasonic Depth Sensor

This sensor measures ultrasonic depth using the same method as the corresponding sensor in the Peak Combo Sensor.

Peak Velocity Sensor

This sensor measures peak velocity using the same method used by the corresponding sensor in the Peak Combo Sensor.

C H A P T E R 3

Sensor Installation and Connection

The ADS® FlowShark® Triton flow monitor and sensors are primarily designed for monitoring flow in sanitary, storm, and combined sewers. The monitor mounts to the manhole rim or wall slightly below the manhole cover or to a rung in the manhole.

A sewer system's hydraulics are much more stable and uniform in the incoming pipe than in the manhole invert or outgoing pipe. Therefore, the sensors mount to a stainless steel expandable ring or stainless steel bands installed in the sewer pipe a short distance upstream from the manhole invert. Installing the sensors upstream minimizes the hydraulic effects and erroneous data readings caused by foamy waters, waves in the flow, sewer noise, non-laminar flow, and obstructions in the manhole.

Following is the basic procedure for installing the FlowShark Triton monitor and sensors at a location:

- **Investigate the Site Characteristics** These characteristics include pipe size and shape, silt level, flow depth, and hydraulic conditions.

- **Prepare the Equipment for Installation** The monitor, communication module, and sensors must be prepared and tested for installation (*See Chapters 4, 5, and 6 for communication, external power (when applicable), and initial monitor setup*).

- **Install the Sensors in the Pipe** This process primarily includes assembling the ring (for standard installations) or preparing the bands (for special installations) to which the sensors attach, mounting the sensors to the ring or bands, securing the sensor cables to the ring or band, and installing the ring or bands in the pipe.

- **Secure and Connect the Cables** This procedure involves securing the sensor cables from the ring or band to the monitor location in the manhole and connecting the sensors to the FlowShark Triton monitor.
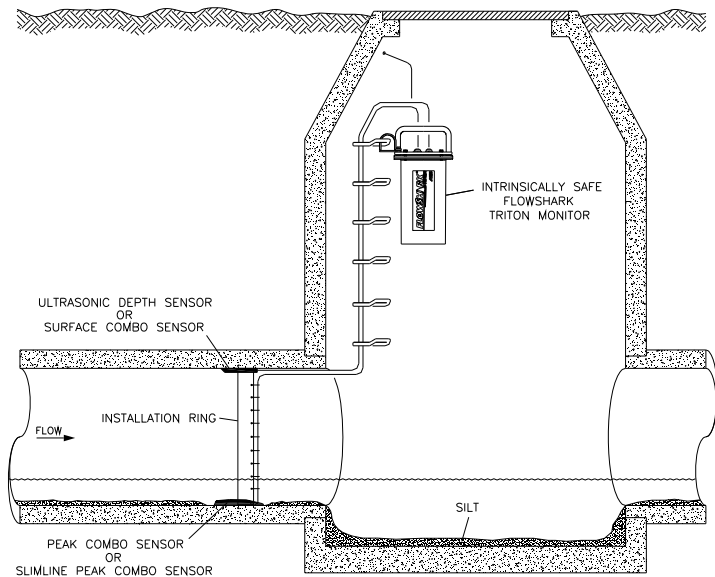
Typical FlowShark Triton flow monitor and sensor installation

This chapter contains instructions for properly installing the sensors in sanitary, storm, and combined sewer lines and manholes.

Note: Manhole and sewer system work involves confined space entry and is inherently dangerous. Therefore, installers and technicians must comply with all federal, state, and municipal regulations concerning confined space entry. ADS is not responsible for any

injuries, damages, claims, or liability resulting directly or indirectly from the use of this installation guide or the installation of any ADS equipment.

Investigating Site Characteristics

Before beginning installation activities, conduct a thorough investigation of hydraulic and site conditions.

Flow Hydraulics

The hydraulics of a site directly affect the monitor's ability to accurately measure flow depth and velocity. The following characteristics indicate when a site exhibits hydraulic conditions favorable for effective flow monitoring activities:

●   **Smooth Flow with Central Peak Velocities** The potential site should exhibit minimal ripples or waves. Choppy or foamy flow will adversely affect sensor accuracy. Bulging pipe joints, upstream curves, or upstream merging of pipes can contribute to choppy surfaces and off-center peak flow velocities.

●   **Absence of Significant Silt Buildup at Pipe Bottom** Silt present at an otherwise favorable site must be accounted for to obtain accurate flow measurements. The mounting ring or band may require rotation (*up to 15 degrees*) to position the Peak Combo Sensor up the side of the pipe and out of the silt. *(Refer to Installing the Ring in the Pipe on page 3-25.)*

●   **No Evidence of Surcharging** Debris present on ladder rungs or joints in the manhole may indicate the site experiences surcharging. If this occurs on a regular basis, consider finding an alternate location for monitoring the flow.

●   **Relatively Quiet Pipe** A monitoring point in a pipe experiencing loud noises, such as active drop connections, can adversely affect the accuracy of air ultrasonic depth measurements.

- **Flow Traveling at Least One Foot Per Second** Slower flows enable debris to settle in the pipe, limiting the accuracy of flow measurements.

- **Higher Elevation than High Water Level that Occurs in Wet Well at Downstream Pump Station** Pipes that are below the high water level of the pump station wet well could experience frequent backup and surcharging. This will increase sensor maintenance and possibly reduce data accuracy.

Pipe and Manhole Characteristics

The physical characteristics of the pipe affect the flow and determine the procedure for installing the sensors. Consider the following factors and perform the following activities when installing the sensors and monitor:

- **Sensor Installation Method** Pipe size and shape determine the installation method to employ for installing the sensors.

  - ❑ **Standard Installation** Select this option to install sensors in *round* pipes from 8 inches (200 mm) to 48 inches (1219 mm) in diameter. Standard installations involve attaching sensors to an adjustable stainless steel ring that mounts inside the pipe.

  - ❑ **Special Installation** Select this option to install sensors *in non-round pipes or round pipes larger than 48 inches. (1219 mm) in diameter.* Special installations involve attaching sensors to steel bands secured to the inside of the pipe.

- **Pipe Height and Width** Measure and record the horizontal and vertical pipe dimensions carefully. Inaccurate pipe measurements—even slightly inaccurate measurements--can skew and misrepresent flow data.

- **Pipe Shape** Taking the appropriate measurements that precisely reflect the exact pipe shape is essential to obtaining accurate flow calculations. Therefore, irregularly-shaped pipes will require additional measurements. Refer to the *Profile User's Guide* #950015 (version B4 or greater) for more information.

  Note: All relevant pipe dimensions and measurements are required for entry in the **Profile** software during monitor configuration and activation. **Q***start* also requires pipe shape, height, and width during these activities.

- **Manhole Depth** Measure the distance from the rim to the manhole invert. Distances beyond 30 feet could require extension cables for the sensors. *See Appendix B.*

Installing the Sensors in the Pipe

This section includes the procedures for performing sensor installations using one of the following methods:

● Standard Installations

● Special Installations

> **Note:** When installing a monitor with wireless communications, it is very important to test the FlowShark Triton and GSM module, EMU, or EMUX with the SIM card installed to be sure the *entire system* functions and to verify network quality of service before installation. This check should be done *before* field deployment and again at the monitoring site before installing the monitor. Refer to *Chapter 4*, *Communication*, for more information.

Standard Installation

Performing a standard sensor installation involves the following process:

● Gathering the parts and supplies

● Gathering the tools and equipment

● Assembling the ring

● Mounting the sensors on the ring

● Securing the cables to the ring

● Installing the ring in the pipe

Gathering Parts and Supplies

Obtain the following supplies before installing the ring and sensors to prevent any costly delays. When ordering, specify the FlowShark Triton flow monitor installation hardware for ring mounting. In addition, please indicate the type of mounting hardware desired for mounting the monitor: *mounting bracket* (wall/rim mount) or *hook* (rung mount).

Qty	Description	ADS P/N
1	FlowShark Triton flow monitor (includes internal battery)	8000-FST-60C
1	Monitor mounting bracket/flange (*for mounting monitor to manhole rim or wall*)	I40–0009
3	Monitor mounting bracket bolt, hex, SS, M8 x 30mm	508058
3	Monitor mounting bracket washer, flat, SS	517-8001254-00
3	Monitor mounting bracket washer, split lock, SS	517-8001274-00
1 as needed	Hook, SS, 2-piece w/ hardware (*for hanging monitor on manhole rung; Alternative to ADS p/n I40-0009*)	8000-0021
1 as needed	Bracket, sliding, Ultrasonic Depth Sensor (mounting plate)	I25-0001
1 as needed	Bracket, sliding, Surface Combo Sensor (mounting plate)	8000-0307
1	Stainless steel ring (sized for pipe)	I25-0081 to 0094 See Appendix B
Up to 2 (1 per monitoring point)	Peak Combo Sensor – upward ultrasonic depth sensor, pressure depth sensor, & peak velocity sensor w/ M3 x 6mm stainless steel, flathead screws	8K-CS4-xx-35/1H (35 ft./10.6m or 100 ft./30.5m cable) [1]
Up to 2 (1 per monitoring point)	Surface Combo Sensor – downward ultrasonic depth sensor, surcharge pressure depth sensor, surface velocity sensor, & surcharge peak velocity sensor	8K-CS5–V2-xx-30 (30 ft./9.1m cable) [1]
Up to 2 (1 per monitoring point)	Ultrasonic depth sensor (*downward ultrasonic depth only*)	8K-CS3-V0-00-30 (30 ft./9.1m cable) [2]

Qty	Description	ADS P/N
Up to 2 (1 per monitoring point)	Ultrasonic depth sensor with pressure option – downward ultrasonic depth sensor & pressure depth sensor	8K-CS3–V0-xx-30 (30 ft./9.1m cable) [1]
Up to 2 (1 per monitoring point)	Slimline Peak Combo Sensor – upward ultrasonic depth sensor & peak velocity sensor w/ M3 x 6mm stainless steel, flathead screws	8K-CS4-35 (35 ft./10.6m cable)
1 as needed	IS standard or custom sensor extension cable for Ultrasonic Depth Sensor *without* Pressure Sensor	8000-0023–xxx [2]
1 as needed	IS Standard or Custom Sensor Extension Cable for Peak Combo, Slimline Peak Combo, Surface Combo, and Ultrasonic Depth (*with pressure option*) Sensors	8000-0025–xxx [2]
as needed	¼- × 2 ¼-in. stainless steel anchor bolts w/ nut and washer	
1	3/8-inch x 3-inch anchor bolt and nut	
1	Replacement dryer tube	3704–0032
1	IS PC communication direct connection cable	8000-0054
1 as needed	GSM modem module	8000-0052
1	Antenna for the GSM module (*or as an option for the EMUX*)	3800-0162 or 3800-0163
1 as needed	Magnet (*for activating diagnostic codes through GSM modem module*)	8000-0140
1 as needed	External Modem Unit (EMU)	3800-0148
1 as needed	External power kit (*includes EMU chassis cable and 10-foot external power cable*)	3800-0181
1 as needed	EMUX (EMU/Multiplexer)	106226E
1 as needed	SIM Card (*for GSM modem module, EMU, or EMUX*)	507181
1 as needed	12V DC power supply	5000-0727
1 as needed	Communication cable (*from monitor to EMU or EMUX*)	106227B-xx [3]

Qty	Description	ADS P/N
4	M3 x 10mm flat head machine screw	507820
15	Plastic push mounts	
1	3/8-in. – 16 thread. x 2-in. (10mm x 55mm x 1.5mm thread) stainless steel stud	
1	3/8 in. – 16 thread (10mm x 1.5mm thread) stainless steel nut	
As needed	3/8 in. (10mm) stainless washer	
15	11-in. (5mm x 300mm) cable ties	
25	4-in. (2mm x 100mm) cable ties	
15	8-in. (4mm x 200mm) cable ties	
15	¼-in. (7mm x 400mm) anchor cable ties	
1	18-inch (457-mm) stainless steel crank handle	I10–0012

[1] IS pressure depth transducers (indicated by -xx- in the part number) are available in Peak Combo Sensors, Surface Combo Sensors, and Ultrasonic Depth Sensors with the Pressure Option in 0 - 5 psi (0 - 0.34 Bar) and 0 - 15 psi (0 – 1.03 Bar) pressure ranges. The Peak Combo Sensor also offers a 0 - 30 psi (0 - 2.07 Bar) option. Example: a Peak Combo Sensor with a $0 – 15$ psi (0 – 1.03 Bar) pressure transducer would be specified in psi: **8K-CS1-D1-<u>15</u>-35**.

[2] Extension cables can be ordered to specific lengths up to 300 ft. (91m). Note the desired length (meters *converted to feet*) in the *–xxx--* portion of the part number. **Standard** lengths are 10 ft. (3.0m), 25 ft. (7.6m), 50 ft. (15.2m), 75 ft. (22.8m), 100 ft. (30.5m), 125 ft. (38.1m), 150 ft. (45.7m), and 200 ft. (61.0m). All other lengths must be custom ordered.

[3] Communication cables can be ordered in 10-, 85-, 100-, or 135-foot (3-, 26-, 30-, or 41-m) lengths. Other cable lengths up to 300 feet (91 m) are also available by request. Indicate the desired length in the *-xx-* portion of the part number.

Gathering Tools and Equipment

Gather the following tools for the installation:

- Battery-powered hammer drill with assorted bits – including the following at a minimum:

  ❑   ¼-inch (6-mm) x 6-inch (150-mm) masonry bit

❑ 3/8-inch(10-mm) x 4-inch (100-mm) [minimum length] masonry bit

❑ 5/16-inch (8-mm) carbide-tipped bit

● Heavy 4-poound (1.5-Kg) hammer

● Rubber mallet

● 24-inch (610-mm) carpenter's level

● Nut driver or socket set (English plus 13-mm for canister hardware)

● Wrenches (English plus 13-mm for canister hardware)

● Screwdrivers (flathead and Phillips head of assorted sizes)

● Thread tap compatible with the thread spec on the monitor mounting stud (3/8-in. standard)

● Diagonal wire cutters

● Folding carpenter's rule with a brass slide

● Mastic tape (ADS p/n 507193) or rubber coaxial stretch tape

Assembling the Ring

The flow sensors mount to a stainless steel ring for installation in the pipe. Several different ring sizes exist, and each ring is adjustable within about 3 inches (76 mm) to fit pipes of different diameters. Assemble the ring in the following way:

> **Note:** These instructions generally apply to overlapping rings. However, the 6-in.(152-mm), 8-in.(178- to 211-mm), 10-in. (229- to 262-mm) and 12-in. (279 to 312-mm) rings do not have an overlapping section. Therefore, these non-overlapping rings will require small modifications during the assembly process. To assemble a non-overlapping ring, proceed directly to step 4.

1. Insert the spreader mechanism screw through the hole in the center of the ring stabilizer. Ensure that the head of the screw fits into the countersunk hole.
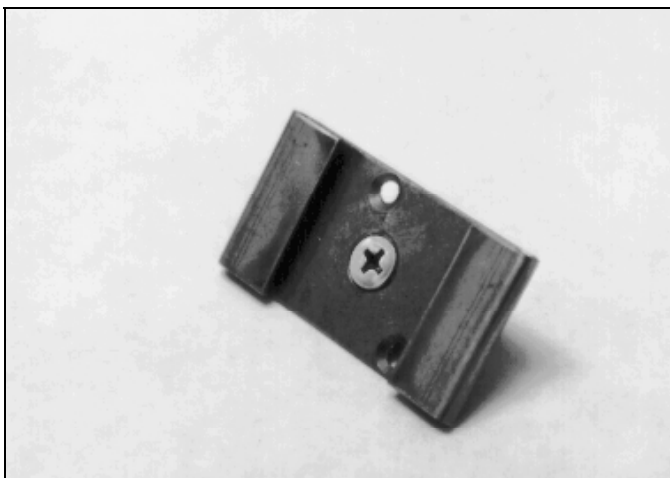
Ring stabilizer with spreader mechanism screw

2. Slide the open end of the ring (end without the welded metal band) through the flanges in the ring stabilizer, making sure the flanges face the outside of the ring and the spreader mechanism screw faces the inside of the ring.

Sliding the ring stabilizer onto the ring

3. Slide the ring stabilizer all the way around the ring until it is about 4 inches (102 mm) from the welded metal band at the other end of the ring.
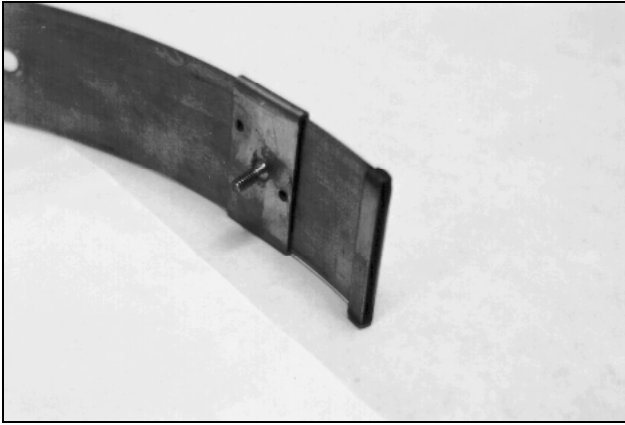
Moving the ring stabilizer into position

4. Position the ring with the downstream edge (edge with the holes) facing you.

5. Install the sensor mounting plate on the ring in the following way based on the sensor type. These sensors use slightly different mounting hardware.

    ❑ **Surface Combo Sensor** Slide the Surface Combo Sensor mounting plate onto the open end of the ring with the back of the mounting plate (side with the slots) facing the outside of the ring. The side with the keyholes should face the inside of the ring. The end of the plate with the keyholes should be extending out from the *upstream* edge of the ring (*opposite* the edge with the holes for securing the sensor cable).
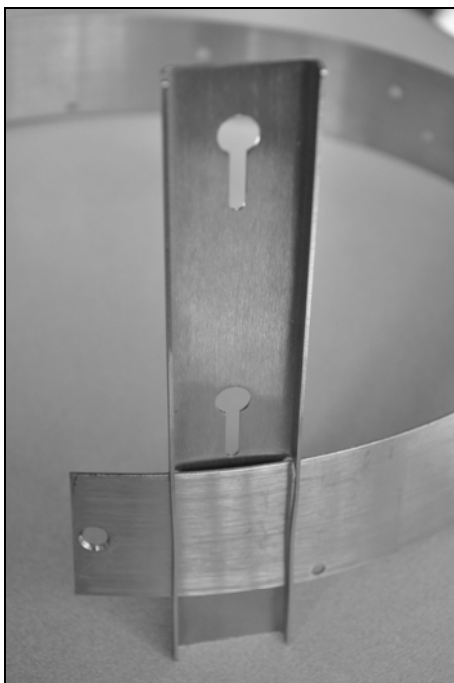
Sliding the Surface Combo Sensor mounting plate onto the ring

Note: The new version of the Surface Combo Sensor (ADS p/n 8K-CS5-V2-XX-30) referenced here and throughout this manual is undergoing final testing and evaluation. Contact ADS Client Services for sensor availability. This new version includes a different mounting plate and involves a slightly different installation procedure, as described in this manual, than the existing Surface Combo Sensor (ADS p/n 8K-CS3-V2-XX-30). To install the mounting plate onto the ring for the *existing* version of the Surface Combo Sensor, refer to the instructions below for the *Ultrasonic Depth Sensor*.

❑ **Ultrasonic Depth Sensor** Slide the Ultrasonic Depth Sensor mounting plate onto the open end of the ring with the back of the plate (side with the slots) facing the outside

of the ring. The side with the backstop should face the inside of the ring. Once the mounting plate is on the ring, the majority of the plate should be extending out from the upstream edge of the ring.
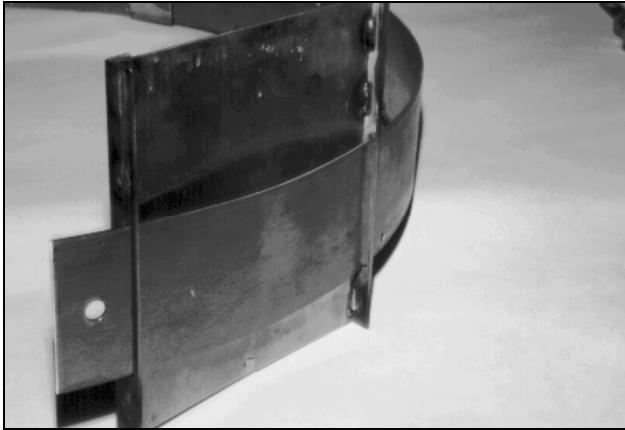
Sliding the Ultrasonic Depth Sensor mounting plate onto the ring

6. Move the sensor mounting plate around the ring.

   Note: Steps 7 and 8 apply only to overlapping rings. Proceed directly to step 9 for non-overlapping rings.

7. Slide the open end of the ring through the slot in the welded band of the ring until it overlaps about 4 inches (102 mm).

8. Spread the ring sections apart so that you can slide the ring stabilizer with the spreader mechanism screw into the gap.
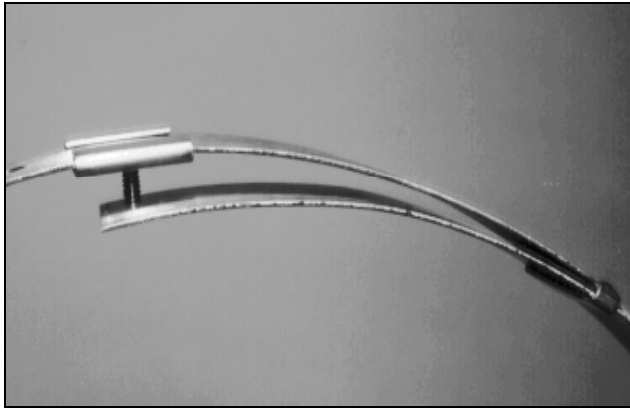
Moving the ring stabilizer into position

9. Perform the following based on the ring type:

❑ **Overlapping** Insert the spreader mechanism screw completely through the hole at the open end of the ring.

❑ **Non-Overlapping** Insert a spreader mechanism screw through the hole at the left end of the ring so that the end of the screw extends inside the ring.
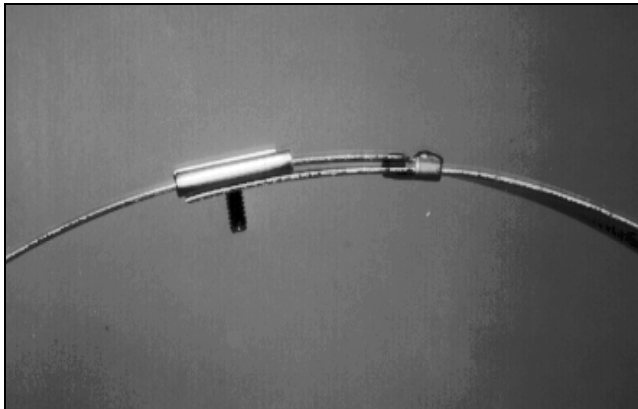
Ring stabilizer fully connected

10. Place the ring on a flat surface with the spreader mechanism screw facing up.

11. Orient the ring with the downstream edge (edge with small holes) facing you.

12. Lay the spreader mechanism across the inside of the ring with the downstream end of the mechanism (end with the large welded nut) facing you, the four spreader bars facing toward the inside of the ring, and the shoulder bolts pointed outside the ring.

13. Place a washer and then the downstream, left spreader bar over the spreader mechanism screw.
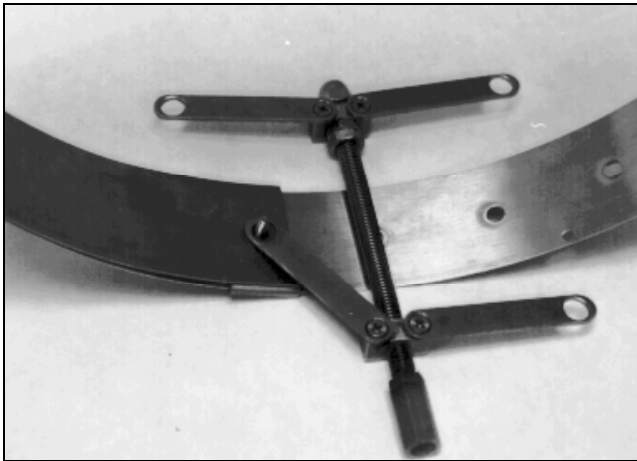
Orienting and attaching the spreader mechanism

14. Place the upstream, left spreader bar onto the same screw.

15. Lightly turn the hex nut onto the screw, ensuring that it passes through the holes in the end of the spreader bar.

Note: Steps 16 through 18 apply only to overlapping rings. For a non-overlapping ring, proceed to step 19.

Attaching the spreader bars

16. Turn the ring until the spreader mechanism is in the 12:00 position.

17. Align the spreader mechanism screw so that the head is visible through one of the ring size adjustment holes.
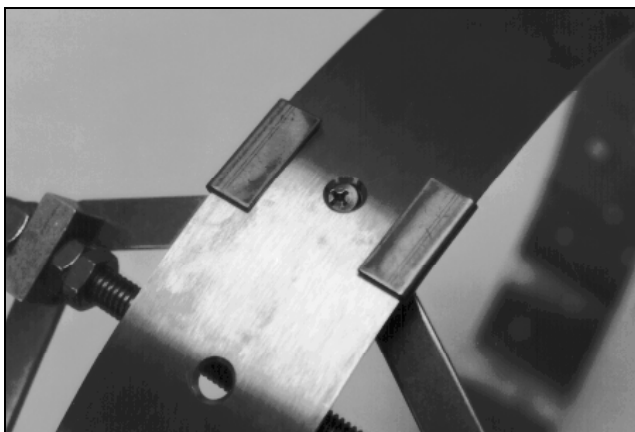
Aligning the screw head and adjustment hole

18. Tighten the screw through the hole using a Phillips-head
    screwdriver while holding the hex nut with a 0.5-inch (12-mm)
    nut driver.
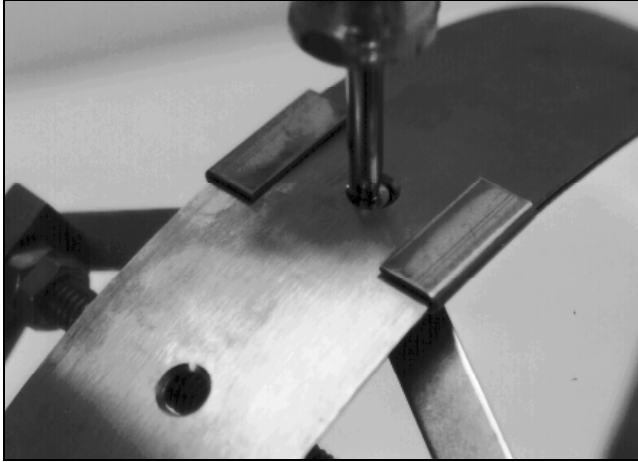
Tightening the spreader mechanism screw and hex nut

19. Insert the second spreader mechanism screw through the
    following hole based on the ring type:

    ❑ **Overlapping** Appropriate ring size adjustment hole on
      the outside of the ring

    ❑ **Non-overlapping** Last hole on the other free end of the
      ring (inserting the screw from the outside of the ring)

20. Slip the large washer onto the screw on the inside of the ring.
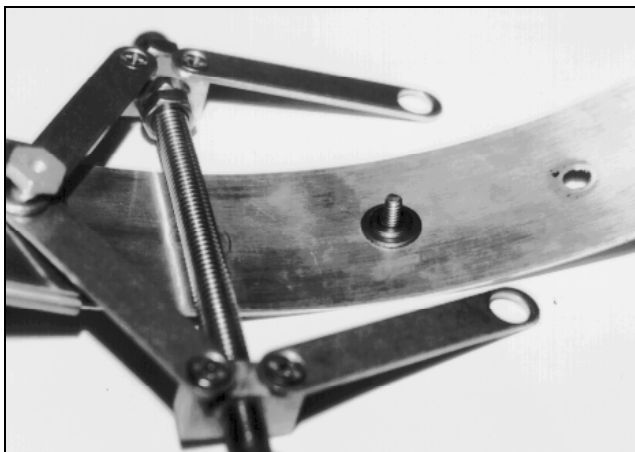
Place the washers onto the second spreader mechanism screw

21. Place the spreader bars over the screw, and tighten a hex nut on the screw.
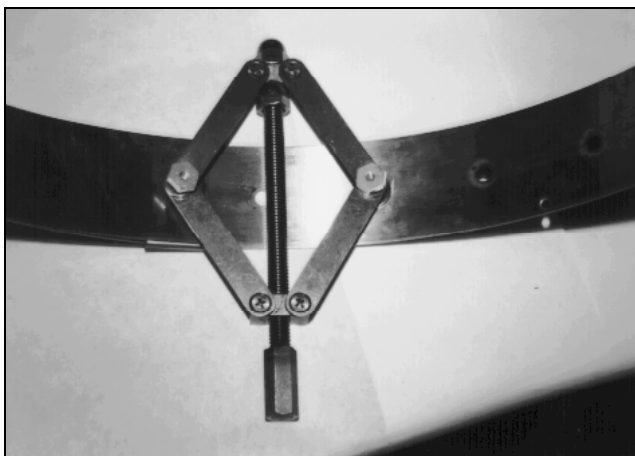
Spreader mechanism attached to the ring (view from inside the ring)

Although the spreader mechanism fits snugly against the inside of the ring, the spreader mechanism may seem loose on the hex nuts. Do not be concerned. The spreader mechanism will tighten once the ring is installed and tightened inside the pipe. The following picture displays how a properly assembled ring with the ultrasonic depth sensor mounting plate should look.
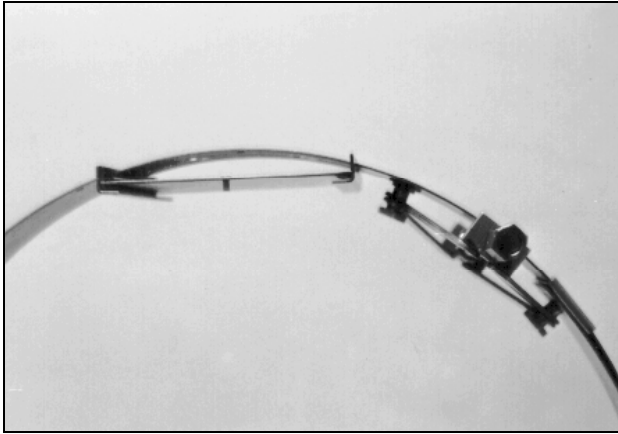
Properly attached spreader mechanism (with Ultrasonic Depth Sensor mounting plate on ring)

Mounting the Sensors to the Ring

The following sections provide instructions on mounting the Peak Combo Sensor and Slimline Peak Combo Sensor to the ring. To ensure the most accurate flow data, standard pipe installations require proper positioning of the sensors on the ring as well as in the pipe. When facing upstream and viewing from the downstream edge of the ring, the sensors should be mounted on the ring in the following locations:

● **Peak Combo Sensor and Slimline Peak Combo Sensor** Mount the sensor as close as possible to the six o'clock position (bottom), provided it is mounted above the level of any silt present at the bottom of the pipe. Any silt covering the sensor could interfere with the sensor signals, potentially producing inaccurate or erroneous readings. To avoid silt, the sensor can be rotated as much as 15 degrees up either side of the pipe (between the 5:30 and 6:30 positions). A physical offset measurement must be taken if this technique is used. Refer to *Installing the Ring in the Pipe* on page 3-25.

ULTRASONIC DEPTH SENSOR
OR
SURFACE COMBO SENSOR

PEAK COMBO SENSOR
OR
SLIMLINE PEAK COMBO SENSOR
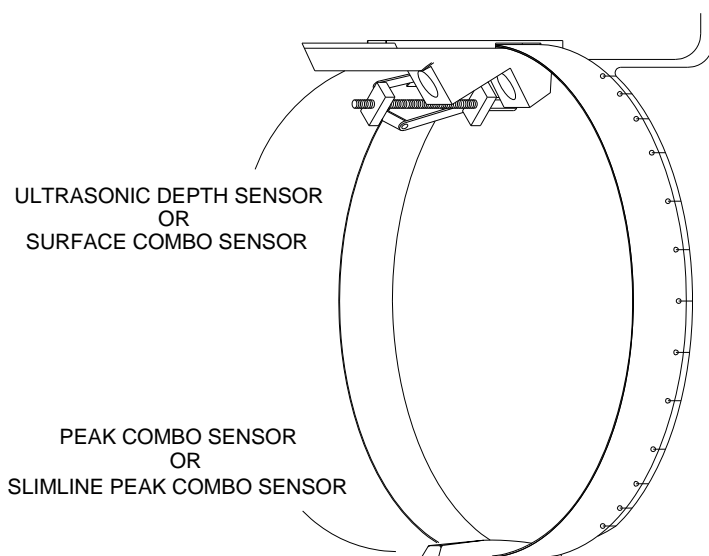
Proper positioning of sensors on the ring (showing the Surface Combo Sensor at top and Peak Combo Sensor at bottom)

● **Surface Combo Sensor or Ultrasonic Depth Sensor** Mount the sensor at the twelve o'clock position (top of the pipe) when the spreader mechanism is in the one o'clock position

Caution: Handle all sensors and cables with extreme care. The sensors and cables contain delicate mechanisms and electronics. Keep sharp objects away from sensor

cables, and avoid stepping or placing heavy objects on the cable during installation.

Mounting the Peak Combo Sensor or Slimline Peak Combo Sensor

Mount the *Peak Combo Sensor* or *Slimline Peak Combo Sensor* to the ring in the following way:

1. Use two M3 X 10mm stainless steel flathead screws (do not substitute any other screws) to mount the sensor at the bottom of the ring (opposite the Surface Combo Sensor/Ultrasonic Depth Sensor) with the tapered end of the sensor facing upstream.

2. Orient the ring so that the Surface Combo Sensor/Ultrasonic Depth Sensor is directly on top. If neither a Surface Combo Sensor nor Ultrasonic Depth Sensor is in use at the top of the pipe, make sure the spreader assembly is directly on top.

3. Secure the sensor cable to the ring. Refer to *Securing the Cables to the Ring* on page 3-24 for instructions on properly securing the cable.
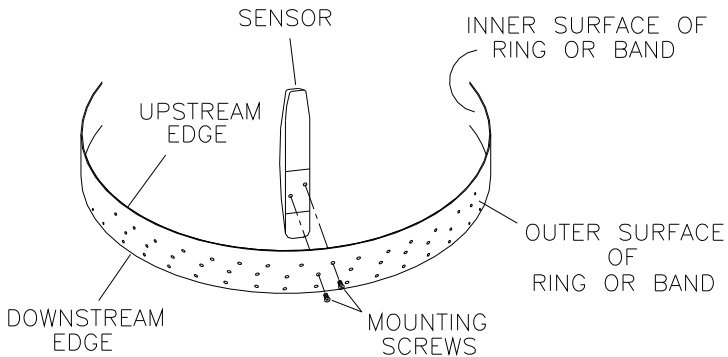
Mounting the Peak Combo Sensor or Slimline Peak Combo Sensor to the ring

Securing the Cables to the Ring

Securing the Peak Combo Sensor or Slimline Peak Combo Sensor cable to the ring helps prevent debris from collecting between the cable and the ring or catching on the loose cable. It also prevents the loose cables from disrupting the flow.

Secure the cable in the following way:

1. Starting at the appropriate sensor location, begin securing the sensor cable with 4-inch (2-mm x 100-mm) cable ties through the pre-drilled holes along the downstream trailing edge of the ring up the side of the ring. Run the cable up the side of the ring opposite the spreader mechanism (the right side of the ring's downstream edge).
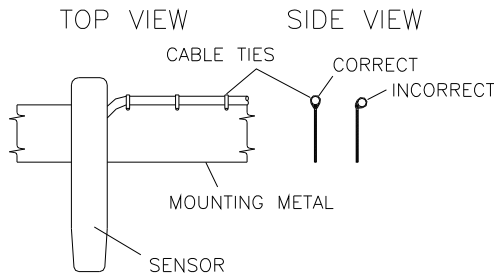
Sensor cabling

2. Continue securing the cables until reaching the Surface Combo Sensor, Ultrasonic Depth Sensor, or the top of the pipe.

3. Pull the ties until they are taut.

    Warning: *Do not over-tighten the cable ties or kink the sensor cables!* The sensor cable sheathes two components: the electrical cables that operate the sensor and an air tube that ventilates the pressure sensor (*when applicable*). Over-tightening the ties or kinking the cable can damage or restrict the air tube, causing erroneous pressure depth readings. In addition, make sure the connector-end of the sensor is not kinked, does not contain moisture, and includes an attached dryer tube filled with active *blue* desiccant.

4. Use the diagonal cutters to cut off the excess portion of the cable ties.

Mounting the Surface Combo Sensor or Ultrasonic Depth Sensor

The Surface Combo Sensor/Ultrasonic Depth Sensor is not mounted prior to installation of the ring. The ring mechanism and sensor mounting plate are assembled as detailed in *Assembling the Ring* beginning on page 3-11. After the ring is installed at the monitoring site, the sensor is inserted into the mounting plate and leveled (*described in the following section*).

Installing the Ring in the Pipe

The ring must fit securely in the pipe with the sensors properly positioned to ensure the most accurate monitoring results. Install the ring in the pipe in the following way:

1. Examine the pipe for possible obstructions to the flow or inhibitors to ring installation.

2. Adjust the ring size to slightly less than the pipe diameter before placing the ring in the pipe by turning the spreader mechanism adjustment nut *clockwise* to *contract* it.

3. Place the ring in the input pipe *at least* 12 inches (305 mm) upstream from the manhole or edge of the pipe with the sensors facing upstream toward the oncoming flow. It must be located far enough upstream from the manhole to minimize the effect of the draw-down caused by a possible drop in the manhole invert.
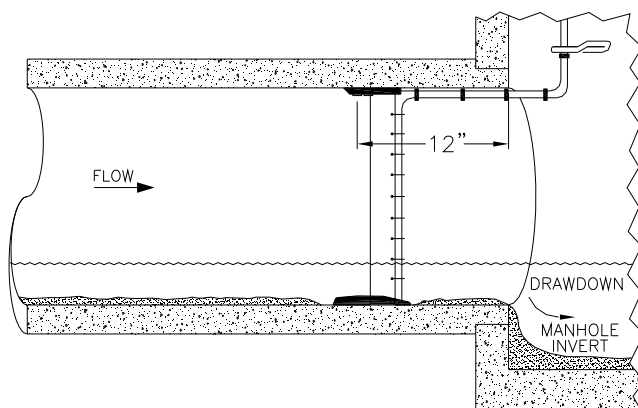
Installing the ring at least 12 inches (305 mm) upstream from the manhole invert

Keep the following in mind:

❑ Be sure to mount the Surface Combo Sensor/Ultrasonic Depth Sensor at the top (crown) of the pipe and to mount the Peak Combo Sensor/Slimline Peak Combo Sensor as close as possible to the bottom center of the pipe, *above* any silt present and *below* the flow surface (during minimum flows).
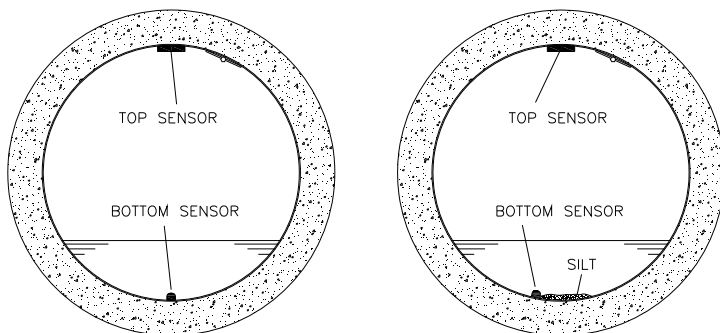
Proper orientation of the ring with the sensors in the pipe with and without silt present. Please note that the sensor mounting plate for the Surface Combo Sensor/Ultrasonic Depth Sensor is centered at the crown of the pipe. The crank spreader mechanism is offset to the side.

The bottom sensor may be rotated off the bottom centerline up to 15 degrees up either side of the pipe (between the 5:30 and 6:30 positions). However, rotating the ring and sensor requires accurately measuring the physical offset.

CENTER
OF
PIPE

15° 15°

MAX ROTATION OFF
BOTTOM CENTER
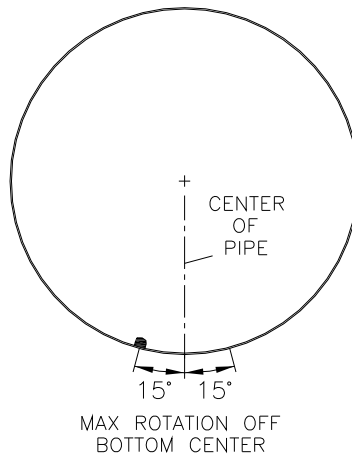
Rotating the Peak Combo Sensor or Slimline Peak Combo Sensor no more than 15 degrees up either side of the pipe (between 5:30 and 6:30 positions)

❑ If necessary, temporarily clear away silt to install the ring. Restore the silt after fully securing the ring (step 7).

❑ Make sure the ring is flat (flush) against the inside surface of the pipe to avoid obstructing the flow or catching debris.

❑ Verify that the Peak Combo Sensor/Slimline Peak Combo Sensor is flush with the pipe surface. Any elevation of the sensor or significant deterioration or imperfection in the pipe surface around the sensor can create an open space in which debris can become trapped. An elevated sensor also can misdirect the signal when taking measurements. These vulnerabilities can quickly result in potential damage or disruption to the sensor and/or erroneous data.
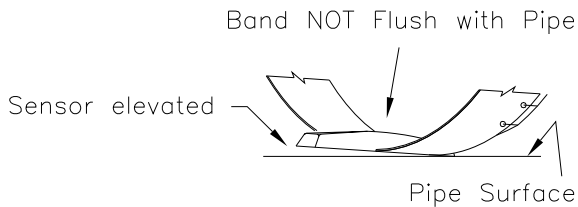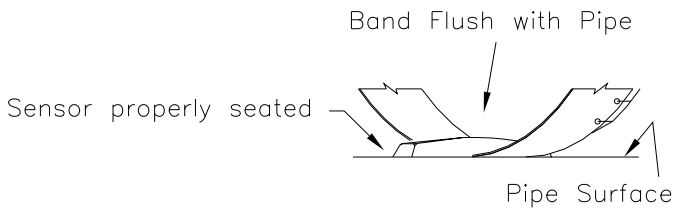
Notice how the elevated sensor provides a gap in which debris can collect
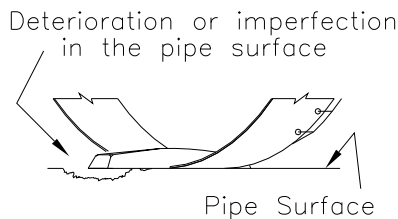
Notice how deterioration in the pipe surface creates a space for debris to collect under the sensor

4. Expand the ring by turning the spreader mechanism nut counter-clockwise with the crank handle or socket. However, do not tighten the ring against the pipe completely at this point.

5. Mount the Surface Combo Sensor or Ultrasonic Depth Sensor to the ring in the following way based on the sensor type:

❑ **Surface Combo Sensor** Mount this sensor by inserting the studs on the back of the sensor into the keyholes on the sensor mounting plate (at the top of the ring) and sliding the sensor back (in a downstream direction) until it is fully in place. The sensor cable should exit the downstream edge of the ring. Orient the sensor

with the depth crystals facing downward toward the inside of the ring (flow surface).

SENSOR MOUNTING PLATE
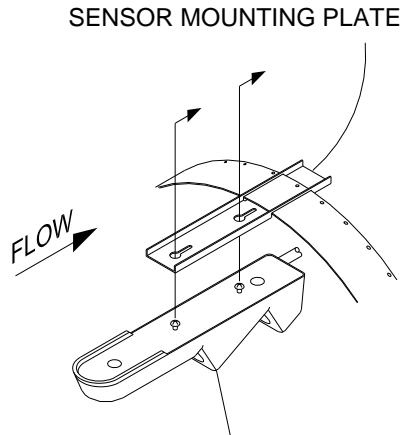
SURFACE COMBO SENSOR

Mounting the Surface Combo Sensor to the mounting plate on the ring

Note: The new version of the Surface Combo Sensor (ADS p/n 8K-CS5-V2-XX-30) referenced here and throughout this manual is undergoing final testing and evaluation. Contact ADS Client Services for sensor availability.   This *new* version includes a different mounting plate and involves a slightly different installation procedure, as described in this manual, than the *existing* Surface Combo Sensor (ADS p/n 8K-CS3-V2-XX-30). To install the *existing* version of the sensor onto the mounting plate, refer to the instructions below for the *Ultrasonic Depth Sensor*.

❑ **Ultrasonic Depth Sensor** Mount this sensor by sliding the sensor into the grooves on the sensor mounting plate (at the top of the ring) from the upstream end until the sensor contacts the backstop. The sensor cable should exit the downstream edge of the ring.   Orient the sensor with the four transducers facing downward toward the inside of the ring (flow surface).

SENSOR MOUNTING PLATE

ULTRASONIC DEPTH SENSOR

FLOW
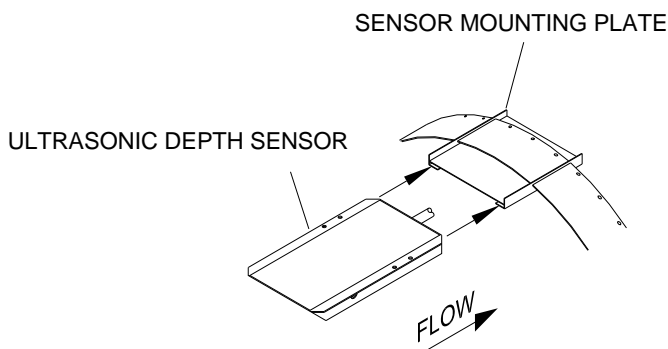
Mounting the Ultrasonic Depth Sensor to the mounting plate on the ring

Note: Handle the Surface Combo Sensor/Ultrasonic Depth Sensor with care, and do not expose it to extreme temperatures for an extended period of time. Keep the sensor in its protective packaging until it is time for installation. Avoid contacting the metal connector at the end of the Surface Combo Sensor cable with the Teflon®-coated crystals on the sensor.

6. Using a 24-inch (500-mm or 1000-mm) carpenter's level, orient the Surface Combo Sensor/Ultrasonic Depth Sensor at the top of the pipe so that the sensor face is parallel and level (from side to side) with the flow surface and pipe crown. *When leveling a Surface Combo Sensor, use a block of uniform dimensions between the level and the flat face of the horizontal ultrasonic depth-sensor portion of the combo sensor.*
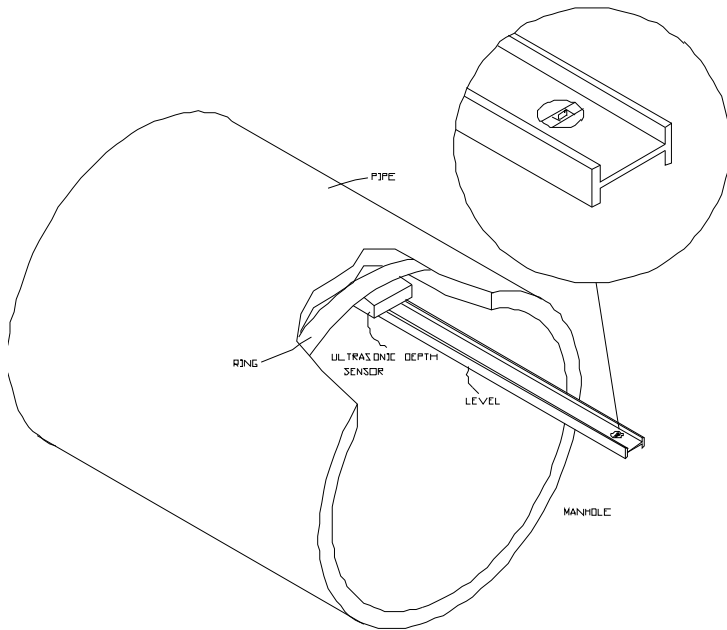
Leveling the ultrasonic depth sensor

If necessary, adjust the level in either sensor in the following way:

❑ Remove the sensor from the mounting plate.

❑ Loosen the ring slightly to allow the plate to move on the ring.

❑ Tap the sensor mounting plate to the right or left with a rubber mallet until it is level.

Warning: Tapping the mounting plate with the sensor attached could damage the sensor. Always remove the sensor before tapping the plate with a mallet.

❑ Reattach the sensor to the mounting plate, and recheck the level.

7. Fully tighten the ring until it fits securely and completely flush against the pipe wall.

   Warning: Avoid over-tightening the ring. This could bend the crank assembly.

8. Install an anchor bolt in the manhole wall just above the pipe crown. Using an anchor cable tie, secure the Surface Combo Sensor cable. It can be further secured up the manhole wall.

