

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

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QR 775003 A2



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CHAPTER 1

Introduction

The ADS® *Intrinsically Safe FlowShark® long-term flow monitor* (FlowShark IS) measures open channel flow in sanitary sewers, storm 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 inner-agency billing
- Monitoring sewage handling facilities (wastewater treatment plants and pump stations)

The battery or external DC-powered, digital signal processor-based FlowShark IS monitor provides exceptional accuracy and reliability in measuring open-channel flow depth and velocity to determine flow rate (quantity) in sewer lines. This flow data is the essential element required to successfully perform investigative, analytical, and reporting activities.

This manual offers detailed instructions on installing the FlowShark IS flow monitor and sensors, providing communication with monitor (remotely by TCP/IP wireless or on-site by serial connection), and performing routine maintenance and troubleshooting on the system.

Intrinsic Safety

Intrinsic Safety is a protection classification for equipment 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 the equipments' deployment in hazardous areas. Areas in which hazardous conditions can be expected to exist on a constant basis are categorized (rated) as Class I, Division 1, in the USA and as Zone 0 in Europe. Some U.S. cities and states have adopted the NFPA (National Fire Protection Association) classification that rates sanitary sewers as Class I, Division 1, areas. Many European Union member states have classified their sanitary sewer systems as Zone 0 or Zone 1 environments.

The FlowShark IS (Model 5000-IS1-xx-x) flow monitor is certified to UL standards in the U.S. and to ATEX standards in Europe, and it is approved for use in all classified (hazardous) sanitary sewer and industrial hazardous areas. Many rest-of-world countries accept the U.S. or ATEX certifications in lieu of their country-specific requirements. **It is the customer's responsibility to ensure that the certification(s) provided for the ADS equipment meets the customer's regulatory requirements.**

Note: FlowShark IS models include 5000-IS1-US-01, 5000-IS1-US, 5000-IS1-01, and 5000-IS1. In the remainder of this manual, all models of FlowShark IS are referred to as ADS Model 5000-IS1, unless otherwise specified.

FlowShark IS System Description

The FlowShark IS unit is approved for use only with approved ADS IS 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.

Sensors

One of each type of IS sensor is approved for connection to the FlowShark IS flow monitor. Following are the approved IS sensors:

- IS Ultrasonic Depth Sensor (ADS p/n 106186A)
- IS Pressure Depth Sensor (ADS p/n 3754-0001/0002/0003)
- IS Doppler Velocity (ADS p/n 106194A)

Extension cables of up to 300 feet are available for these sensors.

Power

The FlowShark IS flow monitor can receive power from an internal or external source:

- **Internal** The FlowShark IS flow monitor can receive power from an internal 9-volt IS battery (ADS p/n 106152A) or 12-volt IS battery (ADS p/n 8000-0043-01/02).
- **External** The FlowShark IS flow monitor can receive power from an external source through an External Modem Unit (EMU – ADS p/n 3800-0148EP). The externally-powered EMU contains protection circuitry that limits the amount of power that can reach the monitor. External power eliminates the need for periodic battery pack replacement and disposal.

Warning: Except as noted below, under no circumstances can external power be applied directly to the monitor. Any attempt to power the monitor without using the EMU will void the warranty and possibly create an unsafe operating condition in hazardous areas.

Note: A legacy Rechargeable Battery Pack (RBP) may be connected to the **COMM** connector on the FlowShark IS in a similar manner as it is connected to the ADS Model 3600[®] flow monitor.

Telemetry

Only the Wireless External Modem Unit (EMU) (ADS p/n 3800-0148 or 3800-148EP) is approved for connection to the FlowShark IS. The EMU provides wireless telemetry via a quad-band GSM/GPRS modem that is isolated and mounted in an enclosure outside the hazardous area. The EMU connects to the FlowShark IS via an approved Communication Cable (ADS p/n 106227A-xxx, where *xxx* represents the length of the cable) that is direct-buried or enclosed in conduit per local regulations.

Note: ADS wireless communication products (in this case, the GSM/GPRS modem in the EMU) use static IP address network services provided by AT&T (formerly *Cingular Wireless*). Therefore, any installation location designated for wireless communication must have access to AT&T 850 or 1900 MHz service. Each wireless device will be fitted with a SIM (Subscriber Identity Module) card that is provisioned by AT&T with specific account and network information for use with ADS software.

Additional Features

Special features of the FlowShark IS flow monitor include the following.

- All monitors are checked carefully before being shipped. Each component is guaranteed to meet specifications. Internal quality inspectors complete the pre-shipping inspection.
- All monitors connect to existing ADS IS 106 series sensors. The female connector is located on the flow monitor chassis; the male connector is located on the sensor cable (*unlike other ADS monitors*). This arrangement of connectors prevents mismatching with non-IS sensors.

- Only limited field repairs to the FlowShark IS are allowed; all other repairs must be performed by an ADS authorized technician. For information on allowable field repairs, refer to *Maintenance Restrictions* on page 1-7.

Installation and IS Considerations

When installing the FlowShark IS flow monitor, carefully follow all local regulations for the installation of IS equipment. For example, many cities only allow the use of IS-certified tools (flashlights, radios, etc.) in manholes. Some cities will not allow the use of an electric drill, battery- 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 collection system owner or the corresponding safety representative.

Special Conditions for Safe Use

During the ATEX approval process, certain conditions are set forth that must be observed when using the approved equipment. These “Special Conditions for Safe Use” can be found in the body of each ATEX Certification (included in this manual), as well as on a page attached to the Declaration of Conformity. Following is a summary of these Safe Use Instructions:

- When internal battery power is in use, the ADS Model 5000-IS1-01 or the ADS Model 5000-IS1-US-01 shall only use one of the following ADS IS battery packs (p/n 106152 (9-volt) or 8000-0043-01/02 (12-volt)).
- The ADS Model 5000-IS1 shall only be used in the hazardous area when fully assembled. Conduct maintenance of internal parts or battery changes only when the unit is located in a safe area.

- Only ADS approved sensors (ADS p/n 106186, 106194, and 3754-0001/0002/0003) shall be connected to the ADS Model 5000-IS1.
- Due to the use of aluminum in the chassis of the ADS Model 5000-IS1, use special care when working with the product in the hazardous area. Avoid any impact with the aluminum parts (especially by rusted iron) that could produce a spark.
- The only devices that may be connected to the **COMM** Connector on the 5000-IS1 are the PC Communication Cable (ADS p/n 106228) and the Communication Cable (ADS p/n 106227) connecting the monitor to the EMU Communication Interface (ADS p/n 106226A). Only factory built communication cables (ADS p/n 106227) shall be used.
- In general, **never** rub any of the plastic parts (specifically, the PVC connector potting boots and the velocity sensor housing) with a dry cloth. This could result in the buildup of dangerous static charges.

Maintenance Restrictions

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

ADS 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 the troubleshooting guidelines in *Chapter 8, Maintenance and Troubleshooting*. The following maintenance procedures can be conducted in the field, and these procedures must be performed only as explained in this manual:

- Install and swap monitor
- Install and swap sensors
- Install and swap battery
- Install and swap wireless modem
- Install and swap SIM
- Clean sensors
- Confirm sensors
- Collect data

Note: In all applications, only ADS IS-certified Service Technicians are authorized to perform component-level service on the FlowShark IS.

For any questions concerning the procedures, warranty information, or level of service you are allowed to perform on a monitor, please contact the ADS Client Services Department at adssupportcenter@idexcorp.com or 877-237-9585.

Warnings, Certifications, FCC 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

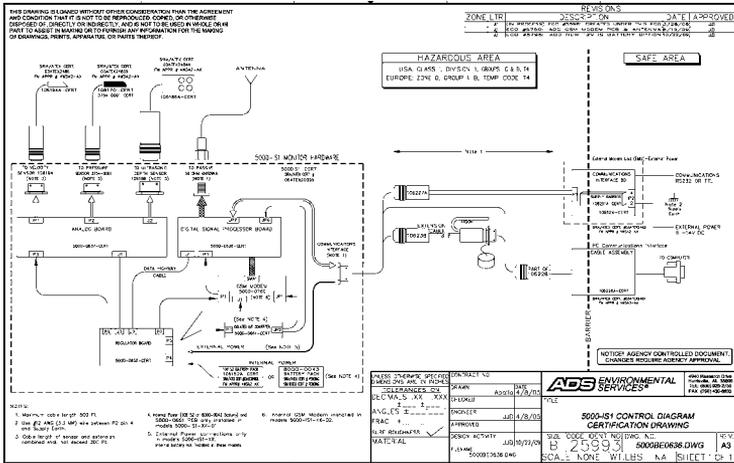
Changes or modifications to the FlowShark IS flow monitor not expressly approved by the party responsible for compliance will void the IS certification.

Personnel performing installation of the FlowShark IS 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 cause damage to the monitor, which would invalidate the warranty.

The FlowShark IS 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 interconnections allowed for the FlowShark IS. It is intended for use by inspection professionals for audit certificate compliance: however, it is beneficial to understand the FlowShark IS system structure.



FlowShark IS control drawing

For a full-size copy of this drawing, please contact ADS Client Services.

FCC Compliance

To comply with the Federal Communications Commission (FCC), and European regulatory agencies, ADS Environmental Services provides the following information about installing and operating the FlowShark IS wireless modem and monitor.

FCC Part 15

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception (which can be determined by turning the equipment off and on), you should try to correct the interference by one or more of the following measures:

- reorient or relocate the radio or television antenna,
- move and/or increase the distance between the computer and the radio or television, and
- plug the computer in an outlet different than the radio or television.

If these suggestions do not help, contact the ADS Client Services Department at adssupportcenter@idexcorp.com or 877-237-9585, or an experienced radio/television technician.

GSM/GPRS Modem Information

ADS has incorporated a third-party FCC approved commercial GSM/GPRS modem as part of their wireless products and has made no modifications to the device or recommended installation.

The following information is an excerpt from the Enfora SA-GL Users Manual (Version 1.04) showing the FCC and European R&TTE-CE Statement for the Enfora GSM1218 GSM/GPRS Wireless Modem:

The modem was tested and certified to meet FCC Parts 15 in a stand-alone configuration, which demonstrated that the GSM1218 SA-GL complies with Part 15 emission limits. FCC Part 22 & Part 24 is covered by the Enfora Enabler-IIG "modular approval" process for a transmitter. This approach, described by FCC Public Notice DA 00-131407 released June 26, 2000, is intended to afford relief to equipment manufacturers by eliminating the requirement for obtaining a new equipment authorization for the same transmitter when installed in a new device.

In order to use the GSM1218 SA-GL without additional FCC certification approvals, the installation must meet the following conditions:

For the transmitter to meet the MPE categorical exclusion requirements of 2.1091, the ERP must be less than 1.5 watts for personnel separation distance of at least 20 cm (7.9 in). Therefore, the maximum antenna gain cannot exceed +3.3dBi. If greater than 1.5 watts exists, then additional testing and FCC approval is required.

R&TTE-CE Information

2.2 R&TTE - CE

The GSM1218 SA-GL modem has been fully tested and complies with all the requirements of EN301 489-1, EN301 489-7 and EN60950-1:2001. Compliance to EN301 511 has been demonstrated by testing on both the GSM1218 and the integrated GSM0108 module.

U.S. Hazardous Area Compliance

The FlowShark IS has been certified for use in Class I, Division 1, Group C & D, hazardous areas by QPS Evaluation Services. All units (monitors) must bear the following label, as well as an individually serialized blue QPS Field Evaluation label to substantiate certification:



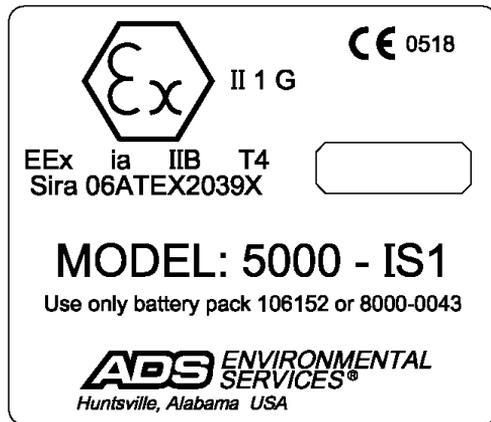
Intrinsically-safe equipment label

European ATEX Hazardous Area Compliance

The following instructions apply to equipment covered by certificate number Sira 06ATEX2039X (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 T1, T2, T3, and T4.
- The equipment is certified for use only in ambient temperatures in the range of 0°C to 40°C and should not be used outside this range.
- The certificate number has an suffix of 'X', which indicates that special conditions of installation and use apply. 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, the user must take suitable precautions to prevent it from being adversely affected, ensuring that the type of protection is not compromised.
 - ❑ Aggressive substances include acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.
 - ❑ Suitable precautions include regular checks during routine inspections or confirming from the material's data sheet that it is resistant to specific chemicals.
- No special inspection or maintenance conditions are required other than a periodic check.
- Units delivered to Europe must bear the following label to substantiate conformance to ATEX standards as approved by SIRA Certification Services:



Sira certification label

The following EC Type Examination Certificates can also be used to substantiate conformance to applicable EU laws for IS equipment:

Note: These certificate copies were current at the time of this manual publication. If the latest versions are required, please contact ADS Client Services.



1 **EC TYPE-EXAMINATION CERTIFICATE**

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

3 Certificate Number: **Sira 06ATEX2039X** Issue: **4**

4 Equipment: **Model 5000-IS1 Flowshark**

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 50014:1997 (amendments A1 and A2) EN 50020:2002 EN 50284:1999

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
EEx ia IIB T4 (Ta=20°C to +40°C)

Project Number 52820981
C. Index 12

D R Stubbings
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

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SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 06ATEX2039X
Issue 4

13 DESCRIPTION OF EQUIPMENT

The ADS 5000 IS1 monitor is a self-contained device that measures and logs depth and velocity in sewer pipes and open channels. Externally the monitor comprises a cylindrical aluminium housing, with four sockets for connection to sensors, communication interface and external power. The sockets are arranged with either a different numbers of pins or are keyed so as to avoid a wrong interconnection.

The enclosure is metallic and provides a degree of protection not less than IP20. The alloy used in the construction of the enclosure contains 1% magnesium by weight. All thread forms are compatible with the alloy used. The monitor enclosure is isolated from the internal circuits so no connection facilities for earthing or bonding conductors are supplied. Enclosure contains no terminals or compartments.

Internally the Monitor comprises: Regulator Board, Analog Board, Processor Board, V-F Board and IS GSM Modem board, interconnection cables between boards and from the boards to the sensor connectors, external power and communication connector, with an option for an internal battery.

The external connectors have the following safety description.

Velocity, Pressure, Ultrasonic Connectors

Uo	=	10.302V (i.e. ±5.151V)
Io	=	2.9 W
Li	=	3.1A
Cf	=	47.8µF @ 5.2V
Cl	=	15.9µF @ 10.4V
Co	=	5.01µF
Lo/Ro	=	76µH/Ω
Li	=	11.155mH

COMM** connector pins (remaining pins)

Uo	=	10.302V (i.e. ±5.151V)
Io	=	1.2974006 W
Li	=	2.94A
Li	=	0
Cf	=	14.8µF @ 10.4V
Cl	=	57.7µF @ 5.2V
Co	=	2.38µF
Lo/Ro	=	109.8µH/Ω

COMM** connector pins K, L and J, M.

Ui	=	10.5V
Ii	=	3.28A (spark)
Pi	=	0.51A (power)
Li	=	5.36W
Li	=	0
Cl	=	0

Aerial Connector

Ui	=	0
Uo	=	9.6V
Io	=	2.15A
Io	=	1.8207W
Cl	=	19.8pF
Li	=	0
Co	=	26µF
Lo	=	30.76µH
Lo/Ro	=	78.21µH/Ω

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SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

**Sira 06ATEX2039X
Issue 4**

Variation 1 - This variation introduced the following changes:

- i. The option to use an isolated voltage to frequency (V/F) converter board to measure the internal battery voltage.

Variation 2 - This variation introduced the following changes:

- i. The option to specify 1N53XX series zener diodes with tolerances higher than 1% was introduced, however, the manufacturer will screen these devices to maintain the use of 1% parts only.
- ii. The value of capacitor C1 was changed from 47 µF to 100 µF on the Regulator PCB.
- iii. Capacitor C12, which has a capacitance value of 100 µF, was added to the Regulator PCB.
- iv. The tolerance of resistor R1 on BOM (Bill-of-Materials) 5000-0638-CERT Rev A2 was changed from 1% to 5%.
- v. The specification of U6, U7, and U8 was amended to allow different versions opto-isolator type CN17 to be used.
- vi. Items 34 and 35 on the BOM 5000-0638-CERT Rev A2 were changed from epoxies type 20-2353R and C (clear) to Cytec Industries, type EN-2521, one part-potting compound.

Variation 3 - This variation introduced the following changes:

- i. The addition of an IS GSM Modem Board.
- ii. A change in the value of fuse F4 from 100mA to 125mA.

Variation 4 - This variation introduced the following changes:

- i. The introduction of a new 12V IS battery pack.
- ii. Modification to the certification label to list the new battery pack.

14 DESCRIPTIVE DOCUMENTS

14.1 Drawings

Refer to Certificate Annexes.

14.2 Associated Sira Reports and Certificate History

Issue	Date	Report no.	Comment
0	4 April 2006	R52A14689A	The release of the prime certificate.
1	13 February 2007	R52A15849A	The introduction of Variation 1.
2	19 December 2007	R52A17367A	This Issue covers the following changes: <ul style="list-style-type: none"> • All previously issued certification was rationalised into a single certificate, Issue 2, Issues 0 and 1 referenced above are only intended to reflect the history of the previous certification and have not been issued as documents in this format. • The introduction of Variation 2.
3	16 July 2009	R52B20270B	The introduction of Variation 3.
4	16 December 2009	R20981C	The introduction of Variation 4 and modifications to Special Conditions For Safe Use 15.1 and 15.2.

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Form 9400 Issue1



SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 06ATEX2039X
Issue 4

- 15 **SPECIAL CONDITIONS FOR SAFE USE** (denoted by X after the certificate number)
- 15.1 The model 5000-IS1 Flowshark monitor shall only be used with one of the following ADS Battery Packs:-
- part number 106152 bearing the certificate number Sira 03ATEX2480X
 - part number 8000-0043 bearing the certificate number Sira 06ATEX2039X
- 15.2 The following external connectors shall only be used as follows, each with up to 300ft of cable
- Velocity socket connected to sensor model 106154, Sira 03ATEX2486.
 - Ultrasonic socket connected to sensor model 106156, Sira 03ATEX2484X.
 - Pressure socket connected to sensor model 3754-0001, Sira 03ATEX2485X.
 - Aerial socket connect to a passive 50Ω antenna.
 - COM1 connector connected to either the PC Communications Interface Sira 03ATEX2481 or 106124 Communications Interface Sira 03ATEX2482
- 15.3 As aluminium is used at the accessible surface of this equipment, in the event of rare incidents, Ignition sources due to impact and friction sparks could occur. This shall be considered when the model 5000-IS1 Flowshark is being installed in locations that specifically require group II, category 1G equipment
- 16 **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II** (EHSRs)
- The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in the reports listed in Section 14.2.
- 17 **CONDITIONS OF CERTIFICATION**
- 17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.
- 17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.
- 17.3 The products covered by this certificate incorporate previously certified devices; it is therefore the responsibility of the manufacturer to continually monitor the status of the certification associated with these devices, and the manufacturer shall inform Sira of any modifications of the devices that may impinge upon the explosion safety design of their products.

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Sira Certification Service

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 Web: www.siracert.com

Certificate Annexe

Certificate Number: Sira 06ATEX2039X
Equipment: Model 5000-IS1 Flowshark
Applicant: ADS Environmental Services

**Issue 0****Regulator Board**

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
5000BS0638-CERT	1 to 2	03	20 Feb 06	Regulator Schematic
5000RB0638-CERT	1 to 9	00	20 Feb 06	Regulator Artworks
5000-0638-CERT	1 to 3	A1	20 Feb 06	Regulator BOM (Note: the number of sheets was corrected in Issue 2)

Analogue Board

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
5000BS0637-CERT	1 to 8	02	20 Feb 06	Analogue Processor, Schematic
5000RB0637-CERT	1 to 9	00	20 Feb 06	Analogue Processor, Artworks
5000-0637-CERT	1 to 2	A1	20 Feb 06	Analogue BOM

Digital Board

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
5000BS0636-CERT	1 to 10	02	20 Feb 06	Digital Processor, Schematic
5000RB0636-CERT	1 to 9	00	20 Feb 06	DSP Artworks
5000-0636-CERT	1 to 2	A1	20 Feb 06	DSP BOM

RTC Module

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
5000BA0674-CERT	1 to 2	01	20 Feb 06	RTC Module Assembly
5000-0674-CERT	1 of 1	A1	20 Feb 06	RTC Module BOM

General Assembly

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
5000CA0683-CERT	1 to 3	A1	20 Feb 06	General Assembly
5000-IS1-CERT	1 of 1	A1	20 Feb 06	General Assembly BOM
5000B0666-CERT	1 of 1	00	20 Feb 06	Main Certification Label
5000AE0682-CERT	1 of 1	00	20 Feb 06	Date Code label
5000AE0660-CERT	1 of 1	00	20 Feb 06	Serial Number Label

Issue 1**V/F Converter Board**

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
5000AS0661-CERT	1 of 1	00	09 Feb 07	V/F Board Schematic
5000RB0661-CERT	1 to 5	A1	09 Feb 07	V/F Board Artwork
5000CA0683-CERT	1 to 3	A2	09 Feb 07	V/F General Assembly
5000-0661-CERT	1 to 1	A1	09 Feb 07	V/F Board BOM
5000-IS1-CERT	1 to 1	A2	09 Feb 07	V/F Assembly BOM
5000AE0661-CERT	1 to 1	00	09 Feb 07	V/F Board Conformal Coating

Issue 2**Regulator Board**

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
5000-0638-CERT	1 to 3	A2	12 Dec 07	Regulator BOM

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Form 9400 Issue 3

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Certificate Annexe

Certificate Number: Sira 06ATEX2039X
Equipment: Model 5000-IS1 Flowshark
Applicant: ADS Environmental Services

**Issue 3****Regulator Board**

Drawing No.	Sheet	Rev.	Date (Sira Stamp)	Description
5000RS0638-CERT	1 to 2	A2	26 Jun 09	Regulator Schematic
5000R80639-CERT	1 to 7	A2	26 Jun 09	Regulator Artworks
5000-0638-CERT	1 to 4	A3	26 Jun 09	Regulator BOM

General Assembly

Drawing No.	Sheet	Rev.	Date (Sira Stamp)	Description
5000CA0663-CERT	1 to 3	A3	26 Jun 09	General Assembly
5000-IS1-CERT	1 to 4	A3	26 Jun 09	General Assembly BOM

IS GSM Modem

Drawing No.	Sheets	Rev.	Date (Sira Stamp)	Title
5000-0760-CERT	1 to 4	A3	26 Jun 09	BOM PCB, GSM Modem, G3, FS JS
5000BS0760-CERT	1 to 4	A1	26 Jun 09	Schematic IS GSM Modem
5000R80760-CERT	1 to 7	A1	26 Jun 09	Artwork IS GSM Modem

Issue 4**General Assembly**

Drawing No.	Sheets	Rev.	Date (Sira Stamp)	Title
5000-IS1-CERT	1 to 4	A4	21 Nov 09	General Assembly BOM

Marking

Drawing No.	Sheets	Rev.	Date (Sira Stamp)	Title
5000B0666-CERT	1 of 1	A2	21 Nov 09	Main Certification Label

IS GSM Modem

Drawing No.	Sheets	Rev.	Date (Sira Stamp)	Title
5000-0760-CERT	1 to 4	A2	21 Nov 09	BOM PCB, GSM Modem, G3, FS JS
5000BS0760-CERT	1 to 4	A2	21 Nov 09	Schematic IS GSM Modem
5000BE0636	1 of 1	A3	21 Nov 09	5000-IS1 Control Diagram

IS 12V Battery Pack

Drawing No.	Sheets	Rev.	Date (Sira Stamp)	Title
8000-0042-CERT	1 of 1	A1	20 Nov 09	PCB, ASSY, BATTERY, IS, 12V, FST, BOM
8000-0043-CERT	1 of 3	A1	20 Nov 09	ASSY, BATTERY, IS, 12V, FST, BOM
8000B0128	1 of 1	A1	20 Nov 09	IS 12V Battery Label
8000BS0042-CERT	1 of 1	A1	20 Nov 09	Schematic IS 12V Battery
8000CE0043-CERT	1 of 1	A1	20 Nov 09	Assy IS 12V Battery
8000R80042-CERT	1 to 4	A1	20 Nov 09	PCB IS 12V Battery

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1 **EC TYPE-EXAMINATION CERTIFICATE**

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

3 Certificate Number: Sira 03ATEX2481

4 Equipment: 106228 PC Communications Interface

5 Applicant: ADS Environmental Services

6 Address: 5025 Bradford 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 confidential report number R53A9754A.

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 50014:1998 (amendments A1 and A2)
- EN 50020:2002
- EN 50284:1999

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
[EEx ia] IIB

Project Number 53A9754
Date 20 May 2004
Re-issued 20 July 2004
C. Index 12

C Ellaby
Certification Officer

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Certification Service

SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 03ATEX2481

Re-issued 20 July 2004 to amend the drawing list.

13 DESCRIPTION OF EQUIPMENT

The IS PC Communications Interface employs opto isolators and is designed to allow a 3600/1600 Flow Monitor (Sira 03ATEX 2480X) to communicate with safe area equipment. It uses approved opto isolators (BAS 01ATEX1278U), the power to these being limited by means of fuses and voltage clamps.

Safety Description

Input from supply

$$U_{in} = 250 \text{ V}$$

14 DESCRIPTIVE DOCUMENTS

14.1 Drawing No. Sheet Rev. Description

106228A-CERT	1 of 2	A4	PCB,PC Comm Intf&Comm CBL, I,S CRIT
106228A-CERT	2 of 2	A4	PCB,PC Comm Intf&Comm CBL, I,S CRIT
106230A,PCB	1 of 5	B	I,S PC Communication Interface
106230A,PCB	2 of 5	B	I,S PC Communication Interface
106230A,PCB	3 of 5	B	I,S PC Communication Interface
106230A,PCB	4 of 5	B	I,S PC Communication Interface
106230A,PCB	5 of 5	B	I,S PC Communication Interface
106280B,DWVG	1 of 1	B3	Label, I,S PC Comm Interface
3600BE0194	1 of 1	A3	Cable, Comm, 106 Monitor, Direct Connect & PCB, I,S PC Communication Interface Certification Drawing

14.2 Report No. R53A9754A

15 SPECIAL CONDITIONS FOR SAFE USE (denoted by X after the certificate number)

None

16 ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in Report No. R53A9754A.

17 CONDITIONS OF CERTIFICATION

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.

17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.

17.3 This certificate relies on the following previously certified products. When they are used as part of the IS PC Communication Interface they shall still be covered by their original certificate

Item	Certificate No	Variation No
Optical Isolator OPI 110C	BAS 01ATEX1278U	Prime
Optical Isolator OPL 1265C	BAS 01ATEX1278U	Prime

Date 20 May 2004

Re-issued 20 July 2004

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Form 9176 Issue 10

Page 2 of 2



1 **EC TYPE-EXAMINATION CERTIFICATE**

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

3 Certificate Number: Sira 03ATEX2482

4 Equipment: 106124 Communications Interface Unit

5 Applicant: ADS Environmental Services

6 Address: 5025 Bradford 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 confidential report number R53A9754A.

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 50014:1998 (amendments A1 and A2)
EN 50020:2002
EN 50284:1999

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
[EEx ia] IIB

Project Number 53A9754
Date 20 May 2004
C. Index 12

D R Stubbings BA MIEE
Certification Manager

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SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 03ATEX2482

13 DESCRIPTION OF EQUIPMENT

The 106124 IS Communications Interface Unit is designed to connect to the 3600/1600 Monitor to external communications systems. It communicates with the Monitor via approved opto-isolators (BAS 01ATEX1278U). A barrier module is installed so that it can supply power to the 3600/1600 Monitor in the absence of an internal battery pack.

Safety Description

U_n	=	250 V
U_o	=	10.5 V
I_o	=	3.28 A
W_o	=	5.36 W

14 DESCRIPTIVE DOCUMENTS

Drawing No.	Sheet	Rev.	Description
106124-CERT	1 of 2	A6	PCB, 106,Comm, I.S. Crit Comp Ref
106124-CERT	2 of 2	A6	PCB, 106,Comm, I.S. Crit Comp Ref
106124A.PCB	1 of 5	D	I.S. Communication Interface
106124A.PCB	2 of 5	D	I.S. Communication Interface
106124A.PCB	3 of 5	D	I.S. Communication Interface
106124A.PCB	4 of 5	D	I.S. Communication Interface
106124A.PCB	5 of 5	D	I.S. Communication Interface
3600BE0191	1 of 1	A4	PCB, Communication Interface I.S (106124A) & External Power (106124C) Certification Drawing
106282B.DWG	1 of 1	B2	I.S. Comm Enclosure Label Detail
106251A-CERT	1 of 2	A3	PCB, Comm Barrier (106124C), I.S.Crit
106251A-CERT	2 of 2	A3	PCB, Comm Barrier (106124C), I.S.Crit
106251A.SCH	1 of 1	D	I.S Communication Barrier
106251A.PCB	1 of 6	F	I.S Communication Barrier
106251A.PCB	2 of 6	F	I.S Communication Barrier
106251A.PCB	3 of 6	F	I.S Communication Barrier
106251A.PCB	4 of 6	F	I.S Communication Barrier
106251A.PCB	5 of 6	F	I.S Communication Barrier
106251A.PCB	6 of 6	F	I.S Communication Barrier
3600BE0193	1 of 1	A2	I.S. Communications Barrier Ass'y Detail Certification Drawing

14.2 Report No. R53A9754A

15 SPECIAL CONDITIONS FOR SAFE USE (denoted by X after the certificate number)

None

16 ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in Report No. R53A9754A.