9. Restore any silt moved to its previous level, and confirm that the Peak Combo Sensor is still above the silt level.

10. Measure the physical offsets for the sensors in the following way.

    ❑ **Peak Combo Sensor/Slimline Peak Combo Sensor Physical Offset** Manually measure the depth of the flow from the bottom of the pipe to the flow surface, and then measure the distance from the *nose* (i.e., front end) of the Peak Combo Sensor or Slimline Peak Combo Sensor to the flow surface. Subtract the second measurement from the initial depth of flow to determine the physical offset.
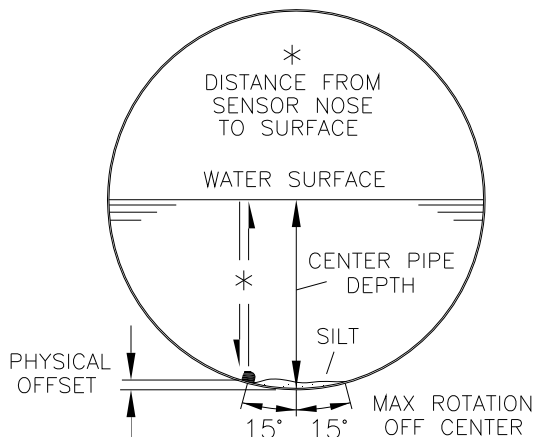
Illustrating the method for determining the physical offset for a rotated Peak Combo Sensor or Slimline Peak Combo Sensor at maximum 15° off center

❑ **Surface Combo Sensor/Ultrasonic Depth Sensor Physical Offset** Measure the distance from the crown (top) of the pipe to the face of the sensor (horizontal surface with the two/four depth crystals) to determine the physical offset.

Note: These offsets are required when configuring the monitor using the **Profile** or **Q***start* software.

11. Secure the sensor cables from the ring to the location at which the monitor is mounted in the manhole. Refer to *Securing the Sensor Cables in the Pipe and Manhole* on page 3-54 for more information.

Special Installations

A special installation requires two independent installations: one for the Surface Combo Sensor or Ultrasonic Depth Sensor and one for the Peak Combo Sensor or Slimline Peak Combo Sensor.

Note: Special installations do not involve spreader mechanisms or rings. All hardware mounts directly to the pipe surface with anchor bolts.

Performing a special installation involves the following process:

● Gathering the parts and supplies

● Gathering the tools and equipment

● Mounting the Surface Combo Sensor or Ultrasonic Depth Sensor

● Mounting the Peak Combo Sensor or Slimline Peak Combo Sensor

● Securing the cables to the band

Before beginning the installation, conduct a thorough investigation of hydraulic and other site conditions. The hydraulics of a site directly affect the monitor's ability to accurately measure flow

depth and velocity. In addition, measure the horizontal and vertical pipe dimensions carefully. Even slightly inaccurate pipe dimensions can significantly skew and misrepresent flow data.

> **Caution:** Handle all sensors and cables with extreme care. The sensors and cables contain delicate mechanisms and electronics. Keep sharp objects away from sensor cables, and avoid stepping or placing heavy objects on the cable during installation. Avoid contacting the metal connector at the end of the Surface Combo Sensor cable with the Teflon-coated crystals on the sensor.

Gathering Parts and Supplies

Be sure to obtain the following supplies before performing a special installation to prevent any costly delays. When ordering, specify the FlowShark Triton flow monitor special installation hardware. In addition, please indicate the type of mounting hardware desired for mounting the monitor: *mounting bracket* (wall/rim mount) or *hook* (rung mount).

Qty	Description	ADS P/N
1	FlowShark Triton flow monitor (*includes internal 12-volt IS battery pack)*	8000-FST-60C
1	Monitor mounting bracket/flange (*for mounting monitor to manhole rim or wall)*	I40–0009
3	Monitor mounting bracket bolt, hex, SS, M8 X 30mm	508058
3	Monitor mounting bracket washer, flat, SS	517-8001254-00
3	Monitor mounting bracket washer, lock, SS	517-8001274-00
1 as needed	Hook, SS, 2-piece w/ hardware (*for hanging monitor on manhole rung; Alternative to I40-0009)*	8000-0021
Up to 2 (1 per monitoring point)	Peak Combo Sensor – upward ultrasonic depth sensor, pressure depth sensor, & peak velocity sensor w/ M3 x 6mm stainless steel, flathead screws	8K-CS4-xx-35/1H (35 ft./10.6m or 100 ft./30.5m cable) [1]
Up to 2 (1 per monitoring point)	Surface Combo Sensor – downward ultrasonic depth sensor, pressure depth sensor, surface velocity sensor, & surcharge velocity sensor	8K-CS5-V2-xx-30 (30 ft./9.1m cable) [1]
Up to 2 (1 per monitoring point)	Ultrasonic depth sensor (*downward ultrasonic depth only)*	8K-CS3-V0-00-30 (30 ft./9.1m cable) [2]
Up to 2 (1 per monitoring point)	Ultrasonic depth sensor with pressure option – downward ultrasonic depth sensor & pressure depth sensor	8K-CS3-V0-xx-30 (30 ft./9.1m cable) [1]
Up to 2 (1 per monitoring point)	Slimline Peak Combo Sensor – upward ultrasonic depth sensor & peak velocity sensor w/ M3 x 6mm stainless steel, flathead screws	8K-CS4-35 (35 ft./10.6m cable)

Qty	Description	ADS P/N
1 as needed	IS Standard or Custom Sensor Extension Cable for Ultrasonic Depth Sensor *without* Pressure Sensor	8000-0023–xxx [2]
1 as needed	IS Standard or Custom Sensor Extension Cable for Peak Combo, Slimline Peak Combo, Surface Combo, and Ultrasonic Depth (*with pressure option*) Sensors	8000-0025–xxx [2]
1 as needed	Bracket, sliding, Ultrasonic Depth Sensor (mounting plate)	I25-0001
1 as needed	Bracket, sliding, Surface Combo Sensor (mounting plate)	8000-0307
1 as needed	Special Surface Combo Sensor/Ultrasonic Depth Sensor install band, SS, 12 in. long (Use with corresponding mounting plate I25-0001)	700-100238-00
As needed by length	Stainless steel mounting band	Contact ADS
1 as needed	Sensor surcharge bracket (used only to mount Ultrasonic Depth Sensor in manhole)	I40-0010
as needed	¼. in. × 2 ¼ in. (M6 x 55mm) stainless steel anchor bolts w/ nuts and washers	
1	Replacement dryer tube	3704–0032
1	IS PC Communication Direct Connection Cable	8000-0054
1 as needed	GSM Modem Module	8000-0052
1	Antenna for the GSM Module	3800-0162 or 3800-0163
1 as needed	Magnet (*for activating diagnostic codes through GSM modem module*)	8000-0140
1 as needed	External Modem Unit (EMU)	3800-0148
1 as needed	External power kit (*includes EMU chassis cable and 10-foot external power cable*)	3800-0181
1 as needed	EMUX (EMU/Multiplexer)	106226E
1 as needed	SIM Card (*for GSM modem module, EMU, or EMUX*)	507181
1 as needed	12V DC power supply	5000-0727

Qty	Description	ADS P/N
1 as needed	Communication cable (*from monitor to EMU*)	106227B-xx [3]
4	M3 x 10mm flat head machine screws	507820
15	Plastic push mounts	
1	3/8 in. - 16 thread. x 2.in. (10mm x 55mm x 1.5mm thread) stainless steel stud	
1	3/8 in. – 16 thread (10mm x 1.5mm thread) stainless steel nut	
As needed	3/8 in. (10mm) stainless washer	
15	11-in. (5mm x 300mm) cable ties	
25	4-in. (2mm x 100mm) cable ties	
15	8-in. (4mm x 200mm) cable ties	
15	¼-in. (7mm x 400mm) anchor cable ties	

[1] Pressure depth transducers (indicated by *-xx-* in the sample part number) are available in Peak Combo Sensors, Surface Combo Sensors, and Ultrasonic Depth Sensors with the Pressure Option in 0 – 5 psi (0 - 0.34 Bar) and 0 – 15 psi (0 - 1.03 Bar) pressure ranges. The Peak Combo Sensor also offers a 0 - 30 psi (0 - 2.07 Bar) option. Example: a Peak Combo Sensor with a 0 - 15 psi (0 - 1.03 Bar) pressure transducer would be specified in psi: **8K-CS1-D1-15-35**.

[2] Extension cables can be ordered to specific lengths up to 300 ft. (91m). Note the desired length (*in feet*) in the *-xxx--* portion of the part number. **Standard** lengths are 10 ft. (3.0m), 25 ft. (7.6m), 50 ft. (15.2m), 75 ft. (22.8m), 100 ft. (30.5m), 125 ft. (38.1m), 150 ft. (45.7m), and 200 ft. (61.0m). All other lengths must be custom ordered.

[3] Communication cables can be ordered in 10-, 85-, 100-, or 135-foot (3-, 26-, 30-, or 41-m) lengths. Other cable lengths up to 300 feet (91 m) are also available by request. Indicate the desired length in the *-xx-* portion of the part number.

Gathering the Tools and Equipment

Gather the following tools for the installation:

- Battery-powered hammer drill with assorted bits – including the following at a minimum:

  ❑ ¼-inch (6-mm) x 6-inch (150-mm) masonry bit

❑ 3/8-inch (10-mm) x 4-inch (100-mm) [minimum length] masonry bit

❑ 5/16-inch (8-mm) carbide-tipped bit

- Heavy 4-pound (1.5-Kg) hammer

- Rubber mallet

- 24-inch (610-mm) carpenter's level

- Nut driver set or socket set (English plus 13-mm for canister hardware)

- Wrenches (English plus 13-mm for canister hardware)

- Screwdrivers (flathead and Phillips head of assorted sizes)

- Threads tap compatible with the thread spec on the monitor mounting stud

- Diagonal wire cutters

- Folding carpenter's rule with a brass slide

- Mastic tape (ADS p/n 507193) or rubber coaxial stretch tape

Mounting Peak Combo Sensors and Slimline Peak Combo Sensors

Two special installation methods are available for mounting the Peak Combo Sensor and Slimline Peak Combo Sensor:

- ¾-band mount

- ½-band mount

Both mounts require almost identical installation methods. The only significant differences are that the ¾-band mount allows the installer to secure the band to *both* sides of the pipe wall and to position the sensor at the bottom center of the pipe. These options are not possible using the ½-band mount. Therefore, the ¾-band mount is the preferable method for mounting the sensors.

However, a ½-band mount may be appropriate for monitoring under the following circumstances:

● Large pipes with deep minimum flows

● Large pipes with excessive silt present
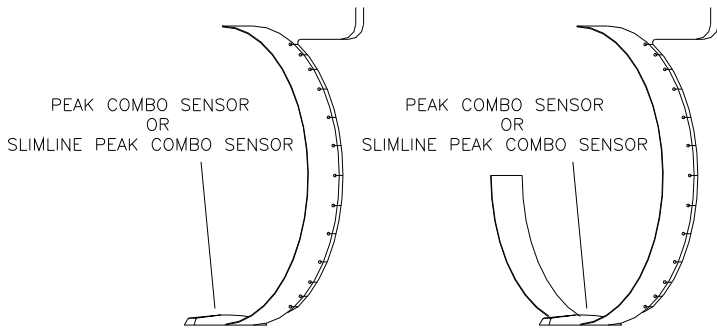
½- (left) and ¾-band (right) mounts

Note: When positioning the special mounting metal, remember the 15° offset limitation on the Peak Combo Sensor/Slimline Peak Combo Sensor.

¾-Band Mount

Perform the following procedure to mount the Peak Combo Sensor or Slimline Peak Combo Sensor (when applicable) in a pipe using the ¾ band mount:

1. Use a hacksaw to cut the band to the appropriate length. Cut the band so that, when installed, it will run approximately ¾ of the circumference of the pipe.

2. Determine which end of the band will be the long end (end extending almost completely up one side of the pipe). For cable routing purposes, ADS recommends reserving the left side of the incoming pipe (upstream from the manhole) for the long end of the band.

3. Locate the sensor at a position on the band based on the existence of silt at the bottom of the pipe:

❑ *If silt is not present*, locate the sensor on the band so it will be at the bottom center of the pipe once installed.

❑ *If silt is present*, locate the sensor slightly up the long end of the band so that it will be above the silt level once installed. However, make sure it will not be more than 15° from the bottom center of the pipe.
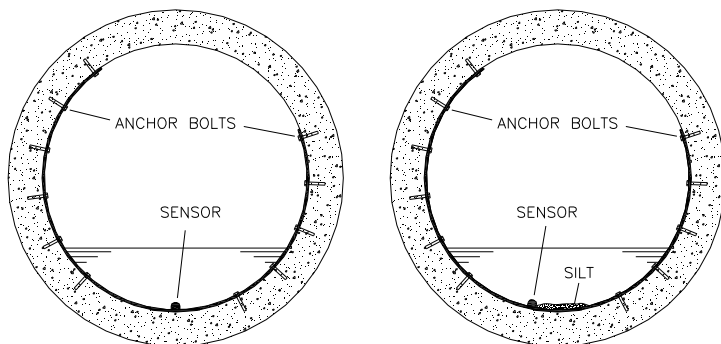
Sensors mounted using a ¾-band mount in the pipe with and without silt

4. Mount the sensor onto the inside of the band with two M3 x 10-mm countersink screws, making sure the tapered, stepped end of the sensor faces the upstream edge of the ring (edge opposite cable tie holes). If mounting holes do not exist on the band at or near the desired mounting location for the sensor, drill holes in the band using a 7/32-inch (3-mm) drill bit.

5. Secure the sensor cables along the downstream edge of the long end of the band according to the instructions in *Securing the Cables to the Band* on page 3-43.

6. Make sure two pre-drilled holes are visible above the flow surface on the short end of the band. Maneuver the band so that the lowest hole is almost at the flow surface.

7. Mark the pipe wall through the lowest hole with a drill, and install a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt with a pneumatic drill.

8. Secure the band to the anchor bolt with a washer and nut.

9. Conform the band to the pipe wall around to the long end of the band so that it is flush with the pipe wall.

10. Install a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt through the pre-drilled hole closest to the flow surface on the long end of the band, and secure the band with a washer and nut.

11. Make sure the band and sensors are flush against the pipe wall with no gaps, and conform the rest of the band to the pipe wall.

12. Install ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolts, nuts and washers at the pre-drilled hole at the short end of the band and at the pre-drilled holes along the long end of the band (above the flow surface) approximately every 12 to 24 inches (305 to 610 mm) to the top end of the band.

13. Measure the physical offset for the sensor by manually measuring the depth of the flow from the bottom of the pipe to the flow surface and then measuring the distance from the *nose* (i.e., front end at the pipe surface) of the sensor to flow surface. Subtract the second measurement from the initial depth of flow to determine the physical offset.

14. Run the sensor cables from the sensor location in the pipe to the monitor location in the manhole according to the instructions in *Securing the Sensor Cables in the Pipe and Manhole* on page 3-54.

½-Band Mount

Perform the following procedure to mount a Peak Combo Sensor or Slimline Peak Combo Sensor in a pipe using the ½-band mount:

1. Use a hacksaw to cut the band to the appropriate length. Cut the band so that, when installed, it will run almost completely down the left side of the pipe.

2. Determine the best location on the band to mount the sensor. The sensor should mount as close as possible to the bottom (end) of the band, making sure the sensor will be both *above* the silt level and *below* the flow surface once installed. It also must not be more than $15°$ from the bottom center of the pipe.

3.   Mount the sensor onto the inside of the band with two M3 x 10-mm countersink screws, making sure the tapered, stepped end of the sensor faces the upstream edge of the ring (edge opposite the cable tie holes).

4.   If mounting holes do not exist on the band at or near the desired mounting location for the sensor, drill holes in the band using a 7/32-inch (3-mm) drill bit.

5.   Secure the sensor cables along the downstream edge of the band according to the instructions in *Securing the Cables to the Band* on page 3-43.

6.   Place the band in the pipe upstream at least 12 inchees (305 mm) [same distance as Surface Combo Sensor or Ultrasonic Depth Sensor, when present] from the manhole invert. Position the band on the left side of the pipe so that the sensors will remain below the flow surface (during minimum flows) and above the silt level.

7.   Orient the band so that one of the pre-drilled anchor bolt holes is just above the flow surface.

8.   Spot drill the pipe wall through the hole, install a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt, and secure the band to the anchor bolt with a washer and nut.

   Note: Make sure the submerged portion of the band is flush with the pipe wall. If it is not, remove the band and conform the band to the pipe.

9.   Install a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt, washer, and nut below the flow surface 30 to 80 mm away from the Peak Combo Sensor or Slimline Peak Combo Sensor on each side. This will hold the sensor securely against the pipe wall and prevent the end of the band from twisting in the flow or catching debris.

10. Conform the portion of the band above the flow surface to the pipe wall, and install an ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt, nut, and washer every 12 to 24 inches (305 to 610 mm) up to the top of the band.
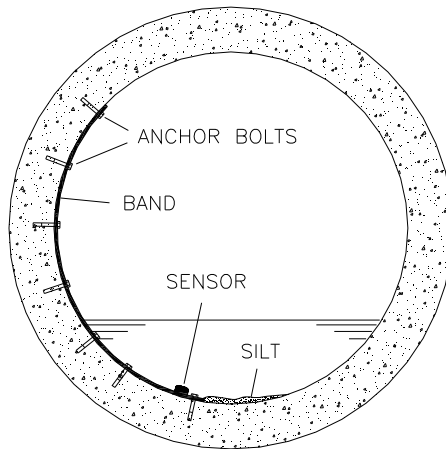
Completed ½-band mount in pipe

11. Measure the physical offset for the sensor by manually measuring the depth of the flow from the bottom of the pipe to the flow surface and then measuring the distance from the *nose* (i.e., front end at the pipe surface) of the sensor to flow surface. Subtract the second measurement from the initial depth of flow to determine the physical offset.

   Note: This value will be necessary when configuring the monitor using the **Profile** or **Q***start* software.

12. Run the sensor cables from the sensor location in the pipe to the monitor location in the manhole according to the instructions in *Securing the Sensor Cables in the Pipe and Manhole* on page 3-54.

   Note: If the pipe is large and the sensor cable cannot reach the pipe crown, attach the sensor cables to 0.5-inch (12-mm) PVC tubing and anchor the tubing to the wall. This will help prevent sensor damage during heavy flow.

Securing the Cables to the Band

Securing the Peak Combo Sensor or Slimline Peak Combo Sensor cable to the band helps prevent debris from collecting between the

cable and the band or catching on the loose cable. It also prevents the loose cables from disrupting the flow.

Secure the cable in the following way:

1. Starting at the appropriate sensor location, begin securing the sensor cable with 4-inch (2-mm x 100-mm) cable ties through the pre-drilled holes along the downstream (trailing) edge of the band up the side of the band. Run the cable up the right side of the band (on the downstream edge of the band).
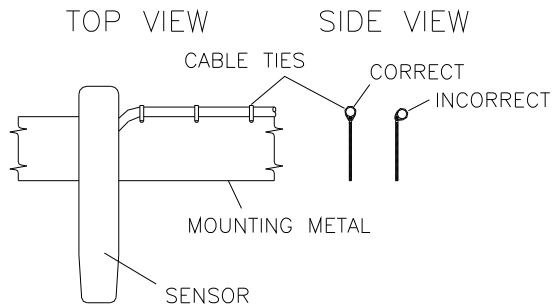
Sensor cabling

2. Continue securing the cables until reaching the Surface Combo Sensor, Ultrasonic Depth Sensor, *or* top of the pipe.

3. Pull the ties until they are taut.

    Warning: *Do not over-tighten the cable ties or kink the sensor cables!* The depth cable sheathes two components: the electrical cables that operate the sensor and an air tube that ventilates the sensor (*when applicable*). Over-tightening the ties or kinking the cable can damage or restrict the air tube, causing incorrect pressure depth readings. In addition, make sure the connector-end of the sensor is not kinked, does not contain moisture, and includes an attached dryer tube filled with active *blue* desiccant.

4. Use the diagonal cutters to cut off the excess portion of the cable ties.

Mounting the Surface Combo Sensor or Ultrasonic Depth Sensor

Two special installation methods are available for mounting the Ultrasonic Depth Sensor and one for the Surface Combo Sensor:

- **Standard Mount** This mount, the most common mounting method in use today, is used for mounting the Surface Combo Sensor or the Ultrasonic Depth Sensor in the pipe during special installations.

- **Surcharge Mount** This mount primarily is used for mounting the Ultrasonic Depth Sensor in the manhole at sites where the flow continually occurs within 2 inches (51 mm) of the top of the pipe, pipe conditions and/or hydraulics prohibit the installation of a sensor in the pipe, or *surcharges* frequently occur. Surcharges are conditions where the flow completely fills the pipe and extends up into the manhole.

Standard Mount

Mount the Ultrasonic Depth Sensor or the Surface Combo Sensor using this method in the following way:

> **Note:** Handle the sensor with care, and do not expose it to extreme temperatures for an extended period of time. Keep the sensor in its protective packaging until it is time for installation. Avoid contacting the metal connector at the end of the Surface Combo Sensor cable with the Teflon-coated crystals on the sensor.

1. Position the Surface Combo Sensor/Ultrasonic Depth Sensor mounting plate in the center apex of the pipe, and scribe a mark on both sides of the mounting plate.

2. Center the 12-inch (305-mm) mounting band, allowing the band to extend about 4 inches (102 mm) beyond each side of the scribed location.

3. Conform one end of the curved band to the pipe configuration, and spot drill to mark the bolt location.

4. Remove the curved band, drill an anchor bolt hole, and gently tap a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt into the hole.

5. Mount the curved band to the anchor bolt through the pre-drilled hole on the band, and hand-tighten a nut with washer to the anchor bolt to secure the band.
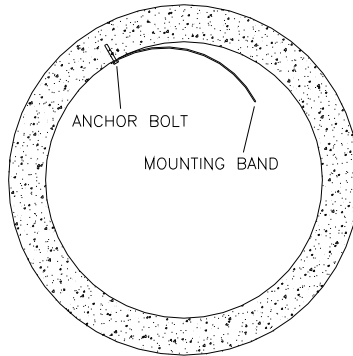
Securing one end of the sensor mounting band

6. Slide the sensor mounting plate onto the band in the following way based on the sensor type:

❑ **Surface Combo Sensor** Slide the plate onto the band with the end of the plate with the keyholes facing *upstream* and the two band slots facing up.

MOUNTING BAND

FLOW

SENSOR
MOUNTING
PLATE
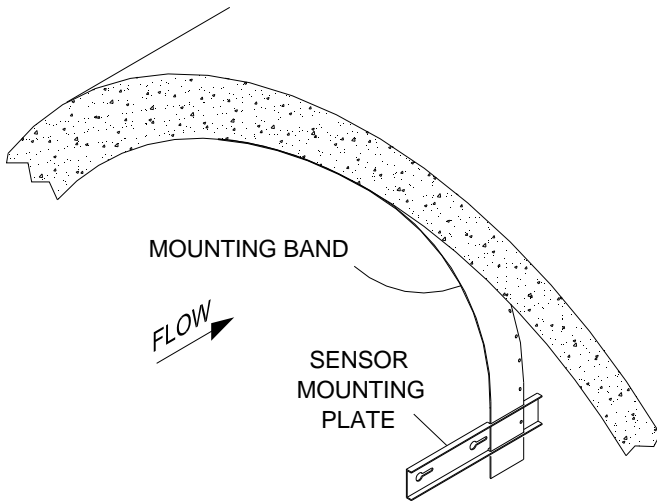
Sliding the mounting plate for the Surface Combo Sensor onto the free end
of the mounting band

Note: The new version of the Surface Combo Sensor
(ADS p/n 8K-CS5-V2-XX-30) referenced here and
throughout this manual is undergoing final testing and
evaluation. Contact ADS Client Services for sensor
availability. This *new* version includes a different
mounting plate and involves a slightly different
installation procedure, as described in this manual, than
the *existing* Surface Combo Sensor (ADS p/n 8K-CS3-V2-
XX-30). To install the mounting plate for the *existing*
version of the sensor onto the band, refer to the
instructions below for the *Ultrasonic Depth Sensor*.

❑ **Ultrasonic Depth Sensor** Slide the plate on the band
   with the backstop edge of the plate facing *downstream* and
   the two band slots facing up.
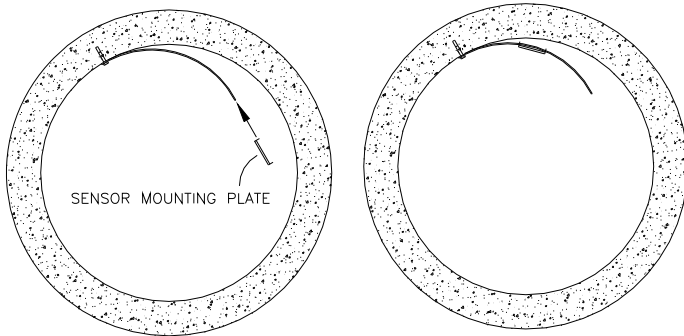
Sliding the sensor mounting plate onto the band

7. Align the sensor mounting plate with the scribe marks, and conform the other end of the curved band with the pipe.

8. Spot drill to mark an anchor bolt location, and mount another ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt to the pipe.

9. Hand-tighten a nut with washer to secure the other end of the band.
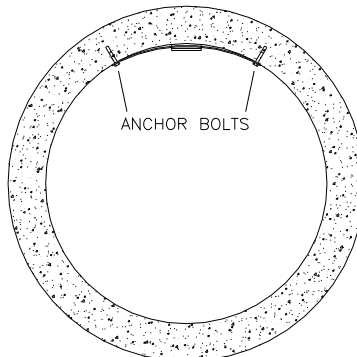
Securing the other end of the band

Note: If the mounting plate has too much side play, attach another anchor bolt approximately 1 inch (22 mm) from the plate.

10. Slide the sensor mounting plate along the metal band until it is level (from side to side) with the flow surface and pipe crown, and tighten the nuts securely with a nut driver. Refer to the instructions on leveling this sensor in *Installing the Ring in the Pipe* beginning on page 3-25.

11. Install the sensor onto the mounting plate in the following way based on the sensor type:

    ❑ **Surface Combo Sensor** Mount this sensor by inserting the studs on the back of the sensor into the keyholes on the mounting plate and sliding the sensor back (in a *downstream* direction) until it is fully in place. The sensor cable should exit the downstream edge of the band.

SENSOR MOUNTING PLATE

FLOW

SURFACE COMBO SENSOR
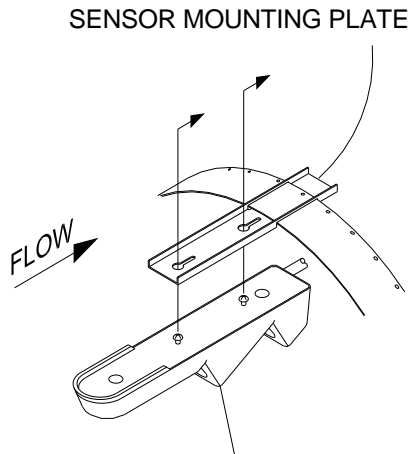
Fastening the Surface Combo Sensor to the mounting plate on the band

> **Note:** Remember, this *new* (available late 2012) version
> of the Surface Combo Sensor (ADS p/n 8K-CS5-V2-XX-
> 30) includes a different mounting plate and involves a
> slightly different installation procedure, as described in
> this manual, than the *existing* Surface Combo Sensor
> (ADS p/n 8K-CS3-V2-XX-30). To install the *existing*
> version of the sensor onto the mounting plate, refer to the
> instructions below for the *Ultrasonic Depth Sensor*.

❑ **Ultrasonic Depth Sensor** Slide the Ultrasonic Depth
    Sensor into position from the *upstream* end of the
    mounting plate until the back of the sensor comes in
    contact with the backstop.
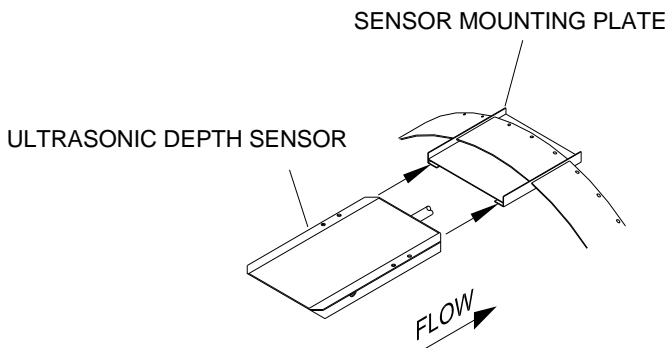
Sliding the Ultrasonic Depth Sensor into the sensor mounting plate on the band

12. Confirm the sensor is still level.

13. Determine the physical offset for the Surface Combo Sensor or
    the Ultrasonic Depth Sensor by measuring the distance from
    the crown (top) of the pipe to the face of the sensor (horizontal
    surface with the two/four ultrasonic crystals on either sensor).
    This value is required when configuring the monitor using the
    Profile or **Q***start* software. For the Surface Combo Sensor, do
    not measure in reference to the the angled surface velocity or
    surcharge velocity portions of the sensor.

Surcharge Mount (applies only to the Ultrasonic Depth Sensor)

For a site that may experience surcharge conditions, mount the Ultrasonic Depth Sensor on the manhole wall directly above the opening of the incoming pipe. This will ensure the sensor measures the range above the flow surface at the location the flow enters the manhole. This method of mounting the sensor requires a special surcharge bracket (ADS p/n I40-0010). Mount the sensor in the following way:

Note: Handle the Ultrasonic Depth Sensor with care, and do not expose it to extreme temperatures for an extended period of time. Keep the sensor in its protective packaging until it is time for installation.
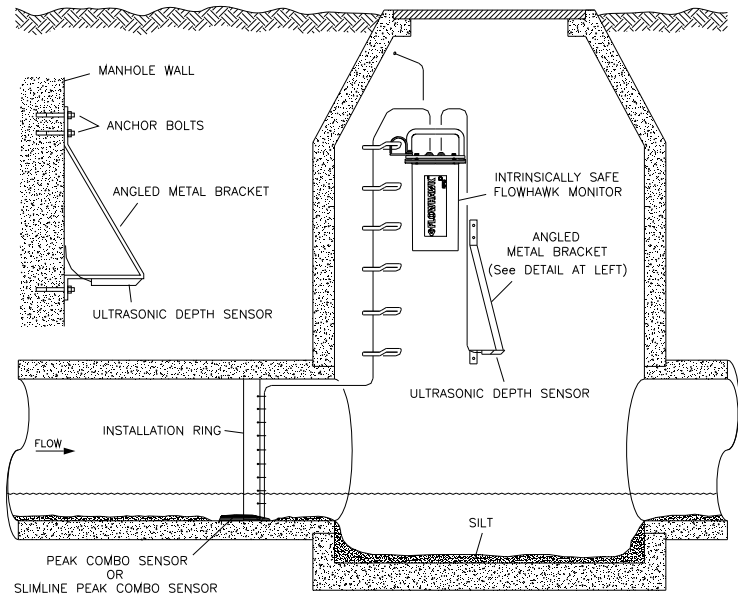
Surcharge Mount

1. Determine the appropriate height at which to mount the Ultrasonic Depth Sensor portion of the surcharge bracket (ADS p/n I40-0010). The sensor slides into the groves of the mounting plate at the lower portion of the bracket. When making this determination, keep in mind that the maximum range of the sensor is 10 feet (3048 mm).

2. Press the bracket firmly against the manhole wall.

3. Identify the three pre-drilled holes at the top of the bracket, and spot drill the manhole wall through the middle hole with a drill.

4. Remove the bracket, and drill and mount a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt.

5. Secure the top of the bracket to the manhole wall with a washer and nut.

6. Push up on the bottom portion of the bracket until the sensor portion of the bracket is level.

7. Hold the bracket firmly in place against the manhole wall.

8. Identify the three pre-drilled holes at the bottom of the bracket, and spot drill the manhole wall through the middle hole with a drill.

9. Rotate the bracket 90°, and drill and mount a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt.

10. Secure the bottom of the bracket with a washer and nut.

11. Slide the sensor into the mounting plate on the bracket, and secure the cable with cable ties to keep the sensor in place.

12. Verify that the sensor portion of the bracket is level using a carpenter's level held to the face of the sensor. If it is slightly out of level, make horizontal adjustments to the bottom portion of the bracket by moving it to the left or right. The oval bottom mounting holes allow minor horizontal adjustments.

13. Drill and mount a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt in one of the other pre-drilled holes at the top portion of the bracket for extra security.

14. Confirm that the sensor is level.

15. Measure the physical offset for the sensor (the distance from the crown (top) of the pipe to the face of the sensor). Enter this distance as a negative value. For example, if it is 24 inches (610 mm) from the top of the pipe to the face of the sensor in the manhole, you would enter -24 inches (-610 mm) for the physical offset.

    Note: This value will be necessary when configuring the monitor using the **Profile** or **Q**_start_ software.

Securing the Sensor Cables in the Pipe and Manhole

Securing the sensor cables from the ring (or band, when applicable), along the pipe crown, and up the manhole helps prevent debris from collecting on sagging cables or between the cables and the pipe crown.

Do not allow sensor cables to hang down in the pipe or sag in the manhole. Loose cables could present a safety hazard in the manhole or increase the potential for sensor or monitor damage to occur. The cables should be secured along the pipe crown and manhole wall under *all* circumstances.

Secure the cables from the ring (or band) to the monitor location in the manhole in the following way:

1. Neatly bundle the cables together with an 8-inch (4-mm x 200-mm) cable tie attached to a plastic anchor installed at the top of the pipe.

    ❑   Drill a hole of the appropriate size for the shank of the plastic anchor in the pipe crown. *Refer to instructions with the anchors.*

    ❑   Drive the plastic anchor into the pipe with a hammer until it is flush and secure.

    ❑   Run the cable tie through the loop in the plastic anchor and around the cables.

    ❑   Tighten the cable tie around the cables, and cut off the excess cable tie material.

    Note: If a plastic anchor will not serve as an adequate anchor for securing the cable bundle based on the structure of the pipe, install a ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolt instead.

> **Warning:** *Do not over-tighten the cable ties or kink the sensor cables!* The depth cable sheathes two components: the electrical cables that operate the sensor and an air tube that ventilates the sensor (*when applicable*). Over-tightening the ties or kinking the cable can damage or restrict the air tube, causing incorrect pressure depth readings.

2. Secure the cables with a cable tie and plastic anchor every 18 to 24 inches (457 to 610 mm) along the pipe crown (when necessary) from the ring to the manhole. *If plastic anchors will not serve as adequate anchors based on the structure of the pipe, install M6 x 55-mm anchor bolts instead.*

3. Secure the cables every 18 to 24 inches (457 to 610 mm) up the side of the manhole to the monitor location. Loose cables could present a manhole safety hazard or increase the potential for sensor or monitor damage to occur. *If plastic anchors will not serve as adequate anchors based on the structure of the manhole wall, install ¼-inch x 2 ¼-inch (M6 x 55-mm) anchor bolts instead.*

> **Warning:** Make sure the connector-end of the sensor is not kinked, does not contain moisture, and includes an attached dryer tube filled with active *blue* desiccant.
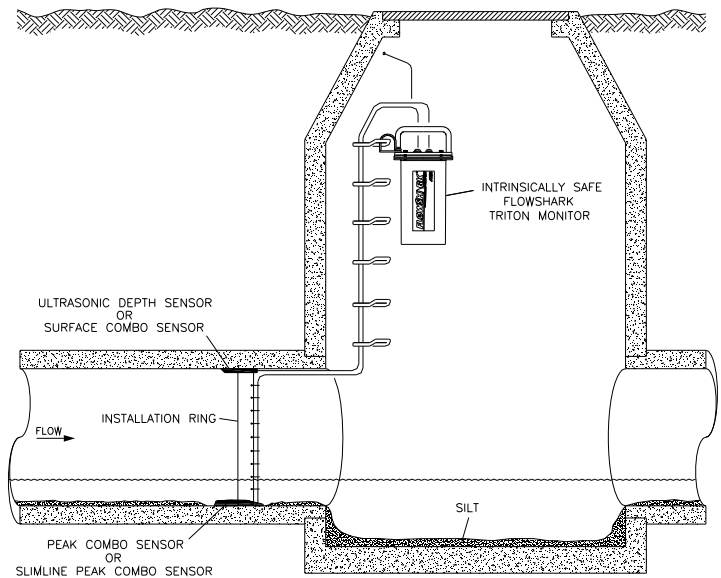
Securing the sensors cables along the pipe and into the manhole

Connecting the Sensors to the Monitor

After installing the ring and sensors and securing the sensor cables to the pipe and manhole wall, connect the sensor cables to the appropriate ports on the top of the monitor. The ports that receive the sensors are labeled **Channel 1** and **Channel 2**.

The FlowShark Triton supports the connection of two sensors in any combination, including two of the same sensor type, to the channel ports. However, to simplify the installation and configuration process, ADS recommends developing a system or convention to ensure consistency when attaching the sensors to the channel ports and assigning the corresponding channels to the sensor devices in **Profile** or **Q***start*.

Establish a priority or order in which particular sensors are assigned to a specific channel and, when applicable and possible, correspond the channel number to the monitoring point. For example, consider always assigning the Peak Combo Sensor to Channel 1 and the second sensor to Channel 2.

Connect the sensor cables to the monitor ports in the following way:

1. Place the monitor in an upright position to view the monitor connector ports.
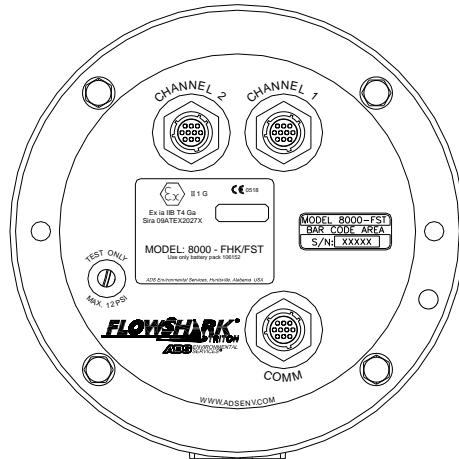
Cable connector ports

2. Visually inspect each sensor connector and monitor connector port for damaged or broken pins. Replace a monitor or sensor with defective ports or connectors.

3. Visually inspect each sensor and monitor connector port for debris and moisture. Clean off any debris, and dry any surface moisture. Compressed air is useful for removing moisture from the inside of the connectors or ports (pin and socket surfaces).

4. Verify that the waterproof seal is present inside each sensor cable end connector. The bright orange, rubber seal should sit at the bottom of the connector with the pins protruding through the seal.

5. Connect each sensor cable to the appropriate port. Tighten each rotating connector collar in a clockwise direction until it clicks, and verify that it is seated correctly.

6. For locations exhibiting the presence of hydrogen sulfide and/or high moisture, provide added protection by wrapping the connection with mastic tape.

7. Seal any unused connectors with a protective cap. If necessary, obtain additional caps from ADS.

Note: An air valve is present in the monitor top. This valve exists only for testing purposes during the manufacturing process. *Do not attempt to fill the monitor with air or pressurize the monitor!*

Securing the Dryer Tube to the Monitor

The Peak Combo Sensor, Surface Combo Sensor, and Ultrasonic Depth Sensor with the Pressure Option each contain a pressure depth sensor with an associated dryer tube. For each combo sensor connected to the monitor, you must secure the corresponding dryer tube (attached to a cable running from the sensor connector) to the monitor in the following way:

1. Attach the dryer tube from the pressure depth sensor in the vertical position to the monitor handle using cable ties. Make sure the clear, flexible tubing coming from the sensor connector the top of the dryer tube is not kinked. If necessary, use a loose cable tie to hold it in an unkinked position.
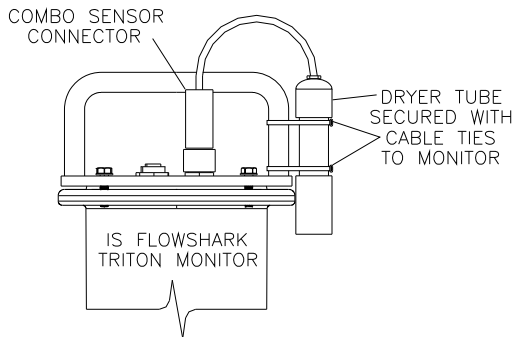
Securing the dryer tube to the monitor using cable ties

2. Make sure the black end cap on the dryer tube is removed before installing the monitor in the manhole.

3. (*applies only when a second dryer tube is present*) Repeat steps 1 through 3 for the other dryer tube, but attach it to the other vertical portion of the handle on the opposite side of the monitor.

C H A P T E R 4

Communication

After installing the sensors in the pipe and connecting the sensors to the ADS® FlowShark® Triton monitor, it is necessary to establish communication with the monitor through wireless communication (remote) or direct connection (on-site). All methods of communication require a field (laptop) computer or office computer equipped with the ADS **Profile®** or **Q***start*™ software.

ADS offers three options for wireless communications:

- **GSM Module** This option involves mounting a GSM module containing a modem inside the manhole next to a battery-powered FlowShark Triton.

- **EMU** This option involves installing an EMU (external modem unit) outside, but in close vicinity to, the manhole in which the monitor is installed. It also requires running a power/communication cable between the monitor and EMU. An EMU is required when the system (monitor/EMU) will receive power from an external DC source.

- **EMUX** This option involves installing an EMUX (external modem unit/multiplexer) outside, but in close vicinity to, the manhole in which the monitor is installed. It also requires running a power/communication cable between the monitor and EMUX and a communication cable between an RTU (remote terminal unit) and the EMUX. An EMUX is required when the system (monitor/EMUX) will communicate with a SCADA RTU through Modbus protocol and receive power from an external DC source. Serving as an interface (multiplexer), the

EMUX enables the RTU to obtain real-time monitor data through a serial connection and the **Profile** software (a user) to communicate with the monitor through a wireless connection.

Direct, on-site communication with the monitor is possible through an IS serial connection between the monitor and a laptop computer.

This chapter contains information and instructions concerning the following:

- Installing the GSM module in the manhole

- Installing the communication cable and the EMU outside the manhole near the external power source

- Installing the communication cable and the EMUX outside the manhole near the RTU and/or external power source

- Connecting directly to the monitor on site

   Note: Manhole and sewer system work involves confined space entry and is inherently dangerous. Therefore, installers and technicians must comply with all national, state, and municipal regulations concerning confined space entry. ADS is not responsible for any injuries, damages, claims, or liability resulting directly or indirectly from the use of this installation guide or the installation of any ADS equipment.

   Warning: The ADS GSM Module requires connection to an external antenna. Only antennas provided by ADS are approved for use. **The user must maintain a distance of 9 inches (229 mm) from the antenna whenever the modem is in operation**.

GSM-Based Wireless Communication

The ADS FlowShark Triton monitor system supports GSM wireless communication through an ADS GSM/GPRS module (including an Enfora modem) using static IP address network services provided by AT&T. Therefore, any location considered for installing wireless communication must have access to AT&T 850 or 1900 MHz service. The user must fit each wireless device with a SIM (Subscriber Identity Module) card provisioned by AT&T with specific account and network information for use with ADS software.

Wireless communications and the quality of service depend on local conditions and service providers.   An optimal location for flow monitoring may not offer the best wireless network coverage. The user is responsible for finding the most reliable network for your project area. Therefore, perform a signal survey to ensure that the monitoring site has adequate reception for wireless communications. Consider consulting local wireless providers for assistance.

> **Note:** Do not rely solely on coverage maps. These can provide misleading information for specific areas. Typically, sewer systems exist in low-lying areas in which network access can be the most difficult to obtain.

Currently, only AT&T static IP SIM cards may be used for communicating through the **Profile** or **Q***start* software platform or networks supporting ADS **IntelliServe**®. This service supports Mobile Terminated service as well as Mobile-Originated (alarm cryout) functionality.

Wireless communication with a FlowShark Triton begins with entering the IP address into the **Profile** or **Q***start* software Location Information File (LIF). When using a SIM card that provides a *public* IP address, the PC must have internet connectivity. When using a SIM card that provides a *private* IP address, the PC first must establish a VPN connection with the SIM provider. Consult ADS Client Services for more information on using private

addresses. Then, the user can connect to a monitor through **Profile**, **Q***start*, or **IntelliServe** (provided the appropriate LIF has been imported from **Profile**)**.** Consult the **Profile** manual #950015 (version B4 or higher) or the **Profile** or **Q***start* online help for further information on wireless setup and use.

Installing the GSM Module

Establishing remote, wireless communications with the battery-powered FlowShark Triton monitor involves installing a GSM module in the manhole.

The ADS GSM Module (p/n 8000-0052) is a polycarbonate enclosure containing an electronic assembly comprised of a modem module and intrinsically safe isolation components. The enclosure has a clear, removable top to allow the user to access the SIM card holder. The module also contains an LED window visible through the clear cover that displays monitor activity and diagnostic codes. Each module bears an IS Certification label, as well as the serial number of the unit. A cable, exiting one side of the module, connects to the monitor communication port. A female SMA connector located on the other side exists for connecting an antenna.

GSM Module and monitor connection cable

Note: For wireless communication, it is very important to test the FlowShark Triton and GSM module with the SIM card installed to verify the *entire system* functions and

confirm network quality of service. Perform this validation *before* deploying to the field and again at the monitoring site before installing the monitor.

Gathering Parts and Supplies

Obtain the following items for the antenna and GSM Module installations:

● GSM module (ADS p/n 8000-0052)

● One of two wireless antennas available through ADS (p/n 3800-0162 or 3800-0163)

● (*applicable only to off-road installations*) Extension cables (15-foot (4.6-m): ADS p/n 507165; 50-foot (15.2-m): ADS p/n 507168)

● AT&T public static IP address SIM card (ADS p/n 507181)

● Magnet (ADS p/n 8000-0140)

● 8-mm anchor bolts with washers and nuts

● Medium-sized non-rotating demolition hammer with a 0.5-inch (13-mm), 0.75-inch (19-mm), or 1-inch (25-mm) masonry chisel (sharpen the chisel before use) and bushing tool, or an abrasive saw or grinder

● Masonry drill bits for drilling through manhole wall, corbel, other materials. Include the following:

   ❑ 0.5-inch (13-mm) diameter (*minimum*) x 12-inch (305-mm) long (minimum) bit

   ❑ 0.5-inch (13-mm) diameter x 36-inch (914-mm) long (*minimum*) bit

   ❑ 1.25-inch (32-mm) diameter x 12-inch (305-mm) bit

● Standard drill bits and masonry bits up to 0.6 inches (15 mm) in diameter

- Medium- to heavy-duty hammer drill (*if no hammer/drill mode is available on the demolition hammer*)

- Trowel or putty knife for scooping asphalt

- Hammer

- Carpenter's rule

- Pen, pencil, or chalk for marking asphalt or concrete

- Shop vacuum

- Wire brush

- Alcohol wipes

- Leather work gloves

- Protective goggles

- Heavy-duty, high-quality caulking gun (for regular-sized tubes)

- Appropriate tools for cutting and removing tarmac or dirt for burying antenna

- Patching and sealing materials for tarmac and for sealing the cable hole into the manhole

- Cable ties for securing cable coils

- Generator or other power source (*for hammer drill*)

- Dry sand

- Commercial asphalt cold patch compound (*approximately 1 cup*)

- Scotch-kote electrical sealing compound (ADS p/n 505171)

- Scotch 130C rubber stretch tape (ADS p/n 145-0001)

Installing the Wireless Antenna

Before installing the GSM Module into the manhole, install one of the following antennas:

●   Wireless, slim, quad-band antenna (ADS p/n 3800-0162)

●   Wireless, mini-wing, quad-band antenna (ADS p/n 3800-0163)
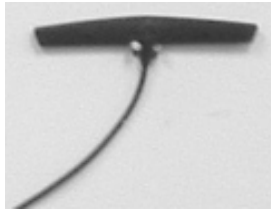
Mini-wing antenna

Install a wireless slim or mini-wing antenna in the road, in dirt, or under other paving materials in the following way:

> **Note:** While this section describes the process for installing these antennas, all wireless antennas provided through ADS also include detailed installation instructions.

1. Determine the appropriate location in the road near the manhole to install the antenna:

    ❑ Locate the antenna in the road between 18 and 30 inches (457 and 762 mm) from the manhole in which the monitor is installed. Position the antenna as far as possible from the massive iron frame and buried flange to prevent shunting of the RF signal.

    ❑ Avoid locations at which cars will remain parked over the antenna for extended periods (hampering the signal strength).

    ❑ Select a location that drains well so that water will not collect over the antenna, blocking the signal.

    ❑ Choose a location that is as flat as possible with stable base material.

❑   Select a location where the antenna will experience minimal direct impact from road traffic, where possible.

❑   Make sure the location exists beyond the manhole's iron rim beneath the road surface. This will enable you to access the manhole corbel when drilling the channel for the antenna cable.

❑   Verify that no buried utility cables exist in the area in which drilling will occur for the antenna installation. Consider contacting a Underground Utility Locating Service for assistance.

2.   Mark the location for the antenna installation, and then mark the location to drill the corbel hole 2.5 to 3 inches (64 to 76 mm) back from the edge of the antenna hole.

3.   Drill a hole from the marked corbel hole location in the road, through the corbel, and into the manhole using the ½-inch (13-mm) by 36-inch (914-mm) hammer drill bit. This will serve as the channel for the antenna cable extending from the antenna to the monitor in the manhole. Be careful to avoid any cables in the manhole, and restart the hole slightly to the right or left if mesh is encountered or resistance occurs.