Date 20 May 2004

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SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 03ATEX2482

17 CONDITIONS OF CERTIFICATION

- 17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.
- 17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.
- 17.3 This certificate relies on the following previously certified products. When they are used as part of the IS PC Communication Interface they shall still be covered by their original certificate

Item	Certificate No	Variation No
Optical Isolator OPI 110C	BAS 01ATEX1278U	Prime
Optical Isolator OPL 1265C	BAS 01ATEX1278U	Prime

Date 20 May 2004

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1 **EC TYPE-EXAMINATION CERTIFICATE**

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

3 Certificate Number: Sira 03ATEX2484X

4 Equipment: 106186 Ultrasonic Depth Sensor

5 Applicant: ADS Environmental Services

6 Address: 5025 Bradford 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 confidential report number R53A9754A.

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 50014:1998 (amendments A1 and A2)
EN 50020:2002
EN 50284:1999

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 1G
EEx ia IIB T4

Project Number 53A9754
Date 20 May 2004
C. Index 12

D R Stubbings BA MIEE
Certification Manager

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Form 9176 Issue 10



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SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 03ATEX2484X

13 DESCRIPTION OF EQUIPMENT

The Ultrasonic Sensor utilises four transducers, each consisting of a piezo electric crystal and associated circuitry. They are all mounted on a common circuit board, but maintained as separate for intrinsic safety purposes. The circuit board and transducers are contained within a metallic housing, which is filled with epoxy type filling compound. Connected to the circuit board is a 300 ft length of multicore cable and a twenty six way connector.

Safety Description

U_i	=	15.0 V
I_i	=	486 mA
W_i	=	1.2 W
C_i	=	3.35 μ F (inc cable)
L_i	=	This device incorporates the following inductance and resistance combinations:
		3.63 μ H @ 60.8 Ω x 4
		300 ft. of cable , 0.002 μ H/ft, 0.016 Ω

14 DESCRIPTIVE DOCUMENTS

14.1 Drawing No. Sheet Rev. Description

100151A.DWG	1 of 1	E1	Ultrasonic Depth Sensor Cable Detail
106186A-CERT	1 of 1	A3	Sensor, 106 Ultrasonic, I.S. Crit Comp
106247B.DWG	1 of 1	B3	I.S. Sensor Potting Boot Chart
3702AE0002	1 of 1	A2	Transducer, specification, ultrasonic, 40 kHz
3752BE0005	1 of 1	A5	I.S. Ultrasonic Depth Sensor Certification Drawing
3702AE0002	1 of 1	A2	Transducer Specification Ultrasonic 40 kHz

14.2 Report No. R53A9754A

15 SPECIAL CONDITIONS FOR SAFE USE (denoted by X after the certificate number)

15.1 In installing this equipment, it should be verified that electrostatic charges cannot be induced in the exposed non-conductive surfaces.

16 ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in Report No. R53A9754A.

17 CONDITIONS OF CERTIFICATION

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.

17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.

Date: 20 May 2004

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1 **EC TYPE-EXAMINATION CERTIFICATE**

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

3 Certificate Number: Sira 03ATEX2485X

4 Equipment: 106170 Pressure Sensor and 3754-0001/2/3 US6X1 Pressure Sensor

5 Applicant: ADS Environmental Services

6 Address: 5025 Bradford 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 confidential report number R53A9754A.

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 50014:1998 (amendments A1 and A2)
EN 50020:2002
EN 50284:1999

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 1G
EEx ia IIB T4

Project Number 53A9754
Date 20 May 2004
C. Index 12


D R Stubbings BA MIEE
Certification Manager

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SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 03ATEX2485X

13 DESCRIPTION OF EQUIPMENT

106170 Pressure Sensor

This consists of a pressure transducer and its associated circuitry. These are contained within a plastic housing and encased in an epoxy type encapsulation material. This, in turn, is connected to a length of multi-core cable and a multi-connector.

Safety Description

U_i	=	15 V
I_i	=	1.19 A
W_i	=	1.2 W
C_i	=	0.951 μ F (inc cable)
L_i	=	150 μ H @ 3.9 Ω (cable)

3754-0001/2/3 US6X1 Pressure Sensor

This consists of a separate pressure transducer and its associated circuitry connected to a conditioning circuit. The transducer etc are contained within a metallic housing and encased in an epoxy type encapsulation material. This, in turn, is connected to a length of multi-core cable and a multi-connector. The conditioning circuit is located within the multi-connector.

Safety Description

U_i	=	15 V
I_i	=	1.88 A
W_i	=	1.2 W
C_i	=	1.66 μ F (inc cable)
L_i	=	60 μ H @ 5.25 Ω (cable)

14 DESCRIPTIVE DOCUMENTS

14.1 Drawings

106170 Pressure Sensor

Drawing No.	Sheet	Rev.	Description
100134A.DWG	1 of 1	C	Pressure Sensor Cable
106170A - CERT	1 of 1	A3	Sensor, 106, Pressure, 0-5 PSI, IS Crit
106175A.PCB	1 of 4	B	Pressure Transducer PCB's Current Excitation
106175A.PCB	2 of 4	B	Pressure Transducer PCB's Current Excitation
106175A.PCB	3 of 4	B	Pressure Transducer PCB's Current Excitation
106175A.PCB	4 of 4	B	Pressure Transducer PCB's Current Excitation
106242A.PCB	1 of 3	A	Pressure Transducer PCB's Current Excitation
106242A.PCB	2 of 3	A	Pressure Transducer PCB's Current Excitation
106242A.PCB	3 of 3	A	Pressure Transducer PCB's Current Excitation
106247B.DWG	1 of 1	B3	I.S. Sensor Potting Boot Chart
3751BE0002	1 of 1	A5	I.S. Pressure Sensor Certification Drawing

Date 20 May 2004

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SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 03ATEX2485X

3754-0001/2/3 US6X1 Pressure Sensor

Drawing No.	Sheet	Rev.	Description
3754BE0001	1 of 1	07	L.S. 106 Replacement Pressure Transducer Certification Drawing
3704AS0017	1 of 1	A1	US600-P4 Reference Schematic
3704AE0017	1 of 1	A1	0-5 PSIG Transducer Specification Reference
3704AE0018	1 of 1	A1	0-15 PSIG Transducer Specification Reference
3704AE0019	1 of 1	A1	0-30 PSIG Transducer Specification Reference
3704AE0028	1 of 1	00	Bill Of Materials For US6X1 Electronic Components Reference
3754-0001-CERT	1 of 1	05	Sensor, 106, Pres, Repl, 0-5PSI, IS Crit
3754AE0004	1 of 1	02	Potting Boot, I.S E

14.2 Report No. R53A9754A

15 **SPECIAL CONDITIONS FOR SAFE USE** (denoted by X after the certificate number)

15.1 In installing this equipment, it should be verified that electrostatic charges cannot be induced in the exposed non-conductive surfaces.

16 **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II (EHSRs)**

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in Report No. R53A9754A.

17 **CONDITIONS OF CERTIFICATION**

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.

17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.

17.3 **3754-0001/2/3 US6X1 Pressure Sensor**

In accordance with clause 10.6 of EN 50020:2002, the insulation between the intrinsically safe circuit and the frame of the apparatus shall be capable of withstanding a 500 V rms test voltage. The supply shall have a sinusoidal waveform with a frequency between 48 and 62Hz. The applied voltage shall be increased steadily to 500 V in a period of not less than 10 s and then maintained for at least 60 s. The applied voltage shall remain constant during the test and the current drawn shall not exceed 5 mA rms.

Date 20 May 2004

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1 EC TYPE-EXAMINATION CERTIFICATE

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

3 Certificate Number: Sira 03ATEX2486

4 Equipment: 106194 Velocity Sensor

5 Applicant: ADS Environmental Services

6 Address: 5025 Bradford 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 confidential report number R53A9754A.

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 50014:1998 (amendments A1 and A2)
EN 50020:2002
EN 50284:1999

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 1G
EEx ia IIB T4

Project Number 53A9754

Date 20 May 2004

C. Index 12


 D R Stubbings BA MIEE
 Certification Manager

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Form 9176 Issue 10

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Sira Certification Service
 Rake Lane, Eccleston, Chester, CH4 5JN, England
 Tel: +44 (0) 1244 870900 Fax: +44 (0) 1244 661330
 Email: ex@hazard@sira.co.uk
 Sira Certification Service is a service of Sira Test & Certification Ltd



sira
Certification Service

SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE

Sira 03ATEX2486

13 DESCRIPTION OF EQUIPMENT

The Velocity Sensor consists of two piezo-electric devices contained in a plastic housing, which is filled with an epoxy type casting compound. This, in turn, is connected to a length of multi-core cable and a multi-way connector.

Safety Description

U_i	=	15 V
I_i	=	2.54 A
W_i	=	1.2 W
C_i	=	6.4 nF (inc cable)
L_i	=	33 μ H @ 4.5 Ω (cable)

14 DESCRIPTIVE DOCUMENTS

14.1 Drawing No. Sheet Rev. Description

100137A. DWG	1 of 1	D1	Cable, Velocity Sensor
106194A - CERT	1 of 1	A2	Sensor, 106, Velocity, I.S. Crit Comp
106247B. DWG	1 of 1	B3	I.S. Sensor Potting Boot Chart
3753BE0002	1 of 1	A5	I.S. Velocity Sensor Certification Drawing

14.2 Report No. R53A9754A

15 SPECIAL CONDITIONS FOR SAFE USE (denoted by X after the certificate number)

None

16 ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in Report No. R53A9754A.

17 CONDITIONS OF CERTIFICATION

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.

17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.

Date 20 May 2004

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Form 9176 Issue 10

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Sira Certification Service

Raife Lane, Eccleston, Chester, CH4 3JN, England
Tel: +44 (0) 1244 670900 Fax: +44 (0) 1244 681330
Email: exhazard@siratc.co.uk

Sira Certification Service is a service of Sira Test & Certification Ltd

Additional Notice of Canadian Emissions Requirements

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus, which were set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques (de la class A) prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

Declaration of Conformity

For European (EC member country) applications, a Declaration of Conformity (DoC) is required to be kept on file at the facility responsible for repair and maintenance of this equipment. A copy of the relevant DoC is also shipped with each product. For any questions about the Declaration of Conformity, contact the ADS Client Services Department at adssupportcenter@idexcorp.com or 877-237-9585.

DECLARATION OF CONFORMITY

Application of Council Directive(s) _____
Standard(s) to which Conformity is Declared _____

Manufacturer's Name.....
Manufacturer's Address.....
.....

Importer's Name.....
Importer's Address.....
.....

Type of Equipment.....
Model No.,.....
Serial.....
Year of Manufacture.....

I, the undersigned, hereby declare that the equipment specified above conforms
to the above Directive(s) and Standard(s).

Place..... (Signature)
Date..... (Full name)
..... (Position)

Sample Declaration of Conformity

Installation and Configuration

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

- **Investigate the Site Characteristics**
 - Flow Hydraulics
 - Pipe and Manhole Characteristics
- **Install the Sensors in the Pipe**
 - Assemble the Ring (when applicable)
 - Mount the Sensors to the Ring or Special Bands
 - Secure the Sensor Cables to the Ring or Special Bands
 - Install the Ring or Band in the Pipe
 - Secure the Sensor Cables Along the Pipe and Up the Manhole
- **Connect the Sensors to the Monitor**
- **Attach the Dryer Tube to the Monitor**
- **Establish Wireless or On-Site Communication with the Monitor**
- **Configure the Monitor (*Profile*[®])**
 - Create the Monitor Location
 - Create the Installation Table
 - Select and Edit the Devices
- **Set the Communication Parameters (*Profile*)**
- **Activate the Monitor (*Profile*)**
- **Run Diagnostics and Perform Confirmations (*Profile*)**
- **Install the Monitor in the Manhole**

Product Warranty

This section includes the warranty information for the ADS® FlowShark® IS 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 date of shipment from ADS. 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 surface 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.

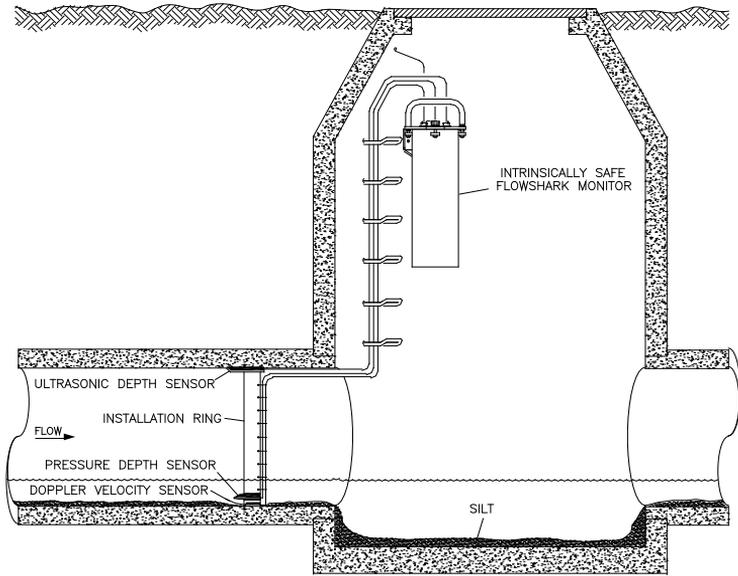
CHAPTER 2

System Overview

The ADS® FlowShark® IS flow monitor uses three flow measurement devices to gather raw flow data: a quadredundant, intrinsically-safe (IS) ultrasonic depth sensor; an IS pressure depth sensor; and an IS Doppler peak velocity sensor. The IS ultrasonic and pressure depth sensors apply independent measurement techniques to collect information used in flow depth calculations. The IS Doppler velocity sensor gathers peak flow velocity data.

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 over 140 days of data logged at a 15-minute sample rate. This data is available to the user for collection, further processing, analysis, and reporting. These reports can assist municipalities and other industry in planning improvements and additions to sewer systems, improving the accuracy of billing information, and providing information for the overall management of sewer systems.

The FlowShark IS 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; the sensors typically attach to a ring installed in the sewer pipe a short distance upstream from the manhole invert. The FlowShark IS monitor can support one of each sensor type. These sensors display exceptional durability and accuracy, even under harsh and turbulent flow monitoring conditions.



Typical FlowShark IS 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 connection cable (on-site communication).

Special software called **Profile**[®] enables 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 code and variables for the site. The LIF contains information such as pipe characteristics, monitor identification, selected devices, 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.

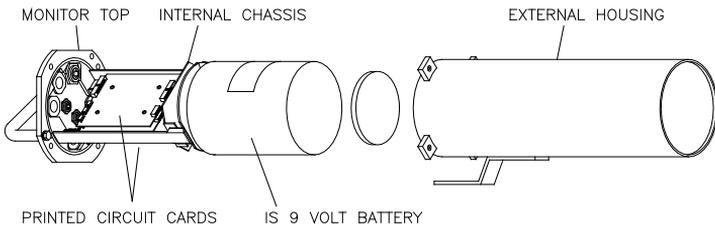
Profile also enables the user to process the flow data, generate graphical and tabular reports, organize data in the user's local directory, and maintain logs of communication between the monitor and the user's PC.

Note: Refer to the *Profile User's Guide* (#950015**) for more information.

ADS FlowShark IS Flow Monitor

The FlowShark IS flow monitor is a waterproof, airtight, cylindrical, marine-grade aluminum canister housing a chassis securing multiple printed circuit boards and a portable power source (when applicable). The one-piece internal chassis, attached to the inside of the monitor lid, provides a mounting surface for the following boards:

- Digital Signal Processor Board
- Analog Board supporting Ultrasonic, Pressure, and Velocity
- Voltage to Frequency Board
- Voltage Regulator Board



FlowShark IS flow monitor with chassis (left) removed from enclosure (right)

The following FlowShark IS monitors are available through ADS:

Part Number	Description
5000-IS1-US-01	With Internal Battery
5000-IS1-US	Without Internal Battery
5000-IS1	For EU without Internal Battery
5000-IS1-01	For EU with Internal Battery

Communications

ADS offers remote wireless communication for the FlowShark IS monitor. The wireless communication is performed over the GSM/GPRS cellular network using *TCP/IP* (Transmission Control Protocol/Internet Protocol) through the modem in the EMU. TCP/IP facilitates high-speed, low-cost, efficient communication in areas with GSM/GPRS coverage.

On-site communication with all monitors is available through an IS PC direct connection cable (ADS p/n 106228A) or an EMU serial cable (ADS p/n 3800-0147).

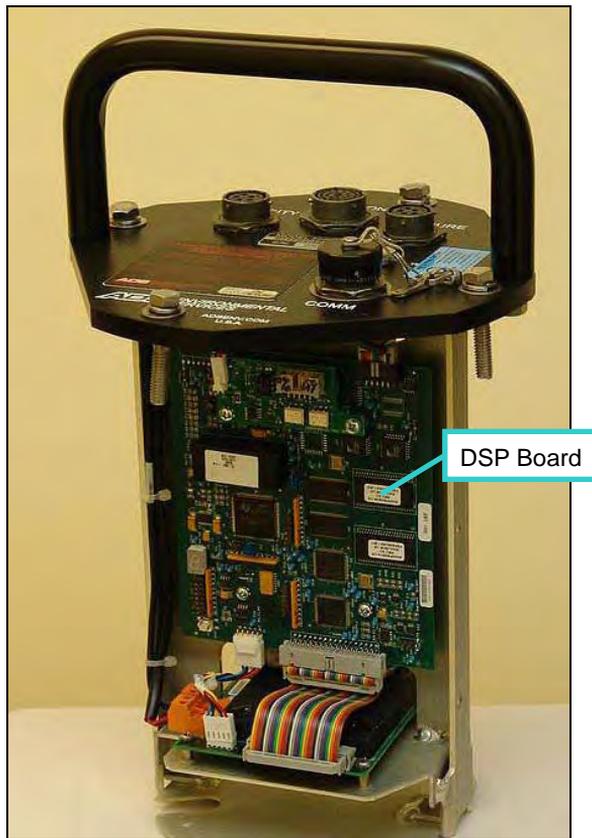
Note: If the monitor is externally powered, the user cannot connect directly to the monitor using the direct connection cable (ADS p/n 106228A cable). The user must use the EMU serial cable (ADS p/n 3800-0147).

Digital Signal Processor

The Digital Signal Processor (DSP) board (ADS p/n 5000-0636) contains the central processing unit (CPU). As the source of all monitor activity, the DSP board is responsible for all of the monitor's high-level functions, including the following:

- Controlling user communication with the monitor
- Scanning the analog board to retrieve and store sensor data
- Maintaining the monitor time and date
- Performing power management
- Providing each board with the parameters required to carry out the associated operations
- Transmitting the stored and current data to the user's PC
- Initiating event notification through alarms

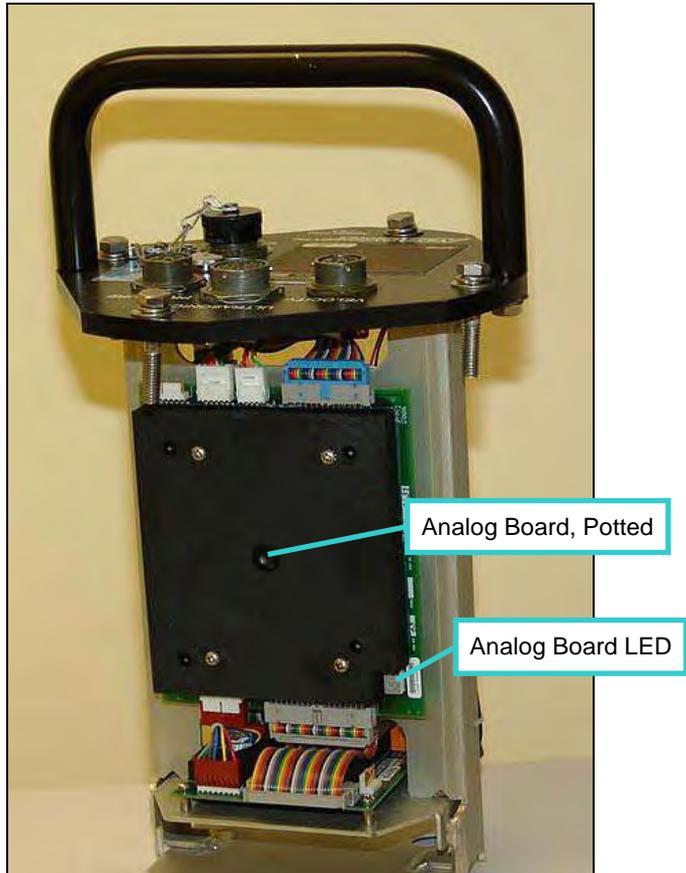
The board allocates portions of memory to firmware (embedded code in the monitor that can be updated remotely) and data storage. A seven-segment (SS) light-emitting diode (LED) located on the processor board indicates the current monitor communication and operational activity. The board also includes 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 Flash, *or non-volatile memory*, which also stores the monitor firmware and configuration information. Flash ensures the monitor maintains the data during battery pack replacement or a power failure.



FlowShark IS DSP Board

Analog Board

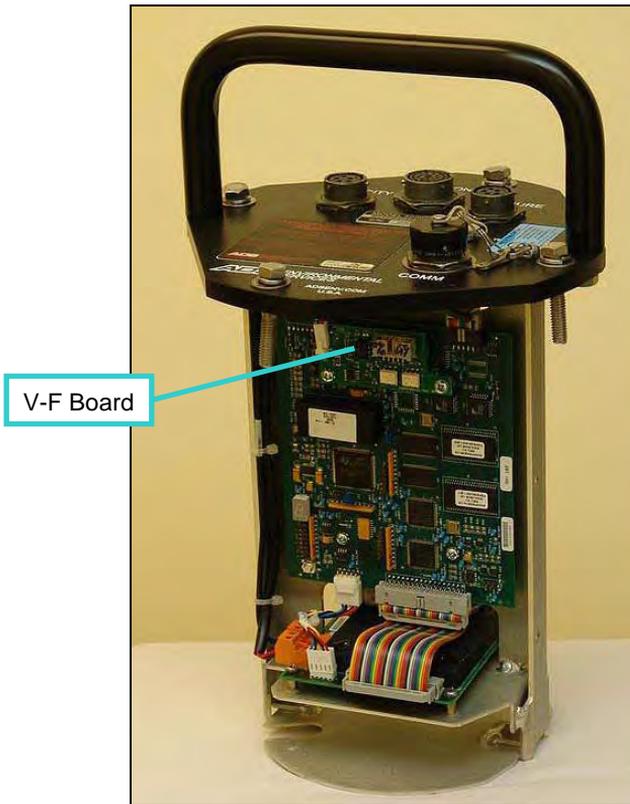
The *Analog* board (ADS p/n 5000-0637) controls the sampling of the FlowShark IS sensors. It receives signals from the DSP board telling it when to initiate sensor readings for the IS ultrasonic, pressure, and velocity sensors. Once the sensor readings are acquired, the analog board sends the readings to the DSP for storage in the FlowShark IS monitor memory.



FlowShark IS potted Analog Board with LED

Voltage to Frequency Board

The *Voltage to Frequency* board (ADS p/n 5000-0661) allows the FlowShark IS monitor to safely read the internal battery voltage. The user can access the internal monitor voltage during data collects to determine whether sufficient voltage is available to power the FlowShark IS monitor. If the voltage drops below a threshold of 6.5 volts, the user will receive a warning that the battery pack requires replacement.



FlowShark IS Voltage to Frequency Board on DSP Board

Voltage Regulator Board

The *Voltage Regulator* board (ADS p/n 5000-0638) regulates and distributes power to the analog and DSP boards. The regulator board is critical to intrinsically-safe operation. It regulates the voltage supplied from the internal IS battery or external power to the FlowShark IS boards to ensure that the monitor always operates within its IS certification requirements. It also contains fuse and current limiting components that will limit and/or interrupt power if a fault condition occurs.



FlowShark IS Regulator Board on DSP Board Side

Connectors

Connectors located on top of the monitor receive the following cabling and components:

- IS ultrasonic depth sensor (ADS p/n 106186A)
- IS Doppler velocity sensor (ADS p/n 106194A)
- IS pressure depth sensor (ADS p/n 3754-0001/0002/0003)
- Communication cable for either on-site (ADS p/n 106228A) or remote (ADS p/n 106227) communications and external power supply
- Air pressure valve (*for testing purposes only*)

The connectors are keyed to ensure that only the proper sensor or communication cable can be connected to each port.

Power

The FlowShark IS flow monitor can receive power internally or externally.

Internal Power

Internal power is supplied to the FlowShark IS flow monitor by an IS 9-volt battery pack (ADS p/n 106152A) *or* an IS 12-volt battery pack (ADS p/n 8000-0043-01/02). The battery pack resides within the FlowShark IS enclosure and powers operations and sustains the monitor memory (RAM) through the power supply on the processor board. The voltage supplied by the IS battery pack is regulated by the Voltage Regulator board for intrinsically-safe monitor operation. The user receives a warning when the voltage from the internal IS battery pack drops below 6.5 volts.

Note: ADS offers a conversion kit (p/n 5000-0780-01) to upgrade an existing FlowShark IS monitor from a 9-volt battery pack to a 12-volt battery pack.



FlowShark IS 9-volt (left) and 12-volt (right) internal battery packs

External Power

The monitor (and EMU) also can receive power from an external DC power source. All external power to the monitor comes through the EMU and is delivered to the monitor via the Communication Cable (ADS p/n 106227). The EMU contains protection circuitry that limits the amount of power that can reach the monitor. The internal monitor and EMU battery packs must be removed prior to connecting the units to external power. External power eliminates the need for periodic battery pack replacement and disposal. For more information, refer to *Chapter 5, External Power*.

Note: Although no longer sold, the Rechargeable Battery Pack (RBP - ADS Model 3600RBP) can be connected directly to the 5000-IS1 or connected via the approved Y cable.

Warning: With the exception of the RBP noted above, under no circumstances can the monitor receive external power directly. Attempting to power the monitor without an EMU will void the warranty and potentially create an unsafe operating condition in hazardous areas.

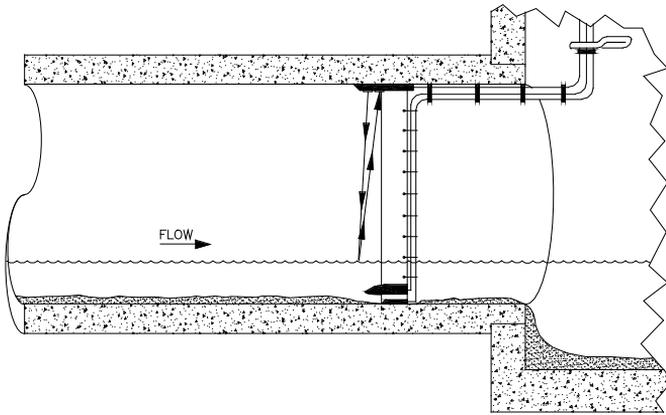
Sensors

The FlowShark IS flow monitor uses various sensors to gather raw flow data. The IS ultrasonic and pressure depth sensors use independent measurement techniques to collect information concerning the depth of the flow. The Doppler velocity sensor gathers peak flow velocity data.

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 hydraulic effects and erroneous data readings caused by foamy waters, flow waves, sewer noise, non-laminar flow, and obstructions in the manhole.

IS Ultrasonic Depth Sensor

The IS ultrasonic depth sensor (ADS p/n 106186A-30), which mounts at the crown of the pipe, transmits sound waves from the sensor face to the surface of the flow. It then measures the time elapsed between transmission and reception of the sound signal. The distance between the sensor face and flow surface is the *range*. Based on the elapsed time and the speed of sound, the monitor calculates the depth of the flow by subtracting the range from the pipe diameter. The monitor compensates for the speed of sound in air using the temperature recorded by one of two temperature sensors housed within the ultrasonic depth sensor. The second temperature sensor serves as a backup.



Ultrasonic depth sensor sending signals to flow surface to determine range

Quadredundancy

Each ultrasonic depth 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.

Ultrasonic Depth Processing

The standard method for processing ultrasonic depth involves firing the sensor once to take readings for predefined transducer pairs. The monitor performs a detailed analysis of all the returning echoes that involves amplifying the good readings and attenuating the false and multiple echoes representing noise and other erroneous readings. It then discards the questionable data, averages the good readings to arrive at a final reading for each of the designated pairs, and logs the final readings in the monitor memory for availability during data collection activities.

Data Scrubbing

Flow conditions and internal structures introduce many potential obstacles to obtaining accurate flow data in sewer systems and manholes. Some of these obstacles may include noise, turbulent or wavy flow, a foamy flow surface, side connections, rungs, broken pipes, or drop connections.

To minimize these effects, ADS uses a process of eliminating erroneous data called *data scrubbing*. Initial data scrubbing occurs routinely in the following way as the monitor takes readings:

- The monitor fires each sensor pair and averages the multiple readings.
- The monitor discards the clearly erroneous readings (i.e., readings well outside the range of the majority of the readings).
- The monitor records the percentage of all acceptable readings used to arrive at the average value.

Secondary scrubbing also can occur during data collection from the monitor to the analyst's PC using the **Profile** software. Refer to the *Profile User's Guide* (950015**) for more information.

IS Pressure Depth Sensor

The IS pressure depth sensor (ADS p/n 3754-0001/2/3-40) typically mounts at the bottom of the pipe. While the ultrasonic depth sensor can only measure depths up to slightly below full pipe capacity, the pressure depth sensor can measure depths greater than a full pipe that might extend up into the manhole (surcharges).

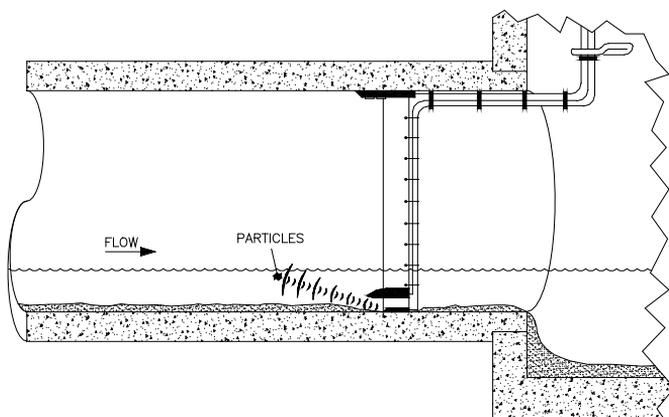
The pressure depth sensor contains a differential pressure transducer that transmits an output voltage corresponding to the difference between the water pressure and the air pressure in the sewer. It measures water pressure through a port on the underside of the sensor and air pressure using an integral vent tube running to the top of the manhole. The monitor calculates the depth of the flow by reading the difference in pressures. The pressure depth system also

compensates for temperature using a temperature sensor housed within the pressure depth sensor.

IS Doppler Velocity Sensor

The IS Doppler velocity sensor (ADS p/n 106194A-35) mounts at the bottom of the pipe. It emits a wide, omnidirectional 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 velocity of the flow based on the *Doppler* effect.

The Doppler effect describes the shift in frequency of a sound wave emitted by a moving object in relation to a stationary point. In this case, the moving objects are particles in the flow, the stationary point is the velocity sensor, and the received signal is the reflection of the sound wave (emitted by the velocity sensor) coming off the particles.



Doppler velocity sensor sending signals reflecting off particles in the flow

CHAPTER 3

Sensor Installation and Connection

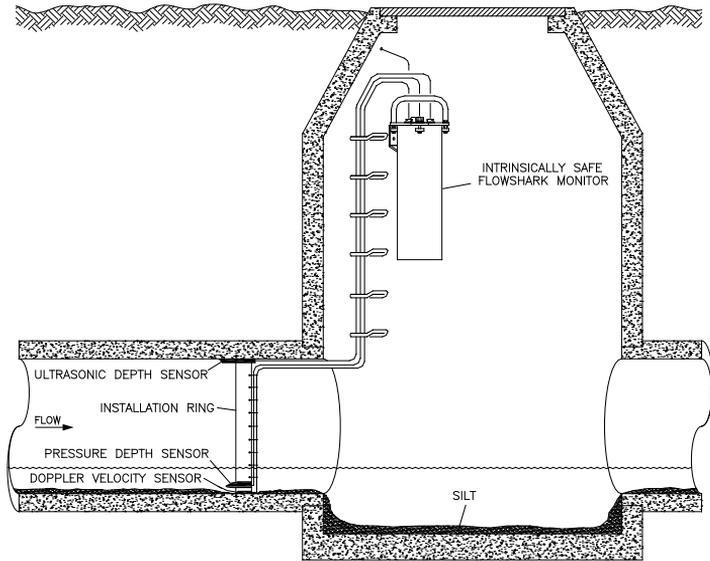
The ADS® FlowShark® IS flow monitor and sensors are primarily designed for monitoring flow in sanitary, storm, and combined sewers. The monitor mounts to the manhole rim or wall slightly below the manhole cover.

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 IS sensors at a location:

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



Typical FlowShark IS flow monitor and sensor installation

This chapter contains detailed instructions for properly installing the sensors in sanitary, storm, and combined sewer lines and manholes. Refer to *Chapter 7, Monitor Installation*, for instructions on installing the monitor in the manhole.

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, curves upstream, or pipes merging upstream can contribute to choppy and off-center peak flows.
- **Absence of Significant Silt Buildup at Pipe Bottom** Silt present at an otherwise favorable site must be accounted for to obtain accurate flow measurements. Therefore, the field crew must measure the silt depth with a ruler and record the results in the **Profile**[®] software.
- **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 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, increasing sensor maintenance and possibly reducing 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 employed for installing the sensors.
 - ❑ **Standard Installation** Select this option to install sensors in *round pipes from 8 to 48 inches 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 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. Even slightly inaccurate pipe dimensions can significantly 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, irregular-shaped pipes will require additional measurements. Refer to the *Profile User's Guide* (#950015**) for more information.

Note: All relevant pipe dimensions and measurements must be entered into the **Profile** software during monitor configuration and activation.

- **Manhole Depth** Measure the distance from the top of the manhole to the bottom of the manhole invert. For distances beyond 30 feet, the sensors will require extension cables.

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

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 IS flow monitor ring-mounted installation hardware.

Quantity	Description	ADS Part Number
1	FlowShark IS flow monitor (includes internal battery)	5000-IS1-US-01 ¹
1	monitor mounting bracket	I40-0003
1	IS Ultrasonic Depth Sensor	106186A-35 (ft)
as needed	IS Ultrasonic Depth Sensor Extension Cable	106137A-xxx ²

Sensor Installation and Connection 3-7

Quantity	Description	ADS Part Number
1	IS Doppler Velocity Sensor with two 4-40 x 5/16-inch stainless steel screws	106194A-35 (ft)
as needed	IS Velocity Sensor Extension Cable	106135A-xxx ²
1	IS Pressure Depth Sensor (0 – 5 psi) with two 4-40 x 5/16-inch stainless steel screws	3754-0001-40 ³ (ft)
as needed	IS Pressure Depth Sensor Extension Cable	106136A-xxx ²
1	replacement dryer tube	3704-0032
1	IS PC Communication Direct Connection Cable	106228A Rev H5
as needed	EMU Serial Cable	3800-0147
15	¼- x 2 ¼-inch stainless steel anchor bolts	101-0002
1	3/8-inch x 3-inch anchor bolt and nut	101-0003
2	3/8-inch x 1-inch stainless steel hex bolts	101-0001
4	3/8 – 16 stainless steel hex nuts	115-0002
5	3/8-inch stainless steel flat washers	155-0001
1	3/8-inch x 2-inch studs	101-0009
15	plastic push mounts	101-0006
15	11-inch cable ties	105-0003
25	4-inch cable ties	105-0001
15	8-inch cable ties	105-0002
15	anchor cable ties	105-0004
1	stainless steel ring (sized for pipe)	125-0081 to 0094 ⁴
1	spreader assembly	110-0003
1	18-inch stainless steel crank handle	110-0012

¹ Additional models of the FlowShark IS monitor are also available: 5000-IS1-US (without internal battery), 5000-IS1 (for EU without internal battery), and 5000-IS1-01 (for EU, with internal battery).

² Extension cables can be ordered in specific lengths up to 300 feet. Note the desired length (in feet) in the xxx portion of the part number. For example, if the application requires a 50-foot extension cable for an IS ultrasonic sensor, the part number would be 106137A-050.

³ IS pressure depth sensors are also available in 0–15 psi (p/n 3754-0002-40) and 0–30 psi (p/n 3754-0003-40).

⁴ The stainless steel ring includes the ring stabilizer bracket (p/n I25-0002), spreader mechanism (p/n I10-0003), and sliding ultrasonic sensor bracket (p/n I25-0001).

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 x 6-inch masonry bit
 - ❑ 3/8-inch x 4-inch (minimum length) masonry bit
 - ❑ 5/16-inch carbide-tipped bit
- 4-pound hammer
- Rubber mallet
- 24-inch carpenter's level
- 7/16-inch nut driver
- Wrenches
- Screwdrivers (flathead and Phillips head of assorted sizes)
- 3/8-inch x 16-inch thread tap
- Diagonal wire cutters
- Folding carpenter's rule with a brass slide
- Mastic tape (ADS p/n 507193) or rubber coaxial stretch tape

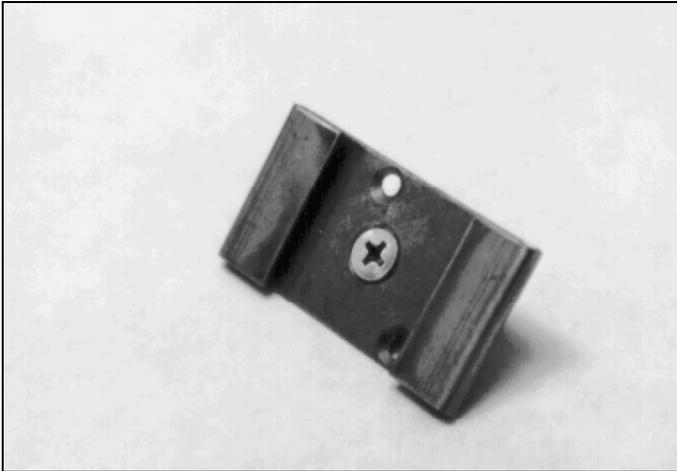
Assembling the Ring

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

Note: These instructions generally apply to overlapping rings. However, the 6-, 8-, 10-, and 12-inch rings do not have an overlapping section. Therefore, these non-overlapping rings require small modifications in the

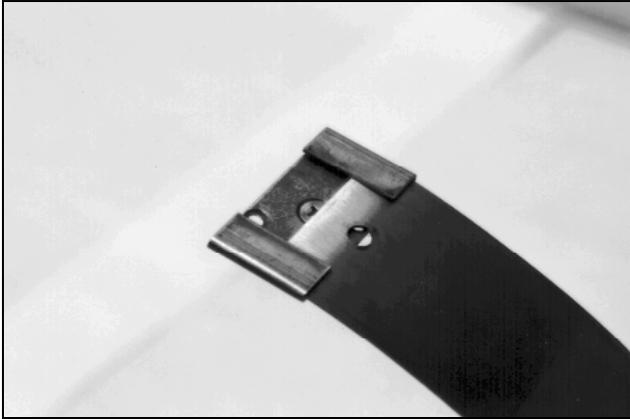
assembly process. To assemble a non-overlapping ring, proceed directly to step 4.

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.



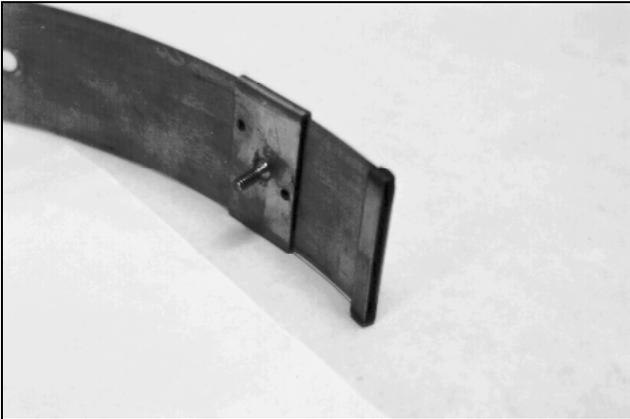
Ring stabilizer with spreader mechanism screw

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

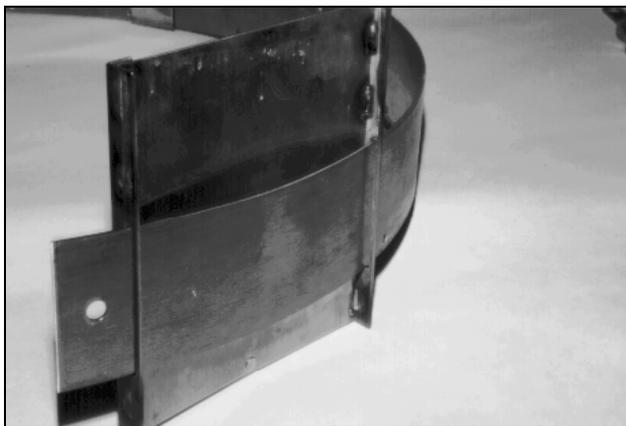
3. Slide the ring stabilizer all the way around the ring until it is about 4 inches from the welded metal band at the other end of the ring.



Moving the ring stabilizer into position

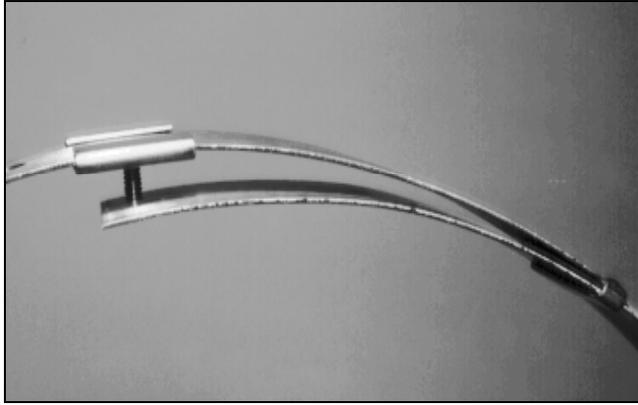
4. Position the ring with the downstream edge (edge with the holes) facing you.
5. Slide the ultrasonic sensor mount onto the open end of the ring with the back of the ultrasonic mount (side with the slots)

facing the outside of the ring. The side with the backstop should face the inside of the ring.



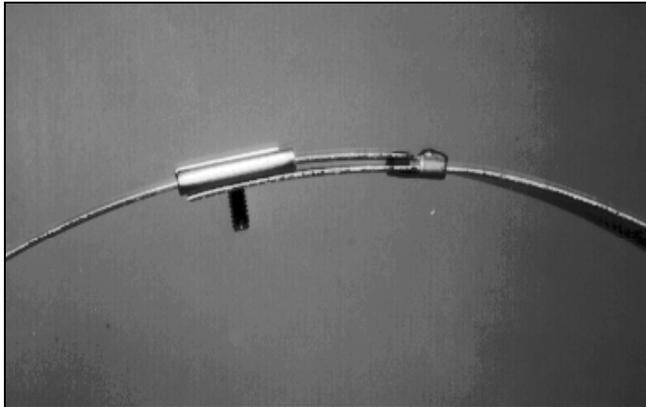
Sliding the ultrasonic sensor mount onto the ring

6. Move the ultrasonic sensor mount 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.
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

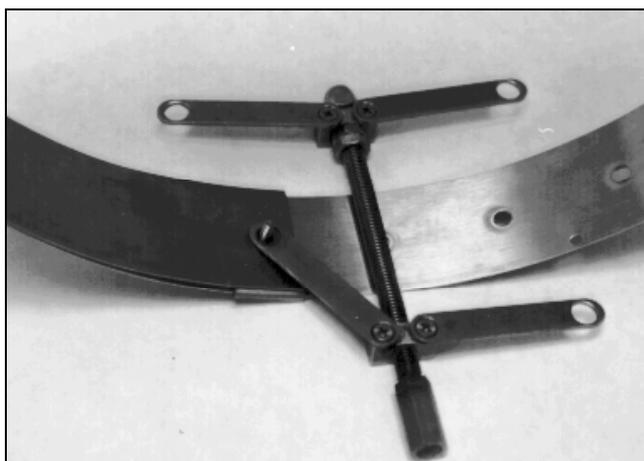
9. Perform the following based on the ring type:
- Overlapping** Insert the spreader mechanism screw completely through the hole at the open end of the ring.
 - Non-Overlapping** Insert a spreader mechanism screw through the hole at the left end of the ring so that the end of the screw extends inside the ring.



Ring stabilizer fully connected

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

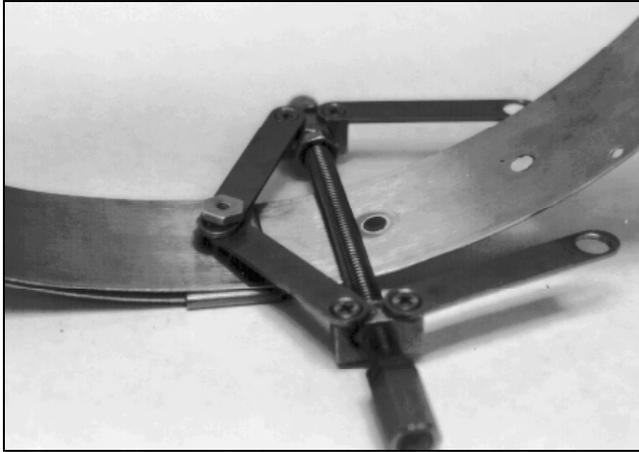
11. Orient the ring with the downstream edge (edge with small holes) facing you.
12. Lay the spreader mechanism across the inside of the ring with the downstream end of the mechanism (end with the large welded nut) facing you, the four spreader bars facing toward the inside of the ring, and the shoulder 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

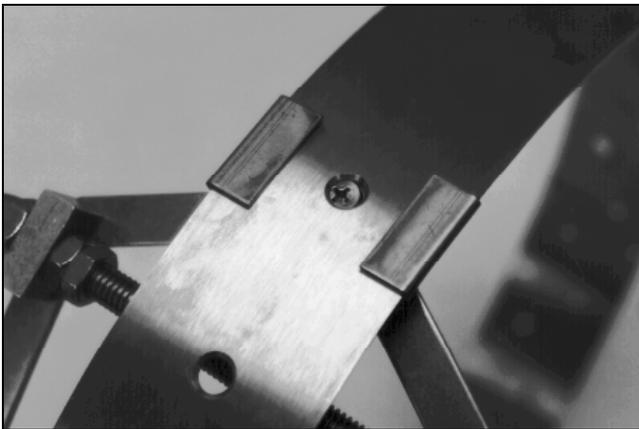
14. Place the upstream, left spreader bar onto the same screw.
15. Lightly turn the hex nut onto the screw, ensuring that it passes through the holes in the end of the spreader bar.

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



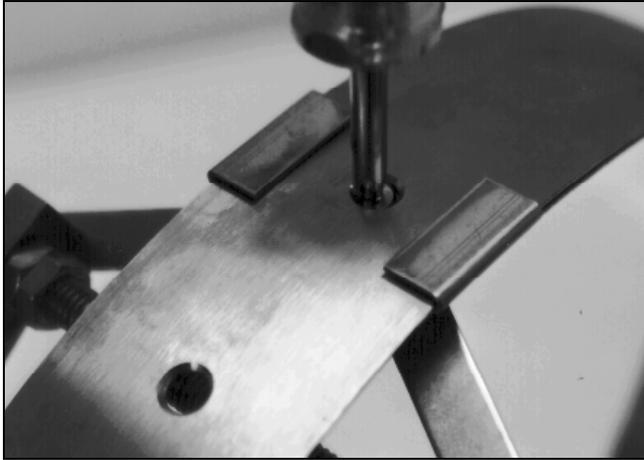
Attaching the spreader bars

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.



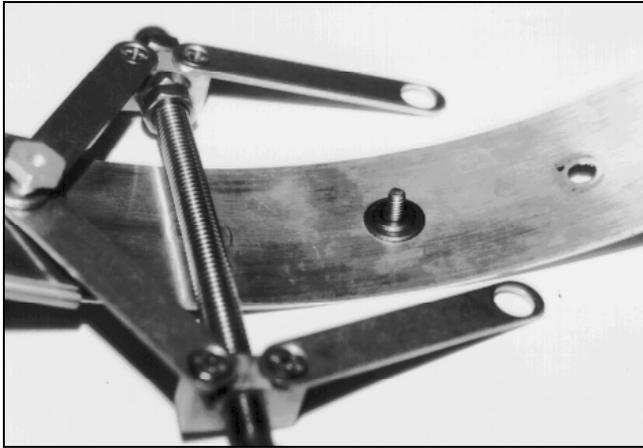
Aligning the screw head and adjustment hole

18. Tighten the screw through the hole using a Phillips-head screwdriver while holding the hex nut with a 1/2-inch nut driver.



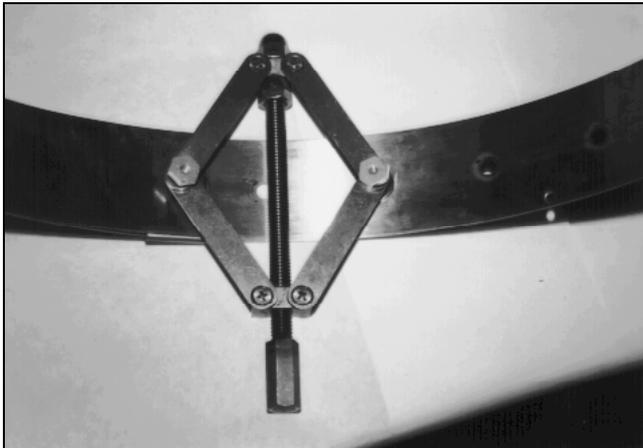
Tightening the spreader mechanism screw and hex nut

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.



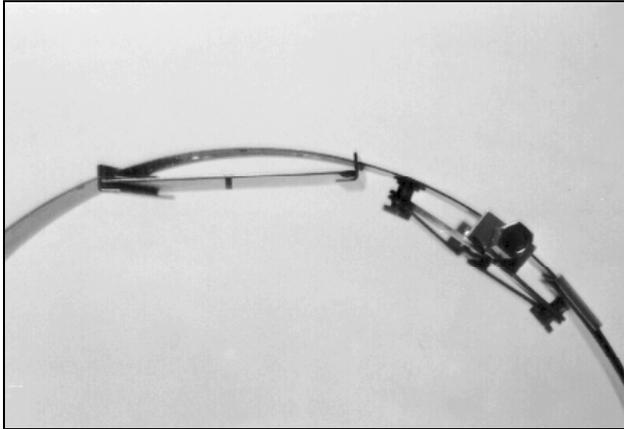
Place the washers onto the second spreader mechanism screw

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 should look.



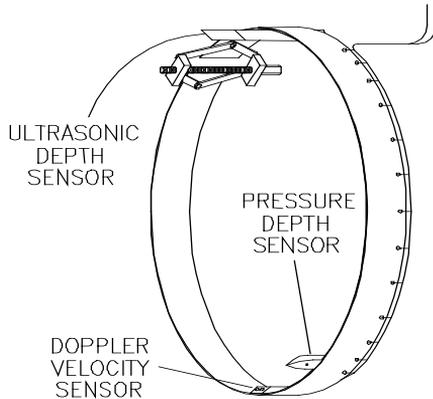
Properly attached spreader mechanism

Mounting the Sensors to the Ring

The following sections provide instructions on mounting the IS ultrasonic depth, IS velocity, and IS pressure depth sensors 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 the downstream edge of the ring, the sensors should be mounted on the ring in the following locations:

- **Ultrasonic Depth Sensor** Twelve o'clock position (top of the pipe) when the spreader mechanism is in the one o'clock position
- **Doppler Velocity 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.)

- **Pressure Depth Sensor** Bottom of the ring slightly to the left of the Doppler velocity sensor (when present)



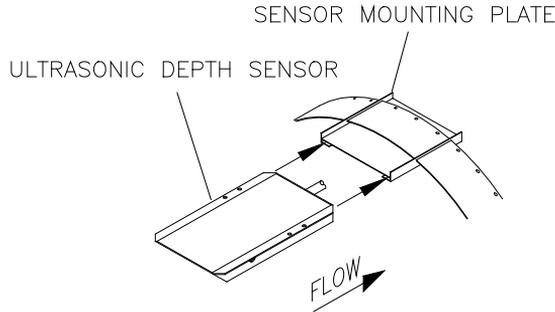
Proper positioning of sensors on the ring

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 Ultrasonic Depth Sensor

Mount the ultrasonic depth sensor to the ring 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.
1. Slide the sensor into the grooves on the sensor mount (at the top of the ring) from the upstream end of the mount 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).



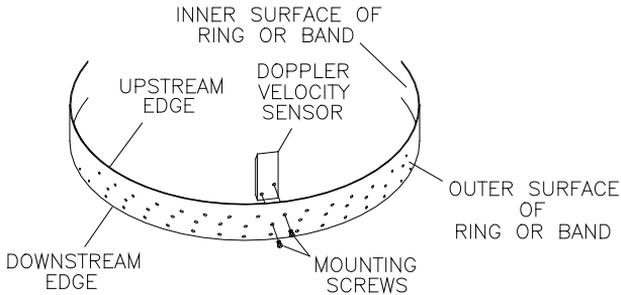
Mounting the ultrasonic depth sensor to the mounting plate on the ring

2. Verify that the ultrasonic depth sensor mounts to the ring at the crown of the pipe.

Mounting the Doppler Velocity Sensor

Mount the Doppler velocity sensor to the ring in the following way:

1. Use two 4-40 x 5/16-inch stainless steel screws (do not substitute any other screws) to mount the sensor at the bottom of the ring opposite the ultrasonic depth sensor with the beveled edge of the sensor facing upstream.



Mounting the Doppler velocity sensor to the ring

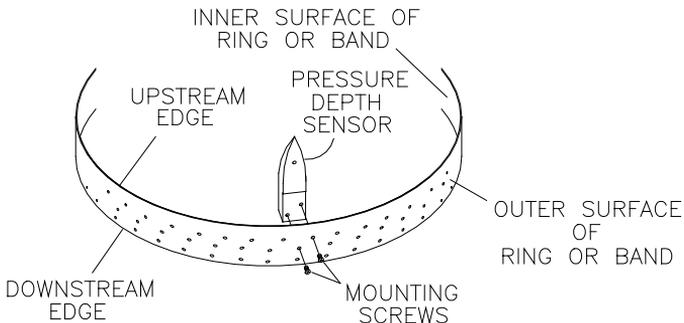
2. Secure the sensor cable to the ring. Refer to *Securing the Cables to the Ring* on page 3-21 for instructions on properly securing the cable.

Note: If the installation includes a pressure depth sensor, wait to secure the sensor cables until both sensors are installed on the ring.

Mounting the Pressure Depth Sensor

Mount the pressure depth sensor to the ring in the following way:

1. Orient the ring so that the ultrasonic depth sensor is directly on top. If an ultrasonic depth sensor is not in use, make sure the spreader assembly is directly on top.
2. Use two 4-40 x 5/16-inch stainless steel screws (do not substitute any other screws) to mount the pressure depth sensor on the bottom inside of the ring with the pointed end of the sensor facing upstream. Mount the pressure depth sensor about 2 inches to the left of the velocity sensor (when present).



Mounting the pressure depth sensor to the ring

3. Secure the sensor cable to the ring. Refer to *Securing the Cables to the Ring* on page 3-21 for instructions on properly securing the cable.

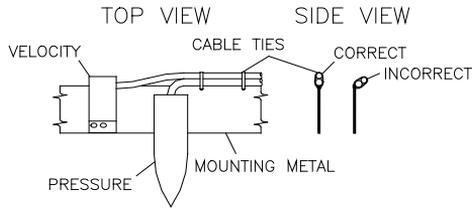
Securing the Cables to the Ring

Securing the Doppler velocity sensor and pressure depth sensor cables 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 Doppler velocity and pressure depth sensor cables in the following way:

1. Starting at the appropriate sensor location, begin securing the sensor cable with 4-inch x 0.08-inch 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 left side of the ring when facing the downstream edge of the ring).

Note: When securing both a pressure depth sensor and a Doppler velocity sensor cable to the ring, place the velocity cable on top of the pressure cable and secure both together.



Sensor cabling

2. Continue securing the cables until reaching the 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 pressure depth cable sheathes two components: the electrical cables that operate the sensor and an air tube that ventilates the sensor. Over-tightening the ties or kinking the cable can damage or restrict the air tube, resulting in incorrect pressure depth readings. In

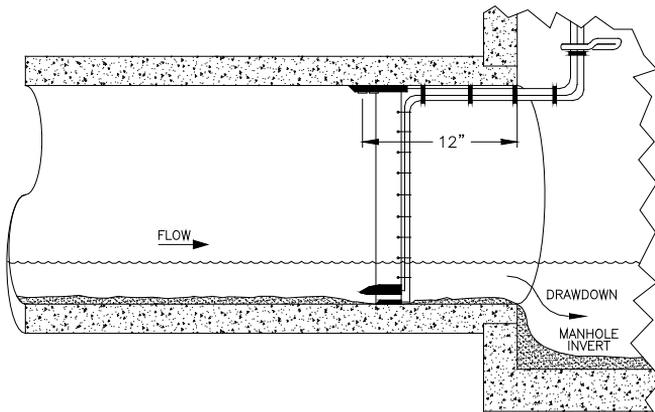
addition, make sure the connector-end of the sensor is not kinked, does not contain moisture, and includes an attached dryer tube filled with active *blue* desiccant.