4.   Cut a 6-inch (152-mm) long by 1.25-inch (32-mm) wide by 0.75-inch (19-mm) deep hole in the road using the non-rotating demolition hammer (*in the hammer only mode*) with the chisel/grinder. This will serve as the installation location for the antenna. The corbel hole should be under the center of this hole.
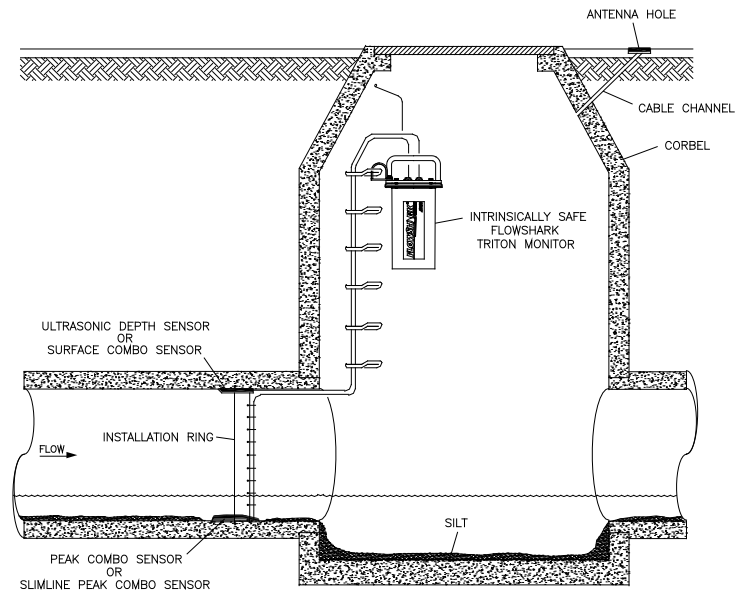
Hole running from antenna installation location to manhole

5. Level the bottom of the hole using the demolition hammer with the chisel and a bushing tool.

6. Thoroughly clean out the hole for the antenna of all debris using a shop vacuum with a brush.

7. If the protective cap is not present on the connector at the end of the antenna cable, clean the connector and tape it up with rubber stretch tape for protection against damage and debris while it is being fed through the channel.

8. Feed the antenna cable into the hole, through the channel, and into the manhole. Smooth any rough edges where the cable enters the corbel hole with the chisel or rubber stretch tape. In addition, pack rubber stretch tape into cable hole to prevent asphalt or sealer from entering the cable hole.

9. Remove the white release tape from the antenna element. Be careful to avoid contacting the black rubber mastic material with anything until the antenna is ready to be seated.

10. Apply a piece of white release tape onto the top of the antenna, and then seat the antenna into the bottom of the hole. Once the antenna is firmly seated, remove the release tape.

11. Apply the asphalt on top of the antenna element. When using asphalt, scoop the warm material into the hole and then pound it in using a hammer. Place a piece of wood or metal between the asphalt and the hammer to prevent the hammer from sticking to the asphalt. Make sure the asphalt protrudes slightly above the level of the road surface.

12. Sprinkle a thick (approximately 1/8-inch) layer of sand over the asphalt, and then pound the sand lightly into the surface. The sand must be used to ensure the asphalt does not adhere to objects, such as vehicle tires, while drying. ADS recommends dusting the surface with sand once again before leaving the site.
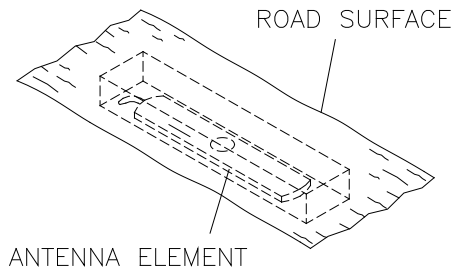
Antenna in cavity with patch

13. Coil the slack antenna cable and temporarily secure it away from the other cables in the manhole. Slack enables the technicians to remove the GSM Module from the manhole for maintenance or service activities with the antenna cable still connected. *Do not bundle the antenna and sensor cables together! This can significantly diminish antenna and sensor signal strength, disrupting communications and limiting sensor accuracy.*

   Note: To prevent signal loss and damage to the cable and antenna, do not kink or bend the antenna cable when coiling.
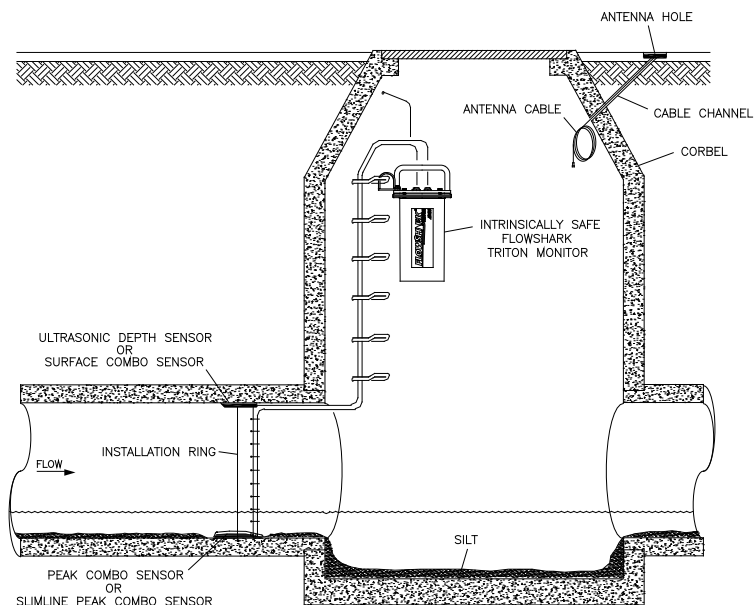
Installation with antenna cable coiled in manhole

14. Seal the space between the antenna cable and the corbel hole
    with electrical duct seal or as required to prevent infiltration
    into the manhole.

    Note: Do not connect the antenna cable to the GSM
    Module until after installing the SIM card.

Installing the SIM Card

The GSM Module requires a standard SIM card for establishing
communication. This module is designed for use with SIM cards
provisioned by AT&T (ADS p/n 507181) for public static IP
address operation. Please contact ADS for specific information on
procuring SIM cards for use in the specific geographic area.

Install the SIM card in the following way:

> **Note:** Locate the GSM module in a dry, non-hazardous area before installing the SIM card. Do not install the SIM card with the module attached to the monitor or damage may occur to the monitor or the GSM module!

1. Record the number of the SIM card (i.e., the IP address) on the site report. You will need this address to reconcile billing and when setting up the LIF in the **Profile** or **Q***start* software. The IP address is printed directly on the SIM card or on a label affixed to the card.
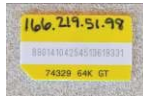
Example of SIM card

2. Loosen the four Phillips head screws from the clear top of the module, and remove the top.
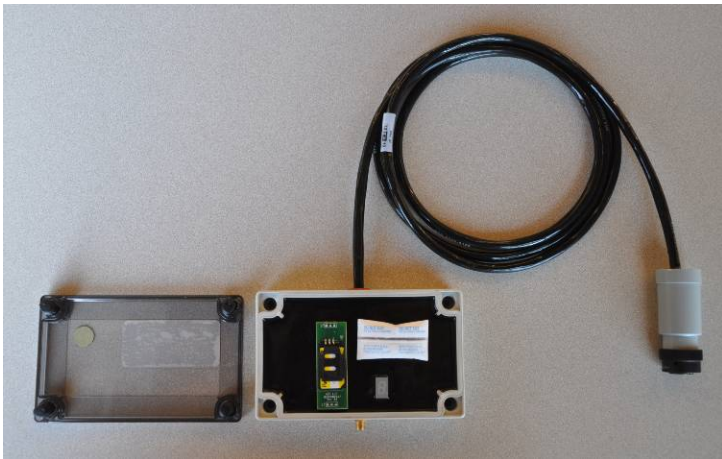
Cover removed from GSM Module

3. Slide back the clip on the SIM card carrier to unlock the carrier. The clip indicates the proper direction for unlocking the carrier.
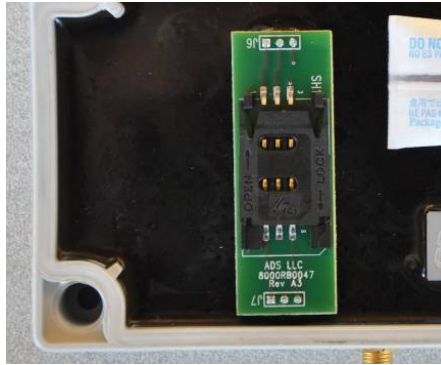
Sliding back clip on SIM carrier

4. Swing up the hinged clip to the carrier and gently insert the SIM card into the slot. Orient the card so that the beveled corner of the card will align with the beveled corner of the carrier once locked into place.

Swinging up hinged clip and inserting card; notice beveled edged of card

5. Close the clip to the carrier, and slide the clip forward to secure the SIM card into place. The clip indicates the proper direction for locking the carrier.

SIM card properly seated and locked in carrier

6. Inspect the gasket and all edges of the module enclosure seal to be sure they are free of any debris.

7. Position the desiccant pack (ADS p/n 507995) in the GSM module above or to the right of the LED window. Make sure the desiccant is fresh by inspecting the center strip on the pack. The center strip on a new, fresh pack should be blue in color. Replace the pack if a pink color is visible through the center strip.

Desiccant pack properly seated and positioned in GSM module

8. Replace the cover to the module, and then replace and tighten the screws until the edges of the box are flush together. *However, do not over-tighten the screws!*

9. Temporarily connect the cable from the antenna to the antenna connector on the GSM module (first removing the electrical tape from the cable end, when applicable) and the communication cable from the module to the **COMM** port on the monitor. Then, activate the diagnostic codes to test communications and the module based on the instructions under *Obtaining Diagnostic Codes from the Monitor* in *Chapter 8*, *Maintenance and Troubleshooting*. Once complete, disconnect the cables before installing the module in the manhole.

10. Wrap electrical tape tightly over the seam (between the cover and the case) of the GSM module enclosure to enhance the seal and to simplify the removal of debris when the module is opened.

Installing the GSM Module

> **Note:** ADS recommends installing the antenna prior to securing the GSM module to the monitor.

> **Note:** The following instructions address a standard installation that involves mounting the GSM module inside the manhole. However, ADS offers an *optional* extension cable (ADS p/n 8000-0044-25) that runs between the monitor and module for mounting the module and antenna outside the manhole. When installing the module outside the manhole, provide adequate protection for the module against environmental elements and vandalism, such as a weatherproof and secure enclosure. In addition, wrap the entire connections of the extension cable and module *and* the extension cable and monitor port with rubber stretch tape, extending onto the cables approximately 2 inches (50

mm) beyond the connection on each side (when applicable).

Install the GSM module in the following way:

1. Place the monitor upright on the ground surface beside the manhole in which the antenna cable is temporarily coiled.

2. Attach the communication cable connector from the GSM module to the corresponding **COMM** port on the monitor.

3. Wrap rubber stretch tape around the entire cable connection (particularly over the gap between the connector and port), extending 1 to 2 inches (25 to 50 mm) onto the cable beyond the connection.

COMMUNICATION CABLE

COAXIAL STRETCH TAPE

COMM PORT

FLOWSHARK TRITON MONITOR
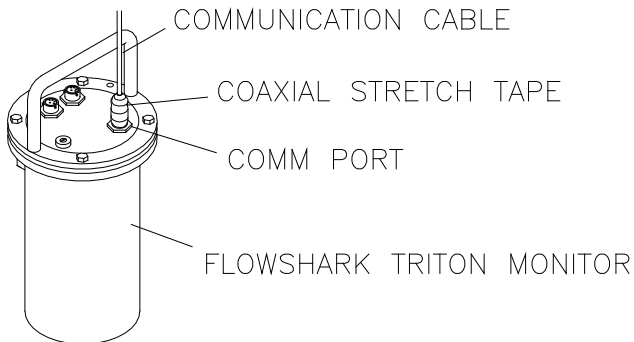
Communication cable connected to monitor with stretch tape properly applied

4. Attach the antenna cable connector to the antenna port on the GSM module.

5. Wrap rubber stretch tape around the entire cable connection, extending onto the cable approximately 2 inches (50 mm) beyond the connection on the module.

6. Secure the communication cable of the GSM module to the short vertical portion of the monitor handle using a cable tie. Orient the module so that antenna port/cable is facing downward, making sure the cable tie is securing the communication cable within 2 to 3 inches (50 to 75 mm) of the

top of the module. Consider the following installation issues when securing the module to the handle:

❑   Whenever possible, secure the GSM module to the side of the handle opposite the side to which the pressure depth sensor dryer tube is attached.

❑   When the monitor will be mounted in the manhole to a ladder rung using a hook, secure the GSM module to side of the monitor handle opposite the side of the monitor to which the hook will be attached.

FLOWSHARK
TRITON MONITOR

COMMUNICATION
CABLE

CABLE TIES

GSM
MODULE

ANTENNA
CABLE
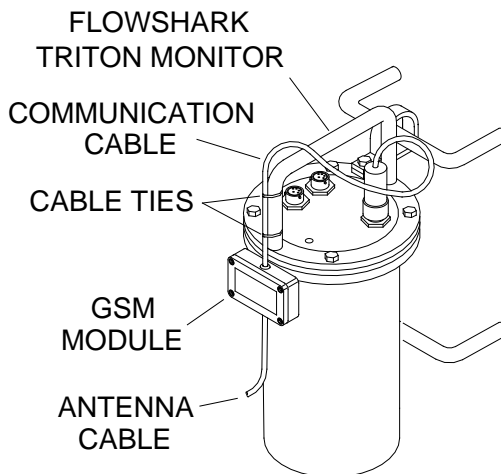
Securing the GSM module to the monitor handle

7.   Carefully coil and secure the remaining slack cabling as necessary. Slack enables the technicians to remove the GSM module from the manhole for maintenance or service activities.

Note: *Remember to avoid bundling the antenna and sensor cables together!* This can significantly diminish antenna and sensor signal strength, disrupting communications and limiting sensor accuracy. In addition, *avoid kinking and bending the cables when coiling* to prevent signal loss and damage to the cables and corresponding equipment.

Installing an EMU

Establishing remote, wireless communications with the external-powered FlowShark Triton monitor involves installing an EMU (ADS p/n 3800-0148) outside the manhole (in which the monitor is installed) at the location housing the external power source. Installing the EMU primarily involves two procedures:

- Installing the communication cable

- Installing the wireless EMU

Installing the Communication Cable

Installing the communication cable involves the following activities:

- Selecting the route for the communication cable

- Contacting the underground utility locating service

- Gathering the necessary tools and materials

- Installing the communication cable

Selecting the Most Appropriate Route for the Communication Cable

The step involves evaluating the most appropriate route for running the communication cable between the manhole and the EMU/power source location. Issues for consideration may include existing landscape, utilities present, and excavation costs.

Consider the following when choosing the route for the cable:

- Choose a route that will not require running the communication cable underneath rough gravel roads. Constant traffic could cause damage to the cable.

- Verify that the communication cable trench will not damage an existing sprinkler system. Locate any sprinkler lines (These are not located by the locator service). Check with homeowner if necessary.

- Avoid flowerbeds and other areas where frequent digging or planting might occur.

    Note: For more information on determining the most suitable cable route, contact the ADS Client Services Department at adssupportcenter@idexcorp.com or 877-237-9585.

    Note: When installing an externally powered EMU (ADS p/n 3800-0148), ADS recommends locating the EMU in close proximity to the power source to maximize the net power available to the EMU.

Contacting the Underground Utility Locating Service

If you must route the communication cable through a yard or a commercial area, ADS strongly recommends contacting an underground utility locating service before beginning installation of the communication cable. Allow 5 to 7 days for this to occur before scheduled excavation activities can begin.

Perform the following to assist the locator's service, minimize the risk of damage to underground utilities, and avoid possible injury or death caused by a potential cable strike:

- Provide the exact route proposed for the cable.

- Clearly mark the proposed route with spray paint or wire flags.

- Create a hand-drawing of the proposed cable route to make sure the locator service looks in the correct area for underground services.

Gathering Tools and Materials

Obtain the following items to perform the installation:

- Ratchet set with 7/16-inch (11-mm) socket

- Pointed shovel

- Claw hammer

- Hammer drill

- Minimum ½-inch (13-mm) diameter masonry bit at least 12 inches (305 mm) in length to drill through the manhole wall or corbel

- Generator for hammer drill (if necessary)

Installing the Communication Cable

After finalizing the cable route, run the communication cable (ADS p/n 106227) between the monitor location and the EMU/power source location in the following way:

> **Note:** The following instructions represent a communication cable installation that occurs from the EMU/power source location to the manhole through soil. If a transition occurs through asphalt or concrete, you must create a ½-inch (13-mm) wide by 1-inch (25-mm) deep (minimum) saw cut trench. The trench and cable must be clean and free of dirt, debris, and grease before you lay the communication cable. Use only approved loop sealant or concrete joint sealant to secure the cable into the roadway. To prevent wear or damage to the communication cable, avoid sharp transitions where the concrete or asphalt transitions to other surfaces.

1. Remove the orange connector from the communication cable end (if attached) and inspect the ends of each small wire extending from the cable.

2. Verify that the wire ends have been stripped correctly with only
    ¼ inch (6 mm) exposed. If they have not been stripped or have
    been stripped incorrectly, prepare the wires in the following
    way:
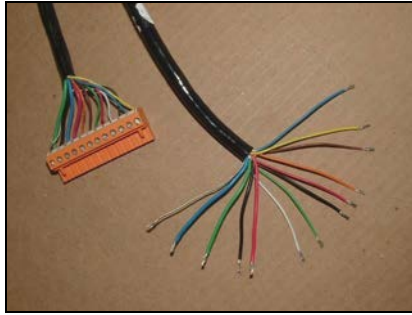
Wire ends stripped ¼-inch

❑   Cut off the old stripped ends (*when applicable*) back to the
    jacket.

❑   Use the small side cutters to carefully remove 4 inches
    (102 mm) of the jacket, and cut away the tension strands
    and any other unnecessary jacket materials.

❑   Using the wire strippers, select the appropriate gauge and
    strip ¼-inch (6 mm) from the end of all conductors. Twist
    each wire end to prevent fraying.

3. Carefully tape together the loose bundle of wires using the
    vinyl electrical tape. Form a taper covering all of the wires,
    keeping it as thin as possible so that it will be able to pass
    through the communication cable entry fitting on top of the
    EMU.
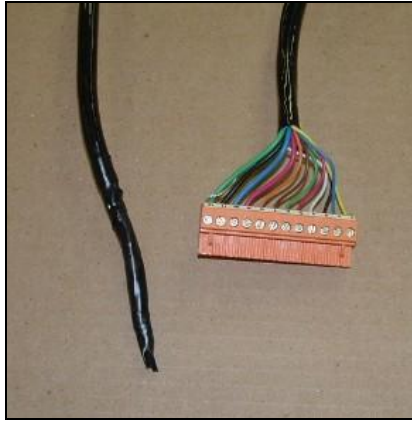
Forming a thin taper using vinyl tape

4. Excavate a trench at least 12 inches (305 mm) deep and 4 inches (102 mm) wide from the EMU/power source location to the monitor location. Consult local regulations to verify the required trench depth for the area.

5. Drill a ½-inch (13-mm) (*minimum*) hole through the corbel (structural foundation holding the manhole cover) or manhole wall to provide a smooth transition for the cable into the trench.

6. Run the communication cable from the monitor location in the manhole to the EMU/power source location. If required by local code, run cable through ¾-inch (19-mm) electrical PVC conduit in the following way:

    ❑ Extend the conduit through the manhole corbel or wall at the monitor location.

    ❑ Lay the conduit in the trench per local regulations and feed the communication cable through the conduit.

    ❑ Extend the conduit approximately 12 inches (305 mm) vertically out of the trench (from the ground surface) at the EMU/power source location.

    ❑ Use urethane foam to seal the space between the conduit and the corbel or manhole wall to prevent infiltration into the manhole.
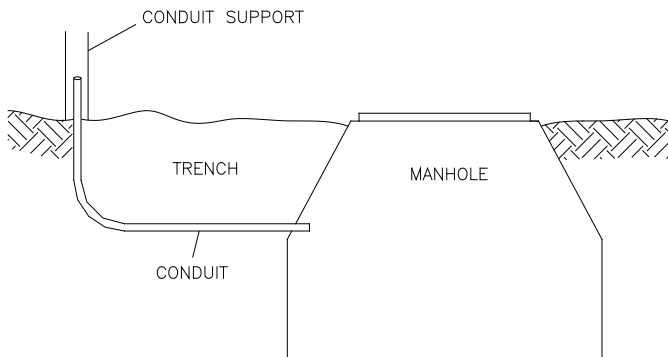
Running the cable and conduit from the manhole to the EMU/power source

7. Provide enough slack in the cable at the manhole end to allow removal of the monitor from the manhole during service activities.

    Note: *Do not connect the cable to the monitor at this time!*

8. Provide approximately 40 inches (1016 mm) of excess cabling at the EMU/power source location.

9. (*applies only to applications requiring conduit*) Use urethane foam or a sealing fitting to form a seal between the communication cable and conduit at each end of the conduit. This will prevent sewer gases from entering the box housing the EMU and power supply, moisture from entering the conduit during a surcharge, and inflow from entering the manhole.

10. Route the communication cable into the bottom of the hole at the EMU/power source location. Verify that there are still 40 inches (1016 mm) of the communication cable exposed, from the bottom of the hole (where the cable enters the hole) to the end of the cable.

11. Backfill the dirt in the hole to grade level at the EMU/power source location, while tamping with a hammer. Restore the landscape as necessary.

Installing the EMU

Installing the wireless EMU involves wiring the communication cable to the Communication Interface/Barrier box and mounting the EMU at the power source location.

EMU Components

The wireless EMU (ADS p/n 3800-0148) houses the following major components:

- Communication Interface/Barrier PCB

- Modem Reset PCB

- Quad-Band TCP/IP Wireless Modem

- Mini-wing Antenna

ADS ships the wireless EMU preassembled. The EMU is ready for wireless communication once connected to a FlowShark Triton IS monitor via a communication cable (ADS p/n 106227B), receiving power from an external power source, and fitted with a SIM card.

Front of EMU

Gathering Tools and Materials

Obtain the following items before initiating installation:

- Medium (No. 2) Phillips head screwdriver

- Small (1/2-inch/13-mm) flat head screwdriver (to fit orange Communication Cable terminal block)

- Wire strippers (with holes to strip 16-, 18-, and 20-gauge wires)

- Small sharp side cutters (*Do not use the big cable tie trimmers used for ring/monitor installs!*)
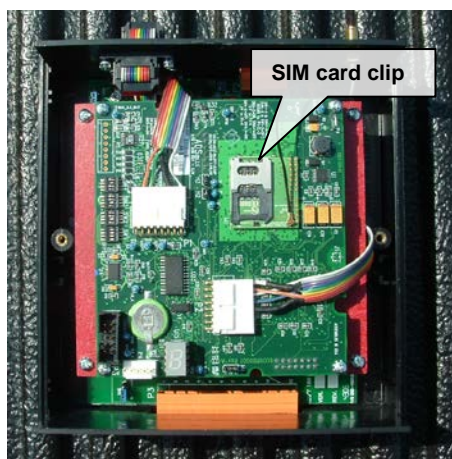
- Vinyl electrical tape (*not stretch tape*)

Wiring the Communication Cable

Once the communication cable has been installed and at least 40 inches (1016 mm) of communication cable extends from the ground, wire the communication cable to the EMU and install the external power kit:

1. Unscrew the 4 large plastic screws with the Phillips head screwdriver and remove the cover to the EMU. Carefully set the cover aside to avoid damage and prevent dirt from contacting the cover gasket.

Inside of EMU with front cover removed

2. Lay the EMU down next to the power source location, and loosen the nut on the communication cable entry fitting. If the fitting is snapped closed, use a small flat-blade screwdriver to gently pry open the ears of the fitting.

Opening the communication cable entry fitting

3. Run the communication cable through the fitting and into the box. Pull enough of the cable through the hole to allow room to hold the cable while attaching the wires to the connector.

Communication cable inserted through the entry fitting

Warning: Verify that the communication cable is *NOT* attached to the flow monitor.

4.   Terminate the 12 wires into the orange connector, using the ⅛-inch flat screwdriver, as shown on the label affixed to the inside cover of EMU box. Make sure all screws are tight.

| Terminal	Wire Color	Gauge Wire
1	Yellow	22
2	Blue (small)	22
3	Black (small)	22
4	White	22
5	Red (small)	22
6	Green (small)	22
7	Brown	22
8	Orange	22
9	Red (large)	18
10	Blue (large)	18
11	Black (large)	18
12	Green (large) *and* bare shield drain wire	18 (green)/ 22 (drain wire)

Note: The wires can become loose while moving the cable. Therefore, after terminating the wires, verify once again that each wire is secure.

5.   Plug the orange connector into the corresponding port on the black Communication Interface/Barrier Box, and then pull back the excess cable from the outside of the EMU.

> **Note:** The port on the Communication Interface/Barrier Box may be difficult to access because of its close proximity to the modem. Therefore, it may be necessary to remove the box from the EMU before connecting the orange connector. Release the box from the back plate of the EMU by grasping the rear edge (next to back plate) and gently, but firmly, pulling to release the Velcro® grips. After seating the orange connector, verify that all connections to the Communication Interface/Barrier Box are secure and reseat the box onto the Velcro.
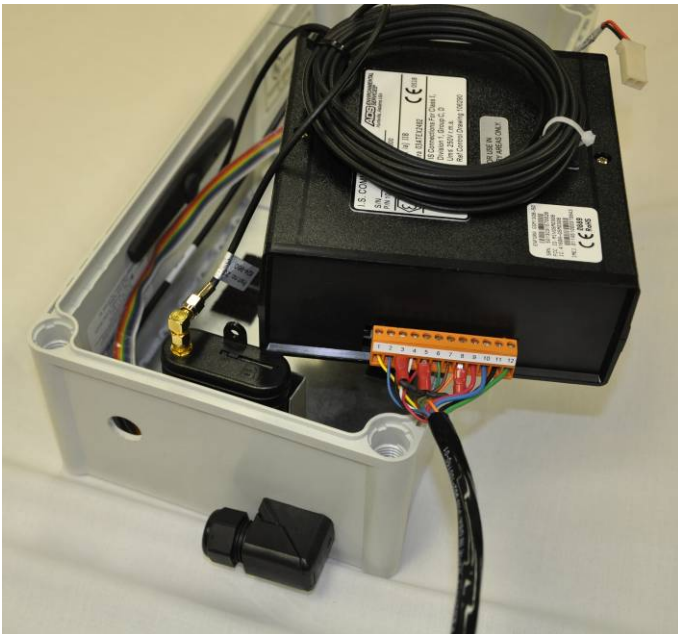
Connecting the communication cable to the Communication Interface/Barrier Box (with the box removed from the EMU)

6. Tighten the nut on the communication cable entry fitting until the cable is secure and cannot be moved in or out of the fitting.

7. Record the IP address of the SIM card (ADS p/n 507181) and then insert the SIM card into the slot in the modem.

Inserting the SIM card into the modem in the EMU

SIM card seated in the EMU modem

8. Slide the SIM lock to the left to secure the card in place.

9. Install the External Power Kit (ADS p/n 3800-0181) in the EMU in the following way:

External Power Kit includes an external power cable (top) and a chassis cable (bottom)

❑ Remove the plug at the top of the EMU to the right of the communication cable entry fitting.

❑ Remove the nut from the metal connector on the chassis cable (from the kit), and lubricate the O-ring on the connector with Parker-O-Lube.

❑ Run the connector up through the hole from the inside out. Make sure the O-ring seats properly into the grove on the inside of the EMU.
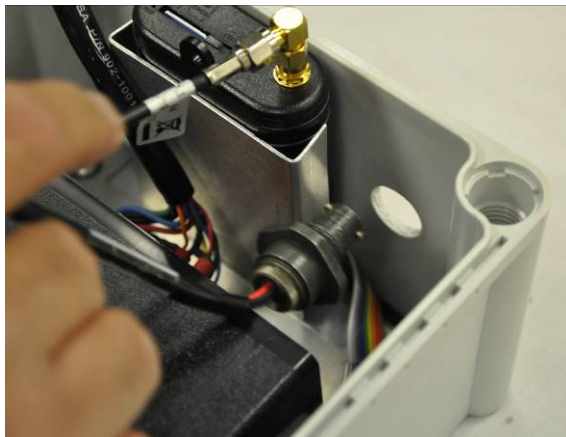
Inserting the chassis connector through the hole in the EMU

❑ Thread the nut back onto the connector on the outside top of the EMU to secure the connector in the hole, and tighten the nut securely with a wrench.

Threading the nut onto the connector from the outside of the EMU

❑ Connect the plastic white connector from the chassis cable to the corresponding connector on the cable attached to the Communication Interface/Barrier Box in the EMU.

Connecting chassis connector to the Communication Interface/Barrier Box

❑ Attach the metal connector from the 10-foot power cable to the chassis cable connector.

Connecting the 10-foot external power cable

Note: If additional cable is required to cover the distance to the DC source, select an appropriate gauge of cable to complete the run. The existing cable is 0.25 inches (6 mm) in diameter and has an ethylene/propylene copolymer jacket. If the cable requires splicing, use a junction box or other method suitable for the environment in which the cable will be installed.

10. Replace the cover on the EMU, and securely tighten the four plastic screws. Be sure the edges of the cover align with the edge of the box and that no wires are trapped in the gasket.

Installing the EMU

Installing the EMU involves mounting the EMU inside the customer-supplied enclosure, disconnecting or removing the battery pack from the monitor (*when applicable*), connecting the communication cable to the monitor, hooking up to the external power source, and verifying the wireless signal. Perform these tasks in the following way:

1. Mount the EMU to the panel inside the enclosure housing the power supply using appropriate fasteners. The holes in which the plastic screws go into to secure the cover of the EMU to the chassis are the same holes through which the fasteners secure the EMU to the enclosure. Therefore, it may be necessary to remove the EMU cover to insert the fasteners through the holes to mount the EMU to the enclosure. If this occurs, replace the cover once the EMU is secured to the enclosure.

One of the holes through which to secure the EMU to the panel

2. (*applicable only to FlowShark Triton monitors containing the 12-volt IS battery pack*) Disconnect the battery pack cable from the regulator dome cable in the FlowShark Triton *or* disconnect and remove the 12-volt IS battery pack completely from the canister.

    WARNING: Failing to disconnect the 12-volt IS battery pack from the monitor regulator and applying external power may result in acid discharge from the battery pack and/or cause the battery pack to explode over time.

3. Connect the end of the communication cable entering the manhole to the **COMM** port on the top of the flow monitor. Wrap rubber stretch tape around the entire cable connection, extending 1 to 2 inches onto the cable beyond the connection.
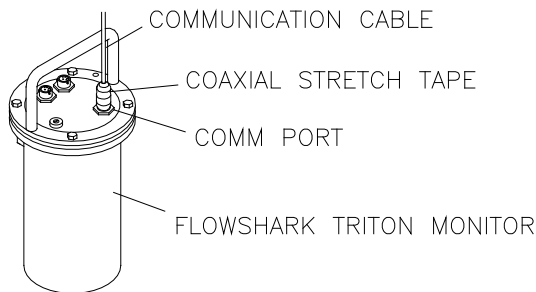
Communication cable from EMU connected to monitor with stretch tape
properly applied

4. Run and connect the external power cable to the power supply,
    and then connect to the power source. Refer to *Chapter 5*,
    External Power, for information and instructions on installing
    the power supply and connecting to the power source.

5. Contact a remote support analyst (with access to the Internet
    and the ADS **Profile** or **Q***start* software). Provide the IP
    address and site name and then have the analyst attempt to
    communicate with the flow monitor and perform standard
    diagnostics or collect data.

6. Have the analyst verify the signal strength of the antenna is
    higher than –85. Valid signal strength can range from -111 to -
    51, with -51 being the highest/best possible signal strength and
    -111 the lowest/worst possible signal strength. A signal
    strength of less than -90 is considered poor and will result in
    poor communication and a higher power drain. It also is likely
    to have a negative impact during both data collection and
    monitor configuration.

Note: The material of which the enclosure housing the EMU is made may impact the strength of the signal available. If the material is significantly reducing the signal strength, consider installing the wireless antenna (currently mounted inside the EMU) outside the enclosure. If this requires drilling holes in the EMU and/or the enclosure, take the appropriate measures to seal the holes around the cable once the antenna is installed to ensure protection for the internal components against the elements.

7. Backfill the trench between the manhole and the location at which the EMU is installed, and restore the landscape as necessary.

Installing an EMUX

Establishing remote, wireless communications with an externally-powered FlowShark Triton monitor that also will be connected serially to a SCADA or other process control system through an RTU (Remote Terminal Unit) requires installation of an EMUX (ADS p/n 106226E). Locate the EMUX outside the manhole (in which the monitor is installed) in the proximity of the RTU and/or external power source within a weatherproof (*for outdoor installation*) or other protective (*for indoor installation*) enclosure. Installing the EMUX primarily involves the following procedures:

● Installing the communication cable

● Installing the EMUX

● Connecting the communication cable to the monitor

● Installing a wireless antenna

● Connecting an RTU to the EMUX

● Providing external power to the unit

Installing the Communication Cable

Unless the monitor will be located outside a manhole, the instructions for installing the communication cable for the EMUX are the same as for the standard EMU. Therefore, please refer to *Installing the Communication Cable* on page 4-19 for instructions.

If the monitor will be installed outside a manhole, proceed directly to the following section, *Installing the EMUX*.

Installing the EMUX

Installing the wireless EMUX primarily involves installing the SIM card in the EMUX, connecting the communication cable to the EMUX, and mounting the EMUX near or adjacent to the RTU and/or external power source.

Gathering Tools and Equipment

Obtain the following items before initiating installation:

- Medium (No. 2) Phillips head screwdriver

- Small (1/2-inch/13-mm) flat head screwdriver (to fit the orange communication cable terminal block)

- Wire strippers (with holes to strip 16-, 18-, and 20-gauge wires)

- Small, sharp side cutters (*Do not use the big cable tie trimmers used for ring/monitor installations!*)

- Vinyl electrical tape (*not stretch tape*)

Installing the SIM Card

Install the SIM card (ADS p/n 507181) in the EMUX in the following way:

1. Record the IP address of the SIM card. The address should be printed directly on the card or on a label affixed to the card.

2. Loosen and remove the two screws from the front cover of the EMUX, and then remove the cover.

EMUX with cover

Inside of EMUX with cover removed

3. Slide the SIM card into the SIM card clip on the board inside the EMUX until it is seated securely in place. Orient the card so that the beveled edge of the card corresponds with the beveled edge on the lower right edge of the clip.
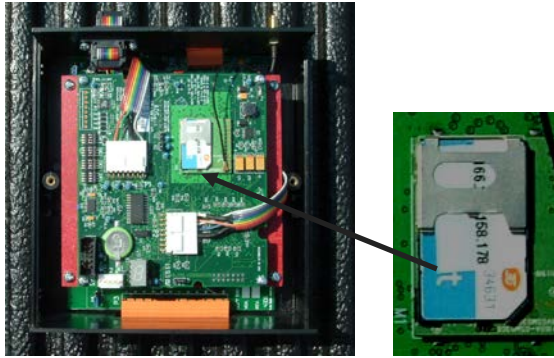
SIM card installed in clip (notice the beveled edge)

4.   Replace the cover onto the EMUX, and replace and tighten the screws.

Connecting the Communication Cable to the EMUX

Connect the communication cable to the EMUX in the following way:

1.   (*applies only to monitors installed in manholes*) Verify that the communication cable has been installed and at least 40 inches (1016 mm) of communication cable extends from the ground at the EMUX location.

2.   Run the communication cable up through the fitting in the enclosure in which the EMUX will be mounted. Pull enough cable through the hole to allow room to hold the cable while attaching the wires to the connector.

   Warning: Verify that the communication cable is NOT attached to the flow monitor.

3.   Terminate the 12 wires from the communication cable into the orange connector on the bottom of the EMUX using the 1/8-inch flat screwdriver. Refer to the label affixed to the EMUX just above the 12-pin port or the table below. Make sure the shrink-wrapped resistors remain in place while terminating the wires, and verify that all the screws are tight.

Terminal	Wire Color	Gauge Wire
1	Yellow	22
2	Blue (small)	22
3	Black (small)	22
4	White	22
5	Red (small)	22
6	Green (small)	22
7	Brown	22
8	Orange	22
9	Red (large)	18
10	Blue (large)	18
11	Black (large)	18
12	Green (large) *and* bare shield drain wire	18 (green)/ 22 (drain wire)

Note: The wires can become loose while moving the cable. Therefore, after terminating the wires, verify once again that each wire is secure.

Communication cable with orange connector (image on left shows wires from cable terminated in the connector)

4. Insert the orange 12-socket connector into the corresponding port on the EMUX. When applicable, pull back the excess cable from the outside of the enclosure, and then tighten the nut

on the cable entry fitting until the cable is secure and cannot be moved in or out of the fitting.
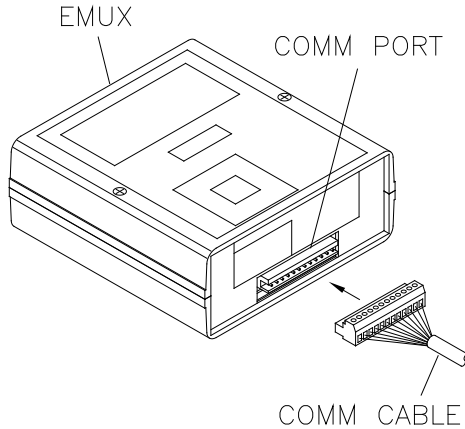
Inserting communication cable connector into the port on the EMUX

Mounting the EMUX

ADS recommends installing the EMUX in the same location or in close proximity to the RTU and/or power source. This minimizes the distance required for the serial cable connecting the EMUX to the RTU and, therefore, maintains a strong signal. It also limits power degradation in transmission. Choose an enclosure for the EMUX that is appropriate for the specific environment in which it will function. When possible, consider mounting the unit in the same enclosure that contains the RTU and/or power source.

- **Outdoor Installation** Mount the EMUX inside a suitable weatherproof enclosure.

- **Indoor Installation** Mount the EMUX inside an appropriate protective enclosure using *good electrical practice*.

Mount the EMUX in the following way:

1. Clean the back surface of the EMUX with alcohol, and then attach two pieces of Velcro (*included*) to the back of the unit.

2. Clean the inside, rear wall of the enclosure with alcohol, and then adhere two mating pieces of Velcro to the surface.

3. Secure the EMUX to the inside of the enclosure with the Velcro.

Connecting the Communication Cable to the Monitor

Connect the communication cable running from the EMUX into the manhole or other monitor location to the monitor in the following way:

1. (*applicable only to FlowShark Triton monitors containing the 12-volt IS battery pack*) Disconnect the battery pack cable from the regulator dome cable in the FlowShark Triton *or* disconnect and remove the 12-volt IS battery pack completely from the canister.

WARNING: The internal 12-volt IS battery pack must be disconnected from the FlowShark Triton regulator *before* the communication cable (*from the EMUX*) is connected to the monitor. Failing to disconnect the 12-volt IS battery pack from the monitor regulator and applying external power may result in acid discharge from the battery pack and/or cause the battery pack to explode over time.

2. Connect the monitor end of the communication cable to the **COMM** port on the top of the flow monitor.

3. For manhole installations, wrap rubber stretch tape around the entire cable connection, extending 1 to 2 inches onto the cable beyond the connection.

COMMUNICATION CABLE

COAXIAL STRETCH TAPE

COMM PORT

FLOWSHARK TRITON MONITOR
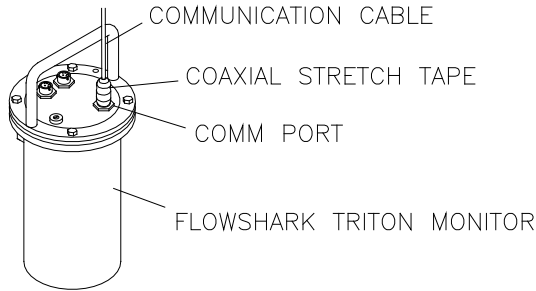
Communication cable from EMUX connected to the monitor with stretch tape properly applied

Installing a Wireless Antenna

The EMUX supports the use of both ADS and customer-supplied wireless antennas. Two wireless antenna options are available through ADS: mini-wing (ADS p/n 3800-0163) and slim (ADS p/n 3800-0162). Customer-supplied antennas must meet the following specifications:

- 50 ohms
- VSWR $\leq$ 1:1.5
- Maximum gain of 3 dBi
- SMA male connection

  Note: This is *NOT* a reverse-polarity connection!

Consider the following when using an ADS antenna:

- **EMUX in Non-metallic Enclosure** When using a non-metallic enclosure to house the EMUX, install the antenna completely within the enclosure:

  ❑ Secure the antenna by removing the protective tape from the antenna and adhering the antenna to the inside wall of the enclosure.

❑ Attach the antenna connector to the gold **ANTENNA** connector on top of the EMUX.

ANTENNA PORT
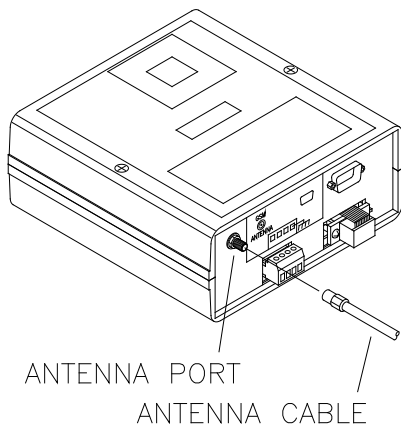
ANTENNA CABLE

Connecting antenna cable to **ANTENNA** port on EMUX

● **EMUX in Metallic Enclosure** When housing the EMUX in a metallic enclosure, the antenna must extend outside the enclosure to ensure adequate reception.

❑ Run the cable through a pre-drilled or existing hole in the enclosure.

❑ Secure the antenna by removing the protective tape from the antenna and adhering the antenna to an appropriate surface outside the enclosure.

❑ Attach the antenna connector to the gold connector on top of the EMUX.

❑ Seal the space between the antenna cable and the enclosure to prevent moisture from entering the enclosure through the hole.

When installing a customer-supplied antenna, follow the vendor's recommendations for properly installing the antenna to ensure adequate reception and then attach the antenna connector to the gold connector on top of the EMUX.

Connecting the RTU to the EMUX

Connect the RTU to the **MODBUS** port (male pins) on the EMUX using a customer-supplied serial cable with a female DB-9 connector configured to an RS-232 connection specification. It also must support 8 data bits, 1 stop bit, no parity. Refer to the following figure to ensure proper wiring to the port:
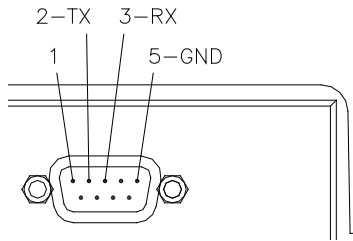
Wiring diagram for **MODBUS** port on the EMUX

Providing External Power to the EMUX

After mounting the EMUX and hooking up the wireless antenna, connect the cable coming from the external DC power source to the EMUX in the following way:

1. Remove the orange 4-plug connector seated in the 4-pin port on the top of the EMUX.

2. Wire the customer-supplied power cable running from the external power supply to the orange 4-plug connector. Terminate the 2 wires from the cable and the wire from earth ground into the appropriate terminals on the orange connector using a 1/8-inch flat screwdriver. Make sure the screws are tight.
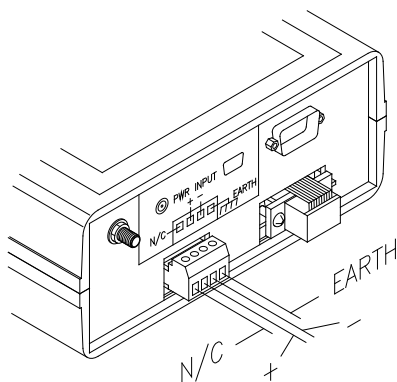
Wiring external power cable and ground to connector on EMUX

3. Reseat the connector (with the cable now attached) into the 4-pin port on the EMUX.

4. Run and connect the external power cable to the power supply and then connect to the power source. Refer to *Chapter 5*, *External Power*, for information and instructions on installing a power supply and connecting to the power source.

5. Contact a remote support analyst (with access to the Internet and the ADS **Profile** software). Provide the IP address and site name and then have the analyst attempt to communicate with the flow monitor and perform standard diagnostics or a data collect.

6. Have the analyst verify the signal strength of the antenna is higher than –85. Valid signal strength can range from -111 to -51, with -51 being the highest/best possible signal strength and -111 the lowest/worst possible signal strength. A signal strength of less than -90 is considered poor and will result in poor communication and a higher power drain. It also is likely to have a negative impact during both data collection and monitor configuration.

Note: Even the material of which a non-metallic enclosure housing the EMUX is made may impact the strength of the signal available. If the enclosure is significantly reducing the signal strength, consider installing the wireless antenna outside the enclosure. If this requires drilling holes in the enclosure, take the appropriate measures to seal the holes around the cable once the antenna is installed to ensure protection for the internal components against the elements.

7. Backfill the trench between the manhole and the location at which the EMUX is installed, and restore the landscape as necessary.

Connecting to the Monitor in the Field (Direct Connection)

The ADS Direct Connect Cable (ADS p/n 8000-0054) allows you to connect directly to the FlowShark Triton with a laptop computer for on-site communications.

Direct Connect Cable

Connect to the monitor with a laptop computer in the following way:

1. Attach the potted cable connector from the ADS Direct Connect Cable to the corresponding **COMM** port on the top of the monitor.

    Note: When using the optional extension cable (ADS p/n 8000-0044-25), run it *between* the monitor and the direct connect cable.

2. Attach the serial connector end of the cable to the proper serial port on the laptop computer.

    Note: If your computer has a USB port and no serial port, run a USB-to-serial adapter cable (and driver software) between the Direct Connect Cable and the computer to perform serial communications. ADS recommends the following USB adapters: Dynex (model DX-UBDB9) and Keyspan (model USA-19S).

3. Designate the appropriate local port on the computer for communication through the **Profile** or **Q***start* software. For a serial connection, designate the local serial port. When using a USB-to-serial adapter cable, designate the local USB port. It will be different than the serial port. For more information, refer to the *Profile User's Guide* #950015 (version B4 or higher).

    Note: The serial port on some older computers may not provide adequate power for the Direct Connect Cable to facilitate communication with the monitor. A USB-to-serial adapter cable can regulate the power going to the Direct Connect Cable, providing sufficient energy for communication. Therefore, if the serial port is preventing communication and a USB port is available on the computer, use a USB-to-serial adapter cable (and driver software) with the Direct Connect Cable to communicate successfully with the monitor. Refer to the previous note for adapter cable recommendations.

C H A P T E R 5

External Power

The ADS® FlowShark® Triton can receive power from an external DC power source. However, any connection of external power to the monitor must occur through a standard external modem unit (EMU, ADS p/n 3800-0148) or an EMUX (EMU/multiplexer, ADS p/n 106226E) for compliance with IS certification.

> **Note:** When installing an externally-powered EMU or EMUX, ADS recommends locating the unit in close proximity to the DC power source to maximize the net power available to the unit.

> **Note:** The externally-powered FlowShark Triton, EMU, and EMUX are not equipped with backup power. Therefore, in the event of an interruption or loss of power at the power source, the monitor will discontinue taking readings until power is restored. However, a loss of power will *not* result in a loss of data. The monitor will retain all stored data in memory.

Installation

A typical installation involving external power includes the following:

- An AC mains power line terminated at a pole or post close to the manhole in which the monitor is installed

- An AC distribution device (i.e., disconnect, fuse, or breaker box) on the pole/post

- A ground rod installed next to the pole/post bonded to the AC distribution device

- An AC to 12-volt DC converter (ADS recommends using the ADS Power Supply (p/n 5000-0727), which works with worldwide AC power (94 – 240 VAC, 50 – 60 Hz))

- A cable running between the external DC source and the EMU or EMUX. The ADS External Power Kit (ADS p/n 3800-0181) designed for use with the EMU includes this cable. However, the customer must supply cabling of the appropriate length and specifications for the EMUX. The DC power supplied must be regulated 12 V +/-10%.

   Note: All work required to run AC power to the pole and wire the power into an approved AC distribution device (i.e., a disconnect, fuse, or breaker) should be performed by a licensed electrician. Typically, an electrical permit from the owner of the collection system or local power authority is required to install a pole or electrical equipment next to a monitor location.

DC Power Requirements and Consumption

To run on external power, the FlowShark Triton system requires a power source capable of supplying a minimum of 1 ampere of 12-volt regulated DC power (12 V +/-10% as measured/available at the EMU or EMUX, not at the power source output). When long cable runs are required, size the supply and cabling to ensure that line losses do not reduce the net power available to the EMU or EMUX. ADS offers a power supply (ADS p/n 5000-0727) for this application. However, if you choose not to use the ADS Power Supply, the alternate power supply must be a high-quality industrial-type power supply with ripple no greater than 250mV P-P.

To support FlowShark Triton monitors running in continuous mode, the external DC power source must be capable of accommodating the following system requirements concerning power consumption, based on the wireless communication option (EMU or EMUX):

Note: The power to the monitor is ATEX/IECEx I.S. compliant at 7-8 VDC.