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

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:

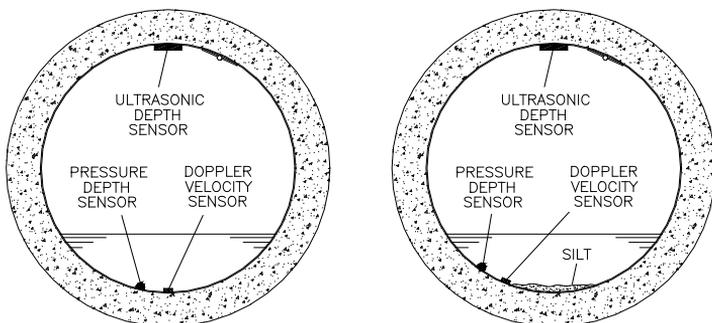
1. Examine the pipe for possible obstructions to the flow or issues that may inhibit proper ring installation.
2. Adjust the ring size to slightly less than the pipe diameter before placing the ring in the pipe by turning the spreader mechanism adjustment nut clockwise.
3. Place the ring in the input pipe at least 12 inches 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 upstream from the manhole invert

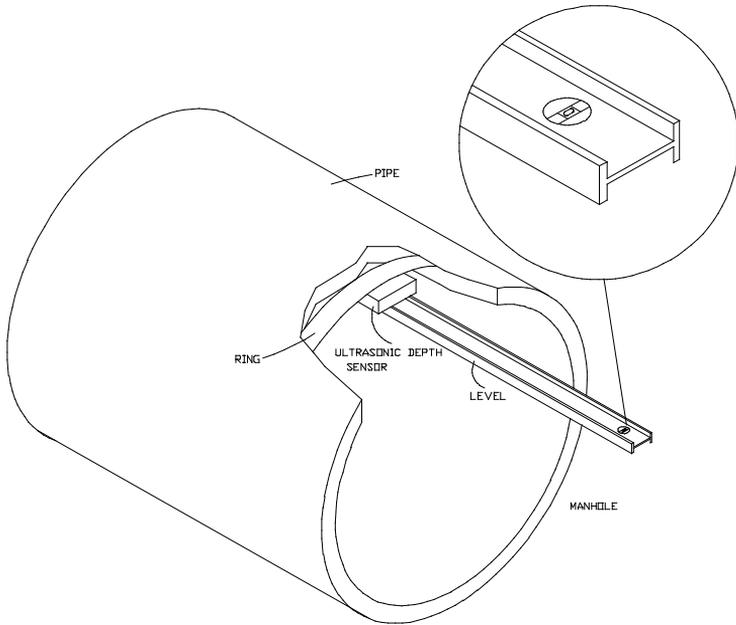
Keep the following in mind:

- ❑ Make sure the ultrasonic depth sensor is at the top (crown) of the pipe, the Doppler velocity sensor is at the bottom of the pipe *above* any silt present and *below* the flow surface (during minimum flows), and the pressure depth sensor is near the bottom.



Proper orientation of the ring with the sensors in the pipe with and without silt present

- ❑ 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 wall of the pipe to avoid obstructing the flow or catching debris.
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. Using the 24-inch carpenter's level, orient the 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.



Leveling the ultrasonic depth sensor

If necessary, adjust the level in the following way:

- Remove the ultrasonic depth sensor from the mount.
- Loosen the ring slightly to allow the plate to move on the ring.
- Tap the sensor mount to the right or left with a rubber mallet until it is level.

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

- Reattach the sensor to the mount, and recheck the level.
6. 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.

7. Restore any silt moved to its previous level, and confirm that the Doppler velocity sensor is still above the silt level.
8. Measure the physical offsets for the ultrasonic and pressure depth sensors.
 - Ultrasonic Offset** Measure the distance from the crown (top) of the pipe to the face of the ultrasonic depth sensor.
 - Pressure Offset** Measure the vertical distance from the bottom of the pressure depth sensor to the bottom, center of the pipe.

Note: These values will be required when configuring the monitor using the **Profile** software.

9. Secure the sensor cables from the ring to the future monitor location in the manhole. Refer to *Securing the Sensor Cables in the Pipe and Manhole* on page 3-43 for more information.

Special Installations

A special installation requires two independent installations: one for the ultrasonic depth sensor and one for the Doppler velocity and pressure depth sensors.

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 ultrasonic depth sensor
- Mounting the Doppler velocity sensor
- Mounting the pressure depth 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.

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 IS flow monitor special installation hardware.

Quantity	Description	ADS Part Number
1	FlowShark IS flow monitor (includes internal battery)	5000-IS1-US-01 ¹
1	monitor mounting bracket	I40-0003
1	IS ultrasonic depth sensor	106186A-30 (ft)
as needed	IS ultrasonic depth sensor extension cable	106137A-xxx ²

Sensor Installation and Connection 3-27

Quantity	Description	ADS Part Number
1	IS Doppler velocity sensor with two 4-40 x 5/16-inch stainless steel screws	106194A-35 (ft)
as needed	IS velocity sensor extension cable	106135A-xxx ²
1	IS pressure depth sensor (0 – 5 psi) with two 4-40 x 5/16-inch stainless steel screws	3754-0001-40 ³ (ft)
as needed	IS pressure depth sensor extension cable	106136A – xxx ²
1	replacement dryer tube	3704-0032
1	IS PC communication direct connection cable	106228A Rev H5
as needed	EMU serial cable	3800-0147
15	11-inch cable tie	I05-0003
25	4-inch cable tie	I05-0001
15	8-inch cable tie	I05-0002
10	anchor cable tie	I05-0004
15	¼- x 2 ¼-inch anchor bolt (with 7/16-inch nut and washer)	I01-0002
1	3/8- x 2-inch stud	I01-0009
1	3/8-inch x 3-inch anchor bolt and nut	I01-0003
2	3/8-inch x 1-inch stainless steel hex bolts	I01-0001
4	3/8 – 16 stainless steel hex nuts	I15-0002
5	3/8-inch stainless steel flat washers	I55-0001
2	4-40 x 5/16-inch screw	I35-0001
8	6-32 washer	I55-0002
4	6-32 x 1-inch machine screw	I35-0004
4	6-32 x 5/16 inch nut	I15-0003
15	plastic push mounts	I01-0006
1	12-inch stainless steel mounting band	I25-0080
1	sliding ultrasonic plate	I25-0001
as needed	ultrasonic sensor surcharge mounting bracket	I40-0010
1	special predrilled 8-foot metal band	I40-0007

¹ Additional models of the FlowShark IS monitor are also available: 5000-IS1-US (without internal battery), 5000-IS1 (for EU without internal battery), and 5000-IS1-01 (for EU, with internal battery).

² Extension cables can be ordered in specific lengths up to 300 feet. Note the desired length (in feet) in the xxx portion of the part number. For example, if the application requires a 50-foot extension cable for an IS ultrasonic sensor, the part number would be 106137A-050.

³ IS pressure depth sensors are also available in 0–15 psi (p/n 3754-0002-40) and 0–30 psi (p/n 3754-0003-40).

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:
 - ❑ 3/8-inch x 4-inch (minimum length) masonry bit
 - ❑ 1/4-inch masonry bit (F35-0018)
 - ❑ 5/16-inch carbide-tipped drill bit (include smaller bits)
- 4-pound hammer
- Rubber mallet
- 24-inch carpenter's level
- Wrenches
- Screwdrivers (flathead and Phillips head of assorted sizes)
- 3/8-inch x 16-inch threads tap
- Diagonal wire cutters
- Folding carpenter's rule with a brass slide
- Mastic tape (ADS p/n 507193) or rubber coaxial stretch tape

Mounting the Ultrasonic Depth Sensor

Two special installation methods are available for mounting the ultrasonic depth sensor:

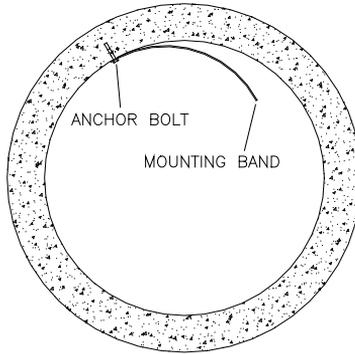
- **Standard Ultrasonic Mount** This option, the most common method employed today, is used for mounting the ultrasonic depth sensor in the pipe during special installations.
- **Surcharge Mount** This option primarily is used for mounting a ultrasonic depth sensor in a manhole at a site where the flow continually occurs within 2 inches of the top of the pipe or a site at which a pressure sensor is not available and *surcharges* frequently occur. Surcharges are conditions where the flow completely fills the pipe and extends up into the manhole.

Standard Ultrasonic Mount

Mount the ultrasonic depth sensor using this method in the following way:

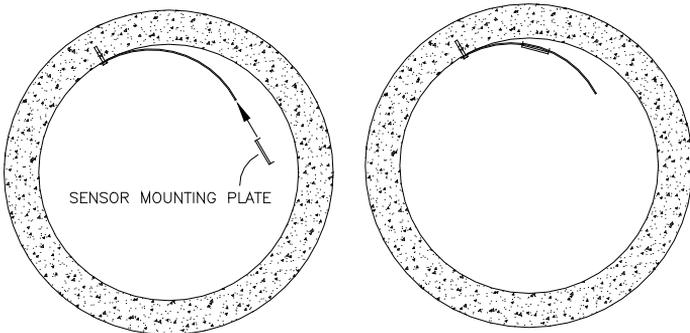
Note: Handle the ultrasonic depth sensor with care, and do not expose it to extreme temperatures for an extended period of time. Keep the sensor in its protective packaging until it is time for installation.

1. Position the sliding ultrasonic plate in the center apex of the pipe, and scribe a mark on both sides of the ultrasonic plate.
2. Center the 12-inch mounting band, allowing the band to extend about 4 inches 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 1/4-inch x 2 1/4-inch 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.



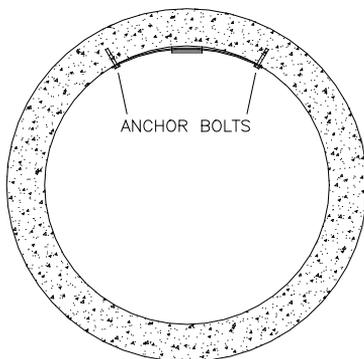
Securing one end of the ultrasonic depth sensor mounting band

6. Slide the adjustable ultrasonic plate onto the band with the backstop edge closest to the invert and the two band slots facing up.



Sliding the ultrasonic depth sensor mounting plate onto the band

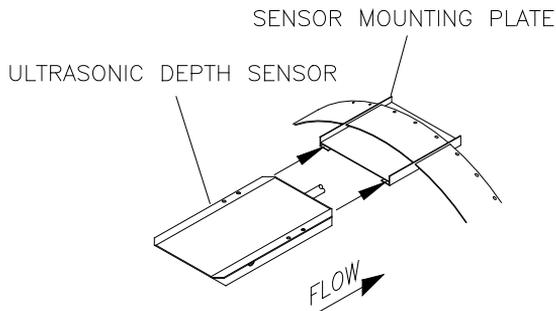
7. Align the sliding ultrasonic plate with the scribe marks, and conform the other end of the curved band with the pipe.
8. Spot drill to mark an anchor bolt location, and mount another 1/4-inch x 2 1/4-inch anchor bolt to the pipe.
9. Hand-tighten a nut with washer to secure the other end of the band.



Securing the other end of the band

Note: If the plate has too much play, attach another anchor bolt approximately 1 inch from the plate.

10. Slide the ultrasonic 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 illustration *Leveling the ultrasonic depth sensor* on page 3-24.
11. Slide the ultrasonic depth sensor into position from the upstream end of the ultrasonic plate until the back of the sensor comes in contact with the backstop.



Sliding the ultrasonic depth sensor into place

12. Confirm the ultrasonic depth sensor is still level.

13. Measure the physical offset for the ultrasonic depth sensor (the distance from the crown (top) of the pipe to the face of the sensor).

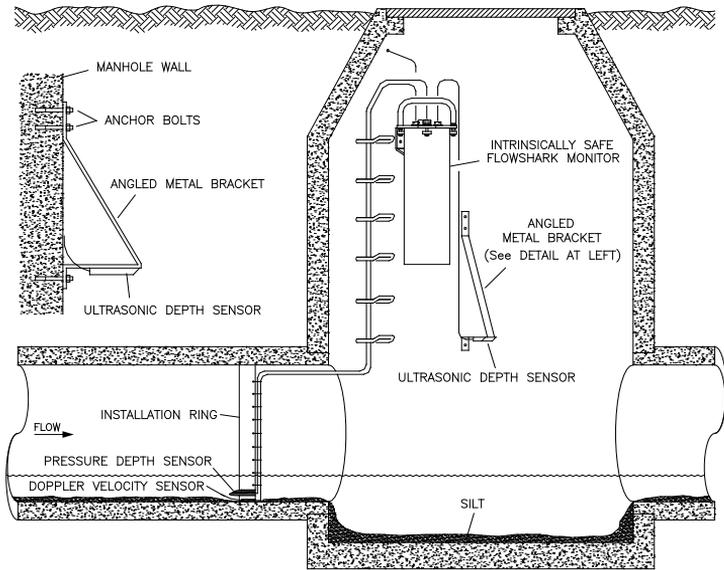
Note: This value will be necessary when configuring the monitor using the **Profile** software.

Surcharge Mount

For a site that may experience surcharge conditions, mount the ultrasonic depth sensor on the manhole wall using a special surcharge bracket (ADS p/n I40-0010) 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. Mount the ultrasonic depth 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.

1. Determine the appropriate height at which to mount the ultrasonic depth sensor portion of the surcharge bracket (*The sensor slides into the grooves 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 12.5 feet (3.8 m).



Surcharge mount

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 1/4-inch x 2 1/4-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 degrees, and drill and mount a 1/4-inch x 2 1/4-inch anchor bolt.

10. Secure the bottom of the bracket with a washer and nut.
11. Slide the sensor into the bracket, and secure the sensor with cable ties to keep the sensor in place.
12. Verify that the sensor portion of the bracket is level using the 24-inch 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 anchor bolt in one of the other pre-drilled holes at the top portion of the bracket for added security.
14. Confirm that the sensor is level.
15. Measure the physical offset for the ultrasonic depth sensor (the distance from the crown (top) of the pipe to the face of the sensor). Enter this distance as negative value when editing the parameters for the *Ultrasonic Device* in **Profile**. For example, if it is 24 inches (610 mm) from the top of the pipe to the face of the sensor in the manhole, the physical offset would be -24 inches.

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

Mounting the Doppler Velocity and Pressure Depth Sensors

Two special installation methods are available for mounting the Doppler velocity and pressure depth sensors:

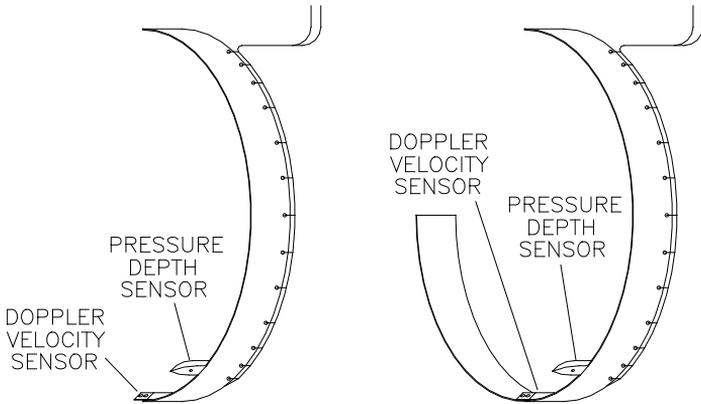
- ¾-band mount
- ½-band mount

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 Doppler velocity sensor at the bottom center of the pipe. These options are not possible using the ½-band mount.

Therefore, the $\frac{3}{4}$ -band mount is the preferable method for mounting the sensors.

However, a $\frac{1}{2}$ -band mount may be appropriate for monitoring under the following circumstances:

- Large pipes with deep minimum flows
- Large pipes with excessive silt present



$\frac{1}{2}$ - (left) and $\frac{3}{4}$ -band (right) mounts

$\frac{3}{4}$ -Band Mount

Perform the following procedure to mount the Doppler velocity sensor and pressure depth sensor (when applicable) in a pipe using the $\frac{3}{4}$ -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 $\frac{3}{4}$ of the length around the inside of the pipe.

Note: The metal bands come in 8-foot lengths. Some larger pipes may require attaching two bands together. In addition, for square-shaped pipes, use a 8-foot straight metal strip.

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 pipe (upstream from the manhole) for the long end of the band.

Note: Position the edge of the band with the cable tie holes (edge with small holes) facing downstream.

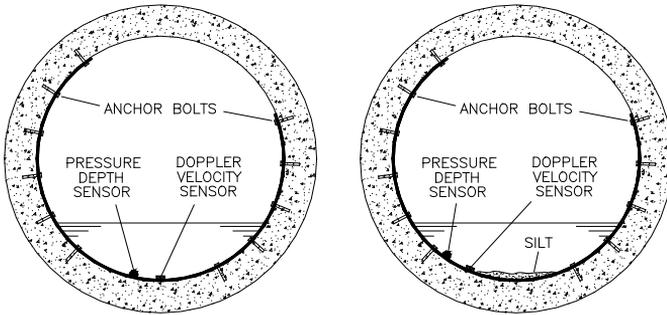
3. Determine the appropriate location on the band to mount the Doppler velocity sensor, making sure the sensor will be both *above* the silt level and *below* the flow surface during minimum flows.
 - If silt is not present, locate the sensor on the band so it will be at the bottom center of the pipe once installed.
 - If silt is present, locate the sensor slightly up the long end of the band so it will be above the silt level once installed.
4. Mount the sensor onto the inside of the band with two 4-40 x 5/16-inch countersink screws, making sure the beveled end of the sensor faces the upstream edge of the ring (edge opposite cable tie holes). If 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 drill bit.
5. When applicable, mount the pressure depth sensor to the band in the following way:
 - Mount the pressure depth sensor 2 inches to the left of the Doppler velocity sensor. *Make sure the sensor will be underneath the flow once installed.*
 - Secure the pressure depth sensor to the band using two 4-40 x 5/16-inch countersink screws. If the sensor does not have screw inserts, use two medium-sized cable ties to secure the sensor to the ring. Crisscross the cable ties across the top of the sensor and underneath the band.
6. 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 3-41.

7. Place the band in the pipe upstream at least 12 inches (same distance as ultrasonic depth sensor, when present) from the manhole invert. Position the band in the pipe so that the sensors will remain below the flow surface (even during minimum flows) and above the silt level.
8. 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.
9. Mark the pipe wall through the lowest hole with a drill, and install a 1/4-inch x 2 1/4-inch anchor bolt with a pneumatic drill.
10. Secure the band to the anchor bolt with a washer and nut.
11. Conform the band to the pipe wall around to the long end of the band so that it is flush with the pipe wall.

Note: Temporarily remove any silt preventing the band from sitting flush against the bottom of the pipe.

12. Install a 1/4-inch x 2 1/4-inch 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.
13. 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.
14. Install 1/4-inch x 2 1/4-inch 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 to the top end of the band.

Note: Whenever possible, secure the band with an additional anchor bolt approximately 3 inches below the flow surface on each side of the pipe. This will help ensure that the band remains flush against the bottom of the pipe below the flow surface.



Sensors mounted using a $\frac{3}{4}$ -band mount in the pipe with and without silt

15. Measure the physical offset for the pressure depth sensor (the vertical distance from the bottom of the pressure depth sensor to the bottom, center of the pipe).

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

16. 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 3-43.

$\frac{1}{2}$ -Band Mount

Perform the following procedure to mount the Doppler velocity sensor and pressure depth sensor (when applicable) in a pipe using the $\frac{1}{2}$ -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 Doppler velocity sensor. The sensor should mount as close as possible to the bottom of the band, making sure the sensor will be both *above* the silt level and *below* the flow surface once installed.

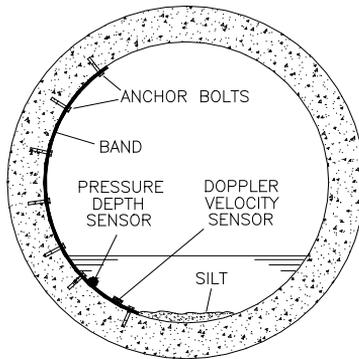
3. Mount the sensor onto the inside of the band with two 4-40 x 5/16-inch countersink screws, making sure the beveled end of the sensor faces the upstream edge of the ring. If holes do not exist on the band at or near the desired mounting location for the sensor, drill holes in the band using a 7/32-inch drill bit.

Note: The edge of the band with the cable tie holes is the downstream edge.

4. When applicable, mount the pressure depth sensor to the band in the following way:
 - ❑ Mount the pressure depth sensor 2 inches to the left of the Doppler velocity sensor. *Make sure the sensor will be underneath the flow once installed.*
 - ❑ Secure the pressure depth sensor to the band using two 4-40 x 5/16-inch countersink screws. If the sensor does not have screw inserts, use two medium-sized cable ties to secure the sensor to the ring. Crisscross the cable ties across the top of the sensor and underneath the band.
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 3-41.
6. Place the band in the pipe upstream at least 12 inches (same distance as 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 1/4-inch x 2 1/4-inch 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 1/4-inch x 2 1/4-inch anchor bolt, washer, and nut below the flow surface 1 to 3 inches away from the Doppler velocity 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 1/4-inch x 2 1/4-inch anchor bolt, nut, and washer every 12 to 24 inches up to the top of the band.



Completed 1/2-band mount in pipe

11. Measure the physical offset for the pressure depth sensor (the vertical distance from the bottom of the pressure depth sensor to the bottom, center of the pipe).

Note: This value will be necessary when configuring the monitor using the **Profile** 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 3-43.

Note: If the pipe is large and the Doppler velocity sensor and pressure depth sensor cables cannot reach the pipe crown, attach the sensor cables to 1/2-inch PVC tubing and anchor the tubing to the wall. This will help prevent sensor damage during heavy flow.

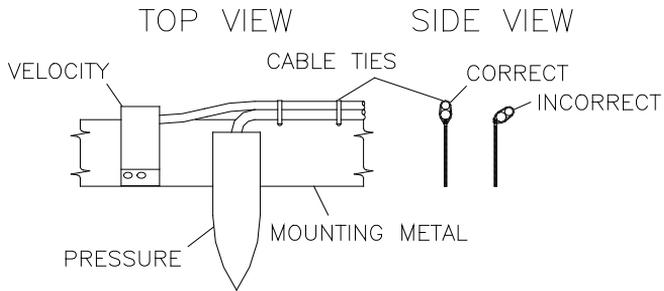
Securing the Cables to the Band

Securing the Doppler velocity sensor and pressure depth sensor cables 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 Doppler velocity and pressure depth sensor cables in the following way:

1. Starting at the appropriate sensor location, begin securing the sensor cable with 4-inch x 0.08-inch 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 left side of the band (when facing the downstream edge of the band).

Note: When securing both a pressure depth sensor and a Doppler velocity sensor cable to the band, place the velocity cable on top of the pressure cable and secure both together.



Sensor cabling

2. Continue securing the cables until reaching the 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 pressure depth cable sheathes two components: the electrical cables that operate the sensor and an air tube that ventilates the sensor. 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.

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:

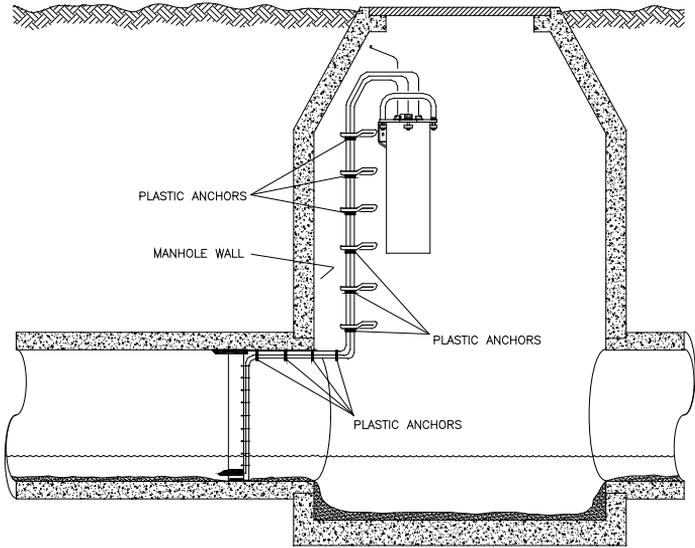
1. Neatly bundle the cables together with an 8-inch x 0.14-inch cable tie attached to a plastic anchor installed at the top of the pipe.

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 1/4-inch x 2 1/4-inch bolt instead.

- Drill a 3/8-inch hole in the pipe crown.
- Drive the plastic anchor into the pipe with a hammer until 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.

Warning: Over-tightening the cable ties may damage the sensor cables.

2. Secure the cables with a cable tie and plastic anchor every 18 to 24 inches 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 1/4-inch x 2 1/4-inch bolts instead.*
3. Secure the cables every 18 to 24 inches 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 1/4-inch x 2 1/4-inch bolts instead.*



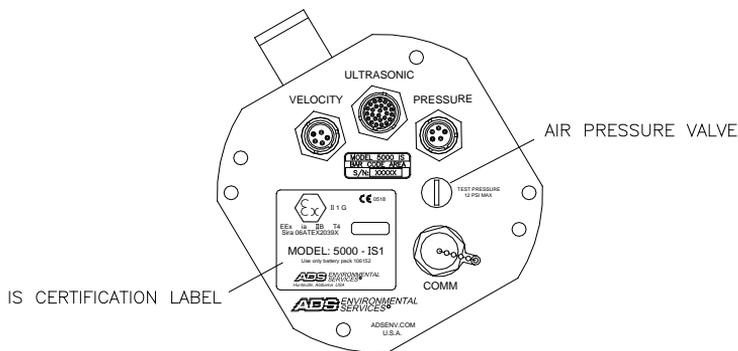
Securing the sensors cables along the pipe and into the manhole

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 are labeled to identify the appropriate connection for each sensor.

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 connector port. The bright orange, rubber seal should sit at the bottom of the connector port with the pins protruding through the seal.

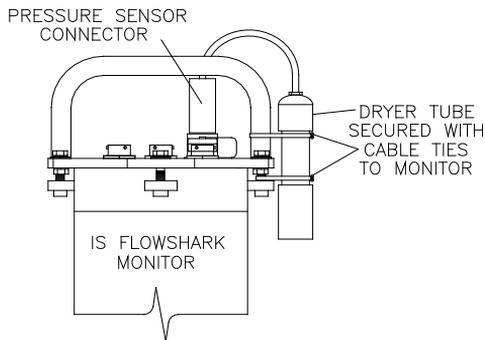
5. Connect each sensor cable to the appropriate port. Tighten each connector in a clockwise direction until it clicks into place, and verify that it is seated correctly.
6. For locations exhibiting the presence of hydrogen sulfide and/or high moisture, provide added protection by wrapping the connection with mastic tape.
7. Seal any unused connectors with a cap. If necessary, obtain additional caps from the regional ADS representative.

Note: An air valve is present in the center of 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

Secure the dryer tube 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 and chassis bolt using cable ties.



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.

CHAPTER 4

Communication

After installing the sensors in the pipe and connecting the sensors to the ADS® FlowShark® IS monitor, it is necessary to establish communication with the monitor (through telemetry or direct connection). This chapter contains instructions on establishing a wireless connection for communicating with the monitor remotely or using a special cable to connect 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 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.

Note: ADS wireless communication products (in this case, the Enfora™ modem in the EMU) use static IP address network services provided by AT&T™ (formerly Cingular Wireless). Therefore, any installation location designated for wireless communication must have access to AT&T 850 or 1900 MHz service. Each wireless device must be fitted with a SIM (Subscriber Identity Module) card that is provisioned by AT&T with specific account and network information for use with ADS software.

Installing the Monitor Communication Hardware

Establishing remote, wireless communications with the FlowShark IS monitor involves installing an External Modem Unit (EMU) outside the manhole (in which the monitor is installed) in a suitable enclosure. Installing the EMU primarily involves the following 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 installer must evaluate the most suitable route for running the communication cable between the manhole and the EMU location. Cable route evaluation criteria may include issues such as the monitor's location in relation existing landscape, utilities present, and excavation costs.

Consider the following when choosing the route for the cable:

- Choose a route that will not require routing 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. Therefore, locate any sprinkler lines. *These will not be located by the locator service.* Check with homeowners when 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 ADS Client Services at adssupportcenter@idexcorp.com or 877-237-9585.

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

Contacting Underground Utility Locating Service

If the communication cable must be routed through a yard or a commercial area, ADS highly recommends contacting an underground utility locating service before initiating installation of the communication cable. For scheduling, allow 5 to 7 days for this to occur before initiating excavation activities.

Do the following to facilitate 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 investigates in the correct area for underground services.

Gathering Tools and Materials

Obtain the following items to perform the installation:

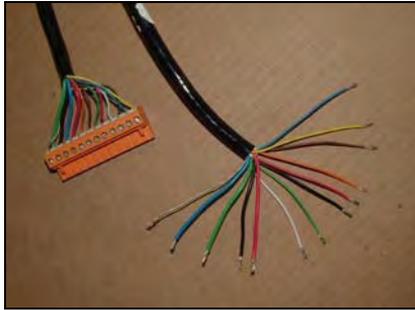
- Ratchet set with 7/16-inch socket
- Pointed shovel
- Claw hammer
- Hammer drill
- Minimum ½-inch diameter masonry bit (at least 12 inches long to drill through manhole wall or corbel)
- Generator for hammer drill (if necessary)

Installing the Communication Cable

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

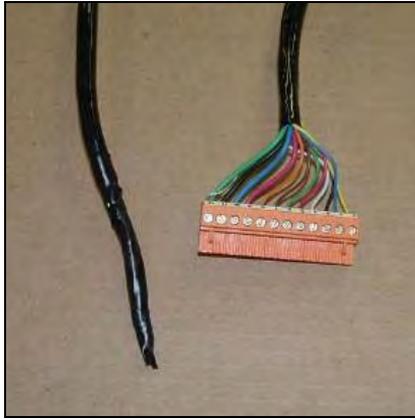
Note: The following instructions represent a communication cable installation that occurs from the EMU location to the manhole through *soil*. If a transition must occur through *asphalt* or *concrete*, create a ½-inch (13-mm) wide by 1-inch (25-mm), at a minimum, deep saw cut trench. Make sure the opening and communication cable are clean and free of dirt, debris, and grease before laying the cable. Use only approved loop sealant or concrete joint sealant to secure the cable into roadway. To prevent wear or damage to the communication cable, avoid sharp transitions where the concrete or asphalt meets 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 the wire ends are stripped correctly with ¼-inch (6 mm) exposed. If any wire ends are not stripped or are stripped less than ¼ inch (6 mm), prepare the wires in the following way:



Wire ends stripped 1/4-inch

- ❑ Cut off the old stripped ends (when applicable) back to the jacket.
 - ❑ Use the small side cutters to carefully remove 4 inches (10 cm) 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 1/4 inch (6mm) from the end of all conductors. Twist each wire end to prevent fraying.
3. Carefully tape together the loose bundle of wires using vinyl electrical tape. Form a taper covering all of the wires, keeping it as thin as possible so that it can pass easily 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 (31 cm) deep and 4 inches (10 cm) wide from the designated EMU 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 (i.e., the 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 location. If required by local code, run the cable through ¾-inch (19-mm) (*minimum*) 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 (31 cm) vertically out of the trench (from the ground surface) at the designated EMU location.

Installing the Wireless EMU

Installing the wireless EMU primarily involves wiring the communication cable to the Communication Interface/Barrier box and mounting the EMU in the customer-supplied, non-metallic protective enclosure at the designated location.

Note: Because these enclosures vary in design and construction, ADS does not designate a specific step or procedure for installing the customer-supplied enclosure in which to house the EMU. ADS recommends installing the enclosure at the EMU location based on the manufacturer's instructions and at the point in the process that is most appropriate for the location and application.

EMU Components

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

- Communication Interface/Barrier PCB (ADS p/n 106124D/106251B)
- Modem Reset PCB (ADS p/n 3800-0143)
- Quad-Band TCP/IP Wireless Modem (ADS p/n 507959)
- Mini-Wing Antenna (ADS p/n 507381)
- FlowShark External Battery (ADS p/n 5000-0557)

ADS ships the wireless EMU pre-assembled; however, the battery is not installed. Perform all EMU installation steps prior to inserting the battery (or connecting to the external power source, when applicable) to avoid damage to the Modem reset PCB.

The unit is ready for wireless communication once connected to a FlowShark IS monitor via a communication cable (ADS p/n 106227), powered by a battery (or external power), and fitted with a SIM card.

Gathering Tools and Materials

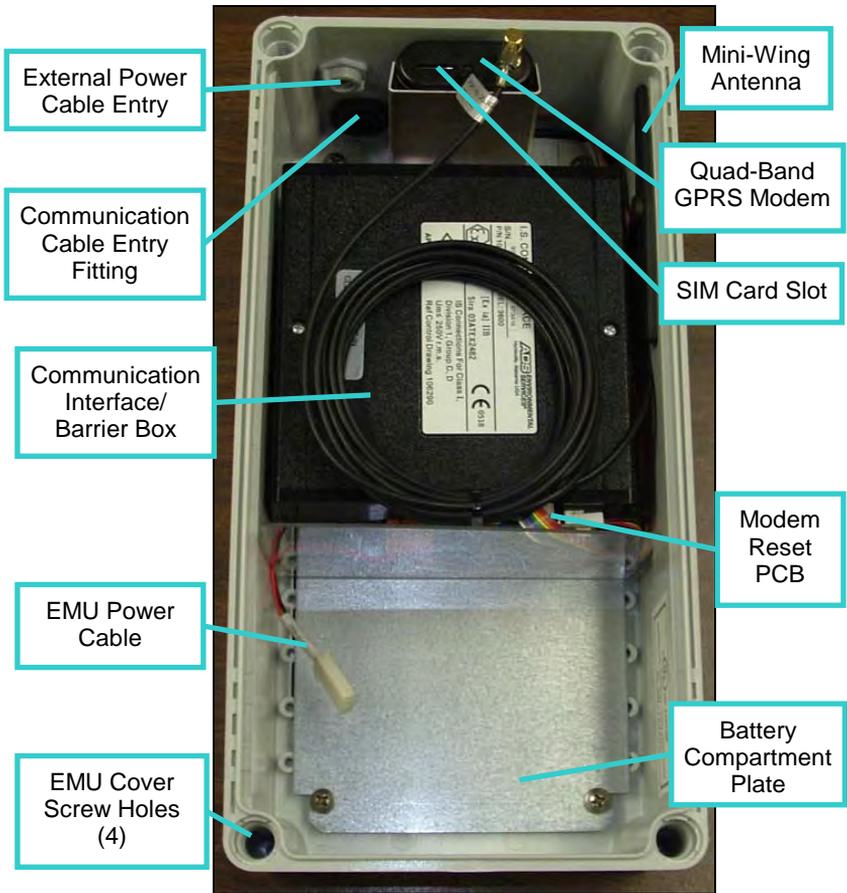
Obtain the following items to perform the installation:

- Medium (No. 2) Phillips head screwdriver
- Small ($\frac{1}{8}$ -inch) flat blade screwdriver (to fit orange communication cable terminal block)
- Wire strippers (with holes to strip 16-, 18-, and 20- gauge wires)
- Small sharp side cutters (not the big cable tie trimmers used for ring/monitor installs)
- Vinyl electrical tape (*not stretch tape*)

Connecting the Communication Cable to the EMU

Before installing the EMU, verify that the communication cable and the enclosure to house the EMU have been installed and at least 40 inches (102 cm) of communication cable is extending into the enclosure. Then, connect the communication cable to the Communication Interface/Barrier box inside the EMU in the following way:

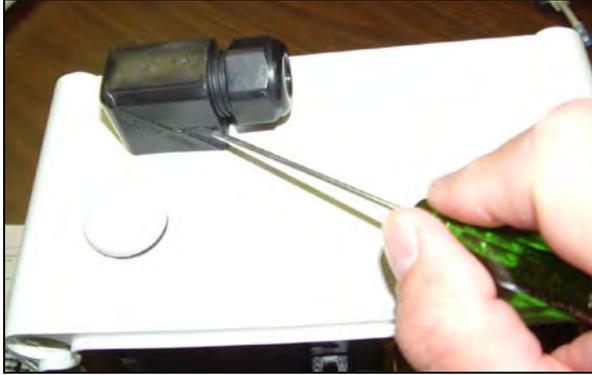
Warning: Leave the communication cable *disconnected* from the FlowShark IS while handling and terminating the cable into the EMU. *Adhere to the following steps precisely to avoid damaging the Voltage Regulator PCB!*



Inside component view of EMU box

1. Unscrew the 4 large plastic screws on the cover of the EMU box by hand and remove the cover. Carefully set the cover aside, taking care not to damage or allow dirt to contact the cover gasket.
2. Disconnect and remove the battery pack from the EMU *or* make sure that external power is disconnected, whichever is applicable.

3. 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

4. Run the communication cable through the fitting and into the box. Pull enough cable through the hole to allow room for holding the cable while attaching the connector.



Communication cable inserted through the entry fitting

Warning: *Make sure the communication cable is NOT attached to the flow monitor!*

5. Terminate the 12 wires into the orange connector in the following way using the 1/8-inch flat screwdriver. This information also displays on a label affixed to the inside cover of EMU box. Make sure all screws are tight.

Terminal	Color of Wire
1	Yellow
2	Small Blue
3	Small Black
4	White
5	Small Red
6	Small Green
7	Brown
8	Orange
9	Large Red
10	Large Blue
11	Large Black
12	Large Green with Bare Shield 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.

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

Note: The port on the Communication Interface/Barrier Box may be difficult to access because of the close proximity of other components, such as the bracket holding the modem. Therefore, it may be necessary to remove the box from the EMU before attaching the orange connector. Release the box from the back plate of the EMU by grasping the rear edge of the box (next to the 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 port on the Communication Interface/Barrier Box

7. Tighten the nut on the communication cable entry fitting until the cable is secure and cannot be moved in or out of the fitting.
8. Record the IP address of the SIM card (ADS p/n 507181), and insert the SIM card into the modem.



Inserting the SIM card into the modem in the EMU

9. Slide the SIM lock to secure the card in place.



SIM card seated in EMU modem

10. (*applies only to battery-powered EMUs*) Re-install the battery pack in the EMU in the following way:

- Install the battery pack into the battery compartment with the cable facing out the left side of the compartment.
- Connect the battery cable to the EMU power cable.

Note: ADS offers EMUs that are equipped to run on either battery power or external power directly from the factory. However, an External Power Kit (ADS p/n 3800-0181) is available through ADS for converting an existing battery-powered EMU to receive power from an external DC source. This kit includes detailed instructions for the conversion.

11. (*applies only to externally-powered EMUs*) Attach the metal connector from the 10-foot external power cable to the chassis cable connector on the top of the EMU.
12. 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, connecting the communication cable to the monitor, connecting to the external power source, and verifying the wireless communication signal. Perform these activities in the following way:

1. Mount the EMU to the panel inside the customer-supplied enclosure 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 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 inside panel of the enclosure

2. (*applies only when using external power*) Make sure the 9- or 12-volt battery pack has been removed from the monitor.

Warning: Failing to remove the battery pack from the monitor before applying external power will damage both the battery pack and the monitor.

3. Connect the monitor end of the communication cable to the **COMM** port on the top of the monitor. Wrap rubber stretch tape around the entire cable connection, extending 1 to 2 inches onto the cable beyond the connection.

4. (*applies only when using external power*) 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**[®] 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 representing the best possible signal strength and -111 representing the lowest/worst possible signal strength. A signal strength of less than -90 is considered poor and will result in poor communication and higher battery drain. It also is likely to have a negative impact on both data collection and monitor configuration. Have the analyst disconnect from the monitor.

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 mounting inside the EMU) outside the enclosure. If this requires drilling holes in the EMU and/or the enclosure, take 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 EMU location, and restore the landscape as necessary.

Connecting to the Monitor in the Field

Communicating with the monitor on-site occurs by connecting directly to the monitor from a laptop or, if an EMU is installed, using the serial cable in the EMU. The ADS **Profile** software must be installed on the laptop computer.

Connecting Directly to the Monitor

Connect directly to the monitor using the IS PC Communication Cable (ADS p/n 106228A rev H5 or higher) in the following way:

Note: The IS PC Communication Cable can be used only with an internally-powered ADS FlowShark IS monitor. Direct connection with an externally-powered FlowShark IS monitor requires the EMU serial cable described in *Connecting to the Monitor through the EMU Serial Cable* on page 4-18.

1. Attach the potted end of the IS PC communication cable to the **COMM** port on the top of the monitor.
2. Attach the serial connector end of the IS PC communication cable to the proper serial port on the laptop computer.



Direct connection using the IS PC communication cable

3. Use the **Profile** software to establish communication with the monitor.

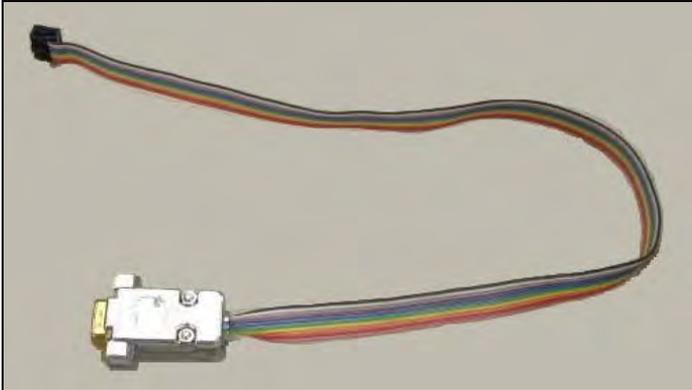
Note: If your computer only has a USB port and no serial port, use a USB-to-Serial adapter cable (and driver software) to perform serial communications. ADS recommends using one of the following USB adapters: Dynex model DX-UBDB9 or Keyspan model USA-19S.

Refer to the *Profile User's Guide* (#950015**) for using the **Profile** software to designate the appropriate local port for serial communication.

Connecting to the Monitor through the EMU Serial Cable

Communicating with the monitor without physically accessing the monitor is possible through the EMU using the EMU Serial Cable (ADS p/n 3800-0147). This requires opening the EMU and connecting the laptop to the Reset PCB using the EMU serial cable.

Note: The EMU must be powered for this type of connection, but the modem does not have to be installed or turned on.



EMU serial cable (ADS p/n 3800-0147)

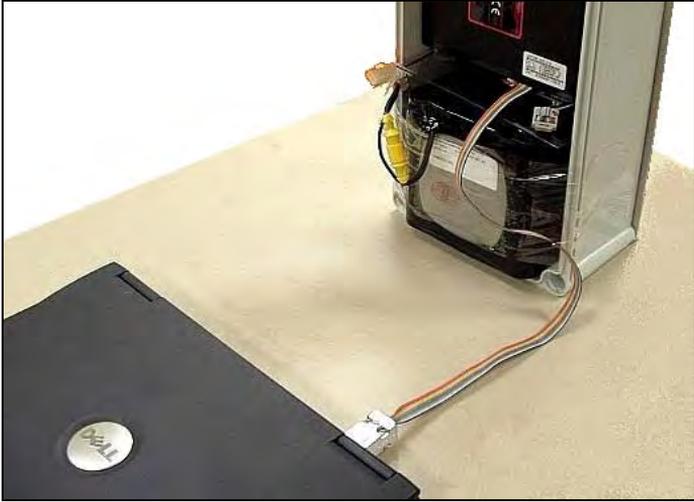
Communicate with the monitor through the EMU in the following way:

1. Disconnect the ribbon cable with the gray connector from the base of the Communication Interface/Barrier box.
2. Attach the black connector from the EMU serial cable to the exposed port.



Connecting EMU serial cable to the EMU Reset PCB

3. Connect the other (metal) end of the cable to the serial port on the laptop computer.



Direct connection using EMU serial cable

4. Use the **Profile** software to establish communication with the monitor.
5. Reconnect the ribbon cable to the Reset PCB when laptop communications are complete.

Refer to the *Profile User's Guide* (#950015**) for using the **Profile** software to designate the appropriate local port for serial communication.

CHAPTER 5

External Power

The ADS® FlowShark® IS system (monitor and EMU) can receive power from an external DC power source connected to the EMU (ADS p/n 3800-0148EP). However, any connection of external power to the monitor must occur through an EMU for compliance with IS certifications.

ADS recommends using external power at sites where the monitor is operating at fast sample rates, frequent wireless communication is expected, and/or the monitor will be installed for several years. Using a single DC source to power both the EMU and the monitor can be cost effective because it eliminates the need for both the IS battery pack and the EMU alkaline pack.

Note: When installing an externally-powered EMU, ADS recommends locating the EMU as close as possible to the power source to maximize the net power available to the EMU.

The following FlowShark IS models support external power:

- 5000-IS1
- 5000-IS1-US

Note: Neither model provides backup power in the event of an external power source interruption. The monitor will not lose data; however, it will stop taking readings until power is restored.

Typical Installation

A typical external power installation includes the following:

- A single-phase, 120-volt AC 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 box, or breaker box) on the pole/post.
- A ground rod installed next to the pole/post bonded to the distribution device.
- An AC to 12V DC converter on the pole/post. ADS recommends using an ADS Power Supply (p/n 5000-0727).
- A cable (ADS p/n 5000-0697) connecting the external DC power source to the EMU. ADS offers a 10-foot long, 0.25-inch diameter external power cable (ADS p/n 5000-0697) with an ethylene/propylene copolymer jacket.

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

DC Power Requirements

The IS FlowShark system requires a power source capable of supplying a minimum of 1 ampere of 12-volt regulated DC power (as measured/available at the EMU, not at the power source output). For long cable runs, size the supply and cabling to ensure that line losses do not reduce the net power available to the EMU. If the application will not involve an ADS Power Supply (ADS p/n 5000-0727), choose a high-quality industrial type power supply with ripple no greater than 250mV P-P.

Installing an ADS Power Supply

The ADS 12VDC Power Supply (p/n 5000-0727) is a universal input supply that automatically adjusts to the proper voltage upon connection. It is housed within a polycarbonate NEMA 4X enclosure with cable glands for AC and DC cable entry and is suitable outdoor mounting.



ADS 12VDC power supply

To use the ADS Power Supply, install the power supply and wire the external power cable in the following way:

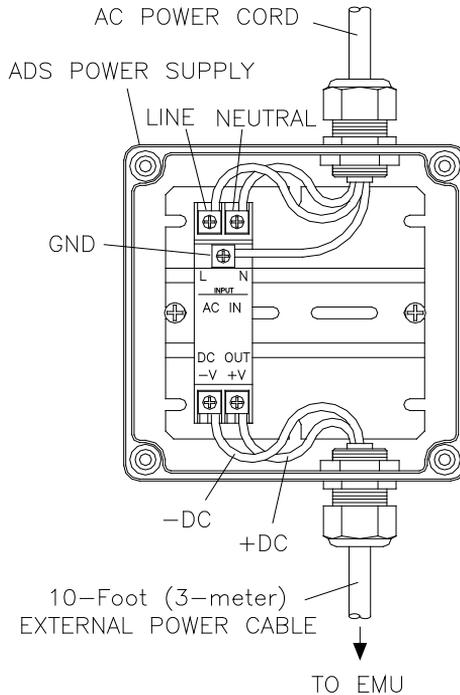
1. Mount the power supply to a panel or other mounting surface using the appropriate fasteners through the four 0.175-inch holes located under the corner cover screws.

Note: Do not drill new holes through the housing for mounting! This will expose the internal components of the enclosure to moisture, creating unsafe operating conditions. It also will void the product warranty. Use only the mounting holes provided under the corner cover screws to mount the supply.

2. Verify that the 6-foot AC power cord on the 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 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 10-foot external power cable (ADS p/n 5000-0697), coming from the EMU, through the cable grip entry hole on the side of the power supply case opposite the AC power cord. If additional length is required, select an appropriate gauge of cable for the end run to the power source. If cable splicing is necessary, use a junction box or other method suitable for outdoor, wet, and/or buried environments.
5. Terminate the wires from the external DC power cable at the power supply 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 and EMU.
 - Communication cable is connected to both the monitor and the EMU.
 - External power cable is connected to the EMU 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.

- 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).

Converting Battery-Powered Equipment to Receive External Power

For existing battery-powered EMUs (ADS p/n 3800-0148) and FlowShark IS monitors, modifications can be made to the EMU enclosure to support connection to an external power source.

Note: Disconnect and remove the battery packs from both the monitor and EMU prior to powering the system from an external source.

ADS offers a kit (p/n 3800-0181) for converting battery-powered EMUs to receive external power. This kit contains all the cabling, hardware, and instructions necessary for performing the retrofit. ADS also offers a power supply (p/n 5000-0727) for powering the EMU. However, an alternate DC power supply may be used provided it meets the specifications indicated in *DC Power Requirements* on page 5-2.



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

CHAPTER 6

Configuration and Activation

After installing the ADS® FlowShark® IS flow monitor and sensors and setting up communication, 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
- Selecting and editing devices
- Setting the communication parameters
- Activating the monitor

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

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

Note: The FlowShark IS monitor is supported by *Profile User's Guide* version 950015B0 or greater, and **Profile** software version 3.0.2 or greater. Prior versions cannot be used.

Configuring the Monitor Location

To ensure the most efficient and useful results for each monitor location, the user must activate the FlowShark IS 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, device 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 communications have already been established for the location, field personnel can perform these activities in cooperation with office personnel. If remote communication is not available, perform configuration and activation on site through direct communication with the monitor.

Launching the Profile Software

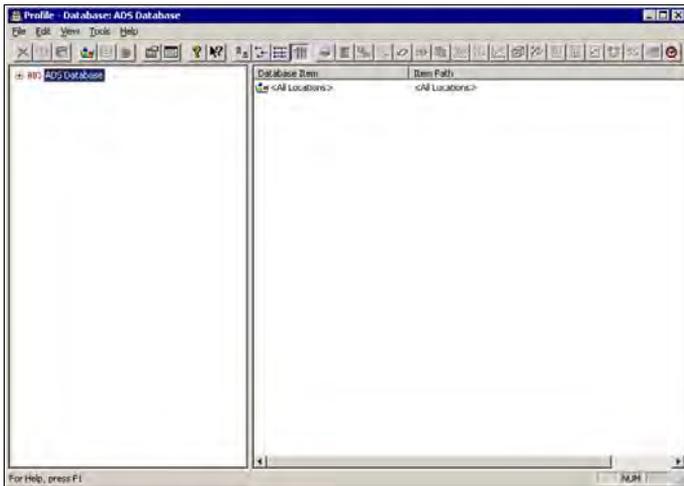
Before traveling to the field for installation, configuration, and activation activities, install the **Profile** software on the field computer.

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 provides the capability to display 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

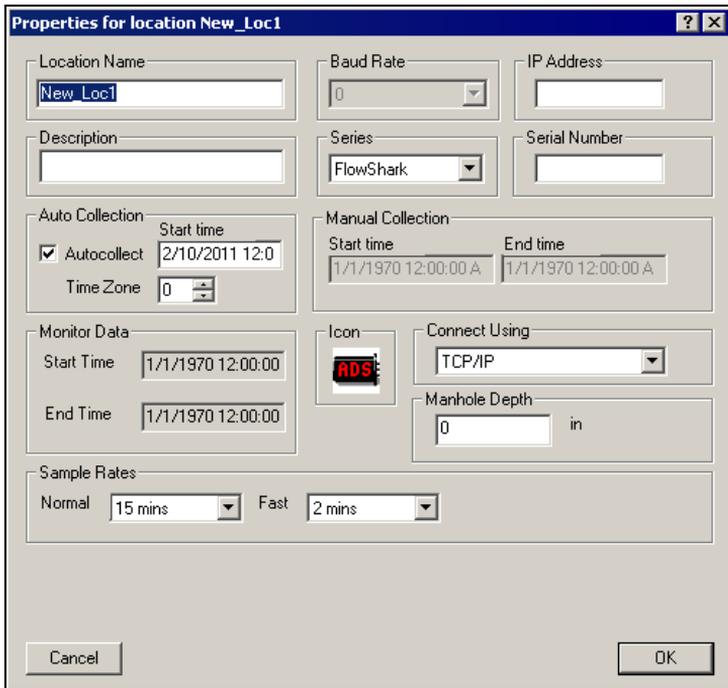
Creating a new location includes entering and setting up the location information in the following way:

1. Select the <All Locations> group located under the database level.
2. Select the **Edit > New > Location** option *or* click on the **New Location** toolbar button.



New Location toolbar button

*Profile adds a new location named **New_Loc1** to the <All Locations> group and displays the **Properties** dialog.*

A screenshot of the 'Properties for location New_Loc1' dialog box. The dialog has a title bar with a question mark and a close button. It contains several sections: 'Location Name' with a text box containing 'New_Loc1'; 'Baud Rate' with a dropdown menu set to '0'; 'IP Address' with an empty text box; 'Description' with an empty text box; 'Series' with a dropdown menu set to 'FlowShark'; 'Serial Number' with an empty text box; 'Auto Collection' with a checked 'Autocollect' checkbox, a 'Start time' field set to '2/10/2011 12:0', and a 'Time Zone' dropdown set to '0'; 'Manual Collection' with 'Start time' and 'End time' fields both set to '1/1/1970 12:00:00 A'; 'Monitor Data' with 'Start Time' and 'End Time' fields both set to '1/1/1970 12:00:00'; 'Icon' with a preview of the 'ADS' icon; 'Connect Using' with a dropdown menu set to 'TCP/IP'; 'Manhole Depth' with a text box set to '0' and the unit 'in'; and 'Sample Rates' with 'Normal' set to '15 mins' and 'Fast' set to '2 mins'. At the bottom are 'Cancel' and 'OK' buttons.

Properties dialog for the new location

3. Enter the new **Location Name**. *Monitor names must follow this convention depending on length:*
 - Use unique names when choosing names that are 8 characters or less in length (e.g., FSIS1, FSIS2, FSIS3).
 - For longer names, up to the first 8 characters can be the same for multiple monitors, provided an underscore (`_`) follows those characters and the characters following the underscore are unique (e.g., FlowShrk_01, FlowShrk_02, FlowShrk_03).
4. Enter the new location **Description**.
5. Select **FlowShark IS** from the **Series** drop-down list.
6. Select the appropriate method of communication from the **Connect Using** drop-down list.
7. (*applies only to wireless communication*) Enter the monitor location **IP Address** for the wireless connection.

Note: Do not use leading zeros before or within the IP address. For example, an IP address of 166.213.006.020 should be entered as 166.213.6.20.

8. Enter the **Serial Number**.
9. Choose one of the following methods for collecting monitor data using **Profile**:
 - Auto Collection** Select the **Autocollect** checkbox to ensure **Profile** collects data ranging from the last timestamp collected or a user-defined start date and time to the current date and time. Edit the corresponding **Start time** field as necessary. *Profile defaults to this option.*
 - Manual Collection** Deselect the **Autocollect** checkbox to ensure **Profile** collects data based on the range designated by the user in the **Manual Collection** section. Edit the corresponding **Start time** and **End time** fields as necessary. The **Autocollect** checkbox must be deselected to enable modification of these fields.

Note: The start and end times displayed in the **Monitor Data** section represent the complete date/time range of flow data available in the monitor memory, based on the last collect to this database.

10. Enter the number of hours difference between local computer on which the database resides and the location of the monitor in the **Time Zone** field. For example, if the computer is in the *Central* time zone and the monitor is located in the *Eastern* time zone, select **1** from this field. If the monitor is in the *Central* time zone and the monitor is located in the *Pacific* time zone, select **-2** from this field.
11. (*optional*) Enter the vertical distance from the manhole rim to the manhole invert in the **Manhole Depth** field.
12. Select the rate at which you want the monitor to log data from the **Normal** drop-down list.
13. Select the increased rate at which you want the monitor to log data for the duration of an event from the **Fast** drop-down list. *This designation applies only when implementing the Dual Data Rate feature in the Advanced Configuration options.*
14. Click on the **OK** button to create a LIF for the location in the database and exit the dialog.

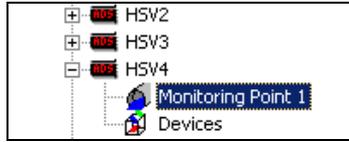
The new monitor location with a single monitoring point is now created and configured in the database.

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 depths and corresponding quantities for the monitor installation.

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.



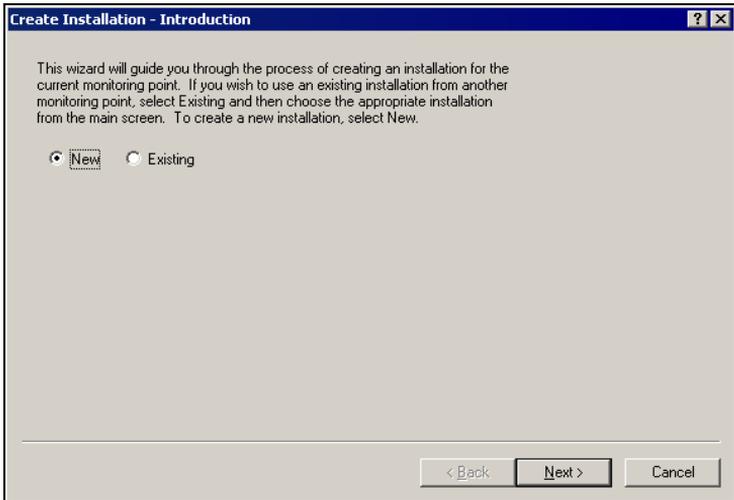
Monitoring Point 1 selected from Location HSV4

2. Select **Tools > Installation Generator** from the main menu *or* click on the **Installation Generator** toolbar button on the **Profile** main screen.