● **EMU** Following are the power requirements for monitors that communicate wirelessly through an *EMU*:

❑ **Monitor and GSM Modem Operating in Standby** 110 mA average (includes EMU, monitor, and GSM modem standby currents)

❑ **Monitor Firing the Peak Combo Sensor, GSM Modem in Standby** 238 mA average (for 3 seconds)

❑ **Monitor Firing the Ultrasonic Depth Sensor, GSM Modem in Standby** 223 mA average (for 3.5 seconds in a 36-inch pipe)

❑ **Monitor Firing Sensors, GSM Modem Active *(e.g., wireless diagnostics)*** 300 mA average

❑ **GSM Modem During Communication, *Idle*** 130 mA

❑ **GSM Modem During Communication, *Active*** 230 mA average (for 360 seconds (6 minutes) while collecting 90 blocks of data)

❑ **Sleep Current with GSM Modem Continuously *On*** 32 mA

❑ **Sleep Current with GSM Modem Continuously *Off*** 2 mA

● **EMUX** Following are the power requirements for monitors that communicate wirelessly through an *EMUX*:

❑ **Monitor Operating in Standby** 156 mA average (includes EMUX, monitor, and GSM modem standby currents)

❑ **Monitor Firing the Peak Combo Sensor** 238 mA average (for 3 seconds)

❑ **Monitor Firing the Ultrasonic Depth Sensor** 223 mA average (for 3.5 seconds in a 36-inch pipe)

❑ **Modbus Data Transfer** 168 mA average (for 1 second)

❑ **GSM Modem During Communication** 230 mA average (for 360 seconds (6 minutes) while collecting 90 blocks of data)

Installing and Wiring an ADS Power Supply to the EMU or EMUX

The ADS Power Supply is a universal AC input supply (suitable for use worldwide) that automatically adjusts to the proper voltage upon connection. It is housed within a polycarbonate NEMA 4X/IP68 enclosure that includes cable glands for AC and DC cable entry. To use the ADS Power Supply, install the power supply and wire the external power cable (from the EMU or EMUX) to the power supply in the following way:

1. Mount the ADS Power Supply (ADS p/n 5000-0727) to the panel or other mounting surface in the enclosure housing the EMU or EMUX using appropriate fasteners through the four 0.175-inch (4.4-mm) holes located under the corner cover screws.

   Note: Do not drill new holes through the power supply housing! This will expose the internal components of the power supply to moisture, creating unsafe operating conditions. It also will void the product warranty.

ADS Power Supply

2. Verify that the 6-foot (1.8-m) AC power cord on the ADS Power Supply is suitable for the application. Customer-supplied cabling also may be used. A cable grip fitting, sized for a 0.125- to 0.375-inch (3.2- to 9.5-mm) OD cable, seals the exit for the DC output cabling. Replace the cable grip fittings to accommodate custom AC supply or DC output wiring, when necessary.

   WARNING: When hard-wiring to the AC supply, ensure that the AC source is de-energized and that all applicable

lockout/tagout and other electrical safety measures are followed.

3. Remove the front cover from the power supply by loosening the 4 plastic screws.

4. Run the external power cable (from the EMU or EMUX) through the entry hole cable grip entry on the side of the power supply case opposite the AC power cord.

5. Terminate the wires from the external DC power cable in the following way:

❑ Connect the **–DC In** wires from the cable to the **–V** terminal in the power supply.

❑ Connect the **+DC In** wires from the cable to the **+V** terminal in the power supply.
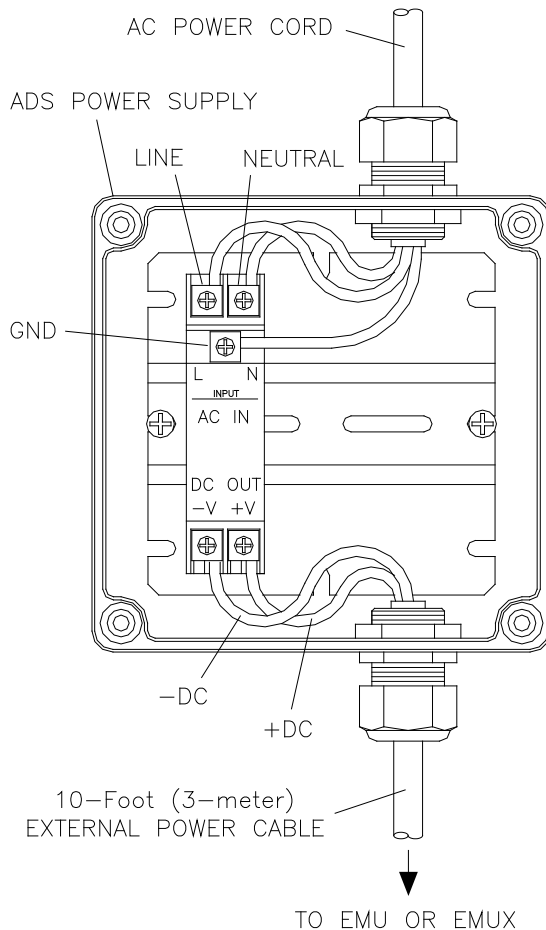
Wiring the external power cable to the ADS Power Supply

6. Verify the following *before* connecting to the power source:

❑ Battery pack has been disconnected and removed from the monitor.

❑ Communication cable is connected to both the monitor and the EMU or EMUX.

❑   External power cable is connected to the EMU or EMUX
        and the ADS Power Supply

7. Connect the ADS Power Supply to the AC distribution device
    (i.e., disconnect, fuse, or breaker box).

8. Ensure the **DC ON** LED is *illuminated* and the **DC LOW** LED
    is *out*.

9. Securely tighten the cable grip fittings and replace the
    enclosure cover. Make sure the cover properly aligns with the
    gasket and that all screws are tightened equally (i.e., snug, but
    not over-tightened).

C H A P T E R 6

Configuration and Activation

After installing the ADS® FlowShark® Triton flow monitor and
sensors and establishing communications, it is necessary to
configure and activate the monitor to begin taking flow
measurements and recording data at the monitor location. This
chapter contains general instructions on the following activities
concerning monitor configuration and activation:

● Creating a monitor location

● Creating an installation (pipe) table (including setting *Gain*)

● Selecting and editing devices (usually attached sensors)

● Setting the communication parameters

● Activating the monitor

This chapter also includes the procedure for running diagnostics on
the sensors, collecting data from the monitor, and upgrading the
firmware (embedded software) in the monitor.

> **Note:** Most configuration, activation, diagnostic, data
> collection, and firmware upgrade activities can be
> performed through either the ADS **Profile**® or **Q***start*™
> software. However, this manual only provides the
> instructions for accomplishing these activities using
> **Profile**. Therefore, if you are using **Q***start*, consult the
> online help within the application for detailed instructions
> on conducting these procedures. **Q***start* is a simple
> configuration, activation, and diagnostic tool primarily

> designed for setting up monitors quickly in the field. It also includes several other features and functions, such as data collection, archival, and display.

Refer to the *Profile User's Guide* #950015 (version B4 or higher) for more detailed instructions on installing the software, collecting monitor data, and configuring, activating, and confirming the monitor.

Hardware and Software Compatibility

Please note the following compatibility requirements for using the FlowShark Triton with the ADS **Profile** and/or **Q***start* software:

- The FlowShark Triton is supported by **Profile**® software version 3.3 and higher and the *Profile User's Guide* #950015 (version B4 and higher). Prior versions do not support this monitor.

- The **Q***start* software can fully support the FlowShark Triton with or without the **Profile** software running on the same computer. However, if you will be using both applications on the same computer, you must be running **Profile** *version 3.4* to ensure optimal support and compatibility between both applications.

- The **Q***start* software only supports FlowShark Triton monitors with the *4.68* or later version of firmware.

Configuring the Monitor Location

To ensure the most efficient and useful results for each monitor location, the user must activate the FlowShark Triton flow monitor with the proper configuration information to satisfy the specific monitoring needs of the project and to reflect actual site conditions. The configuration information includes critical details such as specific pipe characteristics, location description, sensor assignment and parameters, log rates, and other items relevant to the site and project requirements.

The configuration information is stored in a Location Information File (LIF) in the user's local directory or network drive. Certain elements of the LIF are saved to the monitor memory during monitor activation.

This section includes instructions on performing the following activities required for monitor configuration:

● Creating a Monitor Location in the **Profile** database

● Creating an Installation Table for the Monitor Location

● Selecting and Editing Devices

Note: If remote communication already has been established for the location, these activities can be performed in cooperation between field and office personnel. If remote communication is not available, perform configuration and activation on site through direct communication with the monitor.

Starting the Profile Software

Before traveling to the field for installation, configuration, and activation activities, install the **Profile** software on the field computer and register the software using a **Profile** license key provided by ADS.

Once installed, start the **Profile** software from an office or field
computer by selecting **Start > Programs > ADS Corporation >
Profile** from the **Microsoft**® **Windows**® start menu or double-
clicking on the **Profile** icon on the **Windows** desktop.

Profile icon on desktop

*The **Profile** main screen displays.*
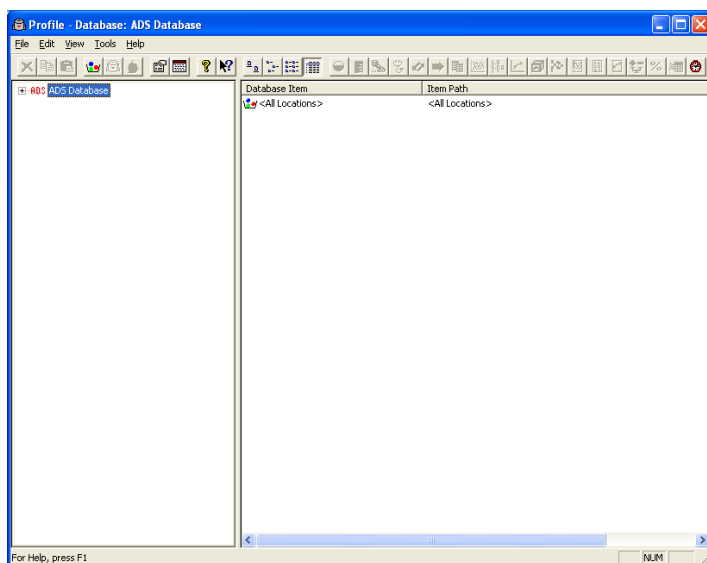
Profile main screen

The left pane displays all the levels and current details for the
selected database on a tree. These levels and details are accessible
by expanding and collapsing the entries on the tree. Click the plus
symbol (+) next to an entry to display the items contained under that
level of the tree; click on the minus symbol (-) next to an entry to
collapse the items under that entry level.

Select an entry or level name in the left pane to display the details
of that entry in the right pane of **Profile**.

The toolbar provides access to various functions and tools in **Profile** based on the item selected in the left or right pane.

Creating a Monitor Location

Creating a new location includes entering and setting up the location information in the following way:

1. Select the **<All Locations>** group located under the database level.

2. Select the **Edit > New > Location** option or the **New Location** toolbar button.

New Location toolbar button

*A new location named **New Location #1** is added to the <All Locations> group and displays the **Properties** dialog.*

Properties dialog for the new location

3. Enter the new **Location Name**. *Do not duplicate more than the first 7 characters of the monitor names for multiple locations, unless the 8th character is followed by an underscore (_) and a unique character(s).* For example, you cannot use the names FSTriton1 and FSTriton2. However, you could use the names FSTriton_1 and FSTriton_2.

4. Enter the new location **Description**.

5. Select **FlowShark Triton** from the **Series** drop-down list.

   *The **Properties** displays the parameters and default options corresponding to a FlowShark Triton monitor. The options contained within the individual parameter fields include only those options relevant to the selected monitor.*

Properties dialog for a new FlowShark Triton location

6. Select the method by which you will communicate with the
    monitor from the **Connect Using** drop-down list.

    ❑ **TCP/IP** Choose this option for wireless, remote
        communication. Selecting this option also requires
        entering the monitor's IP address for the wireless
        connection in the **IP Address** field.

    Note: Do not use leading zeros before or within the IP
    address. For example, an IP address of 166.213.006.020
    contains leading zeros and, therefore, should be entered in
    the following way: 166.213.6.20.

❑ **Modem** *This option corresponds to landline communication, which currently is not supported by the FlowShark Triton.*

❑ **Serial** Choose this option for direct, on-site communication.

7. Enter the monitor's **Serial Number**.

8. Choose one of the following methods for collecting data using **Profile**:

❑ **Auto Collection** Select the **Autocollect** checkbox to ensure **Profile** collects the data for the period from the last timestamp or a user-defined start date and time to the current date and time. Edit the corresponding **Start Time** date and time to initiate auto collection at a user-defined starting time.

❑ **Manual Collection** Edit the **Start time** and **End time** fields to designate the date and time period for which you want **Profile** to collect data from the monitor.

Note: The date and time range displayed in the **Monitor Data** section represent the total range of data available in the monitor memory.

9. Enter the number of hours difference between the your location (or the location of the computer on which the database resides) and the location of the monitor in the **Time Zone** field. For example, if you are in the U.S. *Central* time zone and the monitor is located in the U.S. *Eastern* time zone, enter **1** in this field. If you are in the *Central* time zone and the monitor is located in the *Pacific* time zone, enter -2 in this field.

10. (*optional*) Enter the vertical distance from the manhole rim to the bottom of the manhole invert in the **Manhole Depth** field.

11. Choose the rates at which you want the monitor to log data from the corresponding drop-down lists:

❑ **Normal** Select the standard rate at which you want the monitor to store data.

Note: The **Scan** and **Fast** designations apply when implementing the **Dual Data Rate** feature in MLI. The **Scan** rate also pertains to applications involving Modbus and Telog® Ru-33 operations.

❑ **Fast** Select the *accelerated* interval at which you want the monitor to take and store readings once the threshold defined in MLI has been exceeded. The monitor will remain in this state until the flow conditions at the monitoring point return to normal, as defined in MLI.

❑ **Scan** Select the interval at which you want the monitor to take readings and verify whether an event threshold has been exceeded. These readings are not stored or logged as historical data for future data collection. Instead, the readings taken at a particular date/time in the interval remain available (*or persist*) until they are overwritten by the readings taken at the next consecutive date/time in the interval. For *Modbus* applications, the **Scan** rate also represents the rate at which Modbus updates the data available to the RTU or the Telog Ru-33. The RTU requests this data from either the EMUX (*Buffered Mode*) or the monitor (*Passthrough Mode*). The Telog unit requests this data directly from the monitor. Please note that the EMUX, *when in use*, automatically retrieves the available (i.e., persisting) data from the monitor every minute. When using the *Telog Ru-33*, ADS recommends applying the same interval for both the scan rate in the monitor and the rate at which the Telog unit requests data from the monitor.

12. (*applies only to Modbus/Telog Ru-33 applications*) Select the **Enable** checkbox and modify the following parameters in the **Modbus** section as necessary:

❑ **ID** Enter the slave address number from 2 to 57, 59 to 96, or 98 to 247 you want to be used when facilitating communication between the EMUX and RTU *or* the FlowShark Triton and the Telog Ru-33. The 1, 58, and 97 are used for other addressing purposes and will not be recognized. Choose a number that is unique from the other

slave IDs used by the RTU or Telog unit when referencing other devices. For Telog Ru-33 operations, ADS recommends using *55* as the identifier through which to request data from the monitor.

❑   **Delay Response** Enter the amount of time, in milliseconds, following a request before the monitor returns the requested data to the RTU (*through the EMUX*) or the Telog Ru-33. The maximum delay allowed is 2000 ms. *The default delay response is 10 ms*.

13. Select **OK** to create a LIF for the location in the database and exit the dialog.

The new monitor location with a single monitoring point now exists in the database. A monitoring point is a location within the pipe at which a sensor(s) is installed.

Adding a Second Monitoring Point

Establishing a new monitor location automatically creates one monitoring point; however, each monitor location can support up to two monitoring points. When applicable, add an additional monitoring point to a location in the following way:

1. Select the location for which you want to create a second monitoring point.

2. Click on the **Monitoring Point** button on the toolbar *or* select **Edit > New > Monitoring Point** from the main menu.

Monitoring Point toolbar button

*The second monitoring point displays with the selected location under **Monitoring Point 1**.*

Creating an Installation Table

Creating an installation table involves defining the size, shape, and physical characteristics of the monitoring point in order to allow the software to properly calculate the correct depths and corresponding quantities at the monitoring point. One installation table must be created for each monitoring point.

The user can create an installation table using the **Installation Generator** in the **Profile** software in the following way:

1. Select the monitoring point for which you want to create the installation table.
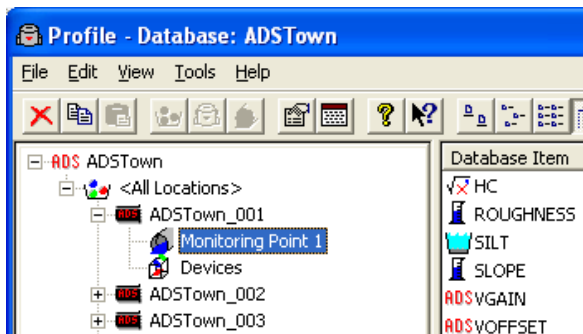
Monitoring Point 1 selected from Location ADSTown_001

2. Select **Tools > Installation Generator** from the main menu *or* click on the **Installation Generator** toolbar button on the **Profile** main screen.

Installation Generator toolbar button

*The **Create Installation – Introduction** dialog in the wizard displays.*
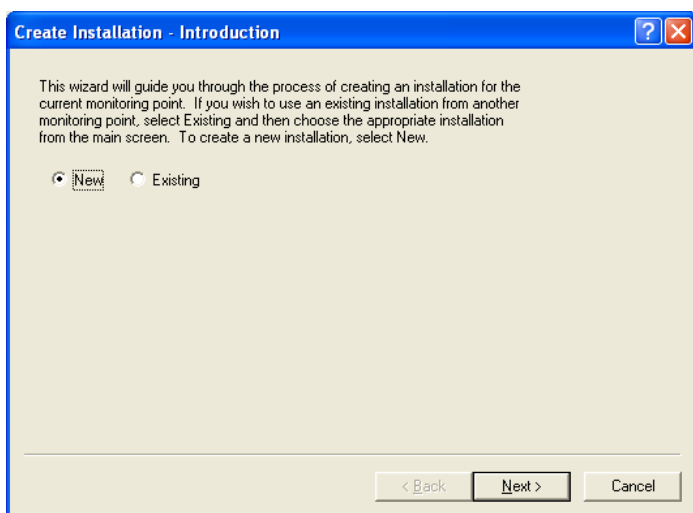
Create Installation – Introduction dialog in the wizard

3.   Select the **New** radio button and then click on the **Next** button.
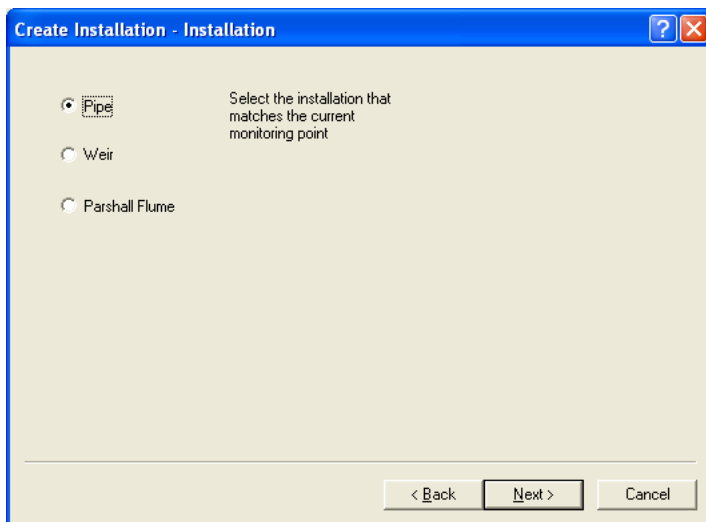
Create Installation – Installation dialog

4.   Select the **Pipe** radio button, and then click on the **Next** button.
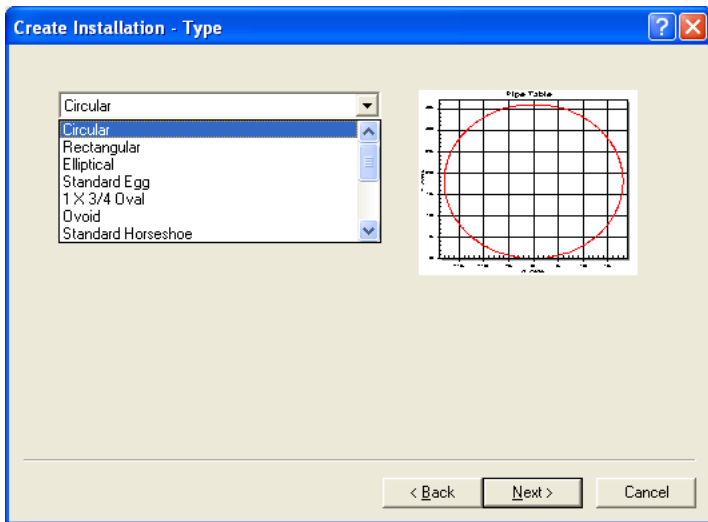
Create Installation – Type dialog
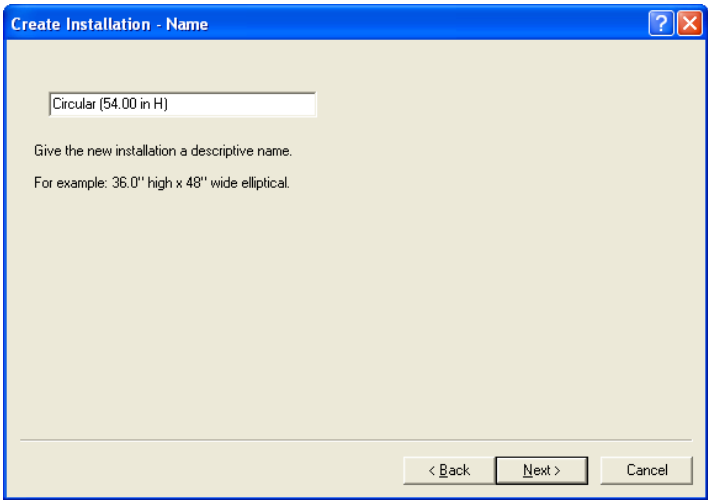
5. Select the type or shape of the pipe from the drop-down list,
    and then click on the **Next** button.
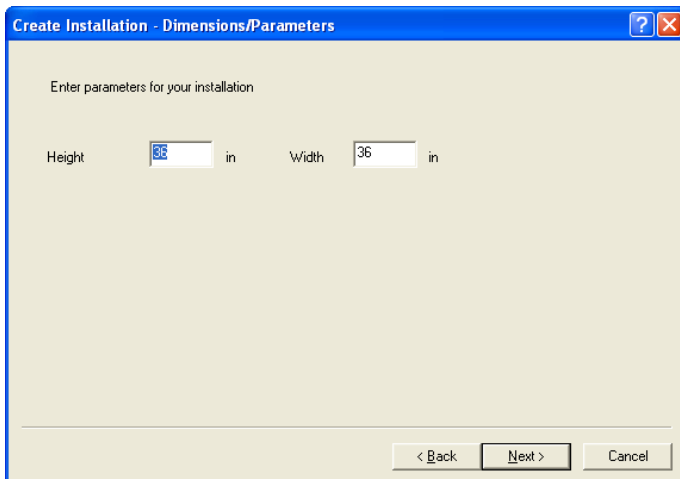
Create Installation – Dimension/Parameters dialog
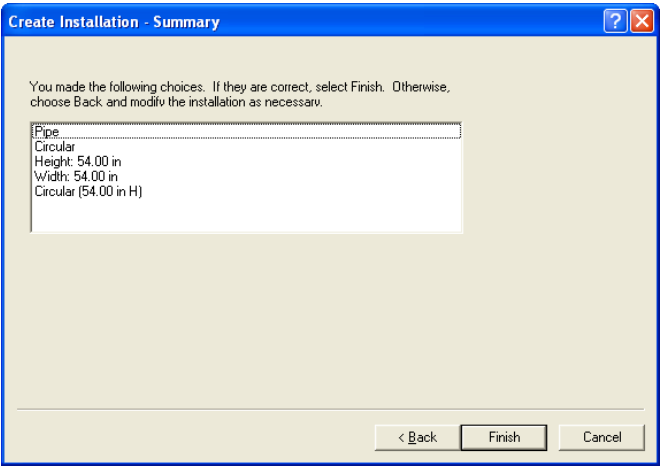
6. Enter the proper pipe dimensions in the corresponding fields, and then click on the **Next** button.

Create Installation – Name dialog

7. Enter an appropriate name for the installation in the text field, and then click on the **Next** button.

Create Installation – Summary dialog

8. Review the installation table selection summary, and then click on the **Finish** button. Select the **Back** button to return to previous dialogs to edit any of the existing selections.
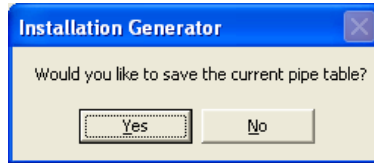
Option to save pipe table dialog

9. Click on the **Yes** button to save the installation table to the **Profile** database for the selected location.

Installation Generator dialog

10. Enter **0.9** in the **VGain** field *or* the average-to-peak ratio, if other than 0.9.

11. Select **File > Exit**.
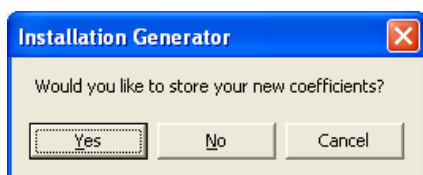
Option to store coefficients

12. Click on the **Yes** button.
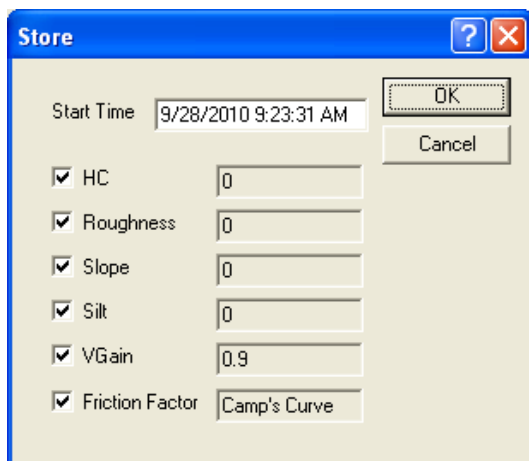
Store dialog displaying coefficients

13. (*optional*) Edit the **Start Time** field to indicate the date and time at which to implement the designated *Gain*.

14. Click on the **OK** button.

> **Note:** Repeat steps 1 through 14 to create an installation table for a second monitoring point corresponding to the location, when applicable.

Selecting and Editing Devices

Select and edit the devices corresponding to the new monitor location to log the desired data. Devices generally represent sensors, but not always. Editing the devices involves setting specific parameters to ensure the monitor and **Profile** properly obtain and process the data. Perform the following steps to properly select and edit devices:

1. Select the location for which you want to select and edit devices from the database.

2. Expand the location contents (monitoring point and devices) by clicking on the expansion symbol ⊞ corresponding to the location and then selecting **Devices**.
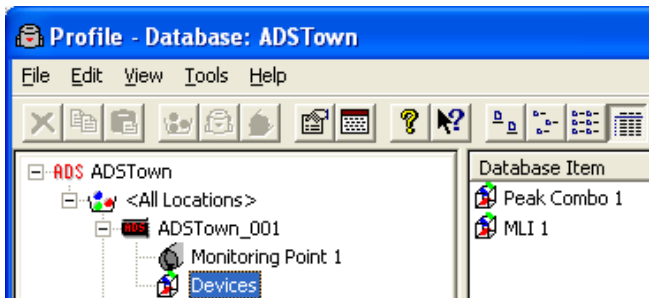
Devices selected for ADSTown_001

3. Select the **Edit > Properties** option *or* the **Properties** toolbar button.

Properties toolbar button

*The **Edit Devices** dialog displays the available devices and devices selected by default for Monitoring Point 1.*
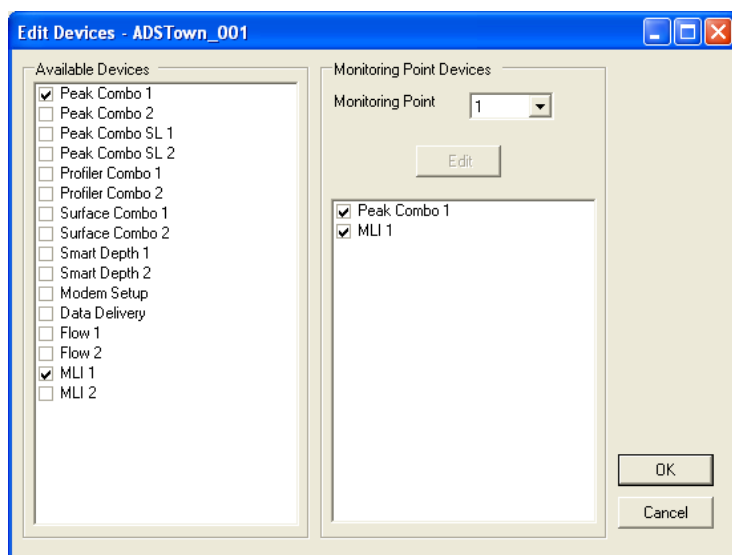
Edit Devices dialog

4. Select the monitoring point to which you want to assign the devices from the **Monitoring Point** drop-down list.

5. Select the checkboxes corresponding to the devices you want to assign to the designated monitoring point from the **Available Devices** selection box. A checkmark *must* display beside a device in the **Monitoring Point Devices** section to ensure **Profile** includes the device in the LIF. *Deselect* the checkboxes corresponding to the devices you want to remove from association with the selected monitoring point from the **Available Devices** section. *Profile selects the **Peak Combo 1** and **MLI 1** devices for the FlowShark Triton flow monitor by default.*

   Note: Because the FlowShark Triton allows you to connect two of the same device type to the monitor at one time, the **Available Devices** list includes two of each device type (e.g., Peak Combo 1 and Peak Combo 2), except for the *Modem Setup* device. However, do not assign two devices of the *same* type to the *same* monitoring point. This will cause the monitor to overwrite

the new data corresponding to one of the duplicate devices with the data from the other device during data collection. In addition, ADS recommends assigning a device to a monitoring point of the same number. For example, assign Peak Combo 1 only to Monitoring Point 1 and Peak Combo 2 only to Monitoring Point 2.

Note: The **Smart Depth 1** and **Smart Depth 2** devices represent stand-alone ultrasonic depth sensors.

Note: The **MLI 1** and **2** and **Modem Setup** devices are not associated specifically with a sensor. *MLI* represents special software included in **Profile** (Basic Code) that is downloaded to the monitor upon activation to support activities such as water quality sampling and event notification. *Modem Setup* represents a list of wireless communication provider's carrier codes.

*The selected devices display in the **Monitoring Point Devices** section.*

6. Set or edit the parameters corresponding to each selected device in the following way:

❑ Select the device you want to edit in the **Monitoring Point Devices** section, and then select the **Edit** button.

*The **Edit [device type] Parameters** dialog displays for the selected device.*

❑ Edit the device parameters. Most device dialogs include multiple tabs representing sensors or other tools that require editing. Refer to the following sections for details concerning the specific parameters corresponding to each device and any associated sensors/tools. Click on and edit each sensor/tool tab as necessary.

❑ Select the **OK** button after editing the device parameters and any associated sensor/tools.

❑ Repeat the three previous steps from step 6 for each
additional device that requires new settings or
modification.

Note: Each **Edit [*device type*] Parameters** dialog
contains default settings.

7. (*applicable only to locations with a second monitoring point)*
Repeat steps 4 through 6 to assign a device(s) to the other
monitoring point and edit the device(s) parameters.

8. Click on the **OK** button to save the device selections and
parameter modifications to the LIF.

Editing the Peak Combo/Peak Combo SL Sensor Device

This section describes the parameters for both the Peak Combo and
Peak Combo SL devices. The Peak Combo SL device represents
the *Slimline Peak Combo Sensor*, which does *not* have a pressure
sensor component. Therefore, **Profile** does *not* include pressure
parameters for the Peak Combo SL device, but does provide them
for the Peak Combo device. All other parameters detailed in this
section are the same for both devices.

Edit Peak Combo 1 Parameters dialog showing the **Ultrasonic** tab

Edit the following **Device Parameters** at the bottom of the dialog, and then edit the individual tabs as described in the following sections.

- **Physical Offset** Enter the physical offset for the sensor at the time of installation if it was installed offset from the bottom center of the pipe. *Refer to Chapter 3, Sensor Installation and Connection, for instructions on measuring the physical offset.* The default physical offset is 0.

- **Channel** Select the channel number of the port on top of the monitor to which the device is connected.

- **Pipe Height** This field displays the pipe height at the monitoring point, based on the installation table. *This parameter is not editable from this location.*

  Note: Under normal conditions, the remaining parameters corresponding to the *Peak Combo and Peak Combo SL devices* should not require modification. However, if additional adjustments are necessary, the following sections provide a detailed description of each parameter.

Ultrasonic tab

Edit the following parameters corresponding to the upward-looking ultrasonic depth sensor in the Peak Combo Sensor/Slimline Peak Combo Sensor (i.e., the *Peak Combo SL device*):

- **Enable** Select this checkbox to ensure the monitor begins taking upward ultrasonic depth readings at the designated interval upon activation.

- **Flow Type** Select the option that best reflects the kind of flow conditions that typically occur at the monitoring point from the drop-down list:

  ❑ **Typical** Flow exhibits a typical diurnal pattern. *This is the default setting.*

  ❑ **Wet/Stagnant** Flow remains in the pipe, but moves only during wet weather events.

  ❑ **Usually Dry** Pipe typically remains dry, except under wet weather conditions.

- **Electronic Offset** Enter the difference that exists between the depth sensor readings and the manually measured depth. *The default value is 0.*

- **Deadband** Select the distance from the sensor face within which readings received will be ignored. The default value (*Auto*) represents a percentage of the flow depth and should be sufficient under normal circumstances. It also is the best option for handling shallow flows. However, consider another value when the sensor readings reveal a potential problem with false drop-outs. Choose a value for the deadband that is sufficiently below the minimum depths that legitimately occur at the monitoring point, yet above the confirmed drop-outs that have been detected. *Refer to the **Profile Software User's Guide** for more information on this parameter.*

- **Store Data** Select this checkbox to ensure the monitor logs the depth data to memory. *This option is selected by default.*

- **Advanced** Select this button to access the **Advanced Parameters** dialog.

Advanced Parameters dialog

Note: Modifications made to the Advanced Parameters should be performed only by or under the guidance of trained ADS personnel. Therefore, ADS recommends leaving the default settings (**Auto**) in place.

Modify the parameters as necessary, and then select **OK** once complete.

❑ **DAC Gain** Choose the method for managing the amplification of the analog signal that returns to the sensor:

– **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

– **Manual** Select this option to enter a fixed value between -12db (lower amplification) and +12db (high amplification) at which to amplify the signal.

❑ **Ping Amplitude** Choose the method for managing the amplification of the analog signal that is sent out, or transmitted from, the sensor. Smaller pipes typically require weaker (quieter) amplification; larger pipes typically require stronger (louder) amplification.

– **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

– **Manual** Select this option to enter the percentage of full amplification at which to transmit the signal. Enter a percentage between 10 and 100 percent, where 100 percent represents maximum amplification.

Pressure tab

Edit the following parameters corresponding only to the pressure depth sensor in the Peak Combo Sensor:

Note: Keep in mind that the Peak Combo *SL* device (i.e., the *Slimline Peak Combo Sensor*) does not have a pressure component. Therefore, **Profile** does not include pressure parameters for this device.

Edit Peak Combo 1 Parameters dialog displaying the **Pressure** tab

- **Enable** Select this checkbox to ensure the monitor begins taking pressure depth readings at the designated interval once activated.

- **Electronic Offset** Enter the difference that exists between the pressure depth sensor readings and the manually measured depth. *The default value is 0.*

- **Store Data** Select this checkbox to ensure the monitor logs pressure depth data to memory. *This option is selected by default.*

Velocity tab

Edit the following parameters corresponding to the Doppler velocity sensor in the Peak/Slimline Peak Combo Sensor:

Edit Peak Combo 1 Parameters dialog displaying the **Velocity** tab

Note: The velocity parameters corresponding to the Peak/Slimline Peak Combo Sensor typically should not require editing. However, if modifications are necessary, ADS does not recommend making changes to these parameters without proper training or assistance.

Note: When using a Peak Combo Sensor and Surface Combo Sensor at the same monitoring point, ADS recommends maintaining the same settings for all of the parameters corresponding to both Peak Velocity (**Velocity** tab on the **Edit Peak Combo Parameters** dialog) and Surcharge Peak Velocity (**Peak Velocity** tab in the **Edit Surface Combo Parameters** dialog) to ensure consistency between the velocity readings.
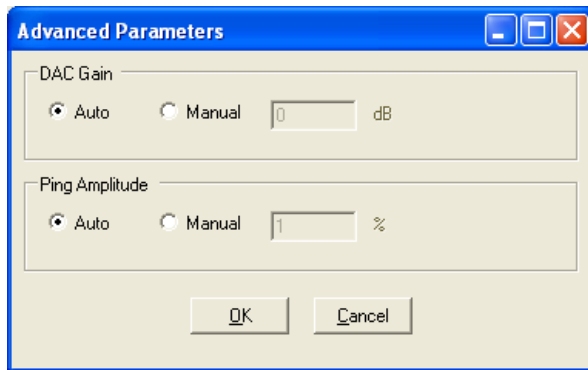
- **Enable** Select this checkbox to ensure the monitor begins taking velocity readings at the designated interval once activated.

- **Flow Type** Select the option that best reflects the kind of flow conditions that typically occur at the monitoring point from the drop-down list:

  ❑ **Typical** Flow exhibits a typical diurnal pattern. *This is the default setting.*

  ❑ **Wet/Stagnant** Flow remains in the pipe, but moves only during wet weather events.

  ❑ **Usually Dry** Pipe typically remains dry, except under wet weather conditions.

- **Sensitivity** Select the appropriate velocity sensor sensitivity from the drop-down list. A sensitivity that is too high may produce noise, causing interference in the signal and resulting in spikes in the data. A sensitivity that is too low can produce readings that are low in comparison with confirmation readings. *The default sensitivity is 10.*

- **Velocity Direction** Select one of the following options that reflects the general direction of the flow at the monitoring point and position of the velocity sensor. *The default is **Forward**.*

  ❑ **Bidirectional** Choose this option for monitoring points that potentially experience reverse flows. The Peak/Slimline Peak Combo Sensor typically is positioned facing upstream into the flow. Choosing this ensures the monitor analyzes both positive and negative values returned from the velocity sensor.

  ❑ **Forward** Choose this option for monitoring points where reverse flows are *not* expected and to ensure the monitor only analyzes positive values returned from the velocity sensor. The Peak/Slimline Peak Combo Sensor typically is positioned facing upstream into the flow. This is the most common, and the default, option for selection. ADS recommends using this setting for most monitoring applications.

  ❑ **Backward** Choose this option for monitoring points at which the Peak/Slimline Peak Combo Sensor has been positioned facing downstream and to ensure the monitor only analyzes flows moving *away* from the face of the sensor. One application in which this would be the preferable option would be for measuring velocity in an outgoing line following two incoming lines in the manhole.

  ❑ **Backward Bidirectional** Choose this option when the Peak/Slimline Peak Combo Sensor is installed facing downstream and to ensure the monitor analyzes flows moving both away from and toward the face of the sensor. This option would be beneficial, for example, when using a weir to measure overflows with the potential of river intrusion.

- **Maximum Velocity** Select the maximum expected velocity that will occur at the site for the monitor to use in fine-tuning the velocity data. The default setting is **Auto**, which serves to optimize the range and resolution of the velocity data samples to match the characteristics of the flow. However, if the velocity readings at the location measure at least 10 feet per

second (fps) on a regular basis, ADS recommends choosing the **15** fps option for this parameter.

● **Transmit Frequency** Select the frequency at which to transmit the signal. ADS recommends leaving the default setting (*Normal*) for older Peak Combo Sensors (serial numbers of *8xxxx*) and selecting the *High* setting for newer Peak Combo Sensors (serial numbers of *1xxx*) and existing Slimline Peak Combo Sensors. However, if hydraulic conditions at the site are resulting in questionable or erroneous readings, consider applying the other frequency option. Contact ADS for assistance when necessary.

● **Gain** This value represents the factor applied to *raw* velocity (RAWVEL entity in **Profile**) to determine average velocity (VELOCITY entity in **Profile**) and to calculate quantity for typical daily flows. **Profile** does not apply Gain to the velocity readings reported in **Diagnostics**, where the raw velocity readings are used for comparison against the manual measurements. This parameter is editable through the **Installation Generator** and the **Quantity Coefficient Generator** in **Profile**.

● **Cross Check Gain** Enter the value by which to multiply raw velocity readings in the monitor to determine average velocity for comparison purposes in the monitor.

● **Store Data** Select this checkbox to ensure the monitor logs the velocity data to memory. *This option is selected by default.*

● **Advanced** Select this button to access the **Advanced Parameters** dialog.

Advanced Parameters dialog

Note: Modifications made to the Advanced Parameters should be performed only by or under the guidance of trained ADS personnel. Therefore, ADS recommends leaving the default settings (**Auto**) in place.

Modify the parameters as necessary, and then select **OK** once complete.

❑ **DAC Gain** Choose the method for managing the amplification of the analog signal that returns to the sensor:

   – **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

   – **Manual** Select this option to enter a fixed value between -12db (lower amplification) and +12db (high amplification) at which to amplify the signal.

❑ **Ping Amplitude** Choose the method for managing the amplification of the analog signal that is sent out, or transmitted from, the sensor. Smaller pipes typically require weaker (quieter) amplification; larger pipes typically require stronger (louder) amplification.

   – **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

– **Manual** Select this option to enter the percentage of full amplification at which to transmit the signal. Enter a percentage between 10 and 100 percent, where 100 percent represents maximum amplification.

Temperature tab

The temperature sensor measures the temperature of the flow at the location at which the sensor is installed. The temperature is logged at the same interval as the other entity data. Both the Peak Combo Sensor and Slimline Peak Combo Sensor (*represented by the Peak Combo SL device*) use temperature data to calculate the speed of sound in water.

Edit the following parameters corresponding to the temperature sensor in the Peak Combo Sensor and Slimline Peak Combo Sensor (*represented by the Peak Combo SL device*):
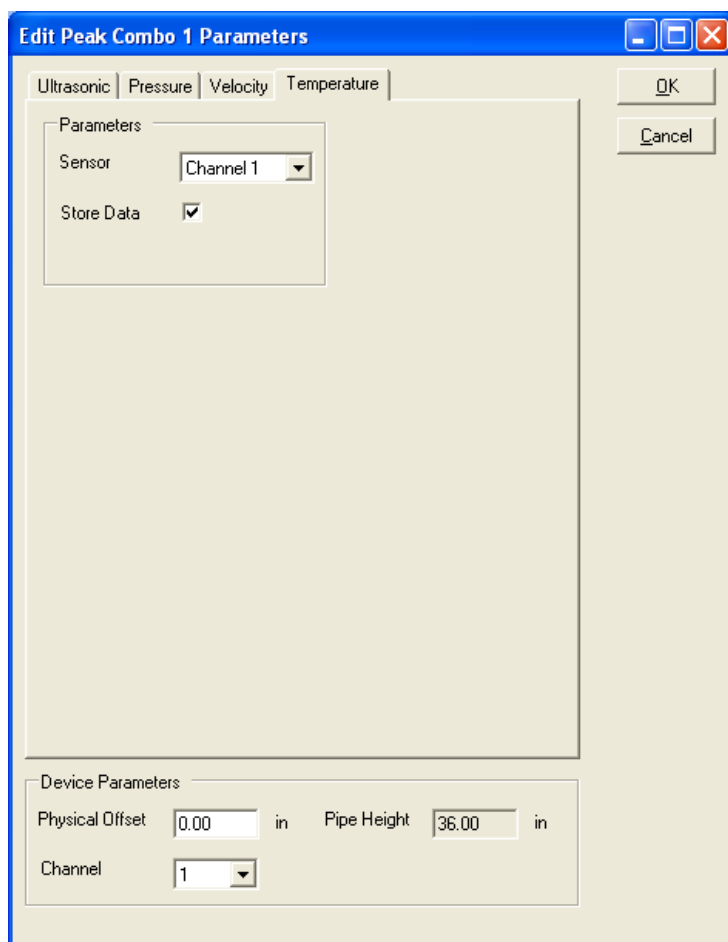
Edit Peak Combo 1 Parameters dialog displaying the **Temperature** tab

● **Sensor** Select the source from which to measure the temperature used when compensating for temperature in Peak/Slimline Peak Combo Sensor readings. The channels correspond to the sensors connected to those channels (ports) on the monitor. The option selected here should be consistent with the option selected for the **Channel** in the **Device Parameters** section at the bottom of the dialog.

Note: The *stored* temperature value is the actual water temperature reading from the Peak/Slimline Peak Combo Sensor.

● **Store Data** Select this checkbox to ensure the monitor logs the temperature data to memory. *This option is selected by default.*

Editing the Surface Combo Sensor Device

The following section provides descriptions for the parameters corresponding to the Surface Combo Sensor device.

Note: The parameters for an Ultrasonic Depth Sensor *with the pressure option* are also set through the **Smart Depth**, **Pressure**, and **Temperature** tabs on the **Edit Surface Combo 1 Parameters** device dialog.

Edit Surface Combo 1 Parameters dialog (**Smart Depth** tab)

Edit the following **Device Parameters** at the bottom of the dialog, and then edit the individual tabs as described in the following sections:

- **Physical Offset** Enter the physical distance from the face of the sensor to the crown (top) of the pipe. *Refer to Chapter 3, Sensor Installation and Connection, for instructions on measuring the physical offset.*

- **Channel** Select the channel number of the port on top of the monitor to which this device is connected.

- **Pipe Height** This field displays the pipe height at the monitor location, based on the installation table. *This parameter is not editable from this location.*

  Note: Under normal conditions, the remaining parameters corresponding to the *Surface Combo device* should not require modification. However, if additional adjustments are necessary, the following sections provide a detailed description of each parameter.

Smart Depth (Ultrasonic) tab

The smart depth sensor measures the distance (or range) from the crown of the pipe to the surface of the flow.

Edit the following parameters corresponding to the downward-looking ultrasonic (smart) depth sensor in the Surface Combo Sensor or the Ultrasonic Depth Sensor with the pressure option:

- **Electronic Offset** Enter the difference that exists between the smart depth sensor readings and the manually measured depth, when applicable. *The default value is 0.*

  Note: An electronic offset is rarely needed. An offset greater than +/- 0.5 inches typically indicates that the physical offset or pipe height has been measured or recorded incorrectly.

- **Mode** Select the mode in which you want the smart depth sensor to operate based on environmental factors or site constraints. Although the current *default* setting is **High Power**, ADS recommends using the **Normal** setting under most conditions. However, if erratic *Smart Depth* readings occur, consider using the **High Power** setting.

- **Store Data** Select this checkbox to ensure the monitor logs the smart depth data to memory. *This option is selected by default.*

- **Advanced** Select this button to access the **Advanced Parameters** dialog.

Advanced Parameters dialog

Note: Modifications made to the Advanced Parameters should be performed only by or under the guidance of trained ADS personnel. Therefore, ADS recommends leaving the default settings (**Auto**) in place.

Modify the parameters as necessary, and then select **OK** once complete.

❑ **DAC Gain** Choose the method for managing the amplification of the analog signal that returns to the sensor:

  – **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

  – **Manual** Select this option to enter a fixed value between -12db (lower amplification) and +12db (high amplification) at which to amplify the signal.

❑ **Surcharge Detection** Select the **Disable** checkbox to prevent the monitor from implementing the Surcharge Detection function when processing smart depth data. For locations that typically do not experience surcharges,

disabling Surcharge Detection eliminates the processing
time required for this function and, as a result, conserves
monitor power.

Surface Velocity tab

Edit the parameters corresponding to the surface velocity sensor in the Surface Combo Sensor.

Edit Surface Combo 1 Parameters dialog displaying the **Surface Velocity** tab

- **Enable** Select this checkbox to ensure the monitor begins taking velocity readings at the designated interval once activated.

- **Transmit Frequency** Select the frequency at which to transmit the signal. ADS recommends leaving the default setting (*Normal*) for most applications. However, if hydraulic conditions at the site are resulting in questionable or erroneous readings, consider applying one of the other frequency options. Contact ADS for assistance when necessary.

- **Sensitivity** Select the appropriate velocity sensor sensitivity from the drop-down list. A sensitivity that is too high may produce noise, causing interference in the signal and resulting in spikes in the data. A sensitivity that is too low can produce readings that are low in comparison with confirmation readings. *The default sensitivity is 15.*

- **Velocity Direction** Select one of the following options that reflects the general direction of the flow at the monitoring point and position of the velocity sensor. *The default is **Forward**.*

  - ❑ **Bidirectional** Choose this option for monitoring points that potentially experience reverse flows. The Surface Combo Sensor typically is positioned facing upstream toward the oncoming flow. Choosing this ensures the monitor analyzes both positive and negative values returned from the velocity sensor.

  - ❑ **Forward** Choose this option for monitoring points where reverse flows are *not* expected and to ensure the monitor only analyzes positive values returned from the velocity sensor. The Surface Combo Sensor typically is positioned facing upstream toward the oncoming flow. This is the most common option for selection. ADS recommends using this setting for most monitoring applications. It also requires less processing time and conserves power.

  - ❑ **Backward** Choose this option for monitoring points at which the Surface Combo Sensor has been positioned facing downstream and to ensure the monitor only analyzes flows moving *away* from the face of the sensor. One

application in which this would be the preferable option would be for measuring velocity in an outgoing line following two incoming lines in the manhole.

❑ **Backward Bidirectional** Choose this option when the Surface Combo Sensor is installed facing downstream and to ensure the monitor analyzes flows moving both away from and toward the face of the sensor. This option would be beneficial, for example, when using a weir to measure overflows with the potential of river intrusion.