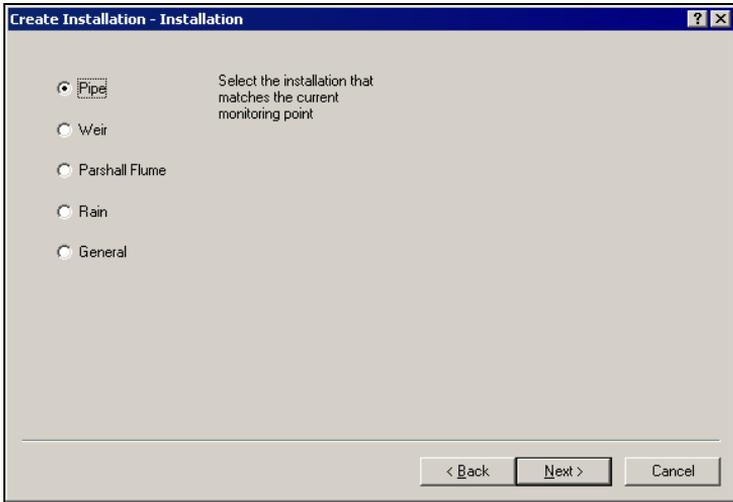
Installation Generator toolbar button

*The **Create Installation – Introduction** dialog in the wizard displays.*



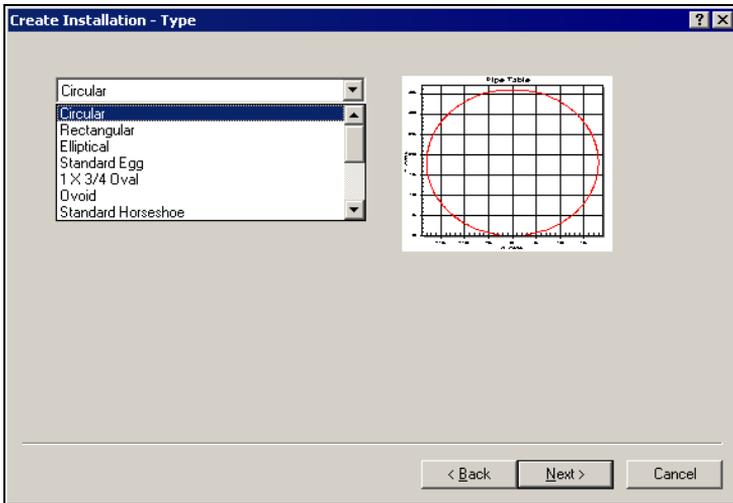
Create Installation – Introduction dialog in the wizard

3. Select the **New** radio button, and then click on the **Next** button.



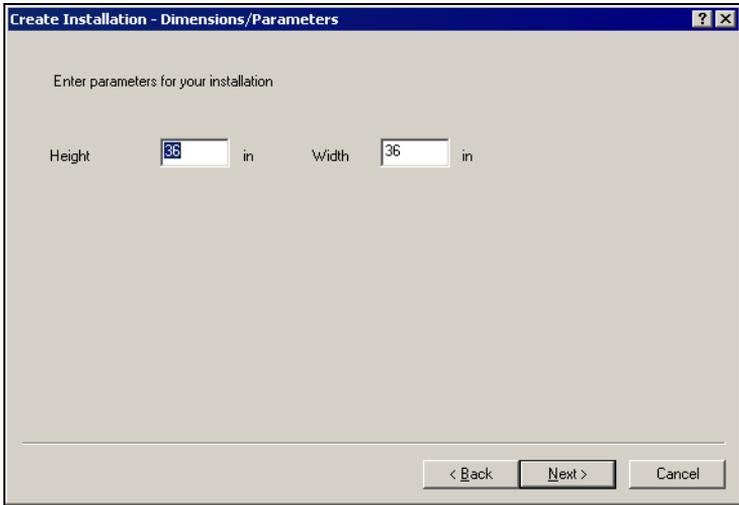
Create Installation – Installation dialog

4. Select the **Pipe** radio button, and then click on the **Next** button.



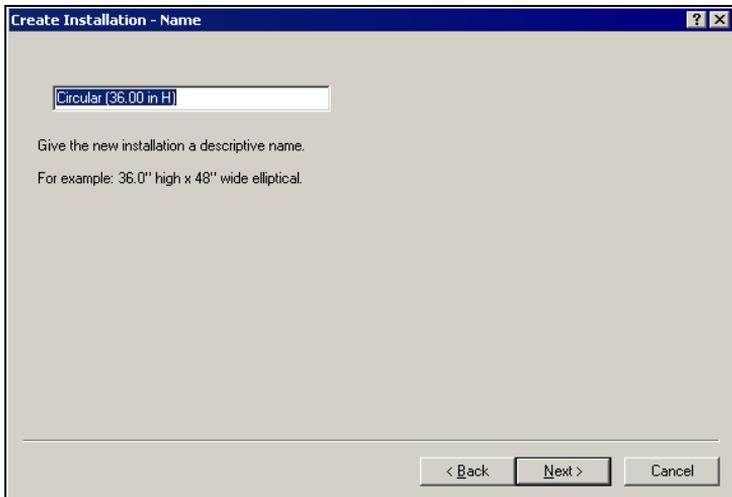
Create Installation – Type dialog

5. Select the type or shape of the pipe from the drop-down list, and then click on the **Next** button.



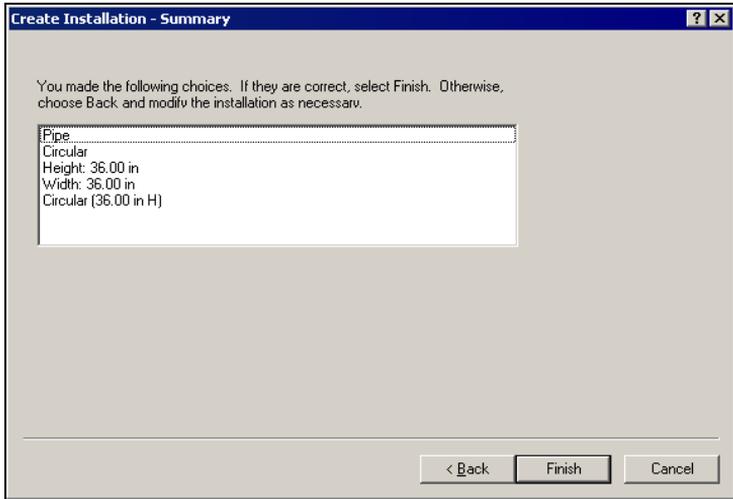
Create Installation – Dimension/Parameters dialog

6. Enter the proper pipe dimensions in the corresponding fields, and then click on the **Next** button.



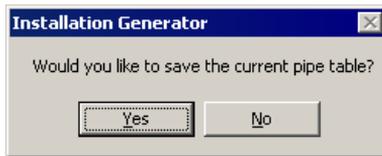
Create Installation – Name dialog

7. Enter an appropriate name for the installation in the text field, and then click on the **Next** button.



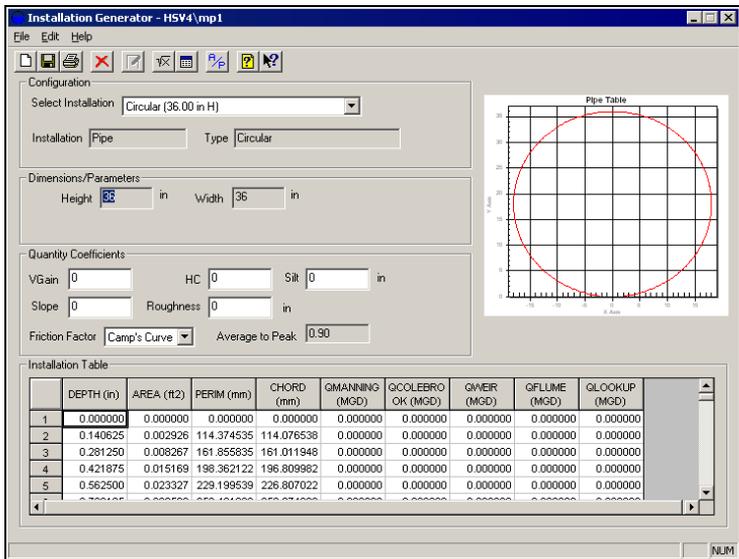
Create Installation – Summary dialog

8. Review the installation table selection summary, and then click on the **Finish** button. Click on 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.



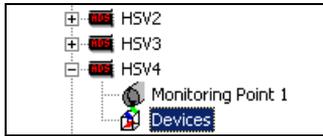
Installation Generator dialog

10. Select **File > Exit** to close the **Installation Generator**.

Selecting and Editing Devices

Select and edit the devices corresponding to the new monitor location to ensure it logs the desired data. 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 selecting/editing devices from the database.
2. Expand the location contents (monitoring point and devices) by selecting the expansion symbol corresponding to the location and then selecting **Devices**.



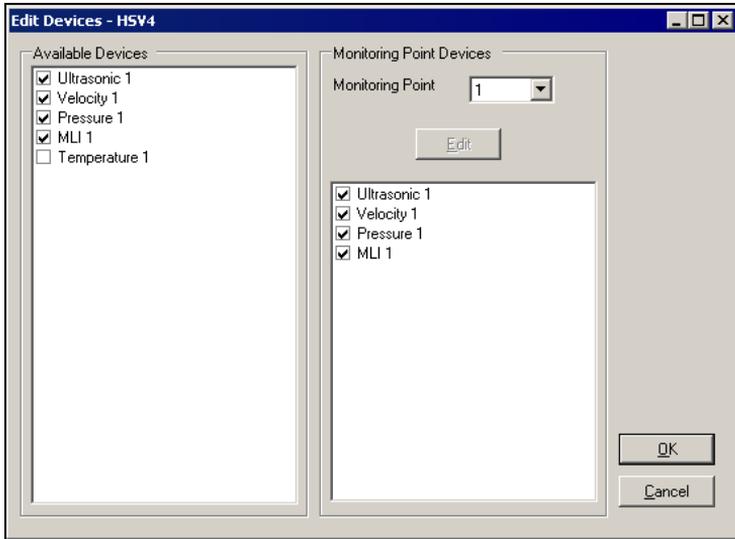
Devices selected for HSV4

3. Select the **Edit > Properties** option *or* click on 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 from the **Available Devices** section corresponding to the devices you do not want to include as associated with the selected monitoring point in the LIF.

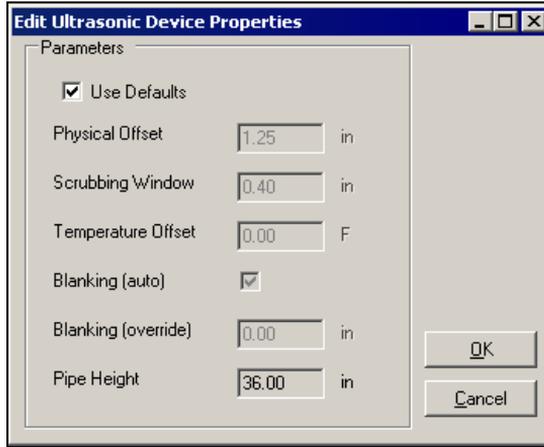
Note: **Profile** selects the Ultrasonic 1, Velocity 1, Pressure 1, and MLI[®] 1 devices for the FlowShark IS flow monitor by default. The MLI device is not specifically associated with a sensor. It represents special software included in the monitor firmware that supports activities such as water quality sampling and event notification.

*The selected devices display in the **Monitoring Point Devices** section.*

6. Repeat steps 4 through 5 to assign devices to Monitoring Point 2, when applicable.
7. As necessary, edit the parameters specific to each device in the following way:
 - Access the device parameters by selecting (*highlighting*) the device you want to edit in the **Monitoring Point Devices** section and then clicking on the **Edit** button.
 - Refer to the following sections for details concerning the specific device parameters.
8. Once you have edited the devices as necessary, click on the **OK** button to save the devices to the LIF.

Editing the Ultrasonic Device

Edit the ultrasonic device in the following way, and then click on the **OK** button when complete:



Edit Ultrasonic Device Properties dialog

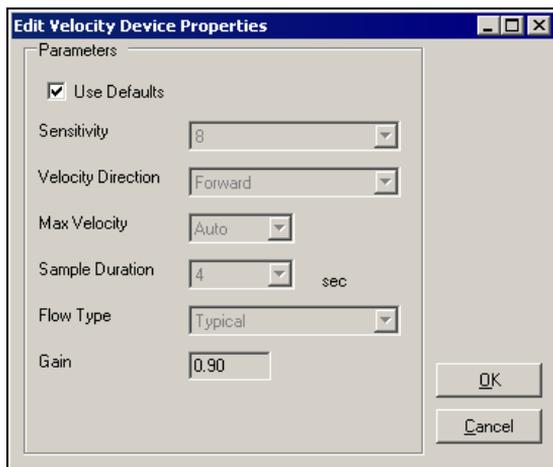
- **Use Defaults** Select this checkbox to apply the default parameters to the ultrasonic device. Deselecting this option enables the parameter fields for editing.
- **Physical Offset** Enter the physical distance between the face of the ultrasonic depth sensor and the top (crown) of the pipe.
- **Scrubbing Window** Enter the allowable difference between individual ultrasonic pair readings and the average reading of all the pairs. If any single pair exceeds the difference, that pair will be flagged and removed from the calculation. The remaining pairs will be averaged to calculate the depth readings.
- **Temperature Offset** *This field should not require modification for the FlowShark IS monitor. No additional temperature compensation is necessary.*
- **Blanking (auto)** Select this checkbox to ensure the monitor disregards depths occurring within a distance from the face of the ultrasonic depth sensor equivalent to 5 percent of the range

from the sensor face to the bottom of the pipe. This (*default*) setting effectively represents the vast majority of pipe/flow conditions. *Therefore, ADS strongly recommends selecting this option for most applications.*

- **Blanking (override)** Enter the distance from the face of the ultrasonic depth sensor within which to ignore data potentially representing erroneous readings. Use this option in place of the *auto-blanking* option (above) to designate a distance *greater than 5 percent* of the range from the face of the sensor to the bottom of the pipe. Do not choose a distance shorter than 5 percent of the range. *ADS recommends using this option only when spikes in the data are occurring beyond the 5 percent range and under direct consultation with an ADS representative.*
- **Pipe Height** This field represents the height of the pipe in which the sensor is installed. *This parameter is not editable from this location.*

Editing the Velocity Device

Edit the velocity device in the following way, and then click on the **OK** button when complete:



Edit Velocity Device Properties dialog

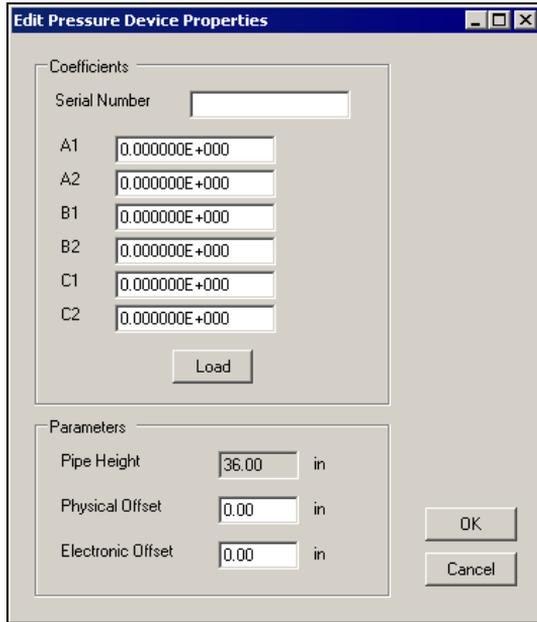
Note: Typically, the velocity device should not require editing. However, when editing is necessary, ADS recommends acquiring proper training or assistance before changing the velocity parameters.

- **Use Defaults** Select this checkbox to apply the default parameters to the velocity device. Deselect this option to enable the fields to allow editing of the velocity device parameters.
- **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 low sensitivity can produce readings that are low in comparison with confirmation readings.
- **Velocity Direction** Select the direction in which the flow occurs or the velocity sensor is positioned.
 - Bidirectional** Choose this option to enable the monitor to properly log both positive *and* reverse flows at the monitoring point when the sensor is positioned to fire upstream (*sensor crystals facing upstream*).
 - Forward** Choose this option to read only positive flows when the sensor is positioned to fire upstream (*sensor crystals facing upstream*).
 - Backward** Choose this option to read downstream flow when the sensor is installed in the outgoing line and positioned in the opposite direction to fire downstream (*sensor crystals facing downstream*). For example, this option may be used when two pipes converge and the sensor is installed in the single outgoing line.
 - Backward Bidirectional** Choose this option to read both downstream and reverse flows when the sensor is installed in the outgoing line and positioned in the opposite direction to fire downstream (*sensor crystals facing downstream*). For example, this option may be used when a weir is installed to measure overflows that may experience river intrusion.

- **Max Velocity** Select the appropriate option from this drop-down list to fine tune the maximum velocity value at the selected monitoring point for greater accuracy in the velocity data. An **Auto** option is available that allows the monitor to dynamically modify the optimal maximum velocity based on the current velocity readings to enhance the precision in processing velocity data. It can read velocities up to 30 feet per second (fps). However, ADS recommends using a fixed value for monitoring points that typically remain dry, such as overflows or sites downstream from pump stations. For these applications, consider choosing the **10** or **15 fps** option, particularly where a sudden surge of flow traveling at more than 3 fps can occur within a single interval.
- **Sample Duration** Select the duration of time for the sensor to fire based on the noise present at the location. This interval should increase with elevated noise levels. ADS recommends restricting the selected interval between 3 and 8 seconds.
- **Flow Type** Select the option corresponding to the conditions that generally reflect the monitoring point at which the Doppler velocity sensor is installed.
 - Typical** Choose this option for locations that consistently experience continuous flow.
 - Wet/Stagnant** Choose this option for locations that experience pooling, with only limited movement in the flow.
 - Usually Dry** Choose this option for locations that are characterized by an absence of flow, except during wet weather conditions.
- **Gain** This represents the factor that is applied to raw velocity to determine average velocity when receiving diagnostic readings and calculating quantity and typical days in the monitor. This parameter is editable through the **Quantity Coefficient Generator** tool in **Profile**.

Editing the Pressure Device

Edit the pressure device in the following way, and then click on the **OK** button when complete:



Edit Pressure Device Properties dialog

- **Serial Number** Enter the serial number listed on the pressure depth sensor.

Note: Entering the pressure depth sensor’s serial number and downloading the pressure coefficients are essential to ensuring the monitor logs accurate pressure depth data.

- **Coefficients** Click on the **Load** button to browse to the folder in the local directory containing the coefficients for the pressure depth sensor (based on the sensor’s serial number). These coefficients also can be entered manually. Download the file containing the pressure coefficients to the local directory from the ADS website in the following way:

- ❑ Access the ADS website at www.adsenv.com on the Internet.
 - ❑ Select **ADS Environmental Services > Support > Client Services**.
 - ❑ Click on the **Download pressure coefficients...** link.
 - ❑ Right-click on the year in which the sensor was manufactured, and select the **Save Target As** option.
 - ❑ Rename the file to reflect the following format: *pressure.xx*, where xx represents the last two digits of the year in which the sensor was manufactured. *Remove the .txt extension!*
 - ❑ Save the file to the appropriate location in the local file system.
- **Pipe Height** This field displays the pipe height at the monitor location. *This parameter is not editable from this location.*
 - **Physical Offset** Enter the vertical distance from the top of the pressure depth sensor to the bottom center of the pipe. ADS recommends measuring this distance manually during the monitor installation or confirmation process. **Profile** defaults to *0 inches*.
 - **Electronic Offset** Enter the difference that exists between the pressure depth sensor readings and the manually measured depth. The default offset is *0 inches*.

Editing the MLI Device

Typically, the MLI device does not require editing. However, if the monitor will be supporting activities such as event notification or dual data rates, refer to the *Profile User's Guide* (#950015**) for detailed instructions on properly setting the applicable parameters.

Setting the Communication Parameters

Setting the communication parameters involves designating the communication ports, minimum voltages, temperature thresholds, and other parameters to ensure proper communication, measurement, and maintenance of the FlowShark IS flow monitor. Modify the communication parameters as necessary.

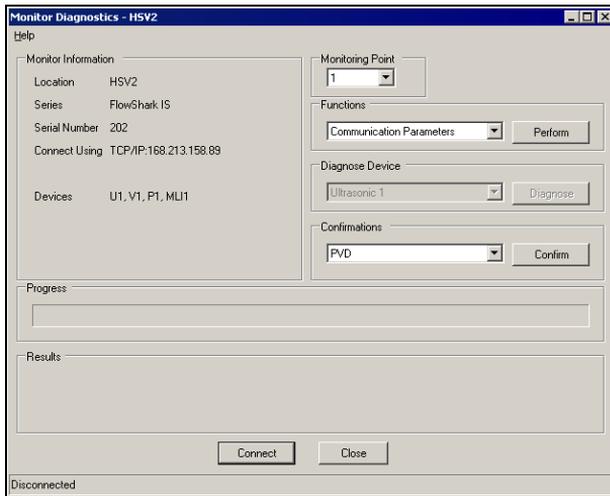
Note: Typically, the default settings should not require modification.

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

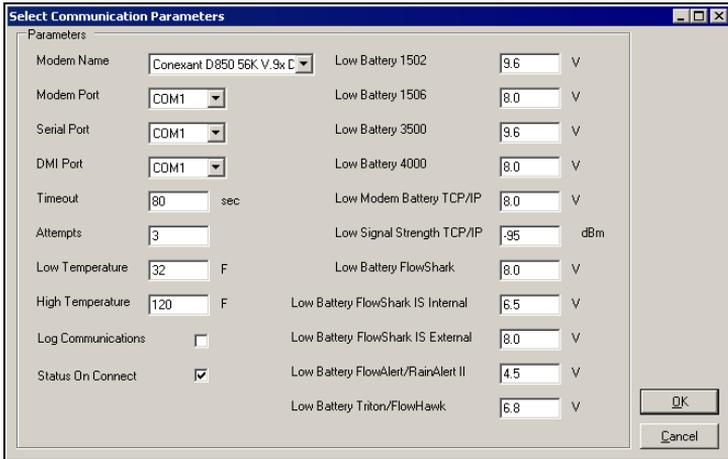
The *Monitor Diagnostics dialog displays.*



Monitor Diagnostics dialog

2. Select **Communication Parameters** from the **Functions** drop-down list, and click on the **Perform** button.

The Select Communication Parameters dialog displays.



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.
 - DMI Port** Select the proper port for communication using the DMI from this drop-down list. This list should include all available ports on your computer.
 - 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 depth sensor, and pressure depth sensor below which you want **Profile** to provide notification.
- High Temperature** Enter the temperature reading from the monitor, ultrasonic 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 concerning the current state of the monitor once monitor communication has been established.
- Low Battery 1502, 1506, 3500, 4000** *(These parameters do not apply to the FlowShark IS flow monitor.)*
- Low Modem Battery TCP/IP** Enter the voltage from the battery inside the EMU powering the wireless modem below which you want **Profile** to provide notification concerning the wireless communication unit, when applicable. *ADS recommends leaving the default battery setting unchanged.*
- Low Signal Strength TCP/IP** Enter the signal strength (in dBm) below which you want **Profile** to provide notification concerning 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 IS monitor.)*
- Low Battery FlowShark IS Internal** Enter the voltage, supplied either by the battery inside the monitor or

an external power source, below which you want **Profile** to provide notification for the FlowShark IS monitor. *ADS recommends leaving the default battery voltage unchanged.*

- Low Battery FlowShark IS External** Enter the voltage supplied from the external power source powering the wireless modem in the EMU and the monitor (when applicable) below which you want **Profile** to provide notification for the FlowShark IS monitor. *ADS recommends leaving the default battery voltage unchanged.*

Note: Notification of low battery voltage or signal strength occurs during the data collection process, during monitor activation, and when receiving TCP/IP communication status. View the associated logs through the **Diagnostics** tool and **Log Viewer** in the **Profile** software.

- Low Battery FlowAlert/RainAlert II** *(This parameter does not apply to the FlowShark IS flow monitor.)*
- Low Battery Triton/FlowHawk** *(This parameter does not apply to the FlowShark IS flow monitor.)*

4. Click on 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 the current monitor firmware (embedded software) and 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.

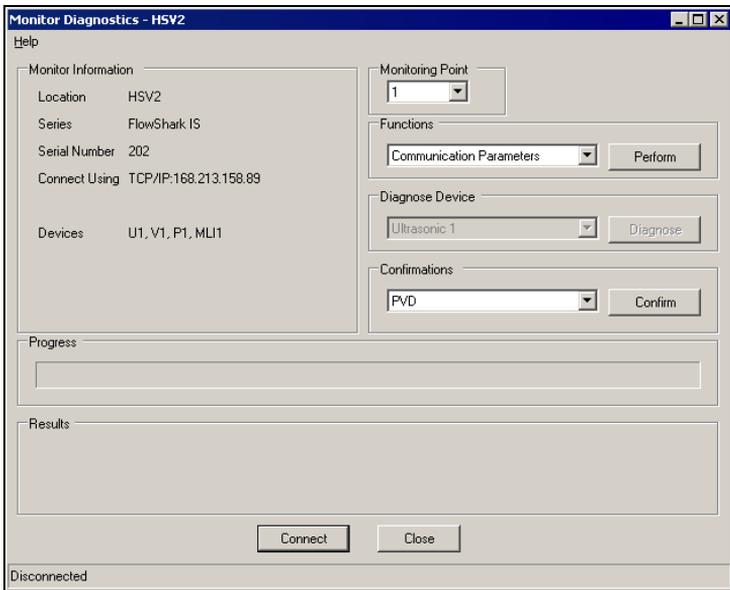
Note: If the monitor has been deactivated (configured to no longer wake-up and take measurements), the user must communicate directly with the FlowShark IS monitor through a serial connection before remote communications can be resumed.

Monitor activation occurs through the **Diagnostics** tool in **Profile**. Activate the monitor in the following way:

1. Select the monitor location you want to activate from the **Profile** main screen, and then click on the **Diagnostics** toolbar button.



*The **Monitor Diagnostics** dialog displays.*



Monitor Diagnostics dialog

2. Click on 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.

***Profile** downloads the configuration and installation information, activates the monitor, and begins logging data based on the selected configuration.*

4. Click on the **Disconnect** button once activation is successful (designated in the **Results** section) and complete.

The local computer disconnects from the monitor.

5. Click on the **Close** button to exit the **Monitor Diagnostics** dialog.

Running Device Diagnostics

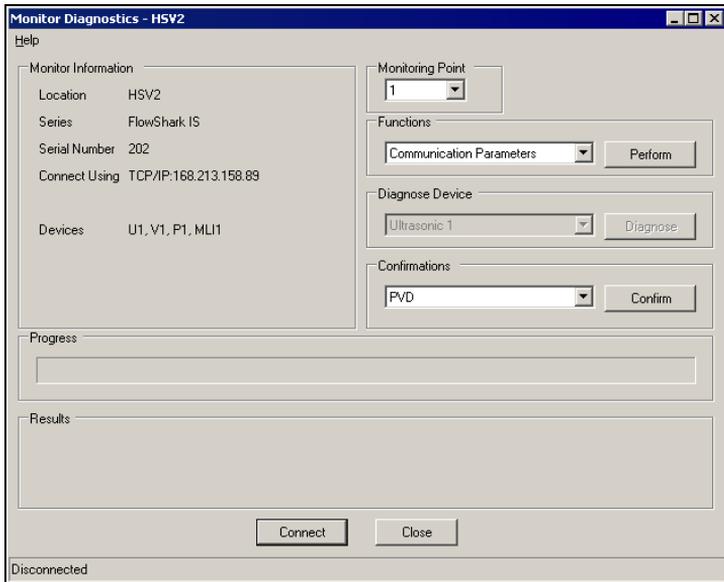
Profile's diagnostics tool enables the user to verify the proper operation of sensors, obtain current readings and status, adjust settings, and identify, diagnose, and troubleshoot potential problems with ultrasonic, velocity, and pressure devices. Run diagnostics for the system devices in the following way:

1. Select the monitor location for which you want to run diagnostics on a device(s) 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

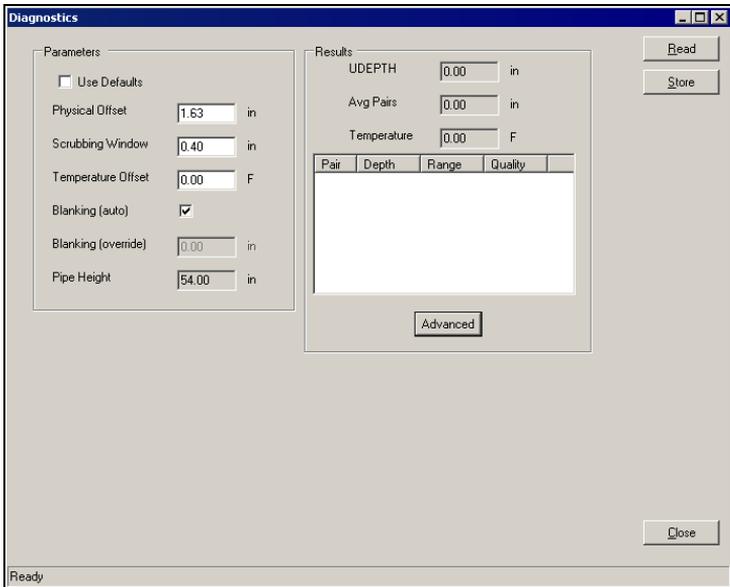
2. Click on the **Connect** button to establish communication with the monitor.

Profile initiates communication with the monitor and establishes a connection.

3. (applies only to the Ultrasonic Device) Run diagnostics on the ultrasonic device in the following way:

- Select the **Ultrasonic 1** device from the **Diagnose Device** drop-down list, and then click on the **Diagnose** button.

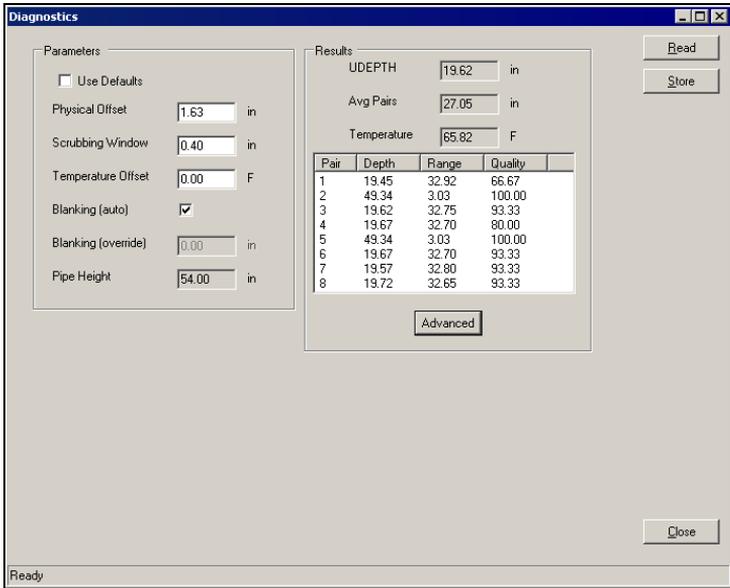
The *Diagnostics* dialog displays the current configuration parameters stored in the LIF for the Ultrasonic 1 device.



Diagnostics dialog for the Ultrasonic 1 device

- Click on the **Fire** button.

The *Results* section displays the current depth and temperature readings measured by the ultrasonic depth sensor.



Diagnostics dialog showing results from ultrasonic depth sensor firing

- Click on the **Advanced** button to view more detailed diagnostic information.
- Verify the accuracy, consistency, and quality of the readings, and edit the configuration parameters as necessary.

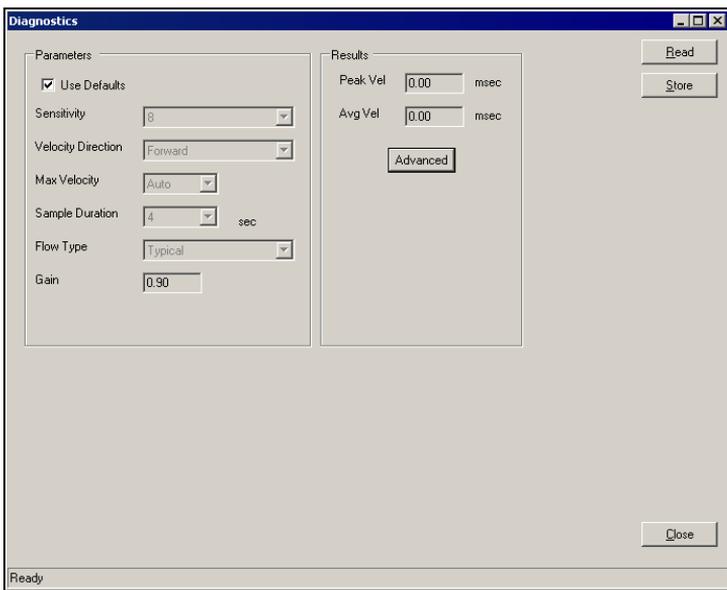
Note: Refer to *Editing the Ultrasonic Device* on page 6-14 for a description of the individual configuration parameters.

- Click on the **Store** button to save any changes made to the device 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 device diagnostics are complete for all the selected devices. However, save the changes to the database before exiting each device window.

- ❑ Click on the **Close** button to exit the Ultrasonic 1 device dialog and return to the **Monitor Diagnostics** dialog.
4. (applies only to the Velocity Device) Run diagnostics on the velocity device in the following way:
- ❑ Select the **Velocity 1** device from the **Diagnose Device** drop-down list, and then click on the **Diagnose** button.

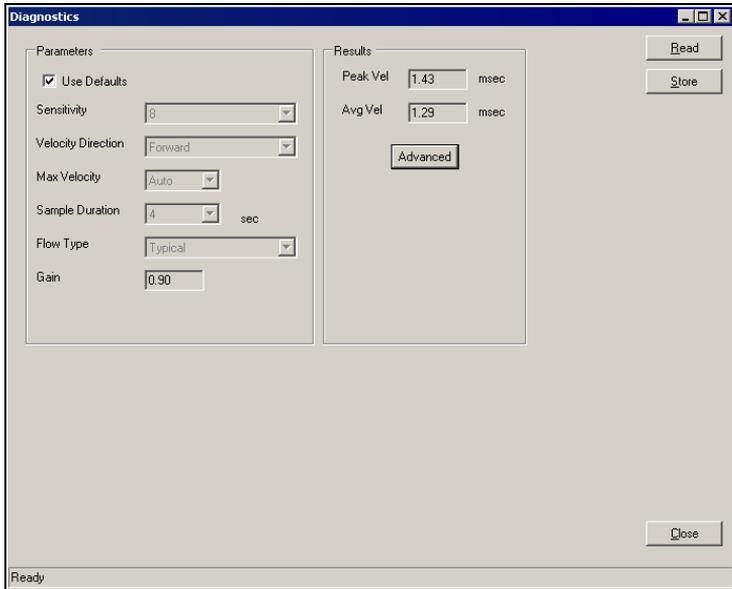
The **Diagnostics** dialog displays the current configuration parameters stored in the LIF for the Velocity 1 device.



Diagnostics dialog for the Velocity 1 device

- ❑ Click on the **Fire** button.

The **Results** section displays the current velocity of the flow measured by the velocity sensor.



Diagnostics dialog showing results from velocity sensor firing

- Click on the **Advanced** button to view more detailed diagnostic information.
- Verify the accuracy of the reading, and edit the configuration parameters as necessary.

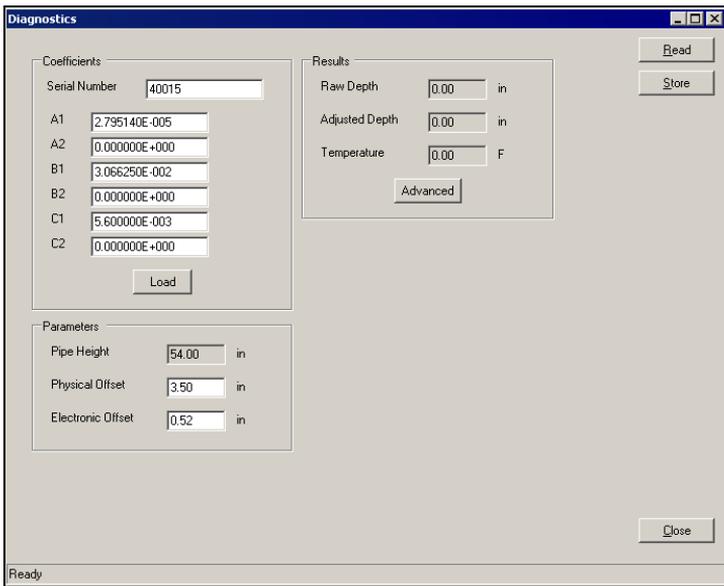
Note: Refer to *Editing the Velocity Device* on page 6-15 for a description of the individual configuration parameters.

- Click on 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, consider waiting to reactivate the monitor with the new LIF until device diagnostics are complete for all the selected devices. However, save the changes to the database before exiting each device window.

- ❑ Click on the **Close** button to exit the Velocity 1 device dialog and return to the **Monitor Diagnostics** dialog.
5. (applies only to the Pressure Device) Run diagnostics on the pressure device in the following way:
- ❑ Select the **Pressure 1** device from the **Diagnose Device** drop-down list, and then click on the **Diagnose** button.

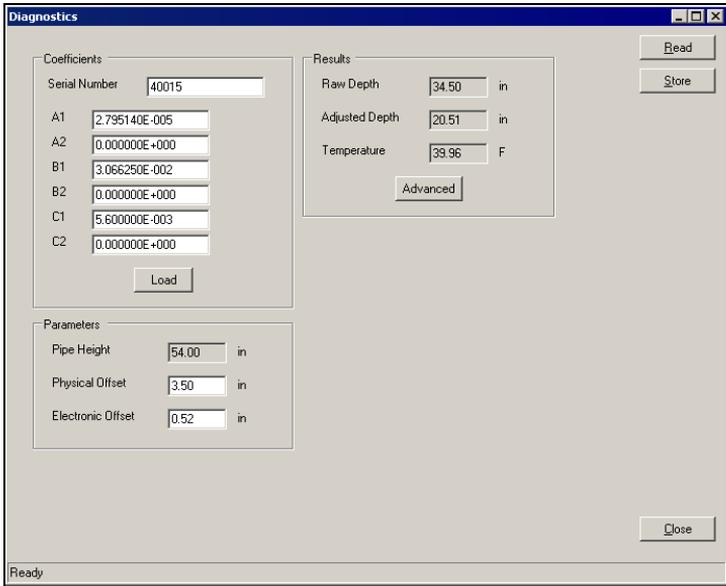
The **Diagnostics** dialog displays the current configuration parameters stored in the LIF for the Pressure 1 device.



Diagnostics dialog for the Pressure 1 device

- ❑ Click on the **Fire** button.

The **Results** section displays the current depth and temperature readings measured by the pressure depth sensor.



Diagnostics dialog showing results from pressure depth sensor firing

- Click on the **Advanced** button to view more detailed diagnostic information.
- Verify the accuracy of the pressure depth and temperature readings, and edit the configuration parameters as necessary.

Note: Refer to *Editing the Pressure Device* on page 6-18 for a description of the individual configuration parameters.

- Click on the **Store** button to save any changes made in the device parameters to the LIF in the database.
 - Click on the **Close** button to exit the Pressure 1 device dialog and return to the **Monitor Diagnostics** dialog.
6. Select **Activate** from the **Functions** drop-down list, and then click on the **Perform** button. For more information on activating a monitor, refer to *Activating the Monitor* on page 6-24.

7. Click on the **Disconnect** button to discontinue communication with the monitor when finished running diagnostics on the system devices.

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**).

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:

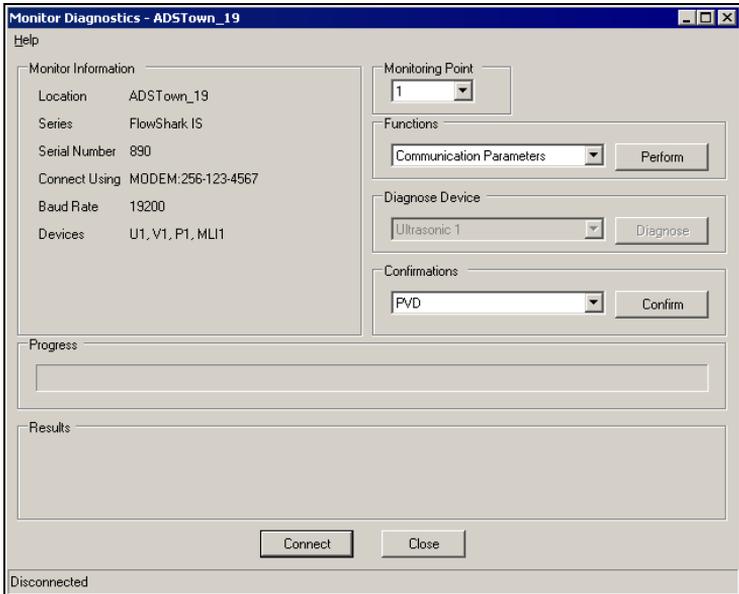
Note: Perform group and scheduled collects using the **Communications** tool.

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.*



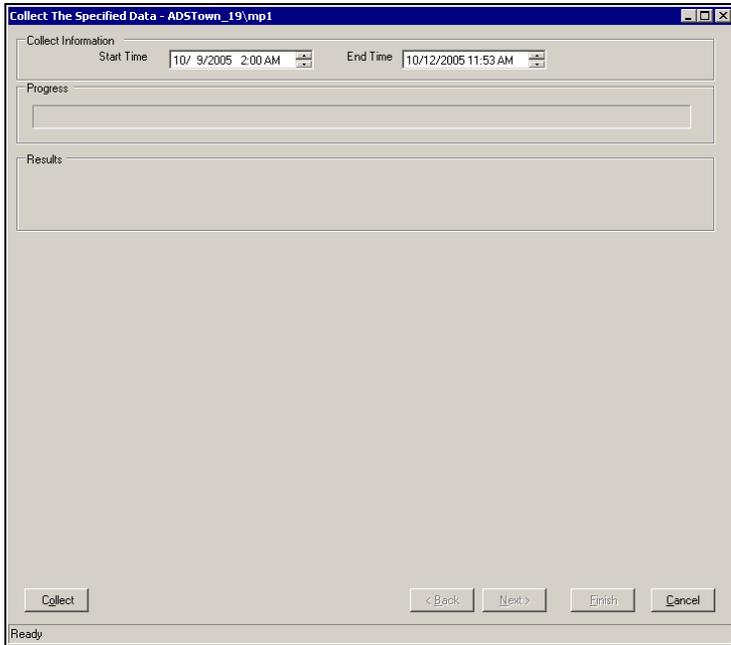
Monitor Diagnostics dialog

2. Click on the **Connect** button to establish communication with the monitor.

Profile initiates communication with the monitor and establishes a connection.

3. Select the **Collect** option from the **Functions** drop-down list, and then click on the **Perform** button.

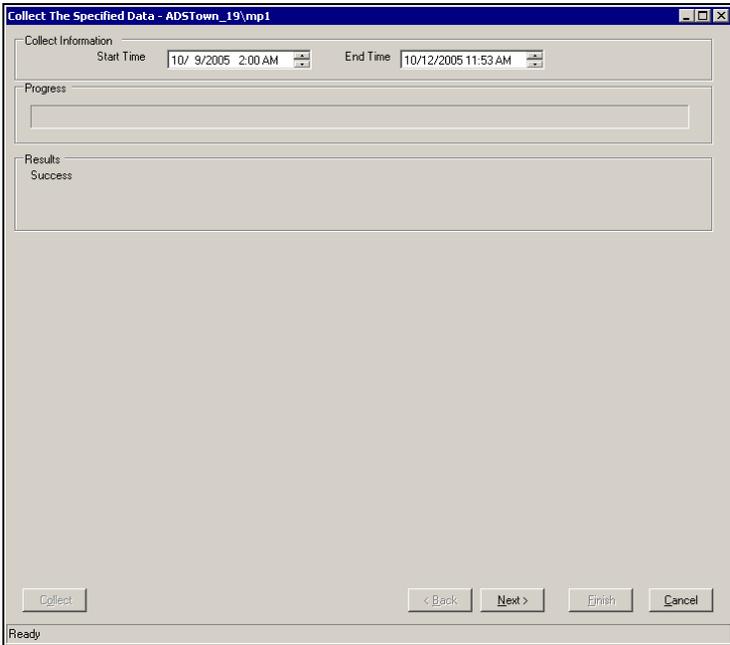
Profile displays the **Collect the Specified Data** dialog.



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** 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 **Autocollect Start time** in the LIF.*
5. Click on the **Collect** button.

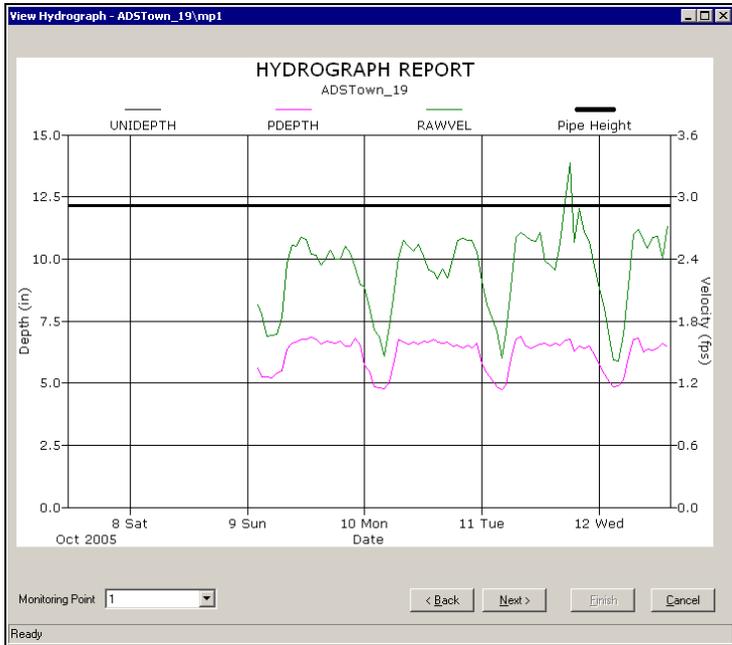
*The **Results** section displays the status of the collect. **Profile** collects all entity data from the monitor for the selected date/time range and stores it in the currently selected database.*



Collect The Specified Data dialog indicating data collection was a success

6. Click on the **Next** button.

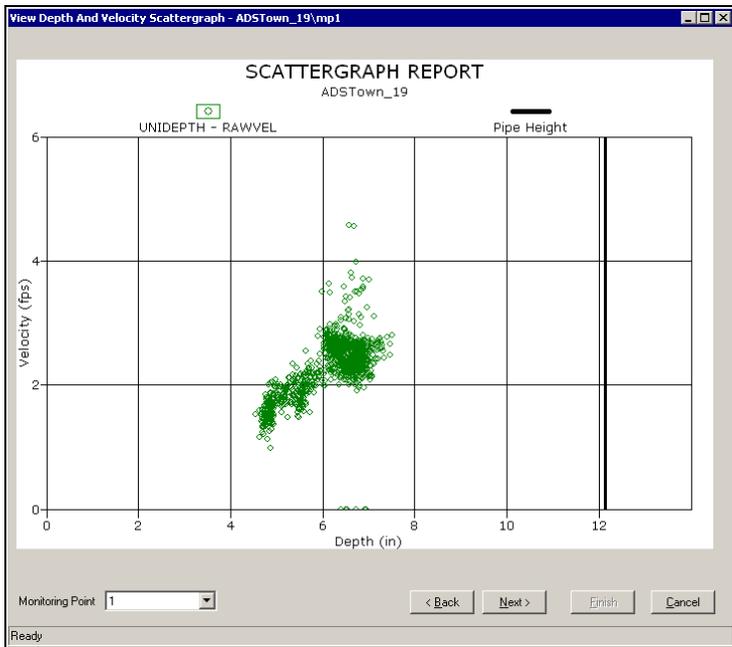
*The **View Hydrograph** – [location name] dialog displays the collected data in hydrograph format.*



View Hydrograph – [location name] dialog

- 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.

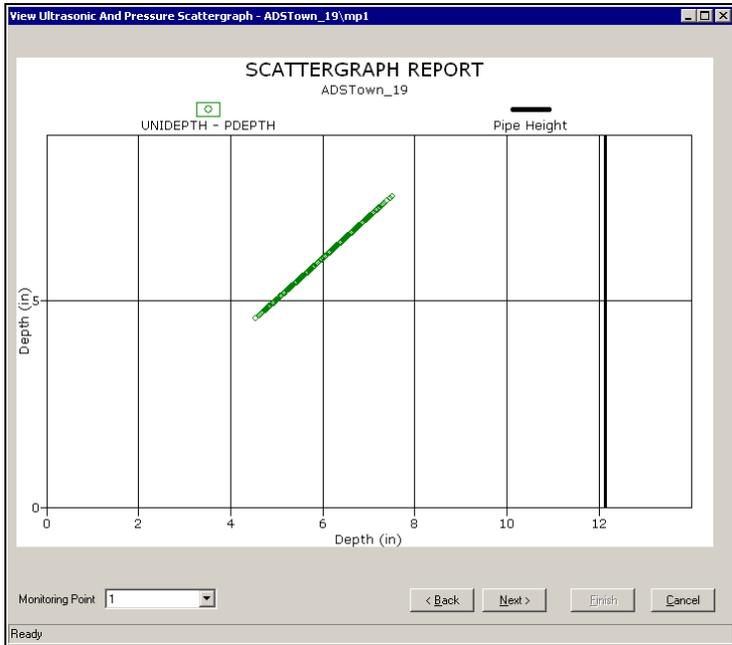
*The **View Depth and Velocity Scattergraph – [location name]** dialog displays the collected depth and velocity data in scattergraph format.*



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.

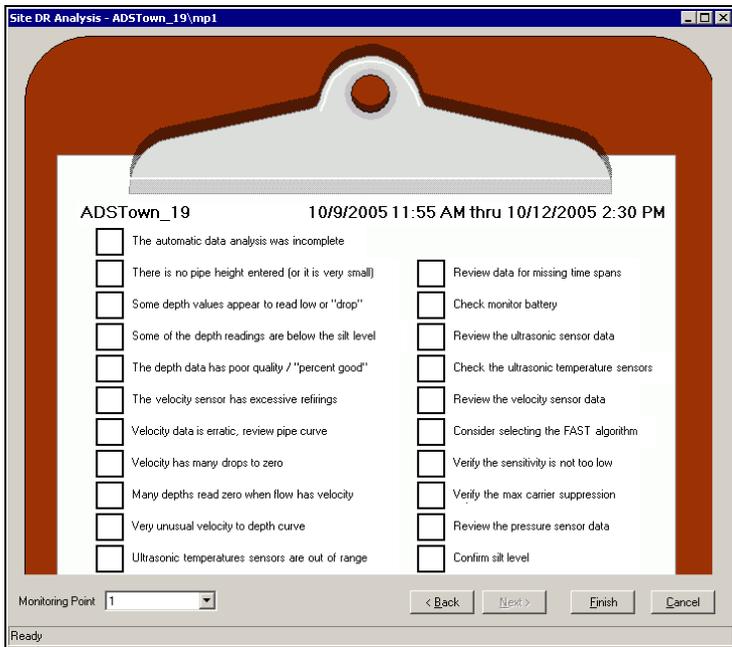
*The **View Ultrasonic and Pressure Scattergraph – [location name]** dialog displays the collected ultrasonic and pressure depth data in scattergraph format.*



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 UNIDDEPTH 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.*

Upgrading the Monitor Firmware

Profile enables you to download updated firmware to the FlowShark IS flow monitor that may include new features and capabilities or performance improvements and enhancements in functions such as data processing, analysis, and communications.

ADS 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. Refer to the *Profile User's Guide* (#950015**) for information on collecting data from the monitor. ADS also requires reactivating the monitor *after* updating the firmware.

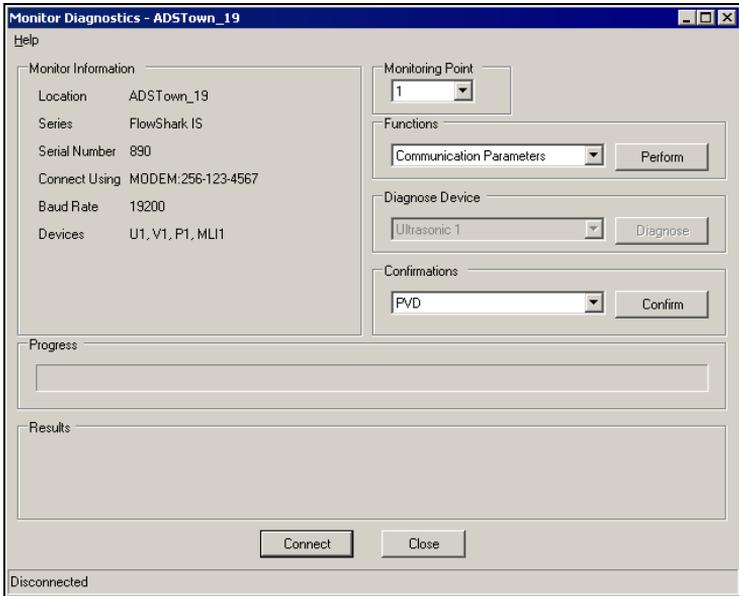
Upgrade the firmware in the monitor memory in the following way:

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.*



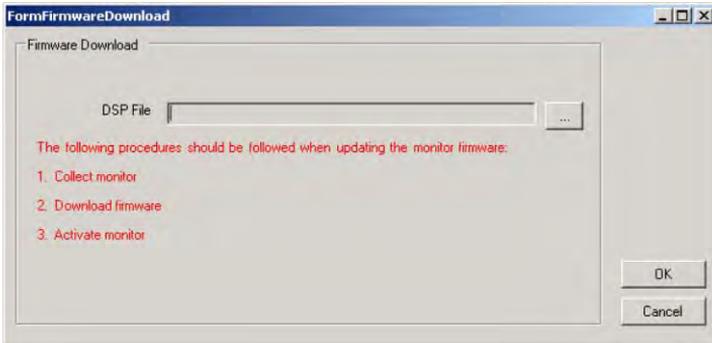
Monitor Diagnostics – [location name] dialog

2. Click on 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 click on the **Perform** button.

*The **Form Firmware Download** dialog displays.*



Form Firmware Download dialog

4. Click on the **Browse** button corresponding to **DSP file** to locate and designate the DSP file applicable to the firmware download. This program file represents the firmware containing the updated code for data processing activities.
5. Click on the **OK** button.

Profile downloads the new firmware to the monitor.

6. Select **Activate** from the **Functions** drop-down list, and then click on 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 an activity log from the **Profile** main screen, and then click on the **Diagnostics** toolbar button.



Diagnostics toolbar button

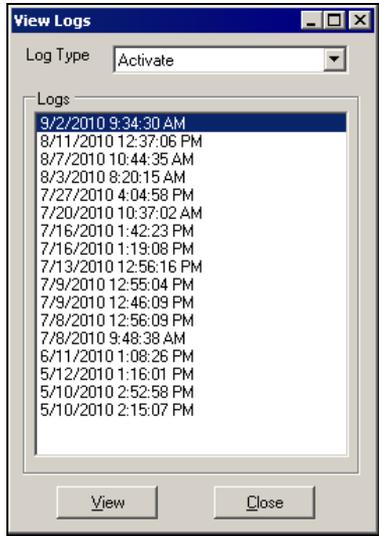
The Monitor Diagnostics dialog displays.

A screenshot of a software dialog box titled "Monitor Diagnostics - HSV5". The dialog has a blue title bar with standard window controls. It contains several sections: "Monitor Information" with fields for Location (HSV5), Series (FlowShark IS), Serial Number (5113), Connect Using (TCP/IP:166.219.50.36), and Devices (U1, V1, ML1); "Monitoring Point" with a dropdown menu set to "1"; "Functions" with a dropdown menu set to "Communication Parameters" and a "Perform" button; "Diagnose Device" with a dropdown menu set to "Ultrasonic 1" and a "Diagnose" button; and "Confirmations" with a dropdown menu set to "PVD" and a "Confirm" button. At the bottom, there are "Connect" and "Close" buttons. A "Progress" bar and a "Results" area are also present but empty. The status bar at the bottom left shows "Disconnected".

Monitor Diagnostics – [location name] dialog

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.
4. Click on the **Perform** button.

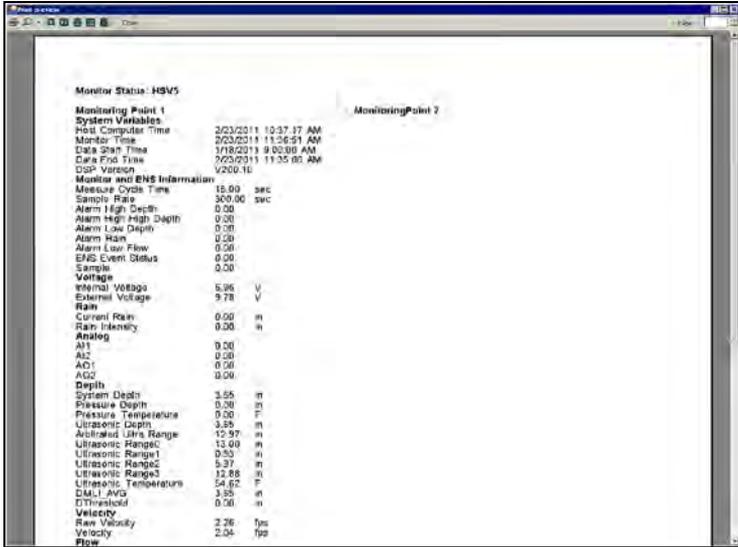
*The **View Logs** dialog displays.*



View Logs dialog

5. Select the kind 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 click on the **View** button.

*The **Print Preview** screen displays the contents for the selected log.*



Example of **Monitor Status** log

7. (optional) Click on the **Print** button to print the contents of the log file.



Print button

CHAPTER 7

Monitor Installation

After installing the sensors and establishing communications, install the ADS® FlowShark® IS 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. 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.

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.

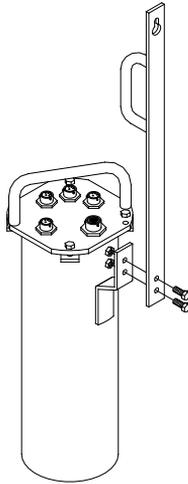
Mounting the Monitor to the Manhole Wall

Mount the monitor to the manhole wall using the monitor bracket in the following way:

1. Determine the appropriate location to mount the monitor bracket to the manhole wall. Consider the following when selecting the proper location:
 - Select a location that will allow for easy removal of the monitor during service visits using the mounting bracket (extension handle).
 - Select a location that exhibits only a minimal potential for experiencing 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 2½ inches deep at the mark, and install a 3/8-inch x 3-inch 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 flange with two 3/8-inch x 1-inch hex bolts, 3/8 – 16 hex nuts, and 3/8-inch washers.

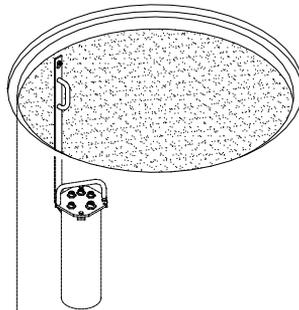


Bolting the mounting bracket to the flange welded to the monitor

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 into 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 1/4-inch x 2 1/4-inch anchor bolts using 14-inch 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

Mount the monitor to the manhole rim using the monitor bracket in the following way:

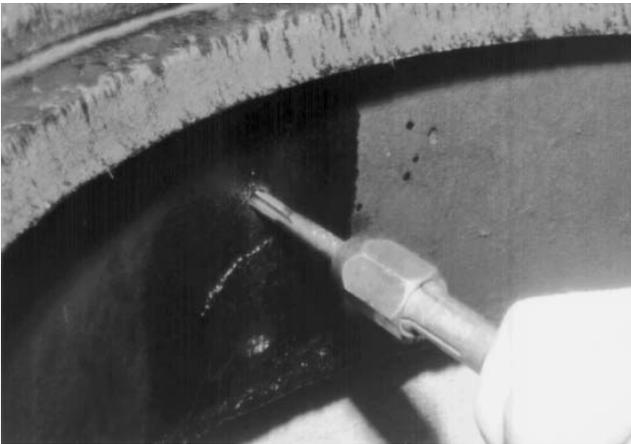
1. Determine the appropriate location to mount the monitor bracket to the inside of the iron manhole rim. Consider the following when selecting the proper location:
 - Select a location that will allow for easy removal of the monitor during service visits using the mounting bracket (extension handle).
 - Select a location that exhibits only a minimal potential for experiencing 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 steel 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 deep using a 5/16-inch carbide-tipped drill bit.

Note: Consider starting the hole using smaller bits to make pilot holes and increasing up to a 5/16-inch bit. In addition, spray cutting oil or another lubricant into the hole while drilling and tapping.



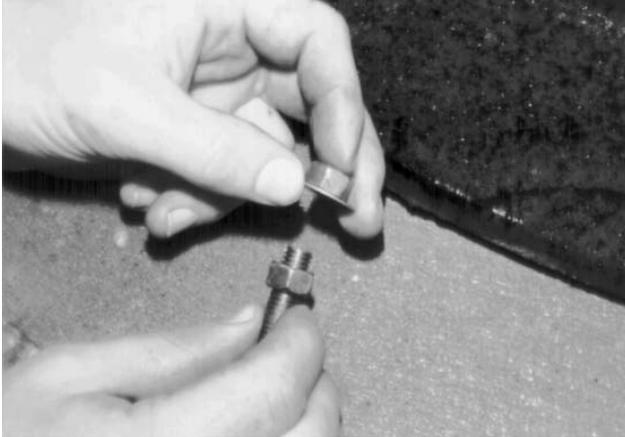
Drilling the hole in the manhole rim

4. Use a 3/8-inch x 16 threads-per-inch tap to cut threads in the hole. Twist the tap clockwise $\frac{3}{4}$ turn, and then back out $\frac{1}{2}$ 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.