● **Maximum Velocity** Select the maximum expected velocity that will occur at the site for the monitor to use in fine-tuning the velocity data. The **Auto** option serves to optimize the range and resolution of the velocity data samples to match the characteristics of the flow. *The default setting is 10 fps.*

● **Duration** Select the amount of time for the sensor to transmit and receive the velocity signal based on the noise present at the monitoring point. Most sites require only a one (1) second (*default*) interval. However, sites that experience elevated noise levels or velocity dropouts to zero require a longer interval (**2**).

● **Coefficient A** Enter the factor (offset) by which to calibrate surface velocity to ensure accurate surface velocity readings across all velocity ranges. ADS strongly recommends using the default setting (*0 fps*) for this offset; therefore, please contact ADS before modifying this setting.

● **Coefficient B** Enter the factor (gain) by which to calculate surface velocity to ensure accurate surface velocity readings across all velocity ranges. ADS strongly recommends using the default setting (*1.00*); therefore, please contact ADS before modifying this setting.

● **Gain** This value represents the factor applied to *raw* velocity (RAWVEL entity in **Profile**) to determine average velocity (VELOCITY entity in **Profile**) and to calculate quantity for typical daily flows. **Profile** does not apply the Gain to the velocity readings reported in **Diagnostics**, where the raw velocity readings are used for comparison against the manual

measurements. This parameter is editable through the **Installation Generator** or the **Quantity Coefficient Generator**.

● **Cross Check Gain** Enter the value by which to multiply raw velocity readings in the monitor to determine average velocity for comparison purposes in the monitor. *The default is 0.90.*

● **Store Data** Select this checkbox to ensure the monitor logs the velocity data to memory. *This option is selected by default.*

● **Advanced** Select this button to access the **Advanced Parameters** dialog.

Advanced Parameters dialog

Note: Modifications made to the Advanced Parameters should be performed only by or under the guidance of trained ADS personnel. Therefore, ADS recommends leaving the default settings (**Auto**) in place.

Modify the parameters as necessary, and then select **OK** once complete.

❑ **DAC Gain** Choose the method for managing the amplification of the analog signal that returns to the sensor:

− **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

      – **Manual** Select this option to enter a fixed value between -12db (lower amplification) and +12db (high amplification) at which to amplify the signal.

❑ **Ping Amplitude** Choose the method for managing the amplification of the analog signal that is sent out, or transmitted from, the sensor. Smaller pipes typically require weaker (quieter) amplification; larger pipes typically require stronger (louder) amplification.

      – **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

      – **Manual** Select this option to enter the percentage of full amplification at which to transmit the signal. Enter a percentage between 10 and 100 percent, where 100 percent represents maximum amplification.

Peak Velocity tab

Edit the parameters corresponding to the (surcharge) peak velocity sensor in the Surface Combo Sensor in the following way:

Edit Surface Combo 1 Parameters dialog displaying the **Peak Velocity** tab

> **Note:** When using a Peak Combo Sensor and Surface Combo Sensor at the same monitoring point, ADS

recommends maintaining the same settings for all of the parameters corresponding to both Peak Velocity (**Velocity** tab on the **Edit Peak Combo Parameters** dialog) and Surcharge Peak Velocity (**Peak Velocity** tab in the **Edit Surface Combo Parameters** dialog) to ensure consistency between the velocity readings. However, you may consider disabling this sensor when both are present to conserve battery life, monitor memory, and data collection time.

● **Enable** Select this checkbox to enable the parameters for modification and to ensure the monitor begins taking velocity readings at the designated interval once activated.

● **Sensitivity** Select the appropriate velocity sensor sensitivity from the drop-down list. A sensitivity that is too high may produce noise, causing interference in the signal and resulting in spikes in the data. A sensitivity that is too low can produce readings that are low in comparison with confirmation readings. *The default sensitivity is 10.*

● **Velocity Direction** Select one of the following options that reflects the general direction of the flow at the monitoring point and position of the velocity sensor. *The default is **Forward**.*

  ❑ **Bidirectional** Choose this option for monitoring points that potentially experience reverse flows. The Surface Combo Sensor typically is positioned facing upstream toward the oncoming flow. Choosing this ensures the monitor analyzes both positive and negative values returned from the velocity sensor.

  ❑ **Forward** Choose this option for monitoring points where reverse flows are *not* expected and to ensure the monitor only analyzes positive values returned from the velocity sensor. The Surface Combo Sensor typically is positioned facing upstream toward the oncoming flow. This is the most common option for selection. ADS recommends using this setting for most monitoring applications.

  ❑ **Backward** Choose this option for monitoring points at which the Surface Combo Sensor has been positioned

facing downstream and to ensure the monitor only analyzes flows moving *away* from the face of the sensor. One application in which this would be the preferable option would be for measuring velocity in an outgoing line following two incoming lines in the manhole.

❑ **Backward Bidirectional** Choose this option when the Surface Combo Sensor is installed facing downstream and to ensure the monitor analyzes flows moving both away from and toward the face of the sensor. This option would be beneficial, for example, when using a weir to measure overflows with the potential of river intrusion.

● **Maximum Velocity** Select the maximum expected velocity that will occur at the site for the monitor to use in fine-tuning the velocity data. The **Auto** (*default*) option serves to optimize the range and resolution of the velocity data samples to match the characteristics of the flow. However, if the velocity readings at the location measure at least 10 feet per second (fps) on a regular basis, ADS recommends choosing the **15** fps option for this parameter.

● **Transmit Frequency** Select the frequency at which to transmit the signal. ADS recommends leaving the default setting (*Normal*) for most applications. However, if hydraulic conditions at the site are resulting in questionable or erroneous readings, consider applying the other frequency option. Contact ADS for assistance when necessary.

● **Gain** This value represents the factor applied to *raw* velocity (RAWVEL entity in **Profile**) to determine average velocity (VELOCITY entity in **Profile**) and to calculate quantity for typical daily flows. **Profile** does not apply the Gain to the velocity readings reported in **Diagnostics**, where the raw velocity readings are used for comparison against the manual measurements. This parameter is editable through the **Installation Generator** or the **Quantity Coefficient Generator**.

Note: The **Cross Check Gain** parameter does not apply to the (Surcharge) Peak Velocity Sensor; therefore, it is not available on the **Peak Velocity** tab.

- **Store Data** Select this checkbox to ensure the monitor logs the velocity data to memory. *This option is selected by default.*

- **Advanced** Select this button to access the **Advanced Parameters** dialog.
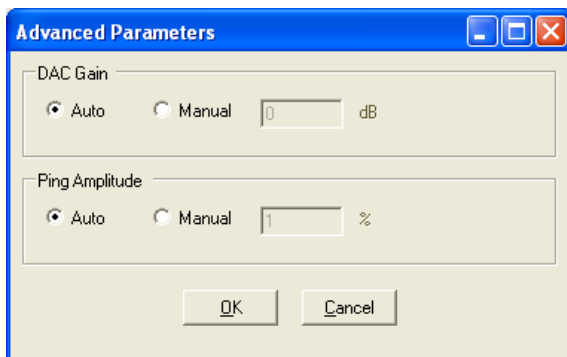
Advanced Parameters dialog

Modify the parameters as necessary, and then select **OK** once complete.

❑ **DAC Gain** Choose the method for managing the amplification of the analog signal that returns to the sensor:

− **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

− **Manual** Select this option to enter a fixed value between -12db (lower amplification) and +12db (high amplification) at which to amplify the signal.

❑ **Ping Amplitude** Choose the method for managing the amplification of the analog signal that is sent out, or transmitted from, the sensor. Smaller pipes typically require weaker (quieter) amplification; larger pipes typically require stronger (louder) amplification.

− **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

–   **Manual** Select this option to enter the percentage of
full amplification at which to transmit the signal.
Enter a percentage between 10 and 100 percent, where
100 percent represents maximum amplification.

Pressure tab

The pressure sensor measures the height of the water above the
sensor (mounted at the crown of the pipe) under surcharge
conditions where the flow has completely filled the pipe and is
rising in the manhole.

Edit the following parameters corresponding to the pressure depth
sensor in the Surface Combo Sensor or the Ultrasonic Depth Sensor
with the pressure option:
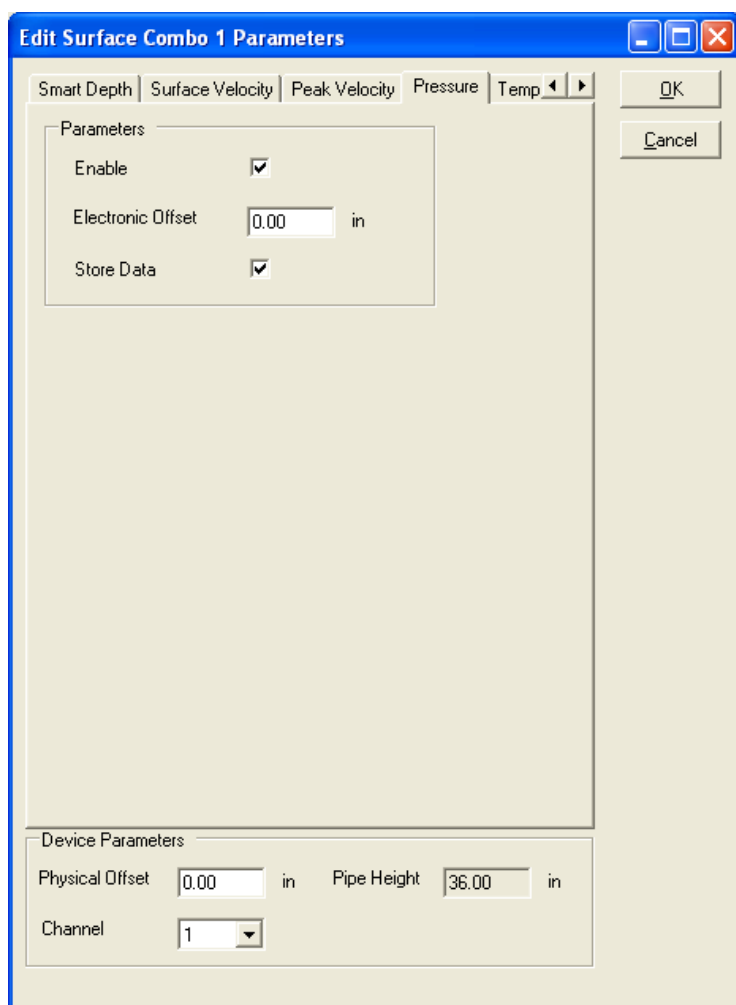
Edit Surface Combo 1 Parameters dialog displaying the **Pressure** tab

- **Enable** Select this checkbox to ensure the monitor begins taking pressure depth readings at the designated interval once activated.

- **Electronic Offset** Enter the difference that exists between the pressure depth readings and the value equal to the pipe

height minus the physical offset of the Surface Combo Sensor. *However, ADS recommends leaving this value at zero.*

● **Store Data** Select this checkbox to ensure the monitor logs pressure depth data to memory.

Temperature tab

Edit the parameters corresponding to the temperature sensor in the Surface Combo Sensor in the same way in which you edited the parameters for the temperature sensor in the Peak Combo Sensor. Refer to the parameter descriptions and instructions for the *Temperature tab* on page 6-31 for detailed information on the individual parameters on the **Temperature** tab.

Editing the Smart (Ultrasonic) Depth Sensor Device

Edit Smart Depth 1 Parameters dialog

Edit the following parameters corresponding to the downward-looking ultrasonic (smart) depth sensor as necessary:

> **Note:** Edit the parameters for an Ultrasonic Depth Sensor equipped with *the pressure option* through the Surface Combo Sensor device. Refer to *Editing the Surface Combo Sensor Device* on page 6-33 for more information.

Parameters

> **Note:** Under normal conditions, the parameters in this section (**Parameters**) should not require modification. However, if additional adjustments are necessary, refer to the detailed description of each parameter.

● **Electronic Offset** Enter the difference that exists between the smart depth sensor readings and the manually measured depth, when applicable. *The default value is 0.*

> **Note:** An electronic offset is rarely needed. An offset greater than +/- 0.5 inches typically indicates that the physical offset or pipe height has been measured or recorded incorrectly.

● **Mode** Select the mode in which you want the smart depth sensor to operate based on environmental factors or site constraints. Although the current *default* setting is **High Power**, ADS recommends using the **Normal** setting under most conditions. However, if erratic *Smart Depth* readings occur, consider using the **High Power** setting.

● **Store Data** Select this checkbox to ensure the monitor logs the smart depth data to memory. *This option is selected by default.*

● **Advanced** Select this button to access the **Advanced Parameters** dialog.

Advanced Parameters dialog

Note: Modifications made to the Advanced Parameters should be performed only by or under the guidance of trained ADS personnel. Therefore, ADS recommends leaving the default settings (**Auto**) in place.

Modify the parameters as necessary, and then select **OK** once complete.

❑ **DAC Gain** Choose the method for managing the amplification of the analog signal that returns to the sensor:

−   **Auto** Select this option to allow the monitor to automatically optimize the amplification of the signal.

−   **Manual** Select this option to enter a fixed value between -12db (lower amplification) and +12db (high amplification) at which to amplify the signal.

❑ **Surcharge Detection** Select the **Disable** checkbox to prevent the monitor from implementing the Surcharge Detection function when processing smart depth data. For locations that typically do not experience surcharges, disabling Surcharge Detection eliminates the processing time required for this function and, as a result, conserves monitor power.

Sensor

- **Physical Offset** Enter the physical distance from the face of the sensor to the crown (top) of the pipe. *Refer to Chapter 3, Sensor Installation and Connection, for instructions on measuring the physical offset. The default offset is **1.25** inches.*

- **Pipe Height** This field displays the pipe height at the monitor location, based on the installation table. *This parameter is not editable from this location.*

- **Channel** Select the channel number of the port on top of the monitor to which this device is connected.

Temperature

The temperature sensor measures the air temperature in the pipe to apply when calculating the speed of sound in air.

> **Note:** Under normal conditions, the parameters in the **Temperature** section should not require modification. However, if additional adjustments are necessary, refer to the detailed description of each parameter.
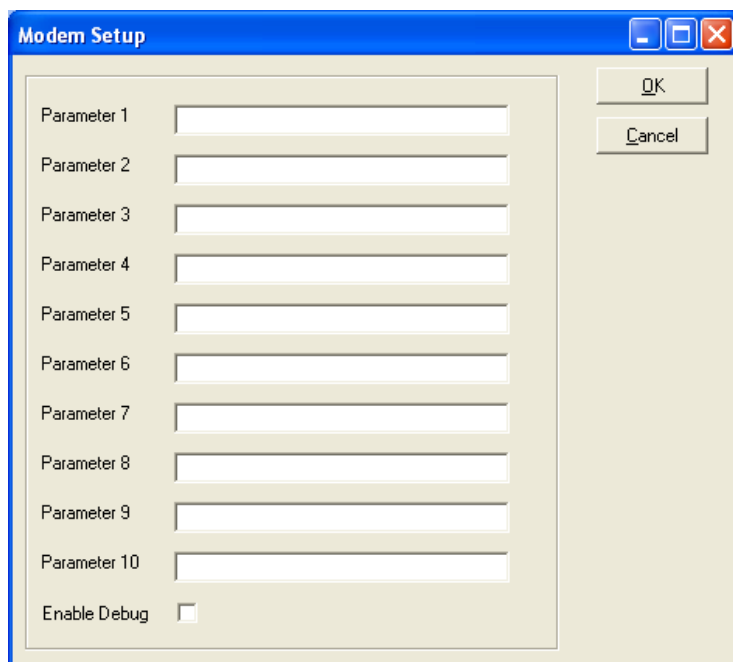
- **Sensor** Select the source from which to measure the temperature used when compensating for temperature in Ultrasonic Depth Sensor readings. The channels correspond to the sensors connected to those channels (i.e., ports) on the monitor. The option selected here should be consistent with the option selected for the **Channel** in the **Sensor** section to the left of the **Temperature** section.

> **Note:** The *stored* temperature value is the actual air temperature reading from the Ultrasonic Depth Sensor.

- **Store Data** Select this checkbox to ensure the monitor logs the temperature data to memory. *This option is selected by default.*

Editing the Modem Setup Device

Modem Setup dialog

> **Note:** The Modem Setup device applies only to monitors equipped with roaming SIM cards for wireless communication and requires advanced knowledge involving wireless networks. Therefore, ADS strongly recommends contacting Customer Support for guidance and assistance before attempting to set up this device.

A roaming SIM card in the monitor modem enables the monitor to perform wireless communication through multiple carrier networks in the vicinity of the monitor location. The Modem Setup device allows you to designate the providers that support the SIM card and offer service in the area as well as prioritize the order in which you want the monitor to attempt to communicate through each provider's network. Priority should reflect the availability, strength,

reliability, and consistency of the carrier's signal to ensure communication.

Parameter 1 on the **Modem Setup** dialog should represent the carrier that you estimate will ensure the highest, most consistent level of success in performing wireless communication. Designate the remaining carriers in descending order of reliability until you have indicated all of the possible carrier options corresponding to your monitor location. Use the following format for entering the carrier information in each field:

at+cops=1,2,""*12345*"", where *12345* represents the wireless carrier code

For example, the carrier information for the provider *Orange* (located in the United Kingdom) would be **at+cops=1,2""23433""**.

Note: *ADS reserves the **Enable Debug** option for internal diagnostic use only.*

Editing the Data Delivery Device

Edit data delivery setup dialog

The Data Delivery device enables the monitor to upload flow data stored in the monitor memory to an **IntelliServe** database or an FTP site at a user-designated interval. To upload the data to an FTP site, you must know the address of the FTP site, the folder at the FTP site in which you want the monitor to place the data, and the username and password the monitor must use to access the site. Edit the data delivery device in the following way:

- **Mode** Select the destination to which you want the monitor to deliver the data. This list includes an **IntelliServe** database or an existing **FTP** site. To deliver data to an **IntelliServe** database, you must enter the IP address for the **IntelliServe** system in the **IP Address** field of the **Alarm Notification** section on the **Edit MLI Device Properties** dialog.

- **Interval** Select the rate at which you want the monitor to upload data to the selected destination. Determine the appropriate interval based on the sample rate for the monitor and the number of entities for which the monitor records data. A faster sample rate and/or a greater number of entities may require a more frequent interval for data delivery.

  Note: The remaining parameters apply only when uploading data to an FTP site.

- **Site** Enter the address of the FTP site to which you want the monitor to send the data.

- **Folder** Enter the name of the folder at the FTP site to which you want the monitor to upload the data.

- **Username** Enter the username through which the monitor can access the FTP site.

- **Password** Enter the password through which the monitor can access the FTP site.

Editing the Flow Device
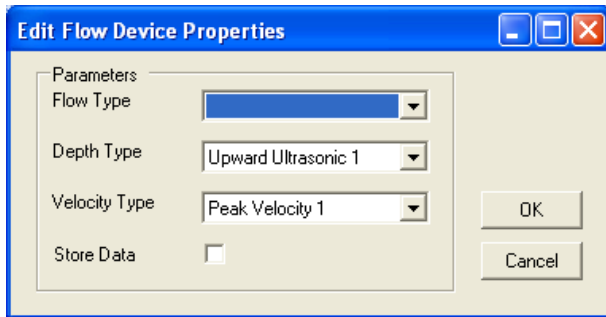
Edit Flow Device Properties dialog

The Flow device enables the monitor to calculate and log flow (QContinuity) based on the type of depth and velocity measurements available to and designated by the user. The device(s) assigned to the monitoring point must be capable of measuring both depth and velocity measurement to enable the monitor to calculate QContinuity. Edit the flow device in the following way:

- **Flow Type** Select **QContinuity** from the drop-down list.

  Note: The options available for **Depth Type** and **Velocity Type** correspond to the devices assigned to the monitoring point.

- **Depth Type** Select the depth sensor from which you want to apply depth data in calculating QContinuity from the drop-down list.

- **Velocity Type** Select the velocity sensor from which you want to apply velocity data in calculating QContinuity from the drop-down list.

- **Store Data** Select this checkbox to ensure the monitor stores the flow data to memory.

Editing the MLI Device

Typically, the MLI device does not require editing. However, if the monitor will support activities such as event notification or dual data rates, refer to the *Profile User's Guide* #950015 (version B4 or higher) for detailed instructions on properly setting the applicable parameters for the MLI device.

Setting the Communication Parameters

Setting the communication parameters involves designating the communication ports and temperature thresholds to ensure proper communication, measurement, and maintenance of the FlowShark Triton flow monitor. Modify the communication parameters as necessary.

> **Note:** Typically, the default settings should not require modification.

1.   Select a monitor location from the **Profile** main screen, and then select **Tools > Diagnostics** from the main menu *or* click on the **Diagnostics** toolbar button.

Diagnostics toolbar button

*The **Monitor Diagnostics** dialog displays.*

2.   Select **Communication Parameters** from the **Functions** drop-down list, and click on the **Perform** button.
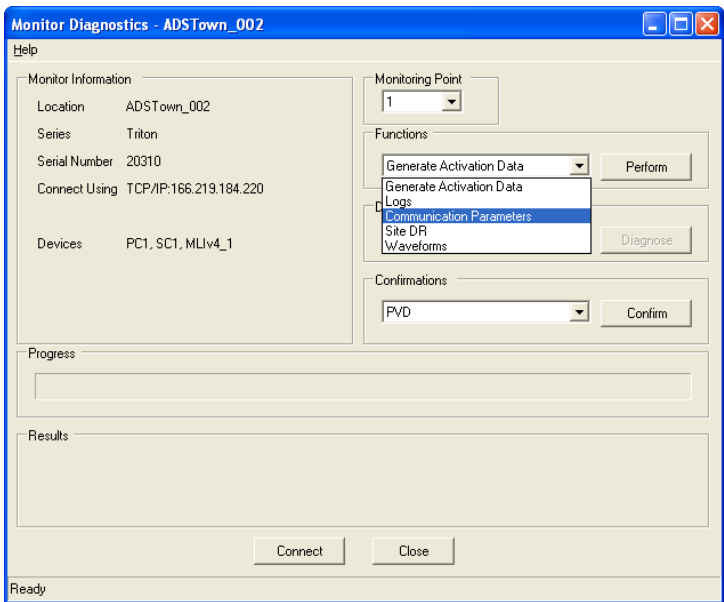
Monitor Diagnostics dialog

*The **Select Communication Parameters** dialog displays.*

Note: The **Communication Parameters** screen is common to all monitor types serviced by the **Profile** software. As a result, some fields and default values are not relevant to the FlowShark Triton and, therefore, will not affect monitor operation.

Select Communication Parameters dialog

3. Select or enter the communication parameters as necessary:

❑   **Modem Name** Select the modem you want to use during modem communication from the drop-down list. This list should include all available modems on your computer.

❑   **Modem Port** Select the proper port for modem communication from this drop-down list. This list should include all available ports on your computer.

❑   **Serial Port** Select the proper port for serial communication from this drop-down list. This list should include all available ports on your computer.

Note: If your computer has only a USB port and no serial port, use a USB-to-Serial adapter cable (and driver software) to perform serial communications. Before attempting communications, make sure that you designate the appropriate port (*not the serial port*) for the USB adapter in **Profile**. ADS recommends the following USB adapters: Dynex-model DX-UBDB9 and Keyspan-model USA-19S.

❑ **DMI Port** (*This parameter does not apply to the FlowShark Triton)*

❑ **Timeout** Enter the number of seconds you want your local computer to wait for a response from the monitor once communication has been initiated.

❑ **Attempts** Enter the number of times you want your local PC to request data from the monitor following a failed attempt while the monitor is still on line.

❑ **Low Temperature** Enter the temperature reading from the monitor, ultrasonic upward depth sensor, and pressure depth sensor below which you want **Profile** to provide notification.

❑ **High Temperature** Enter the temperature reading from the monitor, ultrasonic upward depth sensor, and pressure depth sensor above which you want **Profile** to provide notification.

❑ **Log Communications** Select this checkbox to record all communication activities with the monitor.

❑ **Status on Connect** Select this checkbox to view details of the current state of the monitor when monitor communications are established. If you do not want to view the monitor status details at connect, do not select this checkbox.

❑ **Low Battery 1502,1506,3500,4000** (*These parameters do not apply to the FlowShark Triton)*

❑ **Low Modem Battery TCP/IP** (*This parameter does not apply to the FlowShark Triton)*

❑ **Low Signal Strength TCP/IP** Enter the signal strength (in dBm) below which you want **Profile** to provide notification for the wire communication unit, when applicable. *ADS recommends using -95 dBm for the low signal strength.*

❑ **Low Battery FlowShark** (*This parameter does not apply to the FlowShark Triton)*

❑ **Low Battery FlowShark IS Internal** (*This parameter does not apply to the FlowShark Triton)*

❑ **Low Battery FlowShark IS External** (*This parameter does not apply to the FlowShark Triton)*

❑ **Low Battery FlowAlert/RainAlert II** (*This parameter does not apply to the FlowShark Triton)*

❑ **Low Battery Triton/FlowHawk** Enter the voltage below which you want **Profile** to provide notification for the internal battery in FlowShark Triton monitors. *ADS recommends entering 7.5 to ensure successful communication and operation.*

Note: Notification of low battery voltage or signal strength occurs during the data collection process and during monitor activation. View the associated logs through the **Diagnostics** tool and **Log Viewer** in the **Profile** software.

4.   Select the **OK** button.

Activating the Monitor

After configuring the monitor, *activate* the monitor to initiate the flow monitoring process based on the monitor configuration. Monitor activation involves generating the activation data using the **Profile** software, downloading this data to the monitor, and initiating flow data measurement and logging. The activation data includes relevant portions of the LIF and other configuration parameters necessary to ensure monitoring activities reflect the specific site conditions and project requirements. The monitor requires these files and information to properly measure and record the flow.

Monitor activation occurs through the **Diagnostics** tool in **Profile**. Activate the monitor in the following way:

1. Select the monitor location for activation from the **Profile** main screen, and then click on the **Diagnostics** toolbar button.

    *The **Monitor Diagnostics** dialog displays.*

2. Select the **Connect** button to establish communication with the monitor.

    ***Profile** initiates communication with the monitor and establishes a connection.*

3. Select **Activate** from the **Functions** drop-down list, and then click on the **Perform** button.
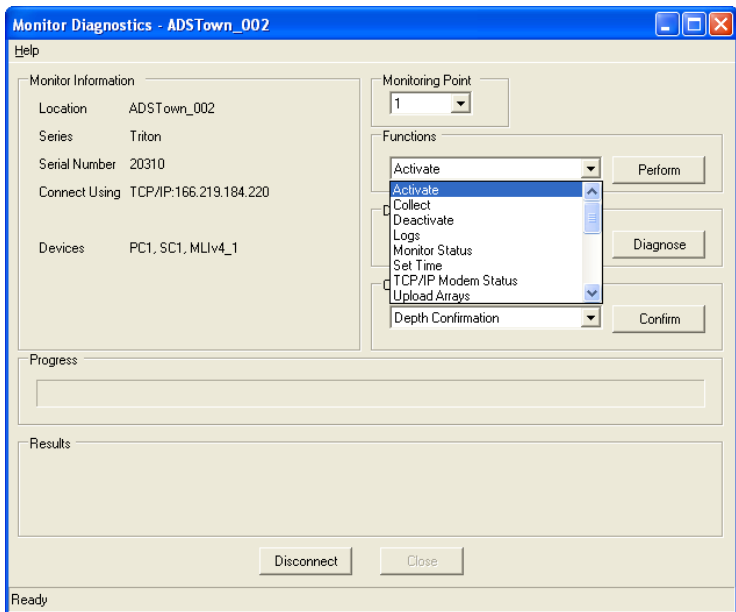
Selecting the **Activate** option from the **Functions** section on the **Monitor Diagnostics** dialog

Profile downloads the configuration and installation information, activates the monitor, and begins logging data based on the selected configuration.

4. Select **Update Connection Type** from the **Functions** drop-down list, and then click on the **Perform** button.

    Note: The FlowShark Triton is configured in the factory for *Serial* (i.e., on-site) communication upon receipt. To configure the monitor for another method of communication (e.g., GPRS), choose the appropriate option through the **Update Connection Type** function. To maintain serial communication as the desired method of communication, skip steps 4 and 5 and proceed directly to step 6.
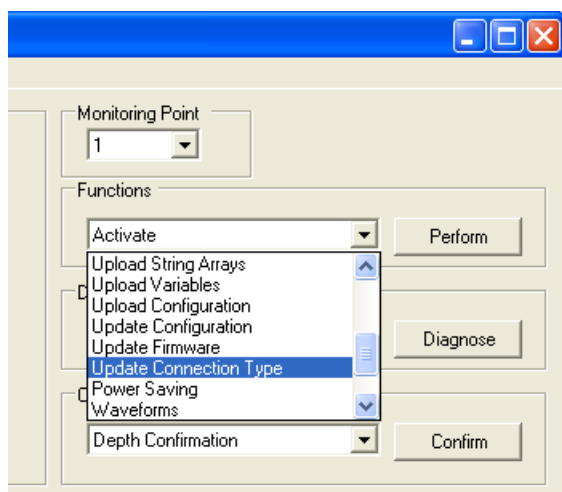
Selecting **Update Connection Type** from the **Functions** drop-down list

*The **Update Connection Type** dialog displays.*
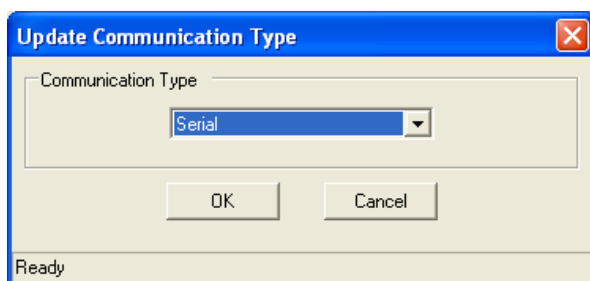
Update Communication Type dialog

5. Select the method through which communication with the monitor will occur from the **Communication Type** drop-down list, and then click on the **OK** button.
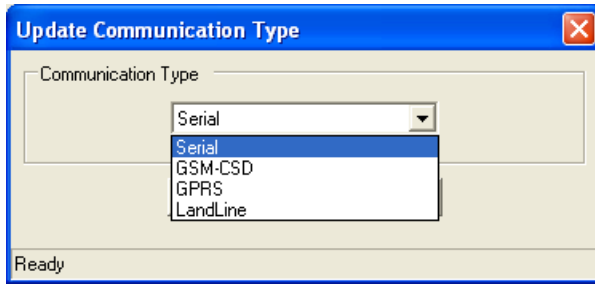
Communication options

6. Click on the **Disconnect** button once activation is successful (designated in the **Results** section) and complete and the communication type has been designated.

    The local computer disconnects from the monitor.

7. Click on the **Close** button to exit the **Monitor Diagnostics** dialog.

Setting Up the RTU to Retrieve the Current Data through Modbus

Following monitor activation, you must program the RTU with the appropriate Modbus register addresses corresponding to the current entity and monitor data you want to retrieve from the monitor. ADS also recommends verifying that the RTU is retrieving the desired output data shortly following monitor activation.

> **Note:** The Telog Ru-33 does not require programming with the Modbus register addresses to ensure it retrieves the correct data. However, consider verifying whether the Telog unit is successfully retrieving data following monitor activation and Telog connection.

Designating the Data for Retrieval

Use the appropriate software application supporting the RTU to designate the entity and monitor data you want the unit to retrieve for the SCADA or other process control system. Refer to *Appendix D*, *Modbus Data Registers*, to view the entity and monitor data available for retrieval and to determine the associated register addresses required for obtaining the selected data.

Verifying the Modbus Output Data

Perform the following to verify the accuracy of the Modbus output values, when applicable:

1. Verify that the monitor has been activated, the RTU has been programmed to retrieve the desired data, and the applicable Modbus application has been launched.

2. Allow the FlowShark Triton monitor to log data for an appropriate amount of time to obtain an adequate amount of data. Please note the interval at which the monitor takes readings for Modbus output is based on the *Scan* rate.

3. Collect the data from the monitor. Refer to *Collecting Data from the Monitor* on page 6-87 for detailed instructions.

4. Compare the data collected from the monitor to the output values obtained through Modbus. The data collected through **Profile** reflects an average of the readings taken over a specific interval; the values retrieved through the Modbus interface represent the current (*persistent*) data in the monitor from the last interval (*readings*). Therefore, the values compared may not be exactly the same, but should be similar.

Running Sensor Diagnostics

Profile's diagnostics tool enables the user to verify the proper operation of sensors, obtain current readings and status, adjust settings, and identify, diagnose, and troubleshoot potential problems with ultrasonic depth, velocity, and pressure sensors. Run diagnostics for the system sensors in the following way:

1. Select the monitor location for which you want to run diagnostics on a sensor from the **Profile** main screen, and then select **Tools > Diagnostics** *or* click on the **Diagnostics** toolbar button.

Diagnostics toolbar button
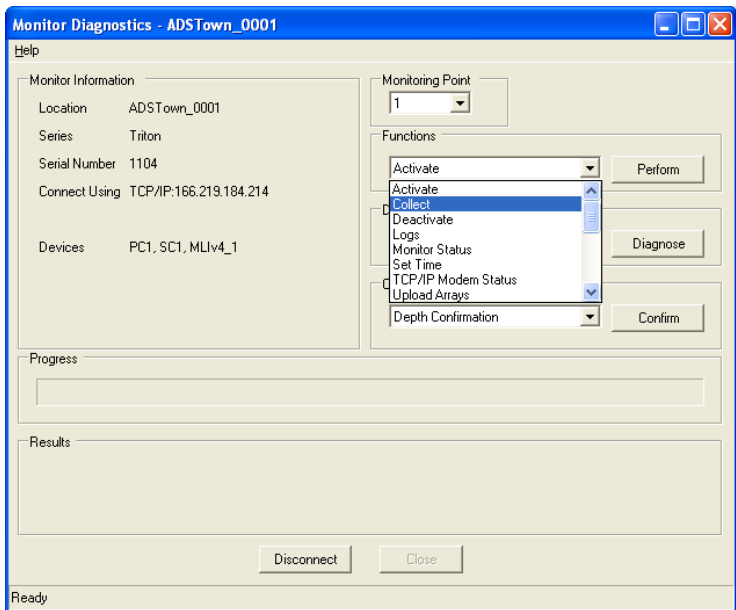
*The **Monitor Diagnostics** dialog displays.*
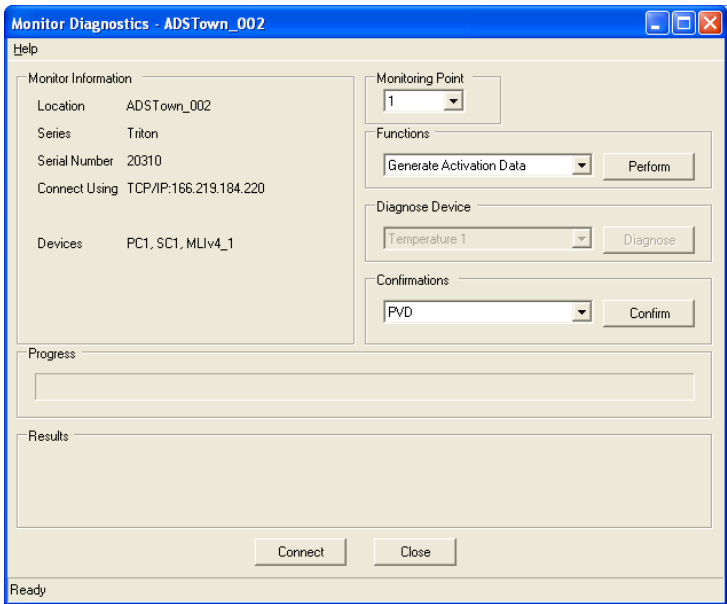
Monitor Diagnostics dialog

2. Select the **Connect** button to establish communication with the monitor.

    Profile initiates communication with the monitor and establishes a connection.
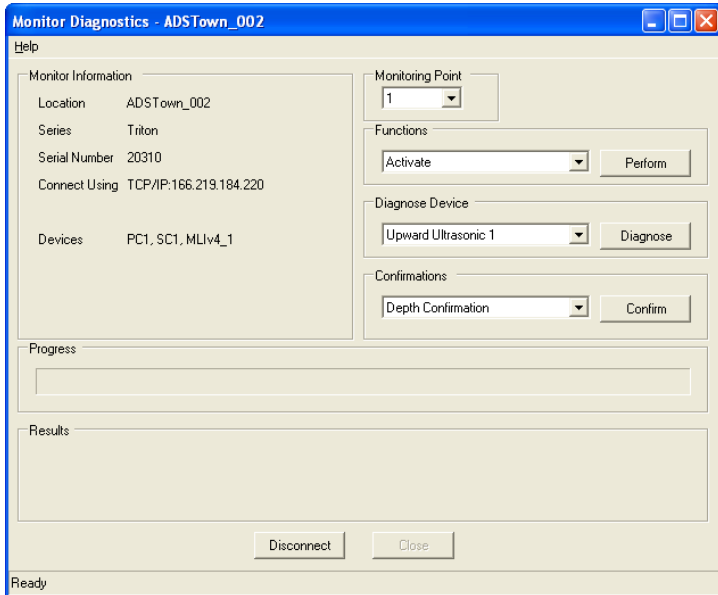
Monitor Diagnostics (Upward Ultrasonic 1) dialog once connected to monitor

3. Run sensor diagnostics based on the instructions outlined in one of the following sections corresponding to the specific sensor type for which you want to run diagnostics:

Ultrasonic Depth Diagnostics

This section provides instructions on running diagnostics on the upward-looking depth sensors found in the Peak Combo Sensor (PC) and Slimline Peak Combo Sensor (PCS) once connected to the monitor through the **Monitor Diagnostics** dialog. Run diagnostics on the *upward ultrasonic depth sensor* in the following way:

1. Select the **Upward Ultrasonic 1** sensor from the **Diagnose Device** drop-down list, and then select the **Diagnose** button. **Upward Ultrasonic 1** refers to the ultrasonic depth sensor in both the Peak Combo Sensor and *Slimline* Peak Combo Sensor.
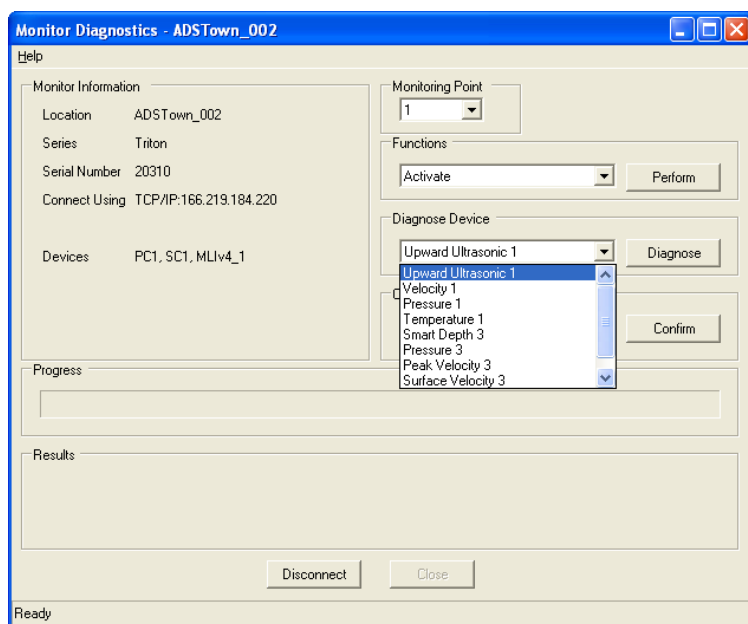
Selecting an **Upward Ultrasonic** device from the **Diagnose Device** drop-down list on the **Monitor Diagnostics** dialog

*The **Diagnostics** dialog displays the current configuration parameters stored in the LIF for the Upward Ultrasonic 1 sensor.*
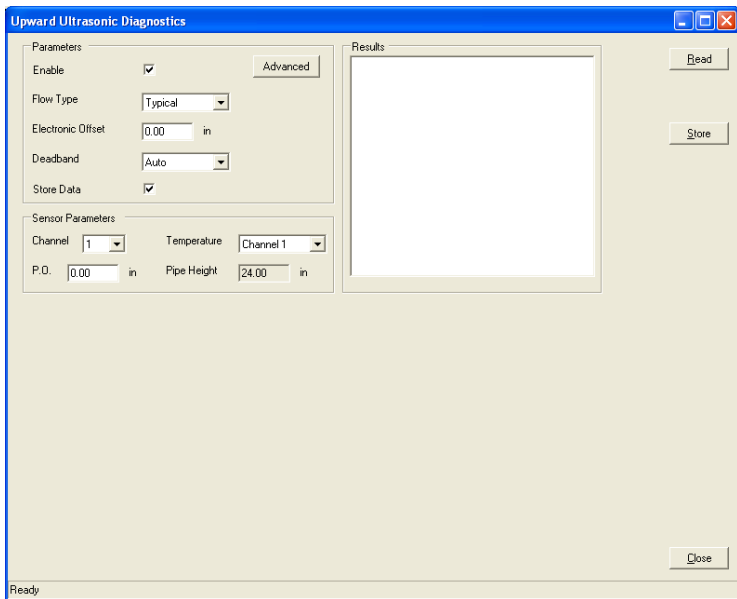
Upward Ultrasonic Diagnostics dialog showing current parameters for the
Upward Ultrasonic 1 device

2. Click on the **Read** button.

*The **Results** section displays the current depth and temperature
readings measured by the upward ultrasonic depth sensor in the
Upward Ultrasonic Diagnostics dialog.*
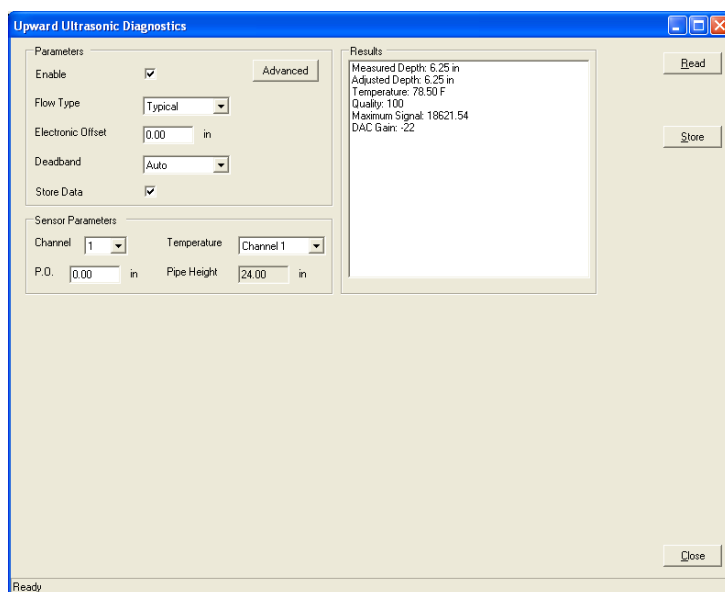
Upward Ultrasonic Diagnostics dialog displaying results for the Upward
Ultrasonic 1 device following sensor firing

3. Verify the accuracy, consistency, and quality of the readings, and edit the configuration parameters as necessary.

   Electronic Offsets can be used to make monitor depth readings coincide with depths measured in the field.

   ❑ Field Depth = UpDepth1 + Electronic Offset

   ❑ If the sensor reading is **Low**, add a positive (+) electronic offset.

   ❑ If the sensor reading is **High**, add a negative (–) electronic offset.

   Note: Enter an electronic offset only when your are confident in the accuracy of the manual measurements and physical offset of the sensor.

4. (*optional*) Click on the **Advanced** button to view more detailed diagnostic information.
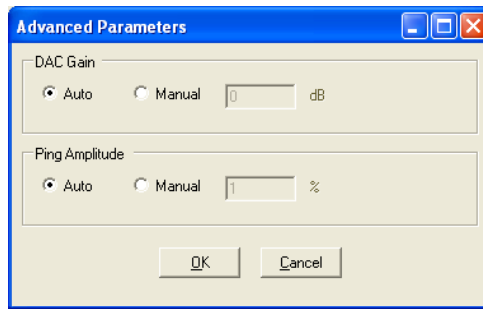
Advanced Parameters dialog

5. Select the **Store** button to save any changes made in the device parameters to the LIF in the database.

    Note: When running diagnostics on multiple devices for the same monitor, finish all device diagnostics before reactivating the monitor with the updated LIF. **Store** the changes for each device to the LIF as you complete them and before you exit the device window. Reactivate the monitor with the new LIF after completing diagnostics on all the selected devices.

6. Select the **Close** button to exit the **Upward Ultrasonic Diagnostics** dialog and return to the **Monitor Diagnostics** dialog.

Pressure Depth Diagnostics

This section provides instructions for running diagnostics on the pressure depth sensors found in the Peak Combo Sensor (PC), Surface Combo Sensor (SC), and Ultrasonic Depth Sensor *with the pressure option* (SC) once connected to the monitor through the **Monitor Diagnostics** dialog. Run diagnostics on the *pressure depth sensor* in the following way:

1. Select the **Pressure [*1 or 3*]** sensor from the **Diagnose Device** drop-down list, and then select the **Diagnose** button. **Pressure 1** represents the pressure sensor in the Peak Combo Sensor;

Pressure 3 represents the pressure sensor in both the Surface Combo Sensor *and* the Ultrasonic Depth Sensor with the pressure option.

*The **Pressure Diagnostics** dialog displays the current configuration parameters stored in the LIF for the Pressure 1/3 sensor.*
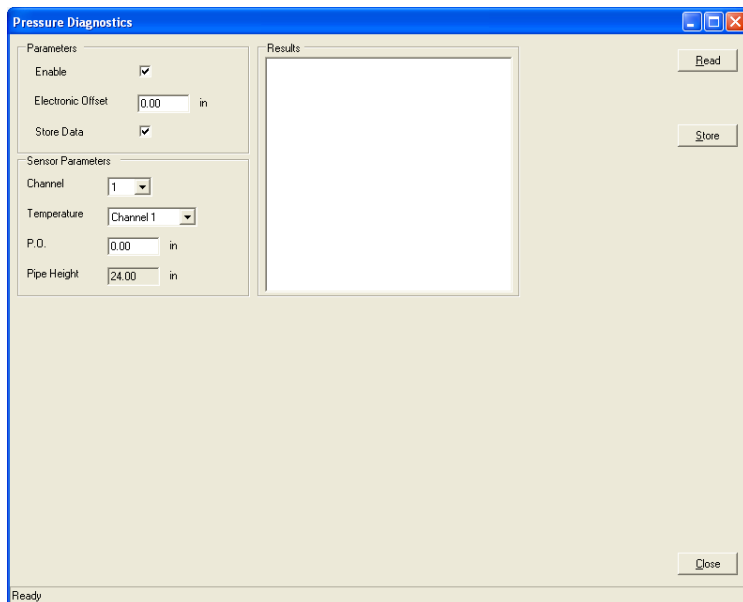
Pressure Diagnostics dialog displaying the current parameters for the Pressure 1 device

2. Click on the **Read** button.

*The **Results** section displays the current depth and temperature readings measured by the pressure depth sensor in the corresponding combo sensor. **Measured Depth** is the depth of the water over the Peak Combo Sensor or surrounding the Surface Combo Sensor pressure sensor. **Adjusted Depth** is the depth of flow in the pipe, calculated after factoring the physical and electronic offsets into the Measured Depth.*

Pressure Diagnostics dialog for the Pressure 1 device displaying the results following sensor firing

3. Verify the accuracy of the pressure depth and temperature readings, and edit the configuration parameters as necessary.

4. Select the **Store** button to save any changes made in the device parameters to the LIF in the database.

5. Select the **Close** button to exit the **Pressure Diagnostics** dialog and return to the **Monitor Diagnostics** dialog.

Velocity Diagnostics

This section provides instructions for running diagnostics on the peak, surface, and surcharge velocity sensors found in the Peak Combo Sensor (PC), Surface Combo Sensor (SC), and Slimline Peak Combo Sensor (PCS) once connected to the monitor through the **Monitor Diagnostics** dialog. Run diagnostics on all of the *velocity sensors* in the following way:

1. Select the **Velocity 1**, **Peak Velocity 3**, or **Surface Velocity 3** from the **Diagnose Device** drop-down list, and then select the **Diagnose** button. **Velocity 1** represents the velocity sensor in both the Peak Combo Sensor and the *Slimline* Peak Combo Sensor, **Peak Velocity 3** represents the surcharge peak velocity sensor in the Surface Combo Sensor, and **Surface Velocity 3** represents the surface velocity sensor in the Surface Combo Sensor.

   *The **Diagnostics** dialog displays the current configuration parameters stored in the LIF for the Velocity 1/Peak Velocity 3/ Surface Velocity 3.*
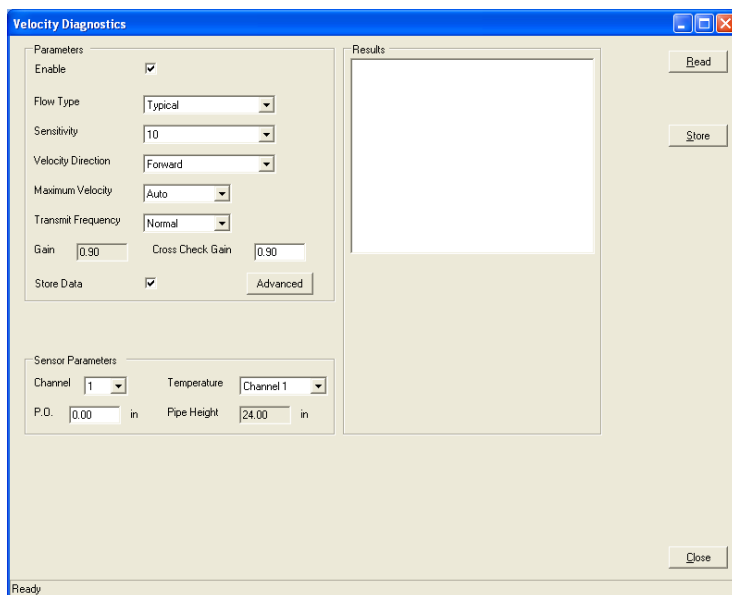
Velocity Diagnostics dialog displaying the current parameters for the Velocity 1 device

2. Click on the **Read** button.

   *The **Results** section displays the current velocity of the flow, temperature, and other factors measured by the selected velocity sensor.*

Velocity Diagnostics dialog displaying the current velocity readings and other data after firing the Velocity 1 device

3. (*optional*) Click on the **Advanced** button to view more detailed diagnostic information.

Advanced Parameters dialog

4. Verify the accuracy of the reading, and edit the configuration parameters as necessary.

5. Select the **Store** button to save any changes made in the sensor parameters to the LIF in the database.

    Note: When running diagnostics on multiple devices for the same monitor, consider waiting to reactivate the monitor with the new LIF until after completing the device diagnostics on all the selected devices. However, save the changes to the database before exiting each device window.

6. Select the **Close** button to exit the **Velocity Diagnostics** dialog and return to the **Monitor Diagnostics** dialog.

Smart Depth Diagnostics

This section provides instructions for running diagnostics on the downward-looking ultrasonic depth sensor found in the Surface Combo Sensor (SC), Ultrasonic Depth Sensor (SD), and Ultrasonic Depth Sensor *with the pressure option* (SC) once connected to the monitor through the **Monitor Diagnostics** dialog. Run diagnostics on the *smart depth sensor* in the following way:

1. Select the **Smart Depth 3** sensor from the **Diagnose Device** drop-down list, and then select the **Diagnose** button.

    *The **Ultrasonic Diagnostics** dialog displays the current configuration parameters stored in the LIF for the Smart Depth 3 sensor.*

Ultrasonic Diagnostics dialog displaying the current parameters for the
Smart Depth 3 device

2.   Click on the **Read** button.

*The **Results** section displays the current depth of the flow,
range, and other factors measured by the Smart Depth
ultrasonic sensor.*
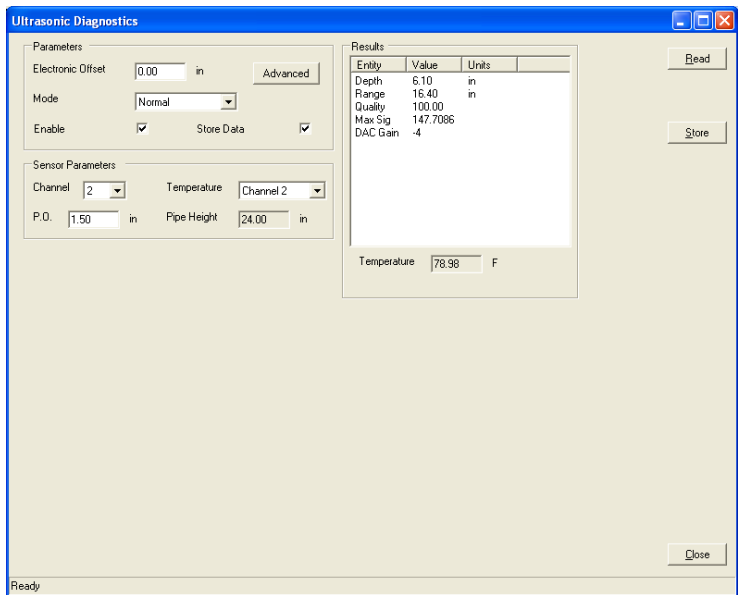
Ultrasonic Diagnostics dialog displaying the results for the Smart Depth 3 device following sensor firing

3. Verify the accuracy, consistency, and quality of the readings, and edit the configuration parameters as necessary.

   Note: You can use an electronic offset to compensate for small differences between the depth readings from the monitor and depths measured in the field. The smart depth sensor uses algorithms and digital data processing to yield significant accuracy in range measurements. Please do not apply electronic offsets without proper training or guidance from ADS.

4. (*optional*) Click on the **Advanced** button to view more detailed diagnostic information.
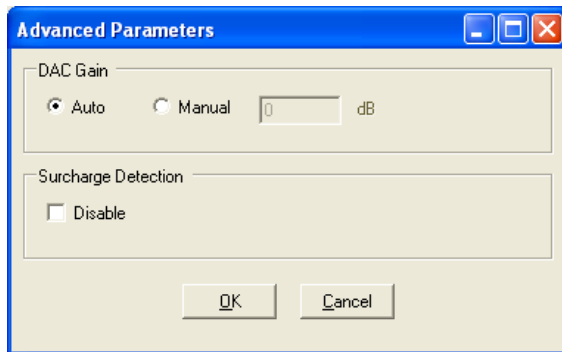
Advanced Parameters dialog

5. Select the **Store** button to save any changes made in the sensor parameters to the LIF in the database.

> **Note:** When running diagnostics on multiple devices for the same monitor, finish all device diagnostics before reactivating the monitor with the updated LIF. **Store** the changes for each device to the LIF once complete and before exiting the device window. Reactivate the monitor with the new LIF after completing diagnostics on all the selected devices.

6. Select the **Close** button to exit the **Ultrasonic Diagnostics** dialog and return to the **Monitor Diagnostics** dialog.

Temperature Diagnostics

This section provides instructions for running diagnostics on the temperature sensors found in the Peak Combo Sensor (PC), Surface Combo Sensor (SC), Slimline Peak Combo Sensor (PCS), Ultrasonic Depth Sensor (SD), and Ultrasonic Depth Sensor *with the pressure option* (SC) once connected to the monitor through the **Monitor Diagnostics** dialog. Run diagnostics on the *temperature sensor* in the following way:

1. Select the **Temperature [*1 or 3*]** sensor from the **Diagnose Device** drop-down list, and then select the **Diagnose** button. **Temperature 1** represents the temperature sensor in both the Peak Combo Sensor and the *Slimline* Peak Combo Sensor; **Temperature 3** represents the temperature sensor in the Surface Combo Sensor and the Ultrasonic Depth Sensor.

   *The **Temperature Diagnostics** dialog displays.*
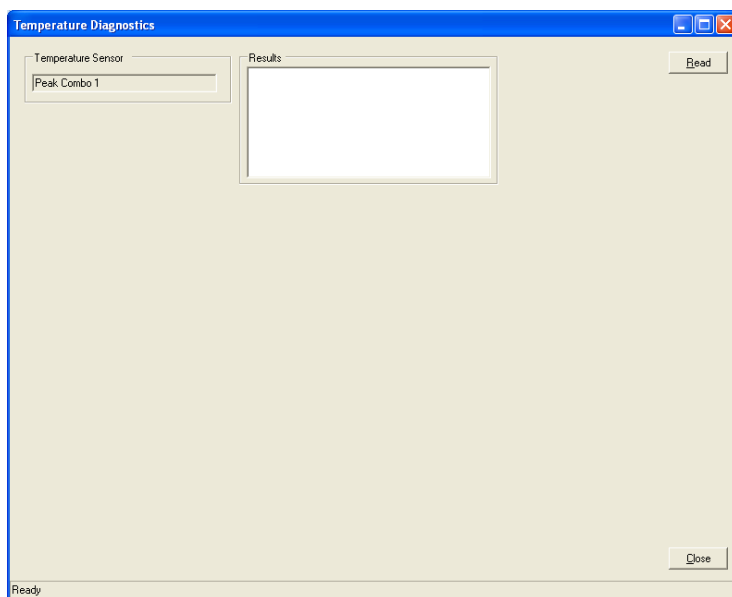
   Temperature Diagnostics dialog for the Temperature 1 device

2. Click on the **Read** button.

   *The **Results** section displays the current temperature in or above the flow measured by the corresponding temperature sensor.*
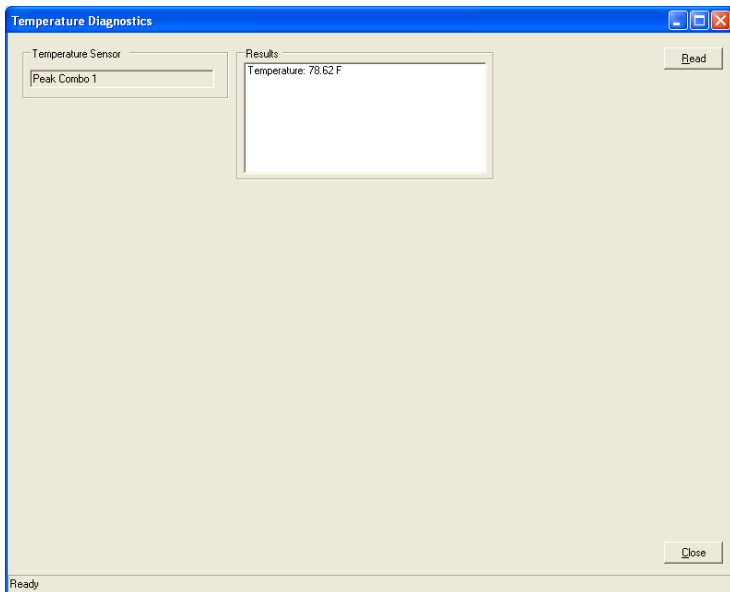
Temperature Diagnostics dialog displaying the current temperature for the Temperature 1 device from the sensor

3. Verify the accuracy of the reading. This reading represents the water temperature.

4. Click on the **Close** button to exit the **Temperature Diagnostics** dialog and return to the **Monitor Diagnostics** dialog.

Activating the Monitor

If a change has been made to any of the sensor parameters, reactivate the monitor through the Diagnostics mode. *Do not reactivate a monitor if no change has been made*.

While connected to the monitor, select **Activate** from the **Functions** drop-down list and then select the **Perform** button.

Select the **Disconnect** button to discontinue communication with monitor when finished running diagnostics on the system sensors.

Note: ADS also recommends performing confirmations to verify the accuracy of the data and equipment. Confirmations involve comparing manual flow depth, temperature, and velocity measurements taken in the field against monitor readings taken electronically. The technician or analyst confirms the accuracy of the data based on the difference between the monitor and field readings. For more information, refer to the *Profile User's Guide* #950015 (version B4 or higher).

Collecting Data from the Monitor

The data collection function available through **Diagnostics** provides enhanced features for viewing and analysis. Once the collection process is complete, **Profile** displays the data in both hydrograph and scattergraph formats based on the entities collected. In addition to the scattergraph displaying the depth-to-velocity relationship, it also displays a scattergraph illustrating the correlation between depth entities.

For analysis purposes, the **Diagnostics** tool automatically processes the data using **Site DR** (data review). This feature identifies issues concerning data quality or missing information and offers recommendations (when necessary) for conducting further review, investigation, or analysis. Collect data from the monitor in the following way:

> **Note:** You can perform group and scheduled collects using the **Communications** tool.

1. Select the monitor location from which you want to collect data, and then select **Tools > Diagnostics** from the main menu *or* click on the **Diagnostics** toolbar button.

Diagnostics toolbar button

*The **Monitor Diagnostics** dialog displays.*
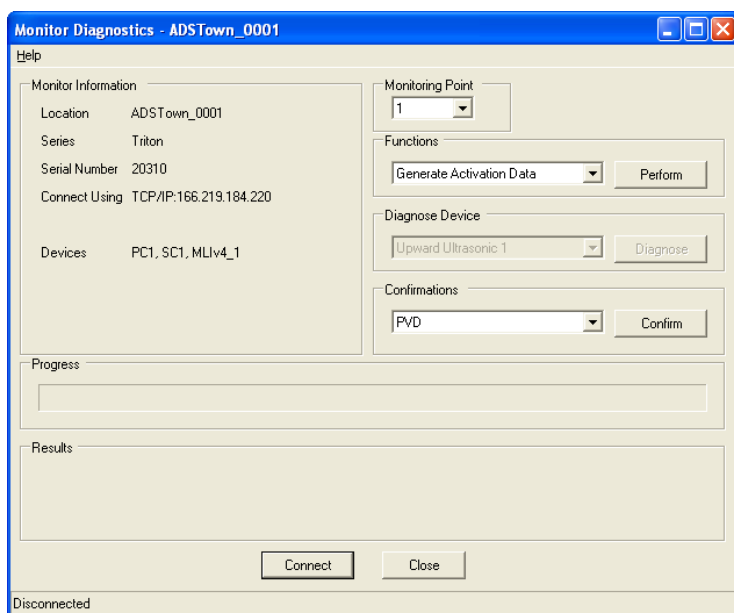
Monitor Diagnostics dialog

2. Select the **Connect** button to establish communication with the monitor.

   Profile initiates communication with the monitor and establishes a connection.

3. Select **Collect** from the **Functions** drop-down list, and then select the **Perform** button.

Selecting the **Collect** option from the **Functions** drop-down list on the
Monitor Diagnostics dialog

*Profile displays the **Collect the Specified Data** dialog.*
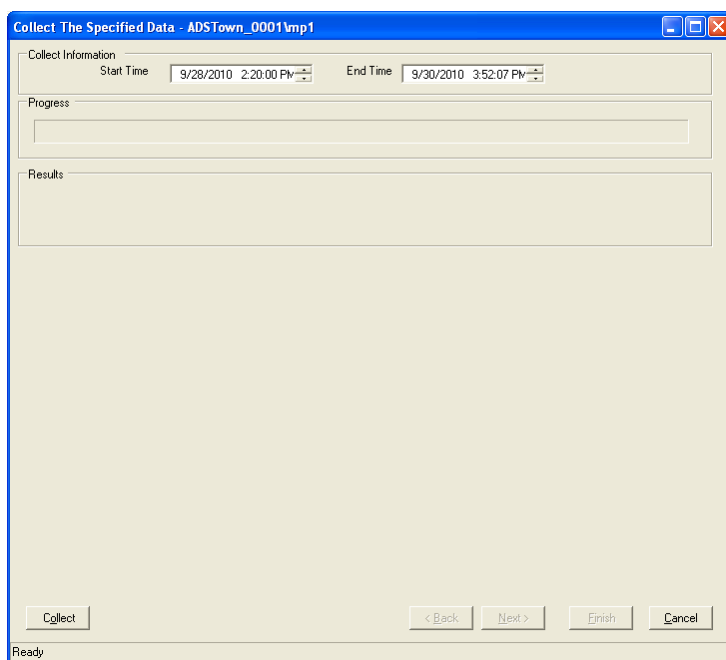
Collect the Specified Data dialog

4.   Designate the range of data you want to collect from the
     monitor by editing the **Start** and **End Time** fields in the
     Collect Information in the section. Edit these fields directly
     by selecting the portion of the date or time stamp you want to
     change and then entering the appropriate designation or using
     the arrows to scroll up and down in the range. *If you do not
     edit the range, the start date and time automatically default to
     the **Auto Collect Start Dates** saved in the LIF. This time is
     defined as the last <u>ending</u> collect date/time plus one second.*

5.   Select the **Collect** button.

     *The **Results** section displays the status of the collect. **Profile**
     collects all entity data from the monitor for the selected
     date/time range and stores it in the currently selected
     database.*
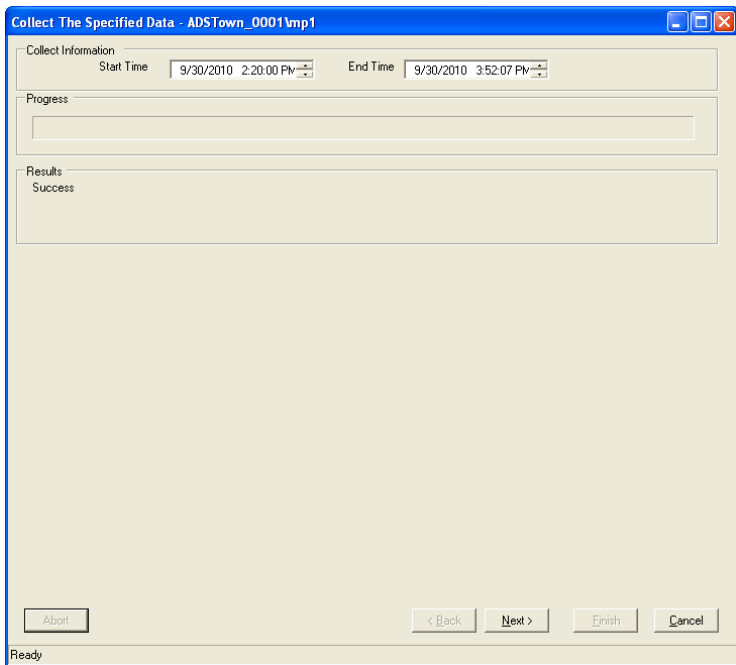
Collect The Specified Data dialog indicating data collection was a success

6.   Click on the **Next** button.

*The **View Hydrograph – [location name]** dialog displays the collected data in hydrograph format.*
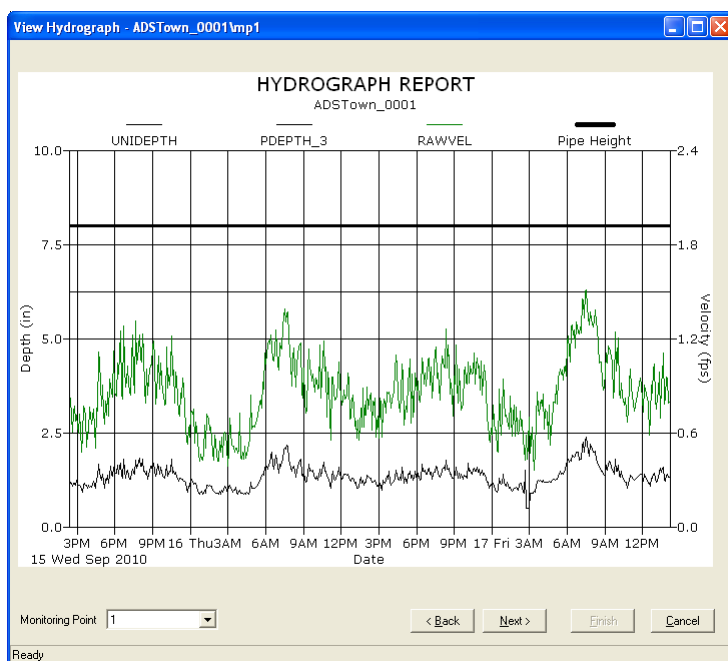
View Hydrograph – [location name] dialog

7. Review the data on the hydrograph, and then click on the **Next** button. Under optimal conditions, the depth and velocity data should reflect a consistent diurnal pattern.

*The **View Depth and Velocity Scattergraph – [location name]** dialog displays the collected depth and velocity data in scattergraph format.*
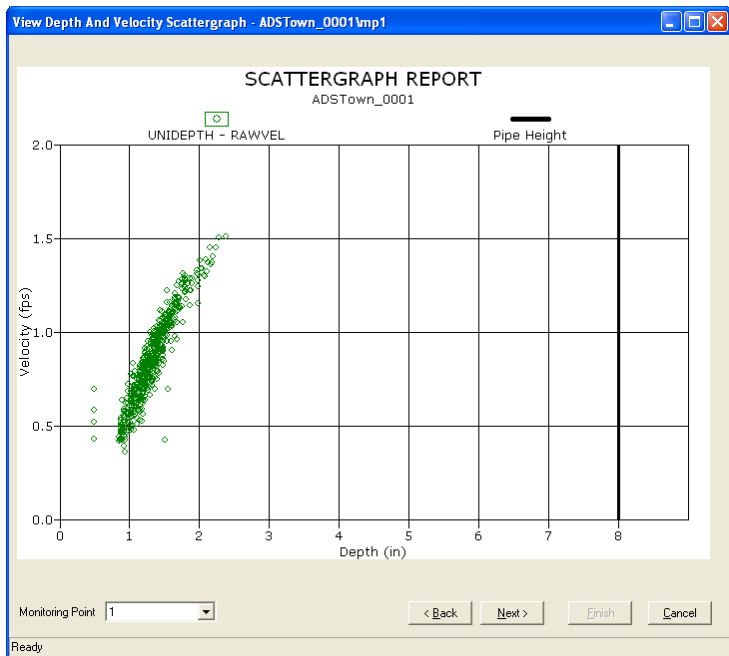
View Depth and Velocity Scattergraph – [location name] dialog

8. Review the data on the scattergraph, and then click on the **Next** button. Under optimal conditions, the data on the graph should reveal velocity increasing with depth.

    *The **View Ultrasonic and Pressure Scattergraph – [location name]** dialog displays the collected ultrasonic and pressure depth data in scattergraph format.*
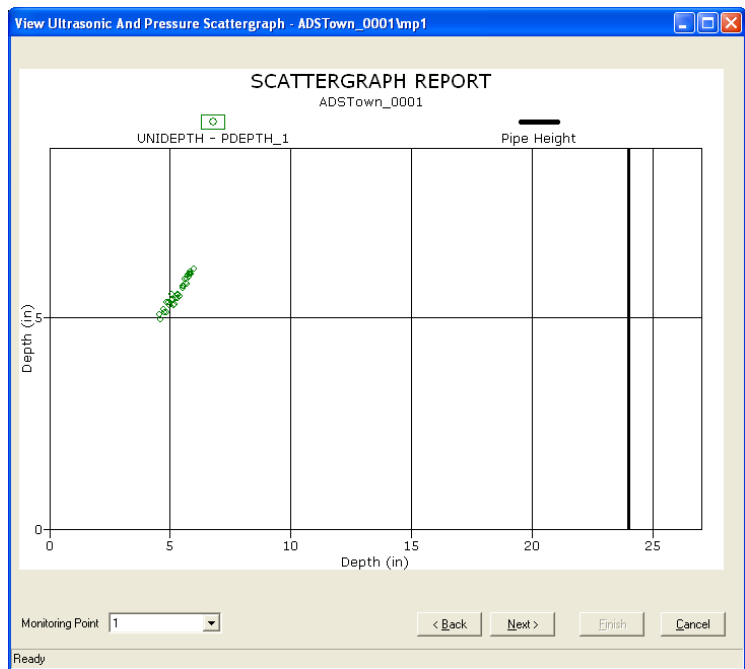
View Ultrasonic and Pressure Scattergraph – [*location name*] dialog

9. Review the data on the scattergraph, and then click on the **Next** button. A properly performing pressure depth sensor should display a one-to-one relationship with the UNIDEPTH data.

*The **Site DR Analysis – [location name]** dialog displays the results of the site data review analysis of the collected data and any recommendations for resolving identified issues.*

Site DR Analysis – [*location name*] dialog

10. Review any issues identified and the suggested actions, and then click on the **Finish** button.

11. Click on the **Close** button.

*The **Monitor Diagnostics** dialog displays. The **Results** section displays the recommendations from **Site DR Analysis** when applicable.*
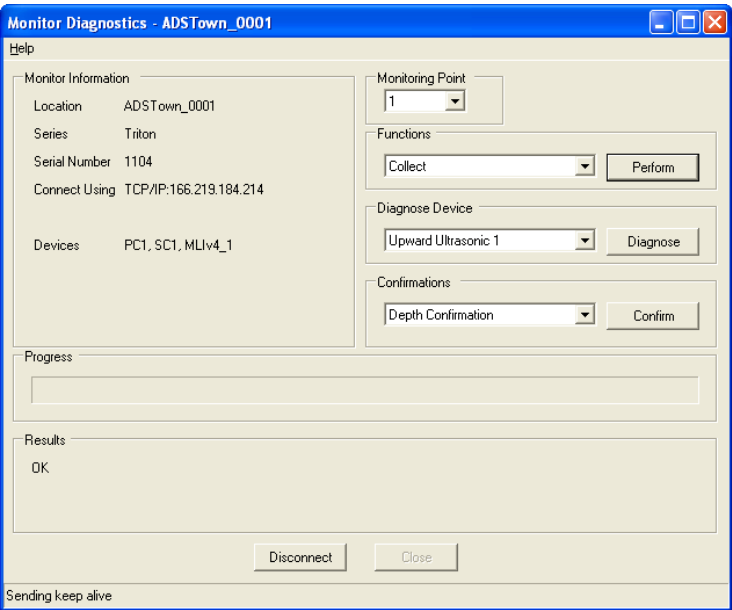
Monitor Diagnostics dialog displaying good results without recommendations

Upgrading the Monitor Firmware

Profile enables you to download updated firmware to the FlowShark Triton flow monitor that may include new features and capabilities or performance improvements and enhancements in functions such as data processing, analysis, or communications.

ADS strongly recommends collecting the data from the monitor *before* updating the firmware in the monitor to avoid losing the flow data stored in the monitor memory. ADS also recommends reactivating the monitor *after* updating the firmware.

Upgrade the firmware in the FlowShark Triton flow monitor memory in the following way:

1.   Select the monitor location for which you want to upgrade the firmware, and select **Tools > Diagnostics** from the main menu or click on the **Diagnostics** toolbar button.

Diagnostics toolbar button

*The **Monitor Diagnostics** dialog displays.*

2.   Select the **Connect** button to establish communication with the monitor.

Profile initiates communication with the monitor and establishes a connection.

3.   Select **Update Firmware** from the **Functions** drop-down list, and then select the **Perform** button.
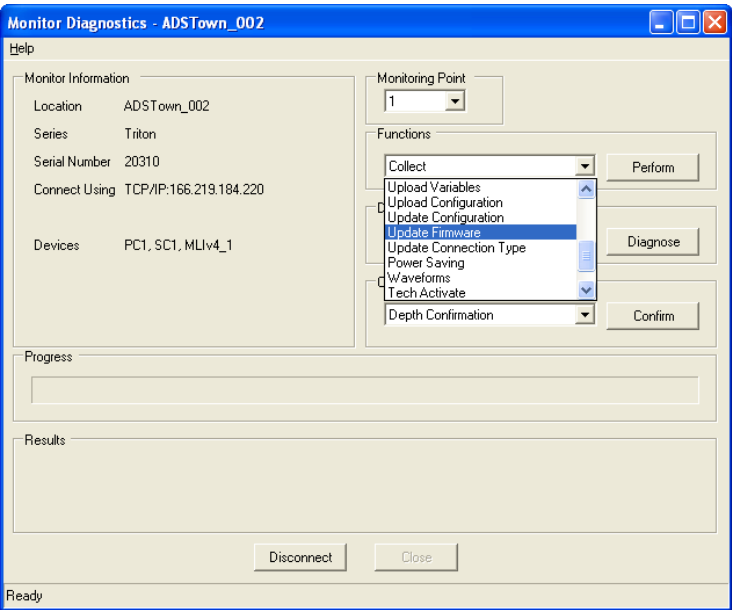
Selecting the **Update Firmware** option from the **Functions** drop-down list on the **Monitor Diagnostics** dialog

*The **Form Firmware Download** dialog displays.*
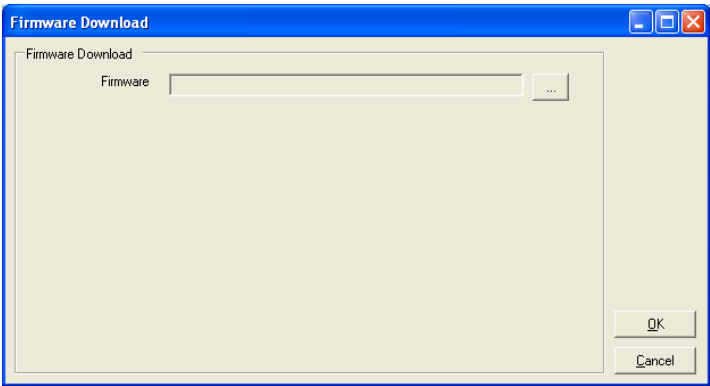
Download Firmware dialog

4. Select the **Browse** button corresponding to the **Firmware** field to locate and designate the file applicable to the firmware download. This program file represents the firmware containing the updated code for data processing activities.

5. Select the **OK** button.

    Profile downloads the new firmware to the monitor.

6. Disconnect from the monitor using **Profile**. If you are connected to the monitor through a direct (serial) connect cable, disconnect the cable from the monitor *after* disconnecting through **Profile**. Then, reconnect the cable to the monitor.

    The firmware is written to the monitor after the connection terminates.

7. Wait a few minutes.

8. Select **Connect** on the **Monitor Diagnostics** dialog

9. Select **Activate** from the **Functions** drop-down list, and then select the **Perform** button.

    Profile activates the monitor with the updated firmware.

Viewing Diagnostic and Data Logs

Profile generates detailed logs for many activities performed through **Diagnostics**, such as monitor activation, data collection, and firmware downloading. These logs are available immediately following the activity and for future access to historical information.

1.   Select the monitor location for which you want to view a diagnsotic or data log from the **Profile** main screen, and then click on the **Diagnostics** toolbar button.

Diagnostics toolbar button

*The **Monitor Diagnostics** dialog displays.*

2.   Select the monitoring point for which you want to view a log from the **Monitoring Point** drop-down list.

3.   Select **Logs** from the **Functions** drop-down list.
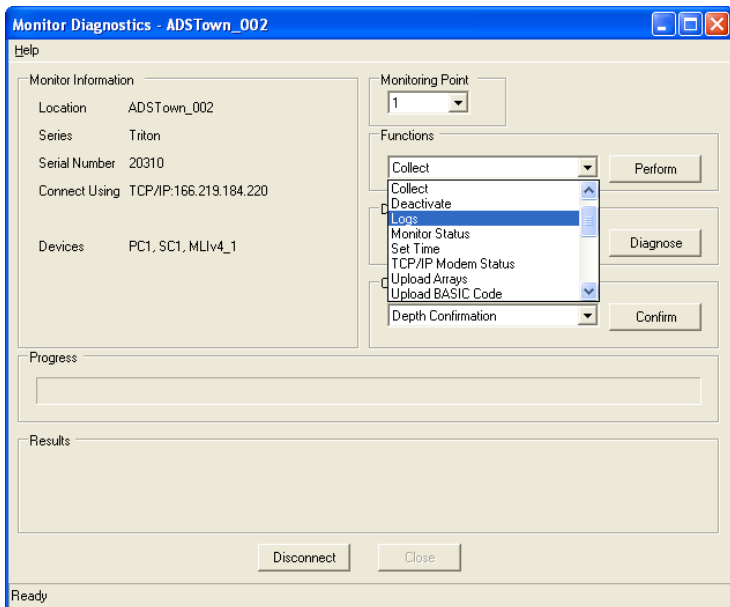
Selecting the **Logs** option from the **Functions** drop-down list on the
Monitor Diagnostics dialog

4.   Click on the **Perform** button.

The View Logs dialog displays.
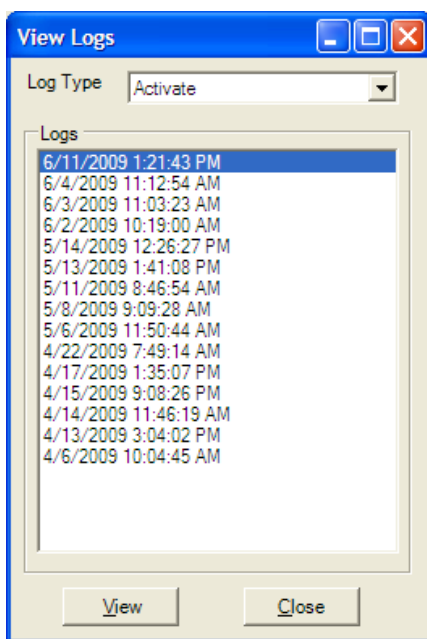
View Logs dialog

5. Select the type of log you want to view from the **Log Type**
    drop-down list.

    *The **Logs** section displays all logs available for the selected
    location and log type.*

6. Select the specific log you want to view, and select the **View
    button**.

    *The **View Logs** dialog displays the logs available for viewing
    corresponding to the selected log type.*

7. (*optional*) Select the **Print** button to print the log file contents.

CHAPTER 7

Monitor Installation

After installing the sensors and establishing communications, install the ADS® FlowShark® Triton monitor in the manhole. The monitor mounts inside the manhole by an aluminum mounting bracket attached to the monitor and bolted to the manhole wall or rim *or* by a hook connected to the monitor that attaches to a rung. The following procedures for monitor installation apply to most sites. However, because manholes differ in many ways, some sites may require the installer to implement slight modifications to the standard installation technique.

> **Note:** When ordering a monitor, please also indicate the mounting option to ensure you receive the appropriate installation hardware: *wall/rim* mount (ADS p/n I40-0009) or *rung* mount (ADS p/n 8000-0021).

Before installing the monitor at the site, activate the monitor to verify that the monitor is configured correctly for the application and that the battery pack is operating at an adequate voltage. Make any necessary changes to the configuration *before* mounting the unit. Refer to *Chapter 8*, *Maintenance and Troubleshooting*, for information on replacing the battery pack, when necessary.

> **Note:** Manhole and sewer system work involves confined space entry and is inherently dangerous. Therefore, installers and technicians must comply with all federal, state, and municipal regulations concerning confined space entry. ADS is not responsible for any injuries, damages,

claims, or liability resulting directly or indirectly from the use of this installation guide or the installation of any ADS equipment.

Mounting the Monitor on Manhole Rung

The simplest way to mount a monitor in a manhole is to attach it to a rung. FlowShark Triton monitors come with a standard hook (ADS p/n 800-0021) for this purpose.

● Make sure the rungs are capable of holding the weight of the monitor and cables. The monitor weighs 30.3 pounds (13.7 kg) with added weight coming from the cables.

● The hook must be closed to prevent accidental dislodging from its support rung. The hook has two pieces, a curved portion that goes over the rung and a straight portion which closes the hook underneath the rung. The hook must be closed and the clamping bolt/nut tight enough to ensure that the straight closure remains in position.
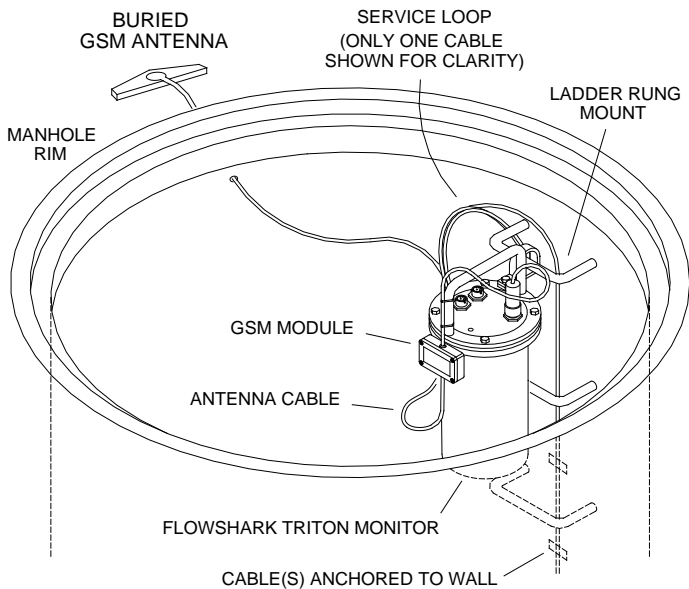
FlowShark Triton monitor secured to a manhole rung

Mounting the Monitor to the Manhole Wall

If the project will involve measuring flow over a long period of time, consider mounting the monitor permanently to the manhole wall. Using a monitor mounting bracket/flange (ADS p/n I40-0009), you can hang the monitor more securely and out of the way to allow use of the rungs.

Mount the monitor handle to the manhole wall as follows:

1. Determine the appropriate location to mount the monitor handle to the manhole wall. Consider the following when selecting the proper location:

   ❑ Select a location that will allow you to remove the monitor easily during service visits using the mounting bracket (extension handle).

   ❑ Select a location that provides only a minimal potential for the monitor to experience surcharge conditions.

   ❑ Select a location that will prevent the manhole lid from potentially damaging the monitor during removal or when rotating in the opening.

   ❑ Select a location that will allow personnel to enter/exit the manhole without removing monitor.

2. Hold the top end of the mounting bracket against the manhole wall, and mark the location for the mounting hole through the keyhole in the bracket.

3. Drill a hole approximately 3 inches (75 mm) deep at the mark, and install a 3/8-inch x 3-inch. (10-mm x 75-mm) anchor bolt in the hole.

   Note: Make sure all anchor bolts, studs, nuts, and washers used in mounting the monitor are stainless steel.

4. Twist a nut onto the anchor bolt, but do not tighten it down.
    Leave enough space between the nut and the wall for the
    thickness of the mounting bracket.

5. Mount the bottom of the bracket onto the monitor mounting
    flange with two M8 x 30-mm stainless steel bolts, two M8
    stainless steel lock washers, and two M8 stainless steel flat
    washers (supplied with the FlowShark Triton when shipped).
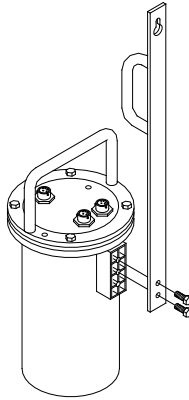
Bolting the mounting bracket to the flange welded to the monitor

6. Carefully lower the monitor into the manhole, and place the
    keyhole of the mounting bracket over the anchor bolt.

    Note: ADS strongly recommends attaching a security line
    to the monitor before lowering it into the manhole to
    prevent the monitor from accidentally dropping down the
    manhole during installation.

7. Tighten and secure the bolt against the mounting bracket.
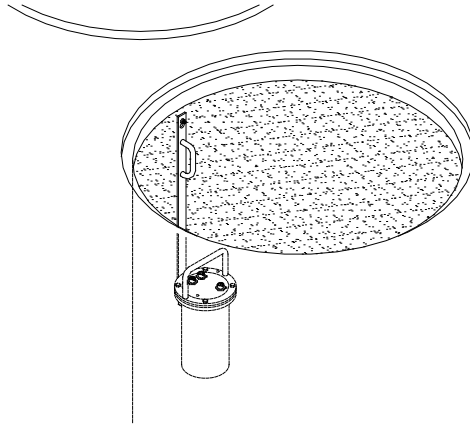
Monitor installed in the manhole

8. Neatly coil and secure the excess sensor and communication cables in the manhole to simplify future monitor service activities. Secure the cables to plastic anchors or ¼-inch x 2¼-inch (M6 x 55-mm) anchor bolts using 14-inch.(5-mm x 300-mm) cable ties.

    Note: Be careful to avoid damaging the sensor cables during installation activities. Even small pinholes in the cable can cause a sensor to malfunction or fail.

Mounting the Monitor to the Manhole Rim

Mounting a monitor to the manhole rim has certain advantages. Removing and reinstalling are easier. The rim may be more structurally sound than deteriorated rungs. However, the manhole lid must clear the mounting hardware while it is removed or replaced.

 Mount the monitor bracket/flange (ADS p/n I40-0009) to the manhole rim in the following way:

1. Determine the appropriate location to mount the monitor handle to the inside of the iron manhole rim. Consider the following when selecting the proper location:

   ❑ Select a location that will allow you to remove the monitor easily during service visits using the mounting bracket (extension handle).

   ❑ Select a location that provides only a minimal potential for the monitor to experience surcharge conditions.

   ❑ Select a location that will prevent the manhole lid from potentially damaging the monitor during removal or when rotating in the opening.

   ❑ Select a location that will allow personnel to enter/exit the manhole without removing monitor.

2. Hold the keyhole at the top end of the bracket against the lower inner rim of the manhole, and mark the location for the stainless steal stud through the keyhole in the bracket. Make sure there will be enough room to lift the bracket up and over the stud when installed.

3. Drill a hole(s) into the manhole rim 1 inch (2.5 cm) deep using a carbide-tipped 5/16-inch drill bit or one that matches the size of the anchor bolt to be inserted.

Note: Consider starting the hole using smaller bits to make pilot holes and increasing up to a the final size bit. In addition, spray cutting oil or another lubricant into the hole while drilling and tapping.

Drilling the hole in the manhole rim

4. Use a 3/8-inch x 16 threads-per-inch (10-mm) tap that matches the stud thread to cut threads in the hole. Twist the tap clockwise ¾ turn, and then back out ½ turn before continuing deeper.
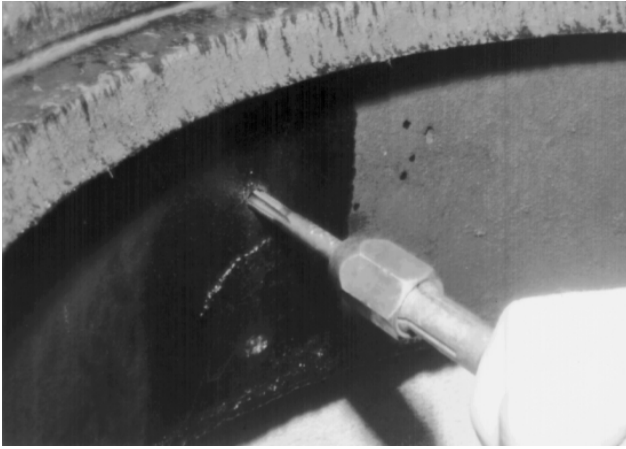
Using the tap to thread the hole

5. Chase the threading action at intervals to clear the metal debris by backing the tap almost completely out of the hole and then screwing it back into the hole. Lubricate the hole between threading.

6. Place two 3/8 – 16 hex nuts (with a 3/8-inch washer in between) onto one end of a 3/8-inch x 2-inch stud.
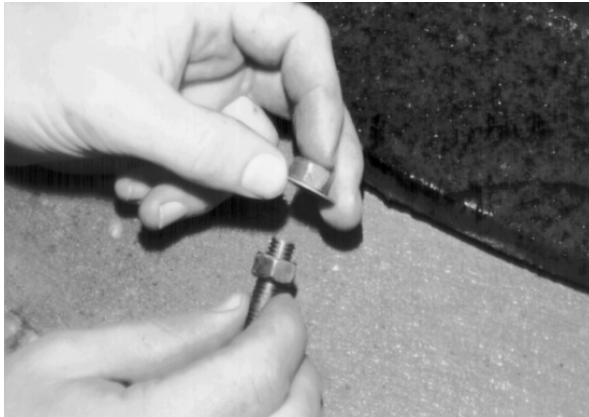
Placing two nuts and a washer onto the stud

7. Using two wrenches, turn the inner nut counter-clockwise and the outer nut clockwise simultaneously to bind the two nuts together on the stud.

Binding the nuts together with the washer in between

8. Install the stud into the tapped hole using the outer nut to engage the wrench. Continue turning the nut clockwise until the stud is seated at least ¾ inch (20 mm) deep in the hole.
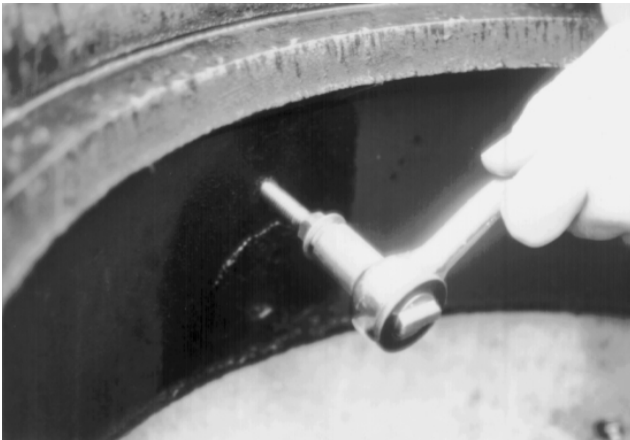
Installing the stud into the hole in the manhole rim

9. Separate the nuts, and turn the inner nut until it is flush against the rim.

10. Slide the washer against the inner nut, and turn the outer nut toward the edge of the stud.

Positioning the nuts on the stud to receive the mounting bracket

11. Mount the bottom of the mounting bracket onto the monitor flange with with two M8 x 35-mm stainless steel bolts, two M8 stainless steel lock washers, and two M8 stainless steel flat washers.

12. It may be necessary to drill new holes in the flange.

13. Carefully lower the monitor into the manhole, and place the keyhole in the bracket over the outer nut on the stud.

> **Note:** ADS strongly recommends attaching a security line to the monitor before lowering it into the manhole to prevent the monitor from accidentally dropping down the manhole during installation.

14. Slide the bracket against the inner nut and washer, and tighten and secure the outer nut against the bracket.

15. Neatly coil and secure the excess sensor and communication cables in the manhole to simplify future monitor service activities. Secure the cables to plastic anchors or ¼-inch x 2¼-inch (M6 x 55-mm) anchor bolts using 14-inch (300-mm) cable ties.

Note: Be careful to avoid damaging the sensor cables during installation activities. Even small pinholes in the cable can cause a sensor to malfunction or fail.

C H A P T E R 8

Maintenance and

Troubleshooting

While the ADS® FlowShark® Triton flow monitor and sensors are designed for dependability and durability, all electronic devices are vulnerable to wear, malfunction, or failure, particularly in a harsh sewer environment. However, many system problems can be avoided altogether by performing routine maintenance and inspections. The design of the monitor enables the user to perform general diagnostics and troubleshooting to prevent, isolate, and correct many problems easily. These serve to minimize unnecessary monitor downtime and data loss.

This chapter provides routine maintenance instructions as well as general diagnostic and troubleshooting guidelines for isolating and correcting monitoring system problems.

> **Note:** Remove the monitor from the manhole before replacing the battery packs or performing service activities that may involve disconnecting cables from the monitor.

Maintaining the System Components

The FlowShark Triton flow monitor and sensors should receive routine on-site inspections and remote confidence checks to maintain the equipment in optimal working condition, minimize monitor downtime, and prevent possible data loss.

ADS recommends performing these inspections following initial system installation, during site visits, and on a scheduled interval (i.e., quarterly or during battery pack replacement).

> **Note:** The only service or maintenance activities ADS permits within the monitor chassis are battery pack and fuse replacement. Therefore, do not handle, alter, modify, remove, or replace any other components inside the monitor. Such actions will void the monitor warranty agreement and the IS certification.

> **Note:** ADS also allows you to replace the quad-band GSM/GPRS wireless modem and modem SIM card in both the GSM Module and the EMU. The SIM card also may be replaced in the EMUX.

Gathering Replacement Parts and Supplies

Gather the following replacement parts and supplies for performing routine maintenance:

- Dryer tube for sensors with pressure depth capability
- Battery pack for FlowShark Triton monitor
- Spare combo sensors as required
- Soft bristle brush
- Paper towels

- Compressed air

- Flat head screwdriver and assorted wrenches

- Magnet (*for troubleshooting wireless communications*)

Inspecting the Monitor

Perform the following inspections during site visits or from a
remote location (when applicable):

- Inspect the monitor mounting bracket to verify that the bracket
  and bolts are free of heavy corrosion and the bolts are tightened
  and secure.

- Verify that the four bolts holding the monitor together are snug,
  and tighten any loose bolts.

- Verify that the monitor is mounted securely in the manhole.

- Inspect the monitor for general integrity. Verify that nothing
  more than surface corrosion is present and that the monitor has
  no obvious mechanical defects. Replace the monitor if
  necessary.

- Perform monitor data confirmations. These can occur from a
  remote location where wireless communication is available.

- Review the applicable logs in **Profile**® or **Q***start*™ to verify the
  status of the monitor clock, communications, firmware, battery
  pack, and temperatures.

- Clean the monitor and sensors regularly with a soft bristle
  brush and paper towels. *However, do not use detergent!*

- Make sure all connector ports on the monitor top are dry. Use
  compressed air or paper towels to dry out wet or damp
  connectors. Note and replace missing interfacial seals in the
  sensor connector ends. As a temporary measure, the
  connectors can be protected against moisture by wrapping with
  self-vulcanizing rubber stretch tape.

Confirming the Monitor

Confirm the accuracy of the sensor subsystems in the monitor on a regular basis through **Profile** or **Q***start*. Confirmation involves comparing manually-measured depth of flow and velocity readings to the monitor's readings. This process also verifies sensor parameters. Refer to the *Profile User's Guide* #950015 (version B4 or higher) or the **Profile** or **Q***start* online help for detailed information on performing confirmation procedures.

Obtaining Diagnostic Codes from the Monitor

The FlowShark Triton enables you to observe monitor activity, view diagnostic information, and confirm test cryouts from the monitor through a small LED window on the GSM module for those monitors using this wireless communication option. The numbers/characters displayed represent specific codes indicating current processes, identification, status, or readings associated with the system and communications. The following sections contain general descriptions and interpretations of the information available through the LED and instructions for accessing information or prompting a message.

LED window in GSM Module

Note: ADS does not offer an EMU that includes an LED window for display. Therefore, externally-powered FlowShark Tritons that perform wireless communication

through EMUs do not support this diagnostic functionality. However, ADS does provide an LED window on the EMUX for monitoring activities occurring through the ports on the EMUX, such as communications and data transfer. Refer to *Appendix D*, *Modbus/EMUX Configuration and Diagnostics*, for more information.

Viewing Monitor Activity Codes

Monitor activities, such as reading sensors or transmitting/receiving messages, display on the LED automatically in the form of individual characters. Each character represents a specific activity. *Appendix C* provides a list of these characters and the activities to which they correspond. The presence of a flashing light at the lower right corner of the LED indicates whether the monitor is involved in active communication. During active communication, this light flashes slowly (approximately once every 1.5 seconds). When the monitor is *not* engaged in active communication, the light neither illuminates nor flashes.

Activating and Reading the Diagnostic Codes

The diagnostic information available through the LED corresponds to power and wireless communication, such as signal strength, battery voltage, and IP address. These codes are particularly useful during site investigation and system installation to ensure an adequate and consistent signal strength, test communications, and verify the monitor IP address.

Accessing and activating the diagnostic codes require you to prompt the GSM module with a small magnet (ADS p/n 8000-0140). Activate the diagnostic code sequence by holding the magnet against the GSM module just to the left of the antenna jack (with LEDs properly oriented) for 1 to 2 seconds and then removing the magnet from the module. The sequence cannot begin until the magnet is removed.

Proper location for magnet on GSM Module

Note: The GSM module will not initiate the diagnostic code sequence while codes representing monitor activity are displaying in the window. Therefore, always verify that the LED window is blank before attempting to activate the code sequence. In addition, make sure the LED window is in clear view before initiating the code sequence.

Codes active after removing magnetic from contact with GSM Module

Upon activation, interpret the diagnostic codes in succession in the following way.

> **Note:** The LED window displays only one number/ character at a time.

- **Ads** indicates code initiation

- **cccc** is followed by the wireless provider's number

- **bbbb** is followed by the battery voltage to two decimal places

- **rrrr** is followed by the wireless communication raw signal strength, then **db**, followed by the signal strength in decibels (*ranging from -51 to -112 dBs; 99 indicates that no signal is available*)

- **nnnn** is followed by the monitor's network IP address

- **PPPP** is followed by the package type (*a package type of at least 48 will support data delivery (i.e., push data)*)

Testing the Monitor Cryout Capability

You can test the monitor's ability to perform a cryout, representing a system event or alarm, to an ADS **IntelliServe®** system (*when*

applicable) by holding the magnet against the GSM module just to the left of the antenna jack (with LEDs properly oriented and antenna connection facing downward) for 5 seconds and then releasing the magnet from the module. The sequence **Cryout** indicates initiation of the cryout test message to **IntelliServe**.

Checking the Monitor Battery Voltage

Check the battery voltage using **Profile** or **Q***start* before installing the monitor and after collecting data. The projected life for the internal monitor battery pack is 15 months at a 15-minute sample rate for the 12-volt battery pack. Actual battery life will vary based on the number of sensors and active functions providing data. However, replace the battery pack as soon as possible whenever the internal voltage for the 12-volt pack is 7.5 volts or less, or if **Profile** or **Q***start* provides a *Low* battery status. Although the monitor may function adequately at 7.5 volts, communications with the monitor will quickly begin to degrade and become inconsistent once the battery voltage drops below 7.2 volts.

Check the current battery voltage in the monitor using the **Diagnostics** tool in **Profile** in the following way:

> **Note:** Consult the **Q***start* online help for instructions on checking the battery voltage in the monitor using **Q***start*.

1.   From the **Profile** software main screen, select the location and monitoring point and then select the **Diagnostics** toolbar button (or select **Tools > Diagnostics** from the main menu).

2.   On the **Diagnostics** dialog, select the **Connect** button to establish communication with the monitor.

3.   Review the **Monitor Status** that displays once communication has been established. Replace the internal battery when the Monitor Status indicates that the internal voltage is *Low*.

   *The **Print Preview** dialog displays the current system information, including the monitor battery voltage, in printable format. Select the **Print** button to print the report contents, if desired.*

Print preview window showing:

Initialization Info: HSV1T

Current Host Time: 4/6/2010 1:49:23 PM
Current Monitor Time: 4/6/2010 1:49:10 PM
Oldest Entry Time: 3/6/2010 7:55:00 PM
Newest Entry Time: 4/6/2010 1:45:00 PM
Data Storage Interval: 300
Monitor Temperature : 67.29 F
Local Communications Status: OK
Firmware Version: V4.61
Model Number: X800
BASIC Code Program Status: OK
BASIC Code Fault: OK
Events Pending Status: None
Abnormal Resets: 0
Battery Voltage: 7.29

Monitor Status report with internal battery pack voltage

Replacing the Monitor Battery Pack

Note: The only service or maintenance activities ADS permits within the monitor chassis are battery pack and fuse replacement. Therefore, do not handle, alter, modify, remove, or replace any other components inside the monitor. Such actions will void the monitor warranty agreement and the IS certification.

Warning: The FlowShark Triton can receive internal power only from the ADS 12-volt IS battery pack (p/n 8000-0043). Do not use any other battery or power source to power the FlowShark Triton internally. ADS does offer an option to power the FlowShark Triton from an external source when used in conjunction with an EMU or EMUX.

ADS currently offers two versions of the 12-volt battery pack for replacing the existing battery pack in the FlowShark Triton, when necessary. However, based on the date on which the monitor and/or battery pack was manufactured, the monitor may contain an earlier version of the 12-volt battery pack that is no longer available. The following table describes the specific battery pack with which to replace the existing battery pack, when the battery voltage is low or falls below the previously specified level.

Part Number for the *Current* Battery Pack	Part Number for the *Replacement* Battery Pack
8000-0043 (potted with PCB)	8000-0043-01 (unpotted with PCB)
8000-0043-01 (unpotted with PCB)	8000-0043-02 (unpotted without PCB)
8000-0043-02 (unpotted without PCB)	8000-0043-02 (unpotted without PCB)

Replacing the 12-volt battery pack involves a relatively simple process. However, this process may include an additional step or part based on the specific type of 12-volt battery pack that requires replacement. Replacing the battery pack in a monitor containing the factory-installed, potted, 12-volt battery pack (ADS p/n 8000-0043) requires a special retainer plug (ADS p/n 8000-0141). The plug provides proper seating and stabilization once the monitor is reassembled following battery pack replacement.

Replacing the battery pack in a monitor containing an unpotted, 12-volt battery pack with a PCB (ADS p/n 8000-0043-01) requires removal of the PCB for reuse with the replacement battery pack (ADS p/n 8000-0043-02).

12-volt battery packs (left – potted; right – unpotted)

Replace the internal battery in the FlowShark Triton monitor in the following way:

1. Collect the data from the monitor (remotely or on-site). This will reduce the risk of data loss once the battery is disconnected.

2. (*applicable only when using a GSM Module*) Remove the monitor from the manhole, and disconnect the communication cable (*running from the GSM module*) from the **COMM** port on the monitor.

3. Move the monitor from the hazardous area (i.e., at least 20 feet (6.1 m) away from the manhole).

4. Remove the 4 bolts securing the top to the canister using a 13-mm nut driver.

5. Wipe away any debris or moisture that could enter the chassis once the unit is opened.

6. Remove the top (with the attached power regulator dome) by pulling it straight up from the canister. The battery rests at the bottom of the canister, and an 18-inch long cable extends from the battery pack to the top.

Viewing 12-volt battery pack in monitor canister from top

7. Place the top next to the canister, and then disconnect the battery cable from the dome cable and set the top/power regulator dome assembly aside.

> **Note:** Keep the underside of the top, the regulator dome, and the top gasket free of dirt, mud, and other debris. Debris and dirt can compromise the seal of the monitor once it is reassembled.

Placing the top next to the monitor (left) and disconnecting the battery pack from the top (right)

8. (*applies only to 12-volt potted battery packs*) Remove the foam spacer disc seated on top of the battery.

9. Pull out the battery pack from the canister using the white handle attached to the top of the pack.

10. (*applies only to 12-volt unpotted battery packs*) Lift off the retainer plug from the top of the battery pack, and disconnect the PCB from the battery pack in the following way:

12-volt battery pack with retainer plug

❑ Carefully slide the thick red band securing the PCB to the side of the battery pack off of the PCB.

❑ Carefully disconnect the PCB from the battery pack at the white plastic connector.
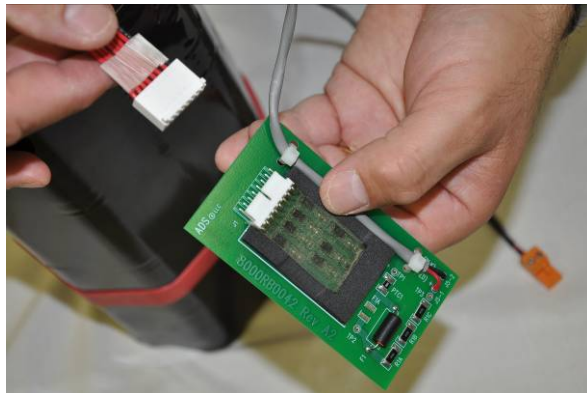
Disconnecting the PCB from the battery pack

❑ Set the PCB temporarily aside in a clean, dry location. *Do not discard! This PCB will be used with the replacement battery pack.*

11. Connect the PCB to the replacement battery pack and then secure the PCB to the side of the pack with the red band.

12. Run the loose cable from the battery pack through the hole in the underside of the retainer plug, and then seat the retainer plug on top of the battery pack. Be sure to pull through the excess cable before fully seating the plug.

13. Lower the battery pack into the monitor canister, and then connect the cable from the battery pack to the monitor top/dome assembly.

14. Coil the excess cabling around the inner wall of the canister, and carefully lower the top/dome assembly back onto the canister. Keeping the proper orientation between the canister and the top is critical to maintaining the watertight and airtight seal on the monitor. Once the top has been torqued down after manufacture, the sealing gasket develops a *memory* profile of the canister lip. Reassembling the two pieces in the same orientation as before helps the gasket mate correctly with the canister lip.

    Note: Be careful to avoid pinching the battery cable between the canister sealing lip and the gasket on the monitor top during reassembly. The cable also can get trapped between the two parts while tightening the bolts on the monitor top, preventing an effective air/watertight seal and potentially damaging the battery cable.

When assembling end—cap to canister,
always align COMM connector
with backside of canister
and molded mounting/handle boss.

Returning the monitor top to the proper orientation with the canister

15. (*applicable only when using a GSM Module*) Reconnect the communication cable from the GSM Module to the **COMM** port on the monitor.

   Note: Do not reconnect the communication cable to the monitor *while the monitor is taking a reading*. This could damage the monitor.

16. Establish communication with the monitor remotely or on site using the IS PC Communication cable (ADS p/n 8000-0054) to verify communication and check the new battery voltage. The internal voltage should now be well above 7.5 volts. Refer to *Connecting Directly to the Monitor* in the *Chapter 4*, *Communication*, for instructions on attaching the IS PC Communication cable to the monitor and laptop computer.

17. Finger-tighten the top bolts to make sure the top and gasket are seated properly. Then, tighten the bolts about halfway to full torque value by tightening the opposite bolts. Finally, tighten

the bolts to approximately ***30 inch-pounds*** (*2.50 foot-pounds/ 3.39 Nm*) to fully secure the top to the canister. If the monitor will not seal, loosen the bolts and check for a trapped wire or debris on either the gasket or the lip. You can increase the torque value on the bolts *incrementally* to assist in sealing. However, tighten the bolts evenly to prevent distorting the gasket and *do not exceed 45-inch pounds (5.0843Nm).*

18. (*applicable only when using a GSM Module*) Wrap rubber stretch tape around the entire communication cable/COMM port connection, extending 1 to 2 inches onto the cable beyond the connection.

COMMUNICATION CABLE

COAXIAL STRETCH TAPE

COMM PORT

FLOWSHARK TRITON MONITOR
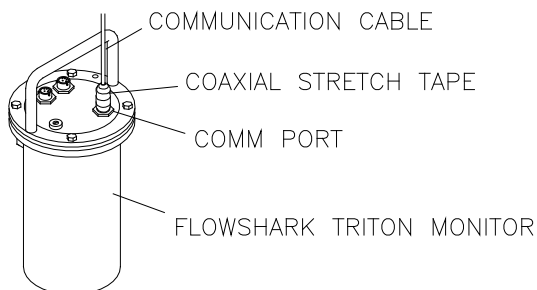
Communication cable from GSM Module connected to **COMM** port on monitor with stretch tape properly applied

Inspecting, Cleaning, and Handling the Sensors

Perform the following sensor inspections during regular site visits:

● Verify that the installation ring or bands are secure and clear of debris.

● Clean the face of the Surface Combo Sensor/Ultrasonic Depth Sensor gently with a soft brush, and wipe the sensor with a clean, moist cloth.

> **Note:** The crystals on the new Surface Combo Sensor (available late 2012) are covered with a Teflon® coating. Therefore, do not use a wire brush or other abrasive, metallic device to clean these sensors.

● Verify that the face of the Surface Combo Sensor/Ultrasonic Depth Sensor is horizontally level with the flow. If necessary, reposition the sensor according to the procedures in *Chapter 3*, *Sensor Installation and Connection*.

● Scrub the faces of the Peak Combo Sensor/Slimline Peak Combo Sensor with a soft bristle brush.

● Confirm that all sensor cables are neatly arranged, securely fastened, and free of debris, cuts, kinks, and breaks that may affect performance. Replace any sensor that has a damaged cable.

When handling, storing, or packing the Surface Combo Sensor, avoid contacting the metal cable connector with the crystals on the sensor. This could damage the Teflon coating covering the crystals.

Replacing the Pressure Depth Sensor Dryer Tube or Desiccant

All combo sensors with a pressure depth sensor and the ultrasonic depth sensor with the pressure option include a pressure depth sensor dryer tube. This tube contains desiccant that absorbs the moisture from the air traveling through the dryer tube into the clear plastic tubing leading to the pressure depth sensor in the pipe. Replace the dryer tube or the desiccant contained within the dryer tube on a regular basis or as necessary. Desiccant can absorb moisture only when it is blue in color. Pink desiccant indicates that it can no longer absorb moisture. Therefore, if the desiccant appears either colorless or pink upon inspection, replace the dryer tube or desiccant immediately.

Replacing the Dryer Tube

Replace the pressure depth sensor dryer tube (ADS p/n 3704-0032) in the following way:

1. Clip the cable ties securing the dryer tube to the monitor.

2. Cut the clear flexible tubing running from the dryer tube to the pressure depth sensor connector at a location close to the brass barbed fitting on the dryer tube.

3. Set aside, but do not discard, the old dryer tube with the used desiccant.

4. Attach a new dryer tube to the pressure depth sensor by inserting the brass barbed fitting into the open end of the plastic tubing running from the sensor connector. Make sure the tubing seats firmly against the fitting to prevent air or moisture transfer.

Inserting the brass barbed fitting into the tube
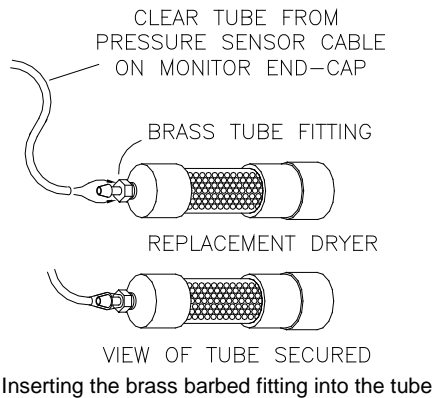
5. Secure the new dryer tube to the monitor.

6. Remove the black end-cap from the dryer tube before re-installing the monitor in the manhole.

    Caution: If the cap is not removed, air will not be able to enter the dryer tube, adversely affecting the pressure depth sensor.

7.   Use the diagnostics function in the **Profile** or **Q***start* software to fire the sensor and check that the sensor is working correctly.

Replacing the Desiccant

When replacing the desiccant inside the pressure depth sensor dryer tube, use indicating beads that are approximately 0.16 inches (4.1 mm) in diameter. Smaller beads may be able to escape the dryer tube, enter the clear plastic tubing leading to the sensor connector. The desiccant beads of the appropriate size for this dryer tube are available through ADS (p/n 901-11055-00).

Replace the desiccant in the following way:

1.   Clip the cable ties securing the dryer tube to the monitor, when applicable.

2.   Use a 5/8-inch nut driver to remove the inset nut at the free end of the dryer tube (end of the tube opposite the brass barbed fitting). *Do not use pliers to remove this nut from the tube!*
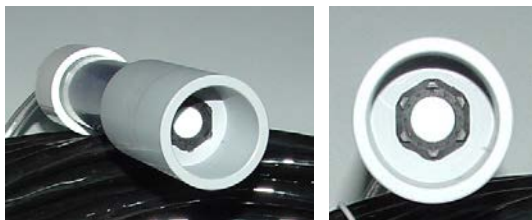
Free end of dryer tube with inset nut

Warning: Do not attempt to access the desiccant in the dryer tube through the end of the tube with the brass fitting! This fitting is not designed for removal. Removing the fitting will damage the dryer tube and break the moisture seal on that end of the tube.

3.   Use needle-nose pliers to gently remove the black foam packing material just inside the opening.

4.   Pour out the old desiccant beads from the dryer tube.

5.   Refill an equivalent amount of new desiccant beads into the tube.

6. Carefully replace the foam packing into the dryer tube.

7. Replace and tighten the nut on the dryer tube.

8. Secure the dryer tube to the monitor using cable ties, when applicable.

9. Use the diagnostics function in the **Profile** or **Q***start* software to fire the sensor and check that the sensor is working correctly.

    Note: Some desiccant may be reused following a special process designed to remove the moisture from the beads. Please consult the desiccant manufacturer for instructions on performing this procedure, when applicable.

Replacing the SIM Card and Desiccant in the GSM Module

Battery-powered FlowShark Triton monitors handle communications through an ADS GSM Module (ADS p/n 8000-0052). This module contains a replaceable desiccant pack and SIM card.

The desiccant pack requires replacement when a pink color is visible through the center strip in the pack. The center strip in a new, fresh pack should be blue in color.

The SIM card typically requires replacement only upon failure, which is rare, or when a change in wireless carrier occurs.

Replace the SIM card (ADS p/n 507181) and/or desiccant (ADS p/n 507995) in the GSM module in the following way:

1. Disconnect the GSM module from the monitor. *Do not replace the SIM card or desiccant while the module is attached to the monitor or damage may occur to the monitor or the GSM Module!*

2. Detach the mounting plate to which the GSM module is secured from the manhole wall, and remove it from the manhole.

> **Note:** Locate the GSM module in a dry, non-hazardous area before opening the cover.

3. Remove the electrical tape sealing the seam between the cover and top of the GSM module enclosure.

4. Loosen the four plastic Phillips head screws from the clear top of the module, and then remove the top.

5. (*applicable only when replacing the desiccant*) Replace the desiccant in the following way:

   ❑ Remove the existing desiccant pack from the module and discard.

   ❑ Inspect the inside of the module for any moisture. If moisture is present, remove it with a clean, dry paper towel.

   ❑ Insert a new desiccant pack (ADS p/n 507995) into the module.
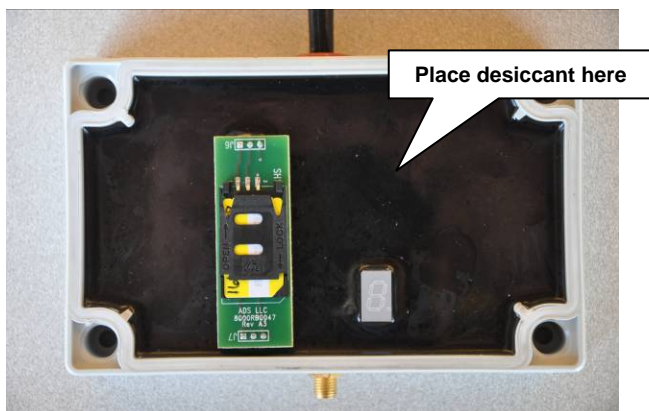
Inserting the desiccant into an open GSM module

6. (*applicable only when replacing the SIM card*) Replace the SIM card in the following way:

   ❑ Inspect the inside of the module for any moisture. If moisture is present, remove it with a clean, dry paper towel.

❏   Slide back the clip on the SIM card carrier to unlock the carrier.
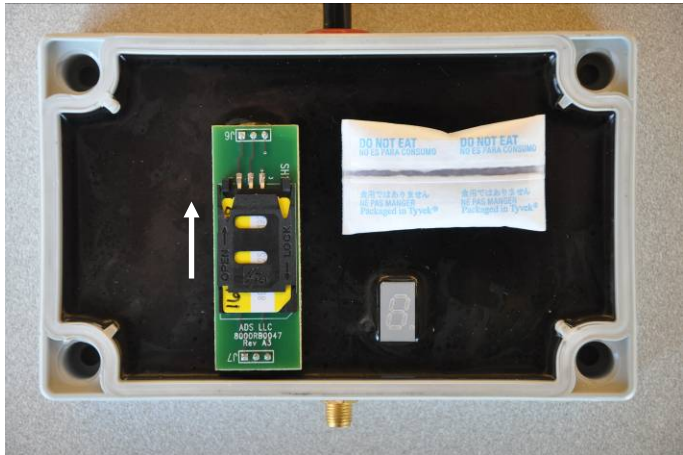
Sliding back the clip to unlock the carrier

❏   Swing up the hinged clip to the carrier and remove the SIM card from the slot.

Opening hinged clip and removing SIM card

❑ Record the number of the new SIM card (i.e., the IP address) on the site report. You will need this address to update the LIF in the **Profile** or **Q**start software. The IP address is printed directly on the SIM card or on a label affixed to the card.

❑ Gently insert the new card into the slot on the SIM card carrier in the GSM module. Orient the card so that the beveled corner of the card will align with the beveled corner of the carrier.

❑ Close the clip to the carrier, and slide the clip forward to lock the SIM card into place.

7. Check the gasket and all edges of the module enclosure seal to make sure they are free of any debris.

8. Replace the cover to the module, and then replace and tighten the screws until the edges of the box are flush together. *However, do not over-tighten the screws!*

9. (*applicable only when replacing the SIM card*) Temporarily re-connect the communication cable from the GSM module to the **COMM** port on the monitor. Then, activate the diagnostic codes to test communications and the module based on the instructions under *Obtaining Diagnostic Codes from the Monitor* on page 8-4. Once complete, disconnect the cable before installing the module back into the manhole.

10. Wrap electrical tape tightly over the seam (between the cover and the case) of the GSM module enclosure. This enhances the seal and simplifies the removal of debris the next time the module is opened.

11. Re-attach the GSM module to the manhole wall, and recoil and secure the antenna cable to the cable tie mount using a cable tie. Refer to *Installing the GSM Module* in *Chapter 4*, *Communication*, for more information.

12. Attach the communication cable connector from the GSM module to the **COMM** port on the monitor.

13. Wrap rubber stretch tape around the entire cable connection, extending the tape 1 to 2 inches onto the cable beyond the connection.

Replacing EMU Components

ADS allows you to replace the following components in EMUs supporting externally-powered FlowShark Tritons, when necessary:

- GSM/GPRS Modem

- SIM Card (ADS p/n 507181)

    Note: Do not open the Communication Interface/Barrier Box inside the EMU under any circumstances. In addition, do not attempt to perform any component-level repair.

Replacing the Modem in the EMU

Replace the quad-band GSM/GPRS modem (ADS p/n 507959) in the EMU in the following way:

1. Disconnect the external power supply running to the EMU.

2. Open the enclosure in which the EMU is installed.

3. Loosen the four plastic screws on the cover of the EMU, remove the cover, and then carefully set the cover aside to avoid damage and prevent dirt from contacting the cover gasket.

4. Disconnect the antenna cable from the modem by unscrewing the gold nut (at the connector end of the antenna cable) from the modem connector.
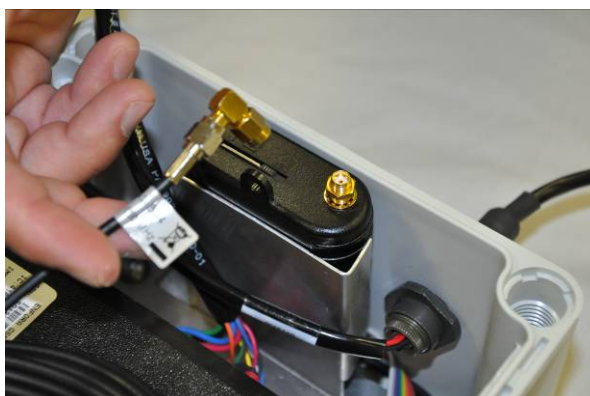
Disconnecting the antenna cable from the EMU modem

5. Carefully slide the modem all the way out of the bracket in which it is secured. It is secured only by friction. A power and communication cable are connected to the back of the modem, so slide it out slowly to avoid accidentally pulling the cables out of the modem prematurely.

Sliding the modem out of the bracket in the EMU

6. Disconnect the ribbon (communication) cable and the black (power) cable from the back of the modem.

Ribbon cable connected to modem

Disconnecting the ribbon and black cables from the back of the modem

7. Connect the ribbon and black power cables to the corresponding ports in the back of the new modem.

8. Carefully slide the modem back into the metal bracket in the EMU, avoiding pinching the cables between the modem and the back panel of the EMU.

9. Insert a new SIM card or the SIM card from the original modem into the slot on the new modem. Refer to the next section, *Replacing the SIM Card in the EMU Modem*, for instructions on removing an existing SIM card from a modem and inserting a SIM card into the modem.

10. Restore external power to the EMU.

11. Enter or confirm the correct IP address is in **Profile** or **Q***start* for the SIM card, and have a data analyst attempt to connect to the monitor remotely to verify communication.

12. Replace and secure the cover to the EMU, and close the enclosure in which it is installed.

Replacing the SIM Card in the EMU Modem

Replace the SIM card (ADS p/n 507181) in the modem housed within the EMU in the following way:

1. Disconnect the external power running to the EMU.

2. Open the enclosure in which the EMU is installed.

3. Loosen the four plastic screws on the cover of the EMU, remove the cover, and then carefully set the cover aside to avoid damage and prevent dirt from contacting the cover gasket.

4. Slide the lock on the front of the modem holding in the SIM card to the right.

Sliding the lock on the to the right

5. Gently press in on the SIM card to release it from the slot. It should slide out slightly from the slot.

6. Remove the SIM card from the modem.

7. Write down the IP address for the new SIM card.

8. Insert the new SIM card into the slot in the front of the modem.

Inserting the SIM card into the EMU modem

9. Slide the lock to the left to secure the SIM card.

10. Restore external power to the EMU.

11. Contact a data analyst to enter the IP address for the new SIM card in **Profile** or **Q***start*, and have the analyst attempt to connect to the monitor remotely to verify communication.

12. Replace and secure the cover to the EMU, and close the enclosure in which it is installed.

Replacing the SIM Card in the EMUX

ADS allows you to replace the SIM card (ADS p/n 507181) in the EMUX supporting the FlowShark Triton, when necessary, in the following way:

1. Disconnect the external power running to the EMUX.

2. Loosen and remove the two screws from the cover of the EMUX, and then remove the cover.

3. Carefully remove the SIM card from the clip holding the card on the board inside the EMUX.

4. Record the IP address for the new SIM card.

5. Slide the new SIM card into the clip until it is seated securely in place.

6. Restore external power to the EMUX.

7. Contact a data analyst to enter the IP address for the new SIM card in **Profile**, and have the analyst attempt to connect to the monitor remotely to verify communication.

8. Replace the cover onto the EMUX, and replace and tighten the screws.

Replacing the Regulator and Fuses in the Monitor

The FlowShark Triton monitor contains a removable power regulator secured to a special dome that resides inside the monitor enclosure and is attached to the monitor top. If a regulator failure occurs, it typically involves a bad fuse on the regulator board corresponding to communications or sensors. However, monitors with regulators manufactured *prior to 2012* do not possess replaceable fuses. Therefore, fuse failures that occur with these units require replacement of the whole regulator/dome assembly. *All monitors that require a new regulator must be returned to ADS for regulator/dome assembly replacement. Do not attempt to exchange a regulator in the field!*

Monitors with regulators manufactured *as of January 2012* contain replaceable fuses that attach to the regulator board on the inside of the dome. This new design allows for the replacement of individual fuses when failures occur, eliminating the need to send a monitor to ADS for an entire regulator/dome assembly exchange. Refer to the *Troubleshooting* section beginning on page 8-38 to identify whether a regulator or fuse may be the source of a particular problem that has arisen within the FlowShark Triton system.

> **Note:** Monitors manufactured as of 2012 contain regulators with replaceable fuses.

The following section includes detailed instructions on replacing fuses (*when applicable*) in FlowShark Triton monitors.

Replacing a Fuse in the Monitor

The regulator boards (*manufactured as of 2012*) in FlowShark Triton monitors have *three* fuses (ADS p/n 508071, 508072, and 508073) that may be replaced independently upon failure. Refer to the *Troubleshooting* section beginning on page 8-38 to identify whether a fuse may be the source of a particular problem that has occurred within the FlowShark Triton system and, if so, which fuse may require replacement.

The 5-volt *blue* fuse corresponds to the sensors and can be blown due to a shorted sensor. If this fuse is blown, the monitor cannot detect the sensors. The 3.3-volt *yellow* fuse is associated with the processor board. When blown, this fuse prevents the monitor from logging data and performing successful communications. The red (main input) fuse is related to the regulator board and rarely blows.

> **Note:** If the troubleshooting procedures indicate that a sensor may have shorted *or* a sensor may have shorted and the 5-volt (blue) fuse on the power regulator in the monitor corresponding to the sensor may have blown, *do not connect the potentially shorted sensor to another monitor* until confirming that the sensor is functional (i.e., not shorted) using a voltmeter. Please contact ADS Client Services for detailed instructions on determining whether a sensor has shorted. If the sensor is shorted, it also will blow the 5-volt fuse in the other monitor.

Since the fuses attach to the board on the inside of the power regulator dome inside the monitor, access to and replacement of a fuse first requires opening the monitor and removing the dome.

Replace a fuse(s) in the monitor in the following way:

1. Collect the data from the monitor (remotely or on-site) to limit the risk of losing data once the battery is disconnected.

2. Remove the monitor from the hazardous area (i.e., at least 20 feet (6.1 m) away from the manhole).

3. Remove the four bolts securing the monitor top to the canister using a 13-mm nut driver.

4. Wipe away any debris or moisture that could enter the chassis once the unit is opened.

5. Remove the top (with the attached power regulator dome) by pulling it straight up from the canister.

6. Place the top next to the canister upside down (with the dome facing upward), and then disconnect the battery cable from the dome cable.

> **Note:** Keep the underside of the top, the regulator dome, and the top gasket free of dirt, mud, and other debris. Debris and dirt can compromise the seal of the monitor once it is reassembled.

Placing the top next to the monitor (left) and disconnecting the battery pack from the top (right)

7. Remove the nut securing the dome to the monitor top using a ½-inch nut driver.
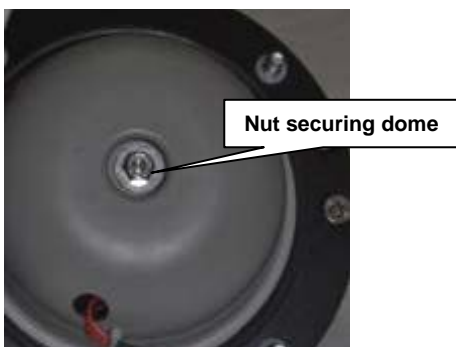
Removing nut securing regulator dome to monitor top

8. Carefully lift off the dome from the top. Notice the three fuses seated on the regulator board on the inside of the dome.
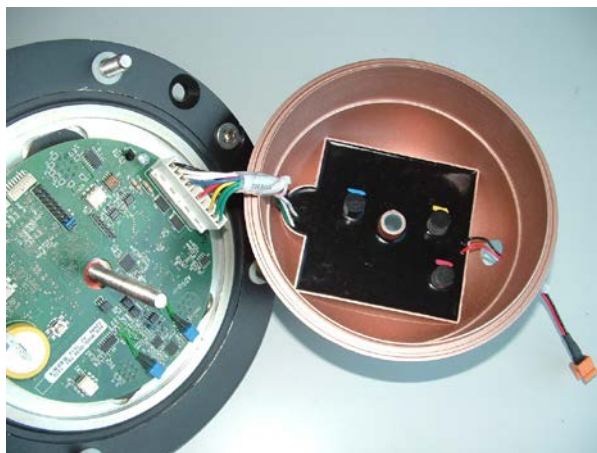
Underside of monitor top (left) and inside of regulator dome (right)

9. Remove the bad fuse(s) from the regulator board by gently, but firmly, pulling and lifting it straight up from the board. Notice that the label on each fuse displays a color bar (red, blue, or yellow) that corresponds to the color coding on the board adjacent to the fuse.

Close up of regulator board showing the three color-coded fuses

Blue fuse removed from the regulator board

10. Carefully insert the new, replacement fuse(s) into the corresponding holes in the dome without bending the fuse filaments. Verify that the color strip on the fuse matches the color on the regulator board adjacent to the holes. Make sure the fuse(s) is seated firmly and securely.

11. Realign and reseat the dome against the monitor top, and replace and tighten the nut securing the dome to the top.

12. Reconnect the battery cable to the cable exiting from the hole in the top/dome assembly.

13. Coil the excess cabling around the inner wall of the canister, and carefully lower the top/dome assembly back onto the canister. Keeping the proper orientation between the canister and the top is critical to maintaining the watertight and airtight seal on the monitor. Once the top has been torqued down after manufacture, the sealing gasket develops a memory profile of the canister lip. Reassembling the two pieces in the same orientation as before helps the gasket mate correctly with the canister lip.

Note: Be careful to avoid pinching the battery cable between the canister sealing lip and the gasket on the monitor top during reassembly. The cable also can get trapped between the two parts while tightening the bolts on the monitor top, preventing an effective air/watertight seal and potentially damaging the battery cable.

When assembling end—cap to canister,
always align COMM connector
with backside of canister
and molded mounting/handle boss.

Returning the monitor top to the proper orientation with the canister

14. Establish communication with the monitor remotely or on site using the IS PC Communication Cable (ADS p/n 8000-0054) to verify communication. Refer to *Connecting Directly to the Monitor* in *Chapter 4*, *Communication*, for instructions on attaching the IS PC Communication cable to the monitor and laptop computer.

15. Finger-tighten the top bolts to make sure the top and gasket are seated properly. Then, tighten the bolts about halfway to full torque value by tightening the opposite bolts. Finally, tighten the bolts to approximately ***30 inch-pounds*** (*2.50 foot-pounds/ 3.39 Nm*) to fully secure the top to the canister. If the monitor will not seal, loosen the bolts and check for a trapped wire or debris on either the gasket or the lip. You can increase the torque value on the bolts *incrementally* to assist in sealing. However, tighten the bolts evenly to prevent distorting the gasket and *do not exceed 45-inch pounds (5.0843Nm).*

Troubleshooting

The FlowShark Triton flow monitor contains several different components that perform many different functions. Since a malfunctioning component increases the risk of losing data, isolating the problem component is essential to performing troubleshooting activities efficiently. Minimizing monitor downtime is critical.

Consider the following when trying to isolate the component or subsystem exhibiting the problem:

● Problems affecting only one of the sensor subsystems are usually caused by one subsystem alone. The problem may exist in the monitor processor board, sensor (or other input device), or cabling.

● Problems affecting more than one subsystem usually can be traced to a problem with the processor board, power source, or communication lines. Problems in one subsystem can create problems in other subsystems when the power source or communication lines are faulty.

● Problems with communications, clock readings, time stamps, and data storage intervals usually arise from faulty processor board components, incorrect information entered on the user's PC, or low batteries.

● Failures occurring outside a connector (i.e., between a connector and the field input or output device) may arise from problems with the field unit or component cabling. Failures occurring on the *inside* (i.e., between a connector and the printed circuit board) may arise from problems with the processor board.

Note: If possible, collect all monitor data prior to swapping sensors or troubleshooting a monitor to prevent possible data loss. In addition, remove the monitor from the manhole before disconnecting cables from the monitor to avoid possible hazards.

Some problems that occur will not require a site visit, such as incorrect equipment identification numbers or other system parameters the user can re-enter on the local PC. However, some problems will require a site visit. When this is necessary, inform the data analyst any time a field crew is en route to a monitor site to troubleshoot problems so that the analyst can attempt to collect the monitor data before they arrive. If the problem is a faulty monitor and the analyst cannot collect the data remotely, replace the monitor and deliver the faulty monitor to the office so the analyst can attempt to collect the data directly. Then, send the monitor to ADS for repair.

This section provides general guidelines for troubleshooting and correcting problems with the FlowShark Triton monitor and sensor subsystems.

General Monitor Problems

The following tables contain general troubleshooting techniques for the FlowShark Triton flow monitor.

Problem	Time stamp on the collected data is incorrect.
Possible Causes	PC clock may have been set to incorrect time when the monitor was activated.
	Monitor time zone difference for the PC clock may not have been set correctly when the monitor was activated.
	Monitor clock may be faulty.
Possible Solutions	Verify the time on the PC clock and correct if necessary.
	Reactivate the monitor to enable the clock.
	Verify the time *zone* setting of the monitor. Correct and reactivate if necessary.
	Collect the data from the monitor and replace monitor if defective.

Problem	Time on the monitor clock is incorrect.
Possible Causes	Monitor clock may be a faulty. Monitor time zone difference for the PC clock may not have been set correctly when the monitor was activated.
Possible Solutions	Verify the time on the PC clock and correct if necessary. Reactivate the monitor to enable the clock. Verify the time *zone* setting of the monitor. Correct and reactivate if necessary. Collect the data from the monitor and replace monitor if defective.

Problem	You receive a **Device Time Out** message in **Profile** or **Q*start***.
Possible Cause	Communications may be marginal. GSM module may be defective.
Possible Solutions	Re-attempt communication with monitor. Verify signal strength. Check a **Profile** or **Q*start*** data collect log or check the TCP/IP Modem Status in **Diagnostics**. If the signal strength indicated is less than -95 (for example: -99), consider re-orienting the antenna and/or installing the antenna in a pedestal above ground. Test with a new GSM module. If communications improve, replace the original with the new module. Contact your regional ADS representative. Replace the monitor if defective.

Problem	Gap exists within the collected data.
Possible Causes	Monitor time may be incorrect.
	Monitor firmware file may be corrupt.
Possible Solutions	Check monitor time, and reset clock if necessary.
	Attempt to collect data within the gap.
	Contact your regional ADS representative.

Problem	Data is missing at the beginning or end of the date range following data collection.
Possible Causes	Monitor activation may have failed.
	Monitor time may be incorrect.
	Monitor's firmware file may be corrupt.
Possible Solutions	Verify whether the monitor has been activated, and activate if necessary.
	Check monitor time, and reset clock if necessary.
	Contact your regional ADS representative.

Problem	Monitor independently discontinues logging data.
Possible Causes	Battery pack may be dead or below minimum voltage requirement (7.5 volts - internal), or external power source may be down.
	3.3-volt fuse on regulator may have blown.
	Monitor memory may have been corrupted during firmware upgrade, causing the monitor to record data only during monitor communications.
Possible Solutions	Replace battery pack.
	Replace the 3.3-volt yellow fuse (*when replaceable*) on the regulator or return the monitor to ADS for power regulator replacement.
	If the monitor is logging data only during monitor communications following a firmware upgrade, contact your ADS regional representative to clear the monitor memory and reactivate the monitor.
	Contact your regional ADS representative.

Problem	An I/O error message displays when communicating with the monitor.
Possible Causes	Communication quality might be marginal.
	Antenna may be defective.
	Processor board may be faulty.
Possible Solutions	Re-attempt communication with the monitor.
	Temporarily attach new antenna, and permanently replace the existing antenna if the error message no longer occurs.
	Replace the monitor if defective.
	Contact your regional ADS representative.

Communication Problems

The following tables contain general troubleshooting techniques for wireless communications.

Problem	Monitor does not answer via wireless communication.
Possible Causes	Signal strength to the modem may be insufficient.
	Battery pack may be dead or below minimum voltage requirement (7.5 volts - internal), or external power source may be down.
	Wireless network failure.
	Monitor may have lost communication with network and cannot re-establish communication.
	Connection type may be incorrect in **Profile** or **Q**start.
	Antenna may be defective.
	Monitor may be defective.
	Modem may be defective.
	3.3-volt fuse on regulator may have blown.
	Leading zeros are included before or within the IP address.

Possible Solutions	Check the diagnostic codes on the GSM module (using magnet) while it is connected to the monitor to verify the IP address is available. If it does not display, disconnect the module from the monitor for at least 1 minute and then reattach the module. Once the LED is no longer illuminating, reactivate the diagnostic codes to verify whether the IP address is now available.
	Relocate the antenna (consider a pedestal mount)
	Replace the antenna.
	Replace the monitor battery pack (*when applicable*) if it is reading below the minimum voltage requirement.
	Verify external power source (*when applicable*) is supplying power.
	Verify the connection type is set to GPRS in **Profile** or **Q***start*.
	Try connecting to other wireless units in the same area (other wireless monitor sites). If all connections fail for similar IP addresses and/or none of the wireless connections are successful, there may be a wireless network outage in your area. Contact your regional ADS representative for them to investigate a possible outage.
	Delete any leading zeros included before or within the IP address.
	Replace GSM/GPRS module, EMU modem, or EMUX, as applicable.
	(*applies only if the software provides a "Getting Monitor Attention" message while attempting to communicate*) Try to communicate with the monitor through a serial (*direct*) connection. If direct communication fails, remove the monitor from the hazardous area (at least 20 feet away from the manhole), disconnect the battery pack, wait at least 1 minute, reconnect the battery pack, and then attempt to communicate. If the monitor still will not communicate, replace the 3.3-volt yellow fuse (*when replaceable*) on the regulator or return the monitor to ADS for power regulator replacement.
	Replace the monitor.

Problem	Modem connects but monitor does not respond.
Possible Cause	Connection Type configuration has reverted to Serial.
	3.3-volt fuse on regulator may have blown.
Possible Solutions	Verify that the communication type is set to GPRS.
	Inspect the communication cable connection between the modem and monitor to determine if the cable is disconnected or has been damaged.
	Connect directly with the monitor using the 8000-0054 cable. Verify the monitor responds. If it does, the GSM module might be faulty. If it does not, remove the monitor from the hazardous area (at least 20 feet away from the manhole), disconnect the battery pack, wait at least 1 minute, and then reconnect the monitor battery pack. If remote communication resumes, try to connect several times to ensure communication is reliable.
	Replace the 3.3-volt yellow fuse (*when replaceable*) on the regulator or return the monitor to ADS for power regulator replacement.
	Contact your regional ADS representative.

Problem	Monitor cannot communicate over a serial connection.
Possible Causes	Serial connection to monitor or field computer may be loose.
	Direct Connect Cable may be damaged.
	Serial port on the computer may not be generating adequate power for the Direct Connect Cable to facilitate communication with the monitor.
	3.3-volt fuse on regulator may have blown.
Possible Solutions	Verify cable connections to monitor and field computer are secure.
	Inspect Direct Connect Cable for damage.
	Run a USB-to-serial adapter cable between the computer's USB port and the Direct Connect Cable.
	(*applies only if the software provides a "Getting Monitor Attention" message while attempting to communicate*) Remove the monitor from the hazardous area (at least 20 feet away from the manhole), disconnect the battery pack, wait at least 1 minute, reconnect the battery pack, and then attempt to communicate. If the monitor still will not communicate, replace the 3.3-volt yellow fuse (*when replaceable*) on the regulator or return the monitor to ADS for power regulator replacement.
	Contact your regional ADS representative.

Ultrasonic Depth Subsystem

The following tables contain general troubleshooting techniques for problems with the ultrasonic depth subsystem corresponding to the Surface Combo Sensor and the Ultrasonic Depth Sensor.

Note: Contact your ADS representative for further diagnosis prior to replacing a sensor.

Problem	Range from ultrasonic depth subsystem is slightly inconsistent with manually measured range.
Possible Causes	Physical offset may be incorrect. Pipe height may be incorrect. Electronic offset might be incorrect.
Possible Solutions	Verify the physical offset, and adjust it if necessary. Verify the pipe height. Verify electronic offset and adjust if necessary.

Problem	Range from ultrasonic depth subsystem is significantly greater than manually measured range.
Possible Causes	Physical offset may be incorrect.
	Pipe height may be incorrect.
	Electronic offset may be incorrect.
	Sensor may not be level.
	Foam or other substance may be absorbing the pulse.
	Sensor may be faulty.
Possible Solutions	Verify the physical offset.
	Verify the pipe height.
	Verify electronic offset and adjust if necessary.
	Make sure the sensor is level and in good condition.
	Check the hydraulic conditions in the pipe.
	Fire the sensor at a shorter distance onto a hard surface to confirm accuracy.
	Replace the sensor.
	Contact your regional ADS representative.

Problem	Range from the ultrasonic depth subsystem is too short (but not zero).
Possible Causes	Pipe height may be incorrect. Electronic offset may be incorrect. Sensor may be dirty. Sensor may be faulty.
Possible Solutions	Verify the pipe height. Verify electronic offset and adjust if necessary. Clean the sensor. Replace the sensor. Contact your regional ADS representative.

Problem	Raw ultrasonic depth data shows depths greater than the pipe diameter.
Possible Causes	Physical offset may be incorrect. Pipe height may be incorrect. Electronic offset may be incorrect. Pipe may be surcharged. Sensor may be dirty. Sensor may be faulty.
Possible Solutions	Verify the physical offset. Verify the pipe height. Verify electronic offset and adjust if necessary. Clean the sensor. Replace the sensor. Contact your regional ADS representative.

Problem	Depth data indicates a surcharged pipe, but the pipe is free flowing.
Possible Causes	Physical offset may be incorrect.
	Electronic offset may be incorrect.
	Pipe height may be incorrect.
	Sensor may be dirty.
	Sensor may be faulty.
Possible Solutions	Verify the physical offset and the pipe height.
	Verify electronic offset and adjust if necessary.
	Clean the sensor.
	Contact your regional ADS representative.
	Replace the sensor.
	Replace the monitor if defective.

Problem	Ultrasonic depth readings are erratic.
Possible Causes	Noise may exist in the sewer pipe.
	Sensor may be dirty.
	Flow may be choppy or foamy.
	Sensor may not be level.
Possible Solutions	Check the flow conditions.
	Clean the sensor.
	Check if the sensor is level and correct if necessary.

Problem	Individual ultrasonic depth readings (SDEPTH_3) from Surface Combo Sensor are consistently equivalent to the value obtained from the following equation: Pipe Height – Physical Offset + 9.99.
Possible Causes	Sensor may be faulty.
	5-volt fuse on regulator may have blown.
Possible Solutions	Replace the Surface Combo Sensor.
	Replace the 5-volt blue fuse (*when replaceable*) on the regulator or return the monitor to ADS for regulator replacement.
	Caution: Do not connect a potentially shorted sensor to another monitor until confirming that the sensor is functional (i.e., not shorted) using a voltmeter. A shorted sensor will blow the 5-volt (blue) replacement fuse on the regulator of the monitor.

Problem	Sensor reports abnormal temperatures.
Possible Causes	Sensor connection to monitor may be loose.
	Temperature sensor may be faulty.
	Sensor may be faulty.
Possible Solutions	Secure sensor connection to monitor if necessary.
	Replace the sensor.

Upward Depth Subsystem

The following tables contain general troubleshooting techniques for the upward depth subsystem corresponding to the Peak Combo Sensor and Slimline Peak Combo Sensor.

Note: Contact your regional ADS representative for further diagnosis prior to replacing a sensor.

Problem	UpDepth data periodically reads 0.63 inches (16 mm).
Possible Causes	Minimum flows are occurring within sensor deadband (extending 1.0 inches (25 mm) up from bottom of Peak Combo Sensor or Slimline Peak Combo Sensor) or the sensor is receiving a strong return signal close to the sensor face. Sensor transmit/receive surfaces are dirty. Sensor or cabling might be faulty.
Possible Solutions	Verify minimum flow depths are not occurring within sensor deadband. Set the deadband on the UpDepth sensor to a setting other than *Auto*, but well below the expected minimum flow depth. Fire the sensor several times to verify whether the readings improve. Ensure the sensor is installed as closely as possible to the 6:00 position in the pipe, silt allowing. Clean the sensor transmit/receive surfaces. Inspect the sensor cables for integrity. Check for moisture in the connector. Contact your regional ADS representative. Replace the sensor. Replace the monitor if defective.

Problem	UpDepth data seems erratic over a full depth range.
Possible Causes	Sensor transmit/receive surfaces may be dirty.
	Sensor may be rotated greater than 15 degrees from center.
	Sensor may be faulty.
	Processor board may be faulty.
Possible Solutions	Clean the sensor transmit/receive surfaces.
	Check the sensor connections.
	Ensure the sensor is installed as closely as possible to the 6:00 position in the pipe, silt allowing.
	Contact your regional ADS representative.
	Replace the sensor.
	Replace the monitor if defective.

Problem	UpDepth readings are abnormally low.
Possible Causes	Sensor transmit/receive surfaces may be covered with silt.
	Sensor may be physically offset in the flow and the correct physical offset has not been measured and/or downloaded to the monitor.
Possible Solutions	Re-measure physical offset of the sensor.
	Check the site conditions, and relocate the sensor if necessary.

Problem	Individual UpDepth_1 values consistently read -9.99.
Possible Causes	Sensor may be faulty. 5-volt fuse on regulator may be blown.
Possible Solutions	Replace the Peak/Slimline Peak Combo Sensor. Replace the 5-volt blue fuse (when replaceable) on the regulator or return the monitor to ADS for regulator replacement. **Caution:** Do not connect a questionable sensor to another monitor before verifying the integrity of the sensor. A shorted sensor will blow the 5-volt (blue) replacement fuse on the regulator in the monitor.

Peak Velocity Subsystem

The following tables contain general troubleshooting techniques for the velocity subsystem corresponding to the Peak Combo Sensor, Surface Combo Sensor (*Surcharge Velocity Sensor only*), and Slimline Peak Combo Sensor. Since the Surface Combo Sensor is mounted at the top of the pipe, potential issues involving a sensor that is out of the flow do not apply to the Surface Combo Sensor.

> **Note:** Contact your regional ADS representative for further diagnosis prior to replacing a sensor.

Problem	Monitor often provides a velocity reading of 0.
Possible Causes	Sensor's velocity transmit/receive surfaces may be dirty or the velocity function is broken.
	Minimum flows may be occurring within the sensor deadband (extending 1.0 inches (25 mm) up from the bottom of the Peak Combo Sensor or Slimline Peak Combo Sensor).
	Cabling between the processor board and the velocity sensor may be bad.
	Velocity parameters may require adjustment.
Possible Solutions	Clean the sensor's transmit/receive surfaces.
	Verify that minimum flows are occurring outside the sensor deadband.
	Check the velocity parameters.
	Inspect the sensor cables for tightness.
	Check for moisture in the connector.
	Contact your regional ADS representative.
	Replace the sensor.
	Replace the monitor if defective.

Problem	Velocity data does not fluctuate much (but is not 0).
Possible Causes	Sensor may be dirty.
	Minimum flows may be occurring within the sensor deadband (extending 1.0 inches (25 mm) up from the bottom of the Peak Combo Sensor or Slimline Peak Combo Sensor).
	Velocity function may be broken.
Possible Solutions	Clean the sensor's transmit/receive surfaces.
	Verify that minimum flows are occurring outside the sensor deadband.
	Check the sensor connections.
	Check the velocity parameters.
	Contact your regional ADS representative.
	Replace the velocity sensor.

Problem	Velocity data seems erratic or exhibits poor quality.
Possible Causes	Sensor's transmit/receive surfaces may be dirty.
	Sensor may be close to extending out of the flow.
	Designated value for the maximum velocity parameter may be too high, creating too broad of a range.
	Sensor may be faulty.
	Processor board may be faulty.
Possible Solutions	Clean the sensor's transmit/receive surfaces.
	Verify whether the flow depth exceeds the sensor deadband at the same time and under the same conditions as the erratic data. Rotate the sensor further toward the center of the pipe if possible.
	Reduce the maximum velocity in the device parameters to narrow the range.
	Check the sensor connections.
	Check the velocity parameters.
	Contact your regional ADS representative.
	Replace the sensor.
	Replace the monitor if defective.

Problem	Velocity readings are abnormally high.
Possible Causes	Sensor's velocity transmit/receive surfaces may be covered with silt or other debris.
	Sensor may be extending out of the flow.
	Flow may be reversed or slower than (0.5 feet per second (0.15 mps)
Possible Solution	Check the site conditions, and relocate the sensor if necessary.

Problem	Individual PEAKVEL_1 or PEAKVEL_3 values consistently read -9.99.
Possible Causes	Sensor may be faulty. 5-volt fuse on regulator may have blown.
Possible Solutions	Replace the Peak, Slimline Peak, or Surface Combo Sensor. Replace the 5-volt blue fuse (*when replaceable*) on the regulator or return the monitor to ADS for regulator replacement. **Caution:** Do not connect a questionable sensor to another monitor before verifying the integrity of the sensor. A shorted sensor will blow the 5-volt (blue) replacement fuse on the regulator in the monitor.

Surface Velocity Subsystem

The following tables contain general troubleshooting techniques for the surface velocity subsystem corresponding to the Surface Combo Sensor.

Problem	Velocity readings are erratic or incorrect.
Possible Causes	Sensor may be dirty or covered by debris. Maximum Velocity setting may require adjustment.
Possible Solutions	Clean the sensor transmit/receive surfaces. Fine-tune Maximum Velocity setting in device parameters.

Problem	Individual SURFACEVEL_3 values consistently read -9.99.
Possible Causes	Sensor may be faulty. 5-volt fuse on regulator may have blown.
Possible Solutions	Replace the Surface Combo Sensor. Replace the 5-volt blue fuse (*when replaceable*) on the regulator or return the monitor to ADS for regulator replacement. **Caution:** Do not connect a questionable sensor to another monitor before verifying the integrity of the sensor. A shorted sensor will blow the 5-volt (blue) replacement fuse on the regulator in the monitor.

Pressure Depth Subsystem

The following tables contain general troubleshooting techniques for the pressure depth subsystem corresponding to the Peak Combo Sensor, Surface Combo Sensor, and Ultrasonic Depth Sensor with the pressure depth option.

> **Note:** Contact your regional ADS representative for further diagnosis before replacing a sensor.

Problem	Pressure depth readings are erratic.
Possible Causes	Pressure vent tube may be pinched or blocked with water. Pressure dryer tube may not be functioning properly. Black cap may still be on the dryer tube.
Possible Solutions	Inspect color of desiccant in dry tube and replace the dryer tube if necessary. Inspect the vent tube along its entire length to ensure the cable is not pinched and that the cable ties securing the vent tube are not too tight. Verify that the black cap has been removed from the dryer tube.

Problem	Pressure depth readings display a good pattern, but are consistently incorrect.
Possible Cause	Sensor physical offset may be incorrect.
Possible Solution	Verify the sensor offset and reactivate with the correct settings if necessary.

Problem	Individual PDEPTH_1 values consistently read 0 under wet pipe conditions.
Possible Causes	Sensor may be faulty.
	5-volt fuse on regulator may have blown.
Possible Solutions	Replace the Peak Combo Sensor.
	Replace the 5-volt blue fuse (*when replaceable*) on the regulator or return the monitor to ADS for regulator replacement.
	Caution: Do not connect a questionable sensor to another monitor before verifying the integrity of the sensor. A shorted sensor will blow the 5-volt (blue) replacement fuse on the regulator in the monitor.

Temperature Subsystem

The following table contains general troubleshooting techniques for the temperature subsystem corresponding to all sensors supporting the FlowShark Triton.

Problem	Temperature readings are excessively low or incorrect.
Possible Causes	Temperature sensor may be faulty.
	Cable connecting sensor to monitor may be loose or broken.
	Processor board may be faulty.
Possible Solutions	Examine the sensor connection to the monitor, and verify that it is properly connected and secure.
	Replace the sensor.
	Replace the monitor if defective.

A P P E N D I X   A

Specifications

This appendix contains specifications for the ADS® FlowShark®
Triton flow monitor and associated subassemblies, sensors, cables,
and communication hardware.

FlowShark Triton Flow Monitor (ADS p/n 8000-FST-60C)

Enclosure	Cylindrical 0.37-inch (6.39-mm) thick, seamless, plastic canister with stainless steel threaded inserts
	Aluminum end-cap attached to canister with four stainless steel bolts and a gasket interface
	Meets NEMA6P/IP68 standard
Dimensions	17.75 inches (451 mm) long by 8.75 inches (222 mm) maximum diameter 6.63 inches (168 mm) minimum diameter
Weight	30.3 pounds (13.7 kg) (with 12-volt battery pack)
Operating Temperature	-4° to 140° F (-20° to 60° C)
Power	Internal: One 12-volt IS alkaline battery pack
	External (*optional*): External DC power source through an EMU

Battery Life	15 months at 15-minute sample rate and weekly communications Actual battery life will vary depending on operating temperature, number of active devices operated, and frequency of communications.
Connectors	U.S. MIL-C-26482 series 1, for environmental sealing, with gold-plated contacts and interfacial seals
Inputs and Outputs	• 2 configurable sensor inputs • 1 communication connector for direct interface with a computer or GSM modem • Air pressure valve (*for testing purposes only*)
Memory	832 kilobytes
Data Storage	150 days for 6 stored entities (Peak Combo Sensor) at a 15-minute sample rate – Refer to *Calculating the Total Days of Storage Available* on page A-3 for details and instructions on calculating the number of days of data that can be stored in memory for a specific application.
Approvals	Hazardous Area – Approved for use in Class I, Div. 1, Groups C & D, Zone 0 in US, and Zone 0 in the EU via SIRA/ATEX Certified under IECEx (International Electrotechnical Commission Explosion Proof) Intrinsic Safety standards for use in Zone 0/ Class I, Div. 1, Groups C & D rated hazardous areas. (See Chapter 1 for a list of countries accepting demonstrated compliance with the IECEx scheme.) Certificate of Compliance from the Canadian Standards Association (CSA) for Intrinsically Safe and Non-Incendive Systems – For Hazardous Locations.

Calculating the Total Days of Storage Available

This section includes a special equation to use in determining the number of days of data that can be stored in the monitor memory based on a specific application. Consider the following when calculating the total days:

- The monitor memory holds 832 kilobytes (or 851,968 bytes) of data.

- The log rate determines the number of readings taken per day. At a *15-minute* sample rate, the monitor will record 96 readings a day for a single entity. At a *5-minute* sample rate, the monitor will record 288 readings a day for a single entity.

- One entity reading consumes 8 bytes of monitor memory.

- The following table lists the standard number of entities recorded for each sensor device. The date/time stamp for a reading is equal to one reading. Therefore, each total below represents the actual entities plus one date/time stamp. A date/time stamp must be included for each monitoring point associated with the monitor.

Peak Combo Sensor	Surface Combo Sensor	Ultrasonic Depth Sensor	Ultrasonic Depth Sensor with Pressure Option	Slimline Peak Combo Sensor
7	6	3	4	6

- Deduct 2 to 3 days from the total days of storage to compensate for additional overhead in memory.

Following is the equation for calculating the total days of storage available in the monitor memory:

Data Storage Available in the Monitor (in Bytes)			=	**Total Days of Storage in the Monitor Memory**
Number of Readings Taken per Day for One entity X	**Memory Consumed for One Entity Reading (Date/Time Stamp)** X	**Number of Entities Logged by the Monitor (based on the selected devices)**		

For example, recording data at a 15-minute sample rate using a Peak Combo Sensor offers approximately 150 days of data storage.

851,968 bytes			=	158 days (*150 when accounting for overhead*)
96 readings X	8 bytes X	7 entities (including 1 for the date/ time stamp)		

Intrinsically-Safe Sensors

Peak Combo Sensor (ADS p/n 8K-CS4-xx-35/1H)

This sensor supports upward ultrasonic depth, peak velocity, and pressure depth.

Enclosure	ABS plastic shell, epoxy-filled
Dimensions	Enclosure: 6.76 inches (172 mm) long x 1.23 inches (31 mm) wide x 0.83 inches (21 mm) high
Cable	Standard size: 35 feet (10.7 m) or 100 feet (30.5 m) long x 0.30 inches (7.6 mm) nominal OD, polyurethane jacket Extension cables available up to 300 feet (91.4 m)
Operating/ Storage Temperature	Operating: -4° to 140° F (-20° to 60° C) Storage: -4° to 167° F (-20° to 75° C) **Note:** This sensor will *not* produce accurate readings in frozen flow.
Upward Ultrasonic Depth	
Upward Depth Accuracy	0.5% of reading or +/- 0.125 inches (3.2 mm), whichever is greater
Deadband	Extending 1.0 inch (25 mm) up from the *bottom* of the sensor
Frequency	250 kHz – 1 MHz
Range	60 inches (1524 mm)
Resolution	0.01 inches (0.25 mm)
Drift	0

Peak Doppler Velocity	
Range	-30 to 30 feet per second (-9.1 to 9.1 m/sec)
Deadband	Extending 1.0 inch (25 mm) up from the *bottom* of the sensor
Frequency	250 kHz
Resolution	0.01 feet per second (0.003 m/sec)
Accuracy	+/- 0.2 ft/sec (0.06 m/sec) or 4% of actual peak velocity (whichever is greater) in flow velocities from -5 to 20 ft/sec (-1.52 to 6.10 m/sec)
Pressure Depth	
Pressure Range	0.0 to 5.0 PSI (0.0 - 0.34 Bar): up to 11.5 feet (3.5 m) 0.0 to 15.0 PSI (0.0 - 1.03 Bar): up to 34.5 feet (10.5 m) 0.0 to 30 PSI (0.0 – 2.07 Bar): up to 69.0 feet (21.0 m)
Pressure Accuracy	0 - 5.0 PSI (0 - 0.34 Bar): +/- 1.4 inches (36 mm) 0 - 15.0 PSI (0 - 1.03 Bar): +/- 4.1 inches (104 mm) 0.0 to 30 PSI (0.0 – 2.07 Bar): +/- 8.3 inches (211 mm)
Pressure Resolution	0.01 inches (0.25 mm)

Surface Combo Sensor (ADS p/n 8K-CS5-V2-xx-30)

This sensor supports downward ultrasonic depth, surface velocity, surcharge peak velocity, and surcharge pressure depth.

Note: The new version of the Surface Combo Sensor referenced here and throughout this manual is undergoing final testing and evaluation. Contact ADS Client Services for sensor availability. Specifications for the existing

version of the Surface Combo Sensor (ADS p/n 8K-CS3-V2-XX-30) are available in the *previous* version of the *FlowShark Triton Installation, Operation, and Maintenance Manual* (QR 775013 A3).

Enclosure	ABS plastic shell, epoxy-filled
Dimensions	10.61 inches (269 mm) long x 2.03 inches (52 mm) wide x 2.45 inches (62 mm) high
Cable	Standard size: 30.0 feet (9.14 m) long x 0.45 inches (11 mm) nominal OD, polyurethane jacket Extension cables available up to 300 feet (91 m)
Operating/ Storage Temperature	Operating: -4° to 140° F (-20° to 60° C) Storage: -4° to 167° F (-20° to 75° C) **Note:** The sensor will *not* produce accurate readings when ice is built up on the sensor.
Downward Ultrasonic Depth	
Accuracy	0.125 inches (3.2 mm)
Deadband	1.0 inch (25.4 mm) from the sensor face or 5% of maximum range, whichever is greater
Frequency	40 kHz
Range	0.5 inches (12.7 mm) (or 5% of maximum range, whichever is greater) to 10.0 feet (3.05 m)
Resolution	0.01 inches (0.25 mm)
Drift	0

Surface Velocity	
Accuracy	+/- 0.25 feet per second (0.08 m/s) or 5% of the actual reading (whichever is greater) in flow velocities from 1.00 to 15.00 ft/sec (0.30 to 4.57 m/s) **Note:** Flow conditions may cause the designated accuracy to vary and hinder or prevent the effective use of surface velocity technology.
Deadband	3 inches (76 mm) from the bottom of the rear, descended portion of the sensor
Minimum Velocity	1 foot per second (0.30 m/sec)
Frequency	*Varies based on the parameter settings*
Range	3 to 42 inches (7 to 1067 mm)
Resolution	0.01 feet per second (0.003 m/sec)
Surcharge Peak Velocity	
Range	-30 to 30 feet/second (-9.1 to 9.1 m/sec)
Frequency	250 kHz
Resolution	0.01 feet per second (0.003 m/sec)
Accuracy	+/- 0.2 ft/sec (0.06 m/sec) or 4% of actual peak velocity (whichever is greater) in flow velocities from -5 to 20 ft/sec (-1.52 to 6.10 m/sec)

Surcharge Pressure Depth	
Pressure Range	0.0 to 5.0 PSI (0.0 - 0.34 Bar): up to 11.5 feet (3.5 m) 0.0 to 15.0 PSI (0.0 - 1.03 Bar): up to 34.5 feet (10.5 m)
Pressure Accuracy	0 - 5.0 PSI (0 - 0.34 Bar): +/- 1.4 inches (36 mm) 0 - 15.0 PSI (0 - 1.03 Bar): +/- 4.1 inches (104 mm)
Pressure Resolution	0.01 inches (0.25 mm)

Ultrasonic Depth Sensor (ADS p/n 8K-CS3-V0-xx-30)

This sensor supports downward ultrasonic depth and optional pressure depth.

Housing	Marine-grade aluminum/epoxy
Dimensions	7.45 inches (189 mm) long x 4.125 inches (105 mm) wide x 0.86 inches (22 mm) high
Cable	Standard size: 30.0 feet (9.14 m) long x 0.45 inches nominal (11 mm nominal) OD, polyurethane jacket Extension cables available up to 300 feet (91 m)
Operating/ Storage Temperature	Operating: -4° to 140° F (-20° to 60° C) Storage: -4° to 167° F (-20° to 75° C) **Note:** The sensor will *not* produce accurate readings when ice is built up on the sensor.

Downward Ultrasonic Depth	
Accuracy	0.125 inches (3.2 mm)
Deadband	1.0 inch (25.4 mm) or 5% of maximum range, whichever is greater
Frequency	40 kHz
Range	0.5 inches (12.7 mm) (or 5% of maximum range, whichever is greater) to 10.0 feet (3.05 m)
Resolution	0.01 inches (0.25 mm)
Drift	0.0 inches/mm
Pressure Depth (*optional*)	
Pressure Range	0.0 to 5.0 PSI (0.0 – 0.34 Bar): up to 11.5 feet (3.5 m)
	0.0 to 15.0 PSI (0.0 – 1.03 Bar): up to 34.5 feet (10.5 m)
Pressure Accuracy	0 – 5.0 PSI (0 – 0.34 Bar): +/- 1.4 inches (36 mm)
	0 – 15.0 PSI (0 – 1.03 Bar): +/- 4.1 inches (104 mm)
Pressure Resolution	0.01 inches (0.25 mm)

Slimline Peak Combo Sensor (ADS p/n 8K-CS4-35)

This sensor supports upward ultrasonic depth and peak velocity.

Enclosure	ABS plastic shell, epoxy-filled
Dimensions	Enclosure: 5.36 inches (136 mm) long x 1.25 inches (32 mm) wide x 0.81 inches (21 mm) high
Cable	Standard size: 35 feet (10.7 m) long x 0.31 inches (7.9 mm) nominal OD, polyurethane jacket Extension cables available up to 300 feet (91.4 m)
Operating/ Storage Temperature	Operating: -4° to 140° F (-20° to 60° C) Storage: -4° to 167° F (-20° to 75° C) **Note:** This sensor will *not* produce accurate readings in frozen flow.
Upward Ultrasonic Depth	
Upward Depth Accuracy	0.5% of the reading or +/- 0.125 inches (3.2 mm), whichever is greater
Deadband	Extending 1.0 inches (25 mm) up from the *bottom* of the sensor
Frequency	250 kHz
Range	60 inches (1524 mm)
Resolution	0.01 inches (0.25 mm)
Drift	0

Peak Doppler Velocity	
Range	-30 to 30 feet per second (-9.1 to 9.1 m/sec)
Deadband	Extending 1.0 inches (25 mm) up from the *bottom* of the sensor
Frequency	250 kHz
Resolution	0.01 feet per second (0.003 m/sec)
Accuracy	+/- 0.2 ft/sec (0.06 m/sec) or 4% of actual peak velocity (whichever is greater) in flow velocities from -5 to 20 ft/sec (-1.52 to 6.10 m/sec)

Direct Connect Cable (ADS p/n 8000-0054)

The direct connection cable supports on-site communications with the FlowShark Triton monitor.

Size	Cable: 0.3 inches nominal. (7.6 mm nominal) OD Length: 16.5 feet (5.03 m)
Construction	2-pair twisted, shielded, 4-conductor cable with polyurethane jacket; in-line opto-isolation; PCB potted in plastic housing
Connections	Factory fitted potted connector on monitor end, DB9 connector on computer end

Wireless GSM Module (ADS p/n 8000-0052)

The wireless GSM module supports the battery-powered FlowShark Triton.

Modem	GSM/GPRS cellular modem using GPRS *TCP/IP* (Transmission Control Protocol/Internet Protocol)
Size	Cable: 0.3 inches (7.6 mm) nominal OD Length: 6 feet (1.82 m) Enclosure: 5.1 x 3.1 x 1.4 inches (130 x 79 x 36 mm)
Construction	Shielded, 10-conductor cable with polyurethane jacket; in-line opto-isolation; PCB potted in plastic housing
Connections	Monitor end: Factory-fitted potted connector Antenna cable: SMA connector
Display	7-segment LED with clear cover
Power	Supplied by IS battery in monitor
Operating Temperature	-4° to 140° F (-20° to 60° C)

External Modem Unit (ADS p/n 3800-0148)

The ADS EMU (external modem unit) supports the externally-powered FlowShark Triton monitor.

Enclosure	Rectangular UL-Recognized NEMA 4X/6P composite enclosure with stainless steel hardware
Dimensions	18 inches (457 mm) high x 6 inches (152 mm) wide x 7.5 inches (191 mm) deep
Weight	12 pounds (5.44 kg)
Operating Temperature	0° to 140° F (-18° to 60° C)
External Power	Requires an external DC power source providing a minimum of 12 volts at 1 amp
Wireless Modem	Enfora Model GSM1308-50 Quad-band GSM/GPRS (850/900/1850/1900 MHz)
Connections	Sealed NEMA 4X right-angle cable grip fitting for communication cable
Communication Cable	Available lengths: 85, 100, and 135 feet (26.0, 30.5, and 41.1 m) Jacket: 0.318-inch (8 mm) OD heavy gauge polyurethane direct burial Conductors: 8-20 gauge and 4-18 gauge Connectors: Factory-fitted, potted (monitor end); field terminated strip connection (EMU end)
FCC ID	FCC ID MIVGSM0308
Antenna	Smarteq™ mini-wing (SMA/TNC)
Protocol	TCP/IP
Addressing	Fixed address via AT&T custom APN

External Modem Unit/Multiplexer (ADS p/n 106226E)

The ADS external modem unit/multiplexer (EMUX) supports the externally-powered FlowShark Triton monitor and SCADA or process control systems.

Enclosure	Rectangular NEMA 1 plastic enclosure with stainless steel hardware
Dimensions	6.26 inches (159 mm) high x 6.08 inches (155 mm) wide x 2.5 inches (64 mm)
Weight	1.5 pounds (0.68 kg)
Operating Temperature	0° to 140° F (-18° to 60° C)
External Power	Requires an external DC power source providing a minimum of 12 volts at 1 amp
Wireless Modem	Enfora Model GSM0308-71 Quad-band GSM/GPRS (850/900/1850/1900 MHz)
Connections	- Communication - Modbus - Antenna - External Power
Communication Cable	Available lengths: 85, 100, and 135 feet (26.0, 30.5, and 41.1 m) Jacket: 0.318-inch (8 mm) OD heavy gauge polyurethane direct burial Conductors: 8-20 gauge and 4-18 gauge Connectors: Factory-fitted, potted (monitor end); field terminated strip connection (EMU end)
FCC ID	FCC ID MIVGSM0308

Antenna	Supports Smarteq™ mini-wing/slim (SMA/TNC) or customer-supplied antenna with the following specifications: • 50 ohms • VSWR<1:1.5 • maximum gain of 3 dBi • Male SMA connector
Communication Protocols	TCP/IP for wireless communication Modbus for data transfer
Addressing	Fixed address via AT&T custom APN

ADS Power Supply (ADS p/n 5000-0727)

The power supply supports external-powered FlowShark Triton monitors.

Enclosure	NEMA 4X Polycarbonate
Dimensions	5.1 inches (130 mm) high x 5.1 inches (130 mm) wide x 5.1 inches (130 mm) deep
Mounting Holes	Four 0.175-inch (4.4-mm) holes for panel mounting
Input Voltage	100-240 VAC, 50/60 MHz
Output Voltage	12V DC, 1.2 A
Connection	AC: Supplied 6-foot line cord (U.S.) or via hardware to AC input terminals DC: Hardware to DC output terminals

A P P E N D I X B

Part Numbers

This appendix contains a parts list of the most commonly ordered and used parts supporting the ADS® FlowShark® Triton flow monitoring system.

Monitors	
8000-FST-60C	FLOWSHARK TRITON MONITOR (*INCLUDES 12-VOLT IS BATTERY PACK*)
8000-FST-EP-60C	FLOWSHARK TRITON MONITOR, EXTERNAL POWER (*EXCLUDES 12-VOLT IS BATTERY PACK*)
Sensors and Sensor Cables	
8K-CS4-05-35	SENSOR, CS4, UPWARD DEPTH, PEAK VELOCITY, PRESSURE SENSOR 0 – 5 PSI (0 – 0.34 Bar), 35-FT (10.6-m) CABLE
8K-CS4-15-35	SENSOR, CS4, UPWARD DEPTH, PEAK VELOCITY, PRESSURE SENSOR 0 – 15 PSI (0 – 1.03 Bar), 35-FT (10.6-m) CABLE
8K-CS4-30-1H	SENSOR, CS4, UPWARD DEPTH, PEAK VELOCITY, PRESSURE SENSOR 0 – 30 PSI (0 – 2.07 Bar), 100-FT (30.5-m) CABLE
8K-CS3-V0-00-30	SENSOR, CS3, US DEPTH, 30-FT (9.14-m) CABLE
8K-CS3-V0-05-30	SENSOR, CS3, US DEPTH, PRESSURE SENSOR 0 – 5 PSI (0 – 0.34 Bar), 30-FT (9.14-m) CABLE
8K-CS3-V0-15-30	SENSOR, CS3, US DEPTH, PRESSURE SENSOR 0 – 15 PSI (0 – 1.03 Bar), 30-FT (9.14-m) CABLE

8K-CS5-V2-05-30	SENSOR, CS5, US DEPTH, SURFACE VEL, PRESSURE SENSOR 0 – 5 PSI (0 – 0.34 Bar), 30-FT (9.14-m) CABLE
8K-CS5-V2-15-30 (available late 2012)	SENSOR, CS5, US DEPTH, SURFACE VEL, PRESSURE SENSOR 0 – 15 PSI (0 – 1.03 Bar), 30-FT (9.14-m) CABLE
8K-CS4-35	SENSOR, CS4, UPWARD DEPTH, PEAK VELOCITY, 35-FT (10.6-m) CABLE
8000-0023-xxx (*xxx represents cable length in feet*)	SENSOR EXTENSION CABLE, FOR SENSORS without PRESSURE; STANDARD LENGTHS: 25 FT (7.6m), 50 FT (15.2m), 75 FT (22.8m), 100 FT (30.5m). CUSTOM LENGTHS TO 300 FT (91m)
8000-0025–xxx (*xxx represents cable length in feet*)	SENSOR EXTENSION CABLE, FOR SENSORS with PRESSURE; STANDARD LENGTHS: 10 FT (3.0m), 25 FT (7.6m), 50 FT (15.2m), 75 FT (22.8m), 100 FT (30.5m), 125 FT (38.1m), 150 FT (45.7m), 200 FT (61.0m). CUSTOM LENGTHS TO 300 FT (91m)
Communication/External Power Parts	
8000-0054	DIRECT CONNECT MODULE & 16-FT (4.8-m) MONITOR CONNECTION CABLE
8000-0052	GSM COMMUNICATION MODULE, SMA ANTENNA TERMINAL, 6-FT (1.82m) MONITOR CABLE
507181	SIM CARD, AT&T, FIXED IP
3800-0162	GSM HIRSCHMAN SLIM ANTENNA with 15-FT (4.8-m) CABLE, SMA CONNECTOR
3800-0163	GSM SMARTEQ MINIWING ANTENNA with 15-FT (4.8-m) CABLE, SMA CONNECTOR
8000-0140	MAGNET, RED (for activating diagnostic codes)
3800-0148	EMU (External modem unit)
3800-0181	EXTERNAL POWER KIT (includes internal chassis cable and external 10-foot power cable)
106226E	EMU, EXTERNAL POWER, SCADA, GWMUX, IS
507959	MODEM, GPRS, QUAD BAND (*replacement modem for EMU*)
5000-0727	12VDC POWER SUPPLY

106227B-xx (*xx represents the cable length in feet*)	CABLE, COMM, FST TO EMU; STANDARD LENGTHS: 10 FT (3.0m), 85 FT (25.9m), 100 FT (30.5m), 135 FT (41.1m) – *other cable lengths up to 300 feet (91.4m) are also available by request*
8000-0054-01	CABLE, ASSY, FS TRITON TO TELOG
8000-0044-25	CABLE, EXT, COMM/GSM, 25 FT (7.6 m)
Monitor Replacement Parts	
8000-0043-01	BATTERY PACK, IS, 12V, UNPOTTED with PCB
8000-0043-02	BATTERY PACK, IS, 12V, UNPOTTED without PCB
8000-0141	RETAINER, PLUG, URATHANE, 12-V IS BATTERY (for use with 8000-0043-01/02)
8000-0042-01	PCB, BATTERY, w/ CABLE
3704-0032	REPLACEMENT VENT DRYER TUBE
507995	DESICCANT PACK, GSM MODULE
8000-0036	PROCESSOR BOARD ASSEMBLY
8000-0197	POWER REGULATOR ASSEMBLY, with REPLACEABLE FUSES, IS, FST[1]
508071	FUSE, MOLDED, 315mA, TH, SLOW BLOW, RED BAND
508072	FUSE, MOLDED, 140mA, 3.3-volt, TH, SLOW BLOW, YELLOW BAND
508073	FUSE, MOLDED, 100mA, 5-volt, TH, SLOW BLOW, BLUE BAND
Standard Size Installation Rings (w/ spreader mechanism & Surface Combo Sensor/Ultrasonic Depth Sensor bracket)	
	RING,SS [STAINLESS STEEL], [Pipe Diam. Range]
I25-0081	RING, SS, 6 IN (152mm)
I25-0082	RING, SS, 7 - 8.3 IN (178 - 211mm)
I25-0083	RING, SS, 9 - 10.3 IN (229 - 262mm)
I25-0084	RING, SS, 11 - 12.3 IN (279 - 312mm)
I25-0085	RING, SS, 12.5 - 14 IN (317 - 375mm)

I25-0086	RING, SS, 313.5 - 15.75 IN (343 - 400mm)
I25-0087	RING, SS, 14.4 - 16.75 IN (368 - 425mm)
I25-0088	RING, SS, 16.75 - 18.75 IN (425 - 476mm)
I25-0089	RING, SS, 18.5 - 20.75 IN (470 - 527mm)
I25-0090	RING, SS, 20.5 - 22.75 IN (521 - 578mm)
I25-0091	RING, SS, 22.5 - 28.75 IN (572 - 730mm)
I25-0092	RING, SS, 38.5 - 36.75 IN (724 - 933mm)
I25-0093	RING, SS, 36.5 - 48.75 IN (927 - 1238mm)
I25-0094	RING, SS, 48.75 - 60.75 IN (1238 - 1543mm)
Other mounting hardware	
I25-0001	BRACKET, SLIDING, ULTRASONIC (CS3)
8000-0307	BRACKET, SLIDING, SURFACE COMBO (CS5)
I40-0007	FLANGE, PIPE SPECIAL INSTALL, PRE-DRILLED, 8 FT (2.44m), SS
700-100238-00	SPECIAL INSTALL RING MATERIAL, SS, 12 IN (304mm) LONG
I40-0009	FLANGE HANDLE (*for mounting monitor in manhole*) 2 IN (51mm) WIDE X 18 IN (457mm) LONG X 0.25 IN (6mm) THICK
508058	BOLT, HEX, SS, M8 X 30MM[2]
517-8001254-00	WASHER, FLAT, SS[2]
517-8001274-00	WASHER, SPLIT LOCK, SS[2]
8000-0021	HOOK, SS, 2-PIECE W/ HARDWARE (FOR MOUNTING MONITOR ON MANHOLE RUNG)
I10-0003	SPREADER MECHANISM FOR RING, COMPLETE, SS
I40-0010	BRACKET, SURCHARGE, with ULTRASONIC SLIDE
I10–0012	24-IN (610-mm) CRANK HANDLE, SS

[1] This item replaces the previous power regulator assembly (ADS p/n 8000-0051), which did not support fuse replacement.

[2] This item is part of the mounting hardware included with the monitor for the flange handle (ADS p/n I40-0009).

Note: In all applications, only ADS IS-Certified Service Technicians are authorized to perform FlowShark Triton board and/or component-level repair.

APPENDIX C

Monitor Activity Codes

This appendix contains a list of the monitor activity codes that display automatically on the ADS® GSM Module LED window while the monitor is running. This list also includes descriptions of the monitor activities corresponding to the codes.

> **Note:** The LED window is available only on the GSM Module supporting battery-powered ADS FlowShark® Triton monitors. Externally-powered FlowShark Triton monitors communicate through the modem in the EMU or EMUX. The modem in the EMU does not have an LED window. However, the EMUX has an LED window for monitoring activities occurring through the ports on the EMUX, such as communications and data transfer. Refer to *Appendix D, Modbus/EMUX Configuration and Diagnostics*, for more information.

> **Note:** Some of the activities share a common code.

Code	Monitor Activity
r	Waiting to receive a message
t	Transmitting a message
d	Running display task
d	Running diagnostic task
P	Processing commands

Code	Monitor Activity
A	Processing alarms
J	No active events
H	Hanging up
t	Reading temperature
b	Reading the (upward) ultrasonic depth sensor or the ultrasonic depth sensor in the Surface Combo Sensor
A	Reading all the sensor pairs from the (upward) ultrasonic depth sensor (stand-alone or integrated sensor in the Surface Combo Sensor)
P	Reading pressure depth (from the Peak Combo Sensor or Surface Combo Sensor)
u	Reading updepth (from the Peak Combo Sensor)
A	Calculating final updepth waveform (from Peak Combo Sensor)
C	Reading peak velocity (from the Peak Combo Sensor)
n	Measuring peak velocity (from the Peak Combo Sensor)
S	Reading surface velocity (from the Surface Combo Sensor)
s	Processing surface spectrums
0	NumReadings – updepth reading number
0	grabNums – number of vpeak grab
0	uPairs – number of ultrasonic pairs being fired
S	Sleep

Code	Monitor Activity
C	Deep sleep (monitor going to sleep)
A	Calling cycle modem power from sleep
b	Running BASIC task

A P P E N D I X   D

Modbus/EMUX Configuration and Diagnostics

This appendix contains essential configuration, diagnostic, and reference information and instructions regarding communication and data exchange involving the FlowShark® Triton, EMUX, and RTU. It specifically addresses the following issues:

- Setting up communication between the PC and EMUX

- Using the onboard diagnostics to configure and program Modbus/modem communications, perform monitor and system tests, and view system parameters

- Programming the RTU with Modbus data registers

- Interpreting the EMUX LED indicators

Note: An RTU (remote terminal unit) is an example of the kind of customer-supplied equipment that uses Modbus acquired data. Many other types of equipment may be connected to FlowShark Tritons; however, all will communicate as described. A PLC (programmable logic controller), an I/O (input/output) server, or other instruments, such as the Telog® Ru-33, may be used in place of an RTU. ADS® references the RTU in this manual primarily because it is the most common type of end-point hardware used with SCADA systems.

Setting up PC-to-EMUX Communication

Performing on board configuration and diagnostics and programming the Modbus data registers requires a physical connection between the EMUX and a PC loaded with a terminal emulator application setup with the appropriate communication parameters.

Connecting the PC to the EMUX

Communication between the PC and EMUX requires the following hardware and software:

- PC or laptop computer with an RS-232 serial port. *If the computer has a USB port, but no RS-232 port, use a USB-to-RS-232 adaptor.*

- DB-9 female-to-female straight-through serial cable

- Terminal emulator program (e.g., ***HyperTerminal*** *by Hilgraeve*) loaded on the PC/laptop

Connect the DB-9 cable to the RS-232 port on the PC/laptop and the **MODBUS** port on the EMUX. Once this connection has been established, provide power to the EMUX.

Setting the Terminal Emulator Communication Parameters

The terminal emulator must have the appropriate parameters for establishing communication with the EMUX. Therefore, once the PC is connected to the EMUX and the EMUX is receiving power, launch the terminal emulator program on the PC/laptop and enter/modify the following communication parameters at the appropriate location in the software:

- **Baud Rate** *19,200*

- **Parity** *None*

- **Data Bits** *8*

- **Stop Bits** *1*
- **Handshaking** *None*

Running the Onboard Diagnostics

The EMUX requires limited configuration and diagnostics to ensure successful operation and communication among the user, RTU, EMUX, and the monitor. Perform these tasks by accessing the on-board diagnostics menus available on the EMUX through the terminal emulator (e.g., HyperTerminal).

Once a connection with the EMUX has been established through the terminal emulator, enter three consecutive bangs (**!!!**) to launch the onboard diagnostics and configuration main menu.
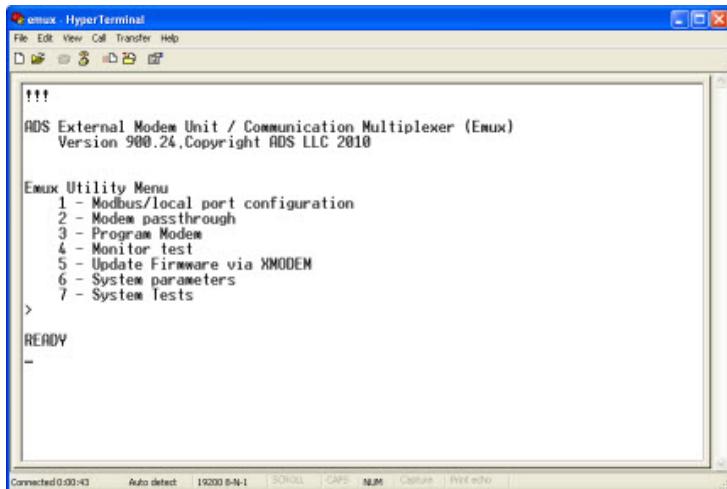
HyperTerminal onboard diagnostics and configuration main menu

The main menu provides access to the 7 configuration/diagnostic menus. To access one of these submenus, simply press the number key corresponding to that menu name. Consider the following guidelines for using the onboard diagnostics:

- The system will exit the current menu or submenu following 30 seconds of inactivity. To return to the initial location before the timeout occurred, enter three consecutive bangs (**!!!**) to return to the main menu from the READY state or hit the appropriate number key to return to a particular submenu from the main menu.

- Exit any submenu by entering a lower case "**x**".

The following sections provide instructions on how to complete the parameters or diagnostics in each submenu.

Modbus/Local (Host) Port Configuration

Selecting this submenu allows you to configure the local (host) port and corresponding modes:

- **Baud Rate** Select the number (1-3) corresponding to the desired baud rate. An asterisk (*****) will display beside the selected option. The new baud rate will be initiated after restarting the EMUX, which occurs through the **System Tests** menu.

- **Intermessage timeout** *This parameter currently is not configurable by the user. It defaults to 2.*

- **Modbus Communications Mode** Enter **5** to toggle between the two available modes. The initial in parentheses (**B** or **P**) indicates the current mode.

  ❑ **Buffered** Choosing this mode maintains the set of real-time data from the monitor on the EMUX. The unit provides this data upon request from the RTU. This data is updated in the EMUX based on the scan rate in the monitor.

  ❑ **Passthrough** Choosing this mode causes all data requests from the RTU to go directly to the monitor.

- • **Power Mode** Enter **6** to toggle between the two available power modes. The initial in parentheses (**C** or **S**) indicates the current mode.

  - ❑ **Sleep** Choosing this mode powers down the EMUX following 60 seconds of inactivity. When powered down, the LED will *not* be illuminated. The unit will awaken when a request or activity occurs at one of the ports.

  - ❑ **Continuous** Choosing this mode maintains the EMUX in an active state, constantly scanning for inputs and processing requests.

Modem Passthrough

Selecting this submenu enables you to interact with the modem in the EMUX. **HI** indicates the unit is in passthrough mode, allowing you to enter any commands the modem has the ability to process. The unit does not reset automatically following a session, so make sure the modem is in the desired mode for EMUX operation before a time out occurs.

Hit **Ctrl-C** to exit passthrough mode.

The unit returns to the main menu following 3 minutes of inactivity (i.e., no interaction between the user and the modem).

Program Modem

Selecting this submenu initiates modem programming and sets the modem to *listen* mode. The modem must be in listen mode to receive a message from another source. The programming/setting process takes several minutes to complete. No on-screen indication of the progress or feedback is included with this operation.

Monitor Test

Selecting this submenu sends a monitor detection query to the monitor communication port. If a monitor is detected, a **Monitor found ID** = *monitor ID* message will identify the monitor. If a monitor is *not* detected, a **Failed to detect monitor** message will display.

Update Firmware via XMODEM

Selecting this submenu enables you to update the EMUX firmware through the terminal emulator or another serial connection that supports XMODEM.

> **Note:** Currently, EMUX firmware updates cannot be performed through wireless communication. Therefore, perform all firmware updates using a serial connection.

From the appropriate screen on the terminal emulator, enter or browse to the desired file for the update (*.BIW*) and select **Xmodem** as the protocol. Then, initiate the update through the emulator. Once the file transfer is complete, the EMUX will restart automatically.

Enter three bangs (**!!!**) to return to the onboard diagnostics main menu.

System Parameters

Selecting this submenu displays the system parameters configured for the EMUX. These parameters can be updated only by activating a monitor attached to the EMUX through **Profile**. The parameters displayed should accurately reflect the configuration of monitor communications with the EMUX.

Following is a brief description of each parameter:

- **Modbus ID** This represents the ID used by the RTU to indicate the specific EMUX/monitor from which to request the data.

- **Modbus response delay** This represents the amount of time, in milliseconds, following the request before the monitor returns the requested data to the RTU through the EMUX.

- **Scan frequency** This represents the interval at which the EMUX requests the latest data from the monitor.

- **Cryout address** This represents the address of the server that will receive the monitor events.

- **Date and Time** This represents the current date and time on the EMUX clock.

System Tests

Selecting this submenu allows you to perform the following system tests:

- **Restart Emux** Enter a **1** to restart the EMUX. Restarting involves initializing all of the runtime variables and reloading the firmware.

- **Toggle CD to monitor** Enter a **2** to set DTR on the EMUX **MODBUS** port to control CD on the monitor. Pressing **2** repeatedly toggles the state. The first attempt may not change the state of the pin, so you may have to press the key multiple times to initiate the change on the monitor.

- **Uart Loopback Test** Enter a **3** to test the UARTs to which the user is *not* connected for onboard diagnostics. The screen will indicate **PASS** or **FAIL** for each UART.

Modbus Data Registers

This section contains tables providing Modbus registers. The first table lists the Modbus data register addresses corresponding to the entities for which the FlowShark Triton provides output data. The RTU requests data from the monitor using the designated registers, and the monitor (through the EMUX) sends the current entity data representing those registers back to the RTU. Therefore, the user

must program the RTU with the appropriate registers based on the type of data desired.

The second table lists the Modbus registers associated with more general FlowShark Triton information.

> **Note:** The entities available are based on the sensors used and the data logged. In addition, all values are floating point, unless otherwise defined.

Register Addresses for Entity Data

The following table contains the entities currently available for output and the associated register addresses. The register addresses for the quality values corresponding to the current data display in parentheses.

Description	Profile Entity	Standard Units of Measure	Registers
Peak Velocity from Peak Combo Sensor	PEAKVEL_1	Feet per Second	40000-40001 (40064-40065)
Upward Ultrasonic Depth from Peak Combo Sensor	UPDEPTH_1	Inches	40002-40003 (40066-40067)
Pressure Depth from Peak Combo Sensor	PDEPTH_1	Inches	40004-40005 (40068-40069)
Water Temperature from Peak Combo Sensor	WATERTEMP_1	Celsius	40006-40007 (40070-40071)
Surface Velocity from Surface Combo Sensor	SURFACEVEL_3	Feet per Second	40016-40017 (40080-40081)
Smart Depth from the Surface Combo Sensor	SDEPTH_3	Inches	40018-40019 (40082-40083)

Description	Profile Entity	Standard Units of Measure	Registers
Pressure Depth from the Surface Comb Sensor	PDEPTH_3	Inches	40020-40021 (40084-40085)
Air Temperature from the Surface Combo Sensor	AIRTEMP_3	Celsius	40022-40023 (40086-40087)
Flow rate based on QContinuity	FLOW1	Millions of Gallons per Day	40024-40025 (40088-40089)
Second Flow rate based on QContinuity	FLOW2	Millions of Gallons per Day	40026-40027 40090-40091)
Peak Velocity from the monitor	RAWVEL	Feet per Second	40028-40029 (40092-40093)
Monitor Battery Voltage (daily)	BTYVOLT	Volts	40030-40031 (40094-40095)
Flow Rate Threshold from monitor	QTHRESHOLD	Millions of Gallons per Day	40032-40033 (40096-40097)
Average Flow Rate from monitor	QMLI_AVG	Millions of Gallons per Day	40034-40035 (40098-40099)
Average Flow Depth from monitor	DMLI_AVG	Inches	40036-40037 (40100-40101)
Depth Threshold from monitor	DTHRESHOLD	Inches	40038-40039 (40102-40103)
Pressure Sensor Calibration Value	PRESSK	n/a	40040-40041 (40104-40105)
Unidepth	UNIDEPTH	Inches	40044-40045 (40108-40109)

Register Addresses for Monitor Information

The following table contains the registers corresponding to more general monitor information:

Description	Standard Units of Measure	Registers
Current Monitor Time	n/a	40128-40129
Last Monitor Scan Time	n/a	40130-40131
Scan (Wakeup) Rate	n/a	40132-40133
Reserved		40134-40135
Depth Conversion Coefficient	Inches	40136-40137
Velocity Conversion Coefficient	Feet Per Second	40138-40139
Volume Conversion	Millions of Gallons per Day	40140-40141
Temperature Conversion Type	Fahrenheit	40142-40143

EMUX LED Window

This section defines the characters, symbols, or activities that may display on the LED window on the front of the EMUX. The code displayed typically refers to an activity occurring through one of the ports on the unit (i.e., monitor **COMM** Port, modem **ANTENNNA** Port, or host **MODBUS** port).

- **Chasing Lights (*circulating segments*)** The EMUX is actively scanning the ports waiting for input.

- **2** The EMUX currently is engaged in wireless modem communication and data processing through the **ANTENNA** port.

- **3** The EMUX is sending output/receiving input through the **MODBUS** port.

- **r** The EMUX is waiting for a response from the monitor through the EMUX **COMM** port.

- **t** The EMUX is sending a message to the monitor through the EMUX **COMM** port.

- **Flashing middle bar** The monitor is not responding following 20 requests from the EMUX.

- **Blinking dot in lower right corner** The wireless modem has a live connection, but currently is not processing data.

A P P E N D I X E

System Configuration and Setup to Support the Telog Ru-33

Using a battery-powered ADS® FlowShark Triton® to support the Telog® Ru-33 Recording Telemetry Unit (RTU) requires some limited configuration and setup. These procedures involve designating the appropriate identification information to enable recognition and data exchange between the ADS and Telog units and using an interface cable to connect the monitor to the RTU.

> **Note:** The Telog Ru-33 must have firmware version 3.300 or later to effectively request data from the FlowShark Triton monitor.

Connecting the units together primarily involves running the ADS Triton-Telog Comm Cable from the battery-powered Ru-33 to the battery-powered FlowShark Triton monitor. This application requires installing both units in the manhole, a hazardous environment. However, ADS offers an optional extension cable (ADS p/n 8000-0044-25) that allows you to install the Telog unit outside the hazardous environment.

> **Note:** The Telog Ru-33 does not possess IS (intrinsically-safe) certification. Therefore, an installation involving connecting the Telog to the IS FlowShark Triton with both units residing *inside the manhole* will *not* be considered intrinsically safe. The installation will be considered

intrinsically safe only when the Ru-33 is installed *outside* the manhole.

Configuring the Monitor to Support the Ru-33

Configuring the FlowShark Triton to support the Telog Ru-33 requires setting three parameters in **Profile** when establishing a new location. Refer to *Creating a Monitor Location* in *Chapter 6*, *Configuration and Activation*, for more information.

- **Scan frequency** This represents the interval at which the monitor takes readings. These readings are available for retrieval directly from the monitor, but are overwritten with new data at each new interval. Therefore, ADS recommends using the same interval for both the scan rate in the monitor and the rate at which the Telog unit requests the data from the monitor.

- **Modbus ID** This represents the Modbus slave ID that will be used by the Ru-33 to indicate the specific monitor from which to request the data. ADS recommends using *55* to identify the FlowShark Triton.

- **Modbus Delay Response** This represents the amount of time, in milliseconds, following the request before the monitor will return the requested Modbus output data to the Ru-33. ADS recommends maintaining the *10 ms* default setting.

Connecting the Monitor to the Ru-33

Connecting the FlowShark Triton to the Ru-33 requires the ADS Triton-Telog Comm Cable (ADS p/n 8000-0054-01). First, connect the black, metal connector (with gray, plastic boot) from the comm cable to the **COMM** port on top of the FlowShark Triton. Then, connect the black, plastic connector from the comm cable to the *sensor port* on the Ru-33. The sensor port is the 9-hole port to the

right of the antenna connector and to left of the small 5-pin connector.
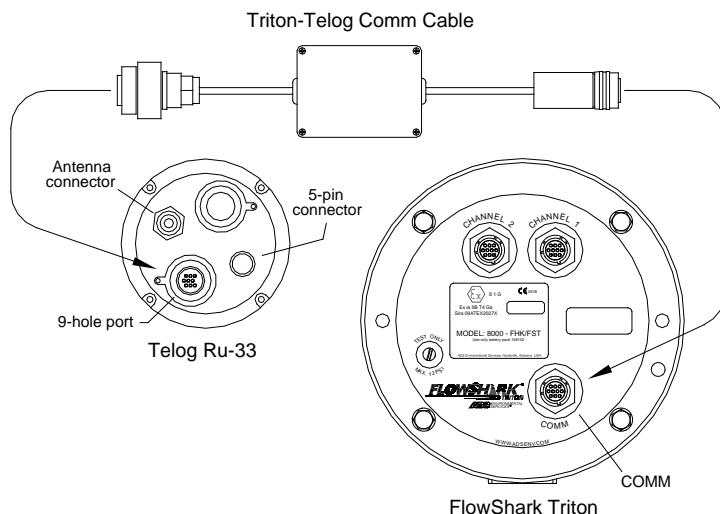
Connecting the Telog Ru-33 to the FlowShark Triton monitor using the Triton – Telog Comm Cable

Note: Do not leave the Triton-Telog Comm Cable connected to the FlowShark Triton monitor when the cable is not also connected to an operational Telog Ru-33. This may cause the FlowShark Triton to remain awake, unnecessarily consuming battery power and, consequently, draining the battery pack. Therefore, disconnect the Triton-Telog Comm Cable from the FlowShark Triton monitor whenever the Telog unit is disconnected from the cable for an extended period of time, removed from the manhole, or out of service.

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