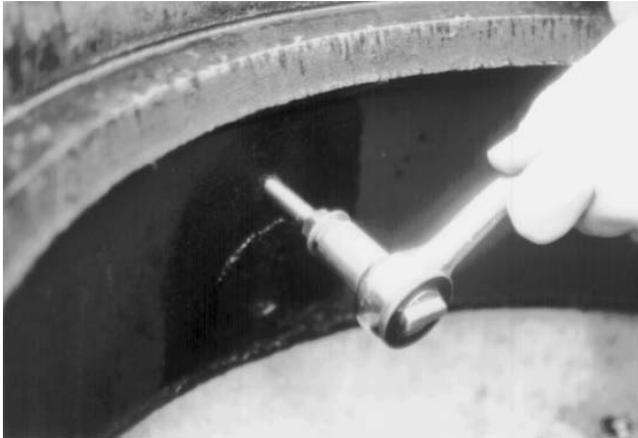
Placing two nuts and a washer onto the stud

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 $\frac{3}{4}$ inch 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 two 3/8-inch x 1-inch hex bolts, 3/8 – 16 nex nuts, and 3/8-inch washers. It may be necessary to drill new holes in the flange.
12. 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 avoid accidentally dropping the monitor down into the manhole during installation.

13. Slide the bracket against the inner nut and washer, and tighten and secure the outer nut against the bracket.
14. 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 1/4-inch x 2 1/4-inch anchor bolts using 14-inch 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.

CHAPTER 8

Maintenance and Troubleshooting

While the ADS® FlowShark® IS 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 pack or performing service activities which may involve disconnecting cables from the monitor. In addition, disconnect telephone service at the network interface box before disconnecting cables from the monitor lid. These activities help prevent possible shock or injury to personnel as well as damage to the equipment during service visits at the monitor location.

Maintaining the System Components

The FlowShark IS 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 activity ADS permits within the monitor chassis is battery pack 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.

Gathering Replacement Parts and Supplies

Gather the following replacement parts and supplies for performing routine maintenance:

- Dryer tube for the pressure depth sensor
- Battery packs for both the EMU and the FlowShark IS monitor
- IS ultrasonic depth, pressure depth, and Doppler velocity sensors
- Soft bristle brush
- Paper towels
- Compressed air
- Flat head screwdriver and assorted wrenches

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 should occur from a remote location when wireless communication is available.
- Review the applicable logs in **Profile**[®] to verify the status of the monitor clock, communications, firmware, battery pack(s), 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.

Confirming the Monitor

Confirm the accuracy of the sensor subsystems in the monitor on a regular basis. 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**) for detailed information on performing confirmation procedures.

Checking the Monitor Battery Voltage

Check the battery voltage using **Profile** before installing the monitor and after collecting data. The projected life for the 9-volt battery pack (*when applicable*) in the monitor is 9 to 12 months at a 15-minute sample rate; the projected life for the 12-volt battery pack (*when applicable*) in the monitor is 11-15 months at a 15-minute sample rate. However, replace the battery pack in a monitor with the 9-volt or the 12-volt battery pack as soon as possible when the internal voltage is 6.5 volts or less, or **Profile** provides a **Low** battery status.

Warning: An external voltage reading below 8.0 volts or an internal voltage of less than 6.5 volts may prevent communication with and data collection from the monitor.

Check the current battery voltage in the monitor using the **Diagnostics** tool in **Profile** in the following way:

1. From the **Profile** software main screen, select the monitor and then select the **Diagnostics** toolbar button (*or select **Tools** > **Diagnostics** from the main menu*).



Diagnostics toolbar button

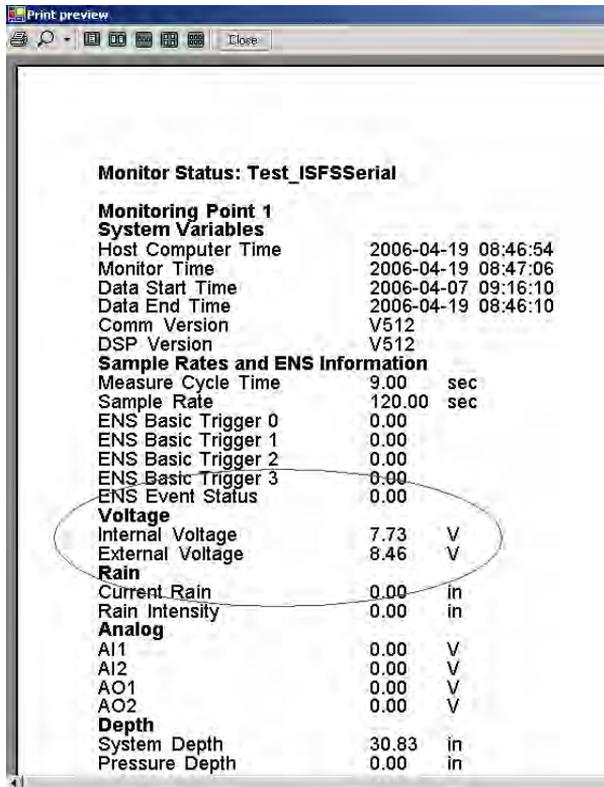
The **Diagnostics** dialog displays.

2. Select the **Connect** button on the **Diagnostics** dialog to establish communication with the monitor.

Profile establishes communication, and the **Monitor Status** displays on a **Print Preview** screen for the selected monitor.

3. Review the **Monitor Status**. Replace the internal battery when 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.



Monitor Status report indicating Internal and External Voltage

Replacing the Monitor Battery Pack

Note: The only service or maintenance activity ADS permits within the monitor chassis is battery pack replacement. Therefore, do not handle, alter, modify, remove, or replace any other components inside the monitor. These actions will void the monitor warranty agreement and the IS certification.

Warning: The FlowShark IS Model 5000-IS1 may only use the 9-volt (ADS p/n 106152) or 12-volt (ADS p/n 8000-0043-01/02) battery pack to power the monitor. *DO NOT use any other battery pack or power source to power the Model 5000-IS1!*



FlowShark IS 9-volt (left – ADS p/n 106152) and 12-volt (right – ADS p/n 8000-0043-01) battery packs

Replacing the battery pack in the monitor is a relatively easy process. However, this process may involve a simple conversion and/or a few additional steps and parts based on the current battery type and future needs. Earlier FlowShark IS monitors have the original 9-volt battery pack; however, more recent models may have the newer 12-volt battery pack that provides a longer battery life. While both battery packs are still available, ADS also offers a simple conversion kit for upgrading an existing FlowShark IS monitor equipped with a 9-volt battery pack to the 12-volt battery pack. The conversion kit (ADS p/n 5000-0780-01) includes a 12-volt battery pack, a special retainer plug, and a slightly longer canister.

The following procedure includes detailed instructions on replacing the battery pack in the monitor. These instructions apply regardless of the particular battery pack in use and include the extra steps required when performing the conversion from the 9-volt to 12-volt battery pack.

1. Contact a data analyst to collect the data remotely *or* collect the data on-site. This will reduce the risk of data loss once the battery is disconnected.
2. Remove the monitor from the hazardous area.
3. Remove the 4 bolts securing the monitor top and chassis to the canister.
4. Wipe away any debris or moisture that could enter the chassis once the inside of the unit is exposed.
5. Using the handle on the monitor top, pull the chassis straight up from the canister. The battery pack sits at the bottom of the canister, and has an 18-inch cable that allows the chassis to be lifted just clear of the canister top.

Caution: Be careful not to pull the chassis away from the canister. This could break off the connector from the voltage regulator PCB.

6. Place the chassis upright next to the canister opening, disconnect the battery pack, and set the chassis aside.

Note: Maintain the chassis in an upright position. The chassis is top heavy and could fall over due to the weight of the sensor cables and uneven ground surface.



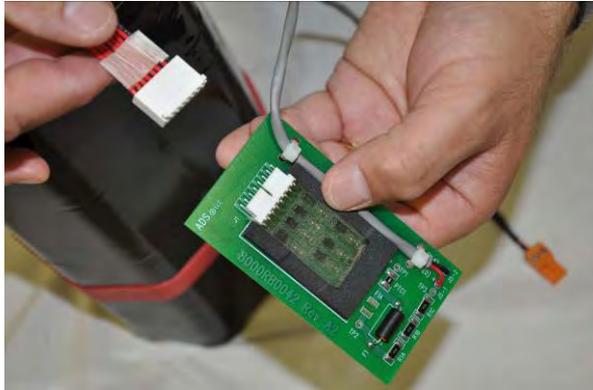
FlowShark IS 9-volt battery pack inside canister

7. *(applies only to the 9-volt battery pack)* Mark the edge of the canister to identify the location of the battery cable standoff (the small pipe protruding from the top of the battery pack).
8. Remove the old battery pack from the canister using the white plastic handle attached to the top of the pack.
9. *(applies only to the 12-volt battery pack)* 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 off 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.*

10. (*applies only to the 12-volt battery pack*) Connect the PCB to the replacement battery pack and then secure the PCB to the side of the pack with the red band. When converting the monitor to a 12-volt battery pack from the 9-volt battery pack, the PCB should already be attached to the new battery pack.
11. (*applies only to the 12-volt battery pack*) 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.
12. Lower the new or replacement battery pack into the canister. Consider the following:
 - When converting to the new 12-volt battery pack, be sure to insert the battery pack into the *new*, extended canister included with the conversion kit.
 - When using a replacement 9-volt battery pack, install and orient the new battery pack so that the cable standoff is in the marked location.
13. Connect the battery pack to the monitor, and then pull up the excess battery cable.
14. Feed the cable into the unit while slowly lowering the chassis into the canister. Align the cable standoff with the notch in the chassis bottom plate (*when applicable*), seat the unit, and align the top bolts. *Be sure not to pinch the battery cable with the chassis!*
15. Connect with the monitor remotely or on site using the IS PC communication cable (ADS p/n 106228 rev H5) to verify communication and check the new internal voltage. The internal voltage should be well above 6.5 volts. Refer to the end of *Chapter 4, Communication*, for instructions on attaching the IS PC communication cable to the monitor and laptop computer.
16. Tighten the bolts to approximately 20-inch pounds to secure the chassis to the canister.

Refer to *Replacing EMU Components* on page 8-14 for instructions on replacing the battery pack in the EMU (*for low external voltage*).

Checking 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 ultrasonic sensor gently with a soft brush, and wipe the sensor with a clean, moist cloth.
- Verify that the face of the 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 pressure sensor and face of the velocity sensor with a soft bristle brush.
- Confirm that all sensor cables are neatly arranged, securely fastened, and free of debris, cuts, and breaks that may affect performance. Replace any sensor that has a damaged cable.

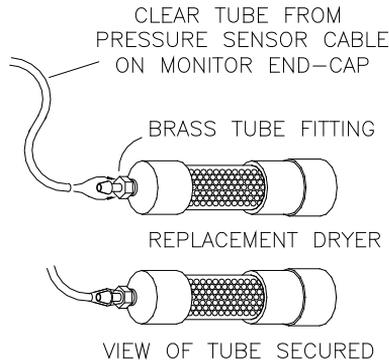
Replacing the Pressure Depth Sensor Dryer Tub or Desiccant

The pressure depth sensor's dryer 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 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 dryer tube with the used desiccant. The desiccant inside the dryer tube can be replaced with new desiccant at a later time so that the tube can be reused as a replacement for another dryer tube in the future.
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 dryer tube to the monitor with cable ties.
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. Evaluate the pressure depth sensor performance for a limited time to ensure no damage has occurred to the sensor electronics.

Replacing the Desiccant

When replacing the desiccant inside the pressure depth sensor dryer tube, use indicating beads that are approximately 0.16 inches in diameter. Smaller beads may be able to escape the dryer tube, entering the clear plastic tubing leading to the sensor connector. 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 16-mm 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!*

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.

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 EMU Components

If a component in the EMU is not functioning, perform the following procedures (as applicable) to *replace* the faulty component.

Note: ADS allows trained field crews to replace the quad-band GSM/GPRS wireless modem, SIM, and EMU battery pack within the EMU box.

Warning: DO NOT open the Communication Interface/Barrier (ADS p/n 106226) Box in the field under any circumstances. Do not attempt any component level repair.

Accessing the EMU for Maintenance Activities

Access the EMU from the enclosure and open the EMU to access the component(s) requiring replacement in the following way:

1. Open or remove the cover from the enclosure in which the EMU is housed.
2. Remove the EMU from the enclosure by releasing the fasteners securing the EMU to the panel inside the enclosure.
3. Loosen the 4 large plastic screws on the cover of the EMU and remove the cover. Carefully set the cover aside to avoid damage and prevent dirt from contacting the gasket on the lid.
4. Refer to one or more of the following sections to perform modem, battery, or SIM replacement.

5. Once maintenance is complete, re-mount and secure the EMU to the panel inside the enclosure using the fasteners.
6. Replace or close the cover to the enclosure.

Replacing the Battery in the EMU

If the Monitor Status report from **Profile** reveals an external voltage of 8.0 volts or less, replace the battery pack in the EMU. The EMU uses one non-IS battery pack (ADS p/n 5000-0557).

Replace the battery pack in the following way:

1. Disconnect the battery cable from the EMU power cable, and remove the battery pack from the EMU.
2. Install the new battery with the cable extending out the left side of the compartment.
3. Connect the cable from the new battery pack to the EMU power cable.
4. Have a data analyst contact the monitor remotely to verify communication and the external battery voltage.
5. Replace the cover on the EMU and tighten the four plastic screws, provided all EMU maintenance is complete.

Replacing the EMU Modem

Replace the quad-band GSM/GPRS wireless modem (ADS p/n 507209) in the EMU in the following way:

1. Disconnect the power (battery or external) running to the EMU/modem.
2. Remove the two Phillips head screws that secure the modem bracket to the back panel of the EMU, and then remove the
3. Disconnect the antenna cable from the modem by unscrewing the gold nut (at the connector end of the antenna cable) from the modem connector.
4. Remove the modem bracket with the modem from the EMU.

5. Carefully disconnect the black (power) and the ribbon (communication) cables from the back of the modem.
6. Slide the existing modem out of the bracket, and insert the new modem into the bracket.
7. Connect the black and the ribbon cables to appropriate ports on the back of the new modem.
8. Reattach the modem bracket to the back panel of the EMU without pinching the cables behind the bracket.
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 from a modem and inserting a new SIM card into the modem.
10. Restore power to the EMU.
11. Enter or confirm the correct IP address in **Profile**, and have a data analyst attempt to contact to the monitor remotely to verify communications.
12. Replace the cover on the EMU and tighten the four plastic screws, provided all EMU maintenance is complete.

Replacing the SIM Card in the EMU Modem

Replace the SIM card in the modem in the following way:

1. Disconnect the power (battery or external) running to the EMU/modem.
2. Slide the lock on the front of the modem holding in the SIM card to the right.
3. Gently press in on the SIM card to release it from the socket. Upon release, it should slide out slightly from the socket.
4. Remove the SIM card from the modem socket.
5. Write down the IP address for the new SIM card, and then insert the new card completely into the socket in the front of the modem.

6. Slide the lock to the left to secure the SIM card in the socket.
7. Restore power to the EMU.
8. Contact a data analyst to enter the IP address for the new SIM card n Profile, and then have the analyst attempt to connect to the monitor remotely to verify communications.
9. Replace the cover on the EMU and tighten the four plastic screws, provided all EMU maintenance is complete.

Troubleshooting

The FlowShark IS 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 board, sensor (or other input device), or cabling.
- Problems affecting more than one subsystem typically 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 boards) may arise from problems with boards or the corresponding cabling.

Note: If possible, collect all monitor data prior to swapping sensors or troubleshooting a monitor to prevent possible data loss. Swapping sensors or batteries does *not* result in stored 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, other 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 IS monitor and sensor subsystem.

General Monitor Problems

The following tables contain general troubleshooting techniques for the FlowShark IS flow monitor.

Problem	Monitor does not answer via wireless communication.
Possible Causes	<p>Signal strength to the modem may be insufficient.</p> <p>Battery pack(s) may be dead or below the minimum voltage requirement (8.0 volts external, 6.5 volts internal).</p> <p>Modem Reset PCB failure may have occurred.</p> <p>Wireless network failure may have occurred.</p> <p>Antenna may be defective.</p> <p>Monitor may be defective.</p> <p>Modem in EMU may be defective.</p> <p>Leading zeros are included before or within the IP address.</p>
Possible Solutions	<p>If signal strength has been marginal, consider trying the other GSM/GPRS operating frequency by connecting the EMU to the other antenna cable. Attempt communications again and verify whether signal strength has improved.</p> <p>Replace either the EMU battery or the monitor battery if either one is reading below the minimum voltage requirement.</p> <p>Try connecting to other wireless units (i.e., other ADS wireless sites) in the same area. If all connections fail for similar IP addresses and/or none of the wireless connections are successful, a wireless network outage may be occurring in the area. Contact your regional ADS representative to investigate a possible outage.</p> <p>Replace the monitor.</p> <p>Delete any leading zeros included before or within the IP address.</p>

Problem	Modem connects but monitor does not respond.
Possible Causes	Reset board failure may have occurred. Communication interface board failure may have occurred. Communication cable is cut or disconnected.
Possible Solutions	Wait 4 hours for the Reset board to reset automatically. Inspect the communication cable connection at the EMU location and the monitor to determine whether the cable is disconnected or has been damaged. Connect directly with the monitor using the direct connect cable (ADS p/n 106228). If monitor communicates and is recording data, the problem resides in communication cable or EMU. Contact your regional ADS representative.

Problem	Time stamp on the collected data is incorrect.
Possible Causes	PC clock may be set to incorrect time. 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. Collect the data from the monitor and replace the monitor if defective.

Problem	Time on the monitor clock is incorrect.
Possible Causes	Monitor clock may be a faulty. PC clock may read incorrect time.
Possible Solutions	Verify the time on the PC clock and correct if necessary. Reactivate the monitor to enable the clock. Collect the data from the monitor and replace the monitor if defective.

Problem	Profile provides a Device Time Out message.
Possible Cause	Communications may be marginal. Analog board may be faulty.
Possible Solutions	Re-attempt communication with the monitor. Replace the monitor if defective. Contact your regional ADS representative.

Problem	Gap exists within the collected data.
Possible Cause	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 it if necessary. Check monitor time, and reset clock if necessary. Run diagnostics in Profile to verify whether a firmware problem may exist. Contact your regional ADS representative.

Problem	An I/O error message displays when communicating with the monitor.
Possible Cause	Processor or analog board may be faulty.
Possible Solutions	Re-attempt communication with the monitor. Replace the monitor if defective. Contact your regional ADS representative.

External Power

The following table contains troubleshooting techniques for problems with the ADS External Power Supply. If another power supply is in use, similar troubleshooting techniques may apply. However, consult the manufacturer's product documentation prior to beginning the troubleshooting process.

Problem	No DC power is available at the EMU.
Possible Cause	Breaker may have tripped. Station power may be off. Power supply may have failed. Power supply wiring may have become disconnected.
Possible Solutions	Restore main power source to station (Owner must perform this operation.). Check for wiring faults and then reset breaker. Look for DC ON LED on the front of the ADS Power Supply. If it is off, but AC power is live, replace the power supply. Contact your regional ADS representative.

IS Ultrasonic Depth Subsystem

The following tables contain general troubleshooting techniques for problems with the ultrasonic depth subsystem.

Note: Contact your regional 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.
Possible Solutions	Verify the physical offset, and adjust it if necessary. Verify the pipe height.

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. 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. 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	Physical offset may be incorrect. Pipe height may be incorrect. Sensor may be dirty. Sensor may be faulty.
Possible Solutions	Verify the physical offset. Verify the pipe height. 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. Pipe may be surcharged. Sensor may be dirty. Sensor may be faulty.
Possible Solutions	Verify the physical offset. Verify the pipe height. Clean the sensor. Replace the sensor. Contact your regional ADS representative.

Problem	Ultrasonic depth data indicates a surcharged pipe, but the pipe is free flowing.
Possible Causes	Physical offset may be incorrect. Pipe height may be incorrect. Sensor may be dirty. Sensor may be faulty. Analog board may be faulty.
Possible Solutions	Verify the physical offset. Verify the pipe height. Clean the ultrasonic depth 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 the level of the sensor.

Problem	Ultrasonic depth 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 the sensor connection to monitor (if necessary). Replace the sensor.

IS Doppler Velocity Subsystem

The following tables contain general troubleshooting techniques for the Doppler velocity subsystem.

Note: Contact your regional ADS representative for further diagnosis prior to replacing a sensor.

Problem	Monitor often provides a velocity sensor reading of 0.
Possible Causes	<p>Sensor may be dirty or broken.</p> <p>Cabling between the analog board and the sensor may be bad.</p> <p>Velocity parameters may require adjustment.</p>
Possible Solutions	<p>Clean the sensor.</p> <p>Check the velocity parameters.</p> <p>Inspect the sensor cables for tightness.</p> <p>Check for moisture in the connector.</p> <p>Contact your regional ADS representative.</p> <p>Replace the sensor.</p> <p>Replace the monitor if defective.</p>

Problem	Velocity sensor data does not fluctuate much (but is not 0).
Possible Cause	<p>Sensor may be dirty</p> <p>Sensor may be broken.</p>
Possible Solutions	<p>Clean the sensor.</p> <p>Check the sensor connections.</p> <p>Check the velocity parameters.</p> <p>Contact your regional ADS representative.</p> <p>Replace the sensor.</p>

Problem	Velocity sensor data seems erratic.
Possible Causes	Sensor may be dirty. Sensor may be faulty. Analog board may be faulty.
Possible Solutions	Clean the sensor. Check the sensor connections. Check the velocity parameters. Contact your regional ADS representative. Replace the sensor. Replace the monitor if defective.

Problem	Velocity sensor readings are abnormally high.
Possible Causes	Sensor may be covered with silt. Sensor may be out of the flow. Flow may be reversed or slower than 0.5 ft/s (0.15 m/s).
Possible Solutions	Check the site conditions, and relocate the sensor if necessary.

IS Pressure Depth Subsystem

The following tables contain general troubleshooting techniques for the pressure depth subsystem.

Note: Contact your regional ADS representative for further diagnosis before replacing a sensor.

Problem	Temperature reading from the pressure depth sensor shows a value of -273° C (-459° F).
Possible Causes	Cable connecting the sensor to the monitor may be loose or broken. Sensor may be faulty. Analog board is not responding or may be faulty.
Possible Solutions	Secure the sensor connection to monitor (if necessary). Replace the sensor. Replace the monitor if defective.

Problem	Pressure depth readings are consistently incorrect.
Possible Causes	Coefficients may be incorrect. Pressure dryer tube may not be functioning properly.
Possible Solutions	Retrieve or enter the correct coefficients, and reactivate the monitor. Inspect the color of the desiccant in the dryer tube, and replace the tube (if necessary).

Problem	Pressure depth readings are consistently off by up to 3 inches (7.62 cm), but temperature readings are accurate.
Possible Cause	Monitor may be configured with an incorrect pressure sensor offset.
Possible Solution	Enter an offset to depth for consistency with confirmation readings.

Problem	Pressure depth sensor temperature readings are incorrect, but depth data is accurate.
Possible Causes	Temperature sensor may be faulty. Analog board may be faulty.
Possible Solutions	Replace the sensor. Replace the monitor if defective.

Problem	Pressure depth sensor temperature and depth readings are erratic.
Possible Causes	Sensor may be faulty. Analog board may be faulty.
Possible Solutions	Examine the sensor and clean if necessary. Replace the sensor. Replace the monitor if defective.

APPENDIX A

Specifications

This appendix contains specifications for the ADS[®] FlowShark[®] IS flow monitor and associated subassemblies, sensors, cables, and wireless communication hardware.

FlowShark IS Flow Monitor (5000-IS1-US-01/ 5000-IS1-US/5000-IS1/5000-IS1-01)

The following table contains the specifications for FlowShark IS monitors. The specifications for weight and power correspond only to monitors containing an internal battery pack (5000-IS1-01 and 5000-IS1-US-01).

Enclosure	Cylindrical 0.13-inch (0.30 cm) thick seamless, marine-grade aluminum with stainless steel hardware, meets IP68 standard.
Dimensions	20 inches (50.80 cm) <i>or</i> 21.6 inches (54.86 cm) long x 6.38 inches (16.21 cm) in diameter
Weight	With 9-volt battery pack: 35 pounds (15.9 kg) With 12-volt battery pack: 34 pounds (15.4 kg) Without battery pack: 16 pounds (7.3 kg)
Operating Temperature	32° to 104° F (0° to 40° C)

<p>Internal Power</p>	<p>One ADS 9-volt or 12-volt IS alkaline battery pack powering the monitor <i>and</i> one ADS non-IS 12-volt alkaline battery pack powering the External Modem Unit.</p>
<p>Battery Life</p>	<p>Monitor (<i>9-volt battery pack</i>): 9-12 months at a 15-minute sample rate with weekly communications.</p> <p>Monitor (<i>12-volt battery pack</i>): 11-15 months at a 15-minute sample rate with weekly communications.</p> <p>EMU: 2-3 months at a 15-minute sample rate with weekly communications.</p> <p>Note: Actual battery life will vary depending on operating temperature and frequency of communications.</p>
<p>External Power Option</p>	<p>Requires an external, low-noise DC power source providing a minimum of 12 volts at 1 amp</p>
<p>Connectors</p>	<p>U.S. MIL-C-26482 series 1, for environmental sealing, with gold-plated contacts and interfacial seals</p>
<p>Inputs and Outputs</p>	<ul style="list-style-type: none"> • IS Ultrasonic depth sensor input • IS Doppler velocity sensor input • IS Pressure depth sensor input • IS Communication/External Power input • Air pressure valve (<i>for testing purposes only</i>)
<p>Approvals</p>	<p>Hazardous Area – approved for use in Class I, Div. 1, Group C&D areas, in US via QPS/UL Cert, and in Zone 0 IIG areas in the EU via SIRA/ATEX</p>

IS Digital Signal Processor Board (5000-0636)

Processor	Texas Instruments VC33 DSP (Digital Signal Processor)
Memory	1 megabyte non-volatile (program, configuration, and data storage); 512 kilobytes static RAM
Data Storage	140 days (1 velocity and 2 depth readings at a 15-minute sample rate)
Comm Protocol	Enhanced AccuYapp for modem, wireless, and serial communications
Clock	Battery-backed RTC Module
Inputs/Outputs	Isolated frequency input (to read IS battery) Isolated serial communications Accubus High-Speed I/O (to other internal PCBs)
Protection	Agency-approved optoisolators; current-limiting resistors

IS Analog Signal Processor Board (5000-0637)

Inputs/Outputs	<ul style="list-style-type: none"> • ADS IS ultrasonic sensor input • ADS IS velocity sensor input • ADS IS pressure sensor input • Internal regulated power • Accubus High-Speed I/O (to other internal PCBs)
Comm Protocol	Enhanced AccuYapp
A/D Conversion	12-bit, 8-channel, 500KHz sample rate
Construction	Front encapsulated with UL-Recognized compound, keyed connectors
Protection	Agency-approved optoisolators; current limiting resistors

IS Voltage Regulator Board (5000-0638)

Inputs	6 to 12 volts (from internal or external source) Accubus
Outputs	3.3v and 5v isolated to analog and DSP PCBs Battery/external power to V-F PCB Isolated Accubus
Protection	Agency-approved fuses; current limiting resistors and optoisolators
Comm Protocol	Enhanced AccuYapp for modem, wireless, and serial communications
Construction	Front and back encapsulated using UL-Recognized compound, keyed connectors

Voltage to Frequency Board (5000-0661)

Protection	Agency-approved optoisolators; current limiting resistors
Construction	UL-Recognized conformal coating, keyed connectors

Wireless External Modem Unit (3800-0148 and 3800-0148 EP)

Enclosure	Rectangular UL-Recognized NEMA 4X/6P composite enclosure w/stainless steel hardware
Dimensions	18 inches (45.7 cm) high x 6 inches (15.2 cm) deep x 7.5 inches (19.1 cm) wide. <i>Size includes antenna and top grip fittings.</i> Note: Stabilizing legs add an additional 6 inches to the length.
Weight	12 pounds (26.4kg) without battery
Operating Temperature	0° to 140° F (-18° to 60° C)
Power	One ADS non-IS 12-volt alkaline battery pack
External Power Option	Requires an external DC power source providing a minimum of 12 volts at 1 amp
Connections	Communication cable and antenna cables enter through sealed NEMA 4X right-angle cable-grip fittings
Wireless Modem	Enfora LLC Model GSM1218 Quad-Band GSM/GPRS (850/900/1850/1900 MHz)
FCC ID	FCC ID MIVGSM0108

Antenna	Hi-Gain Center-fed Capacitive Monopole
Protocol	TCP/IP
Addressing	Fixed address through AT&T Custom APN
Network Attach	Refreshed every 4 hours through hard-reattach

Communication Interface Board (106124D)

Protection	BASEEFA-approved optoisolators, current-limiting resistors, and agency-approved fusing
Construction	Inside EMU enclosure in plastic sub-enclosure

ADS Power Supply (5000-0727)

Size	5.1 inches (13 cm) x 5.1 inches (13 cm) x 5.1 inches (13 cm)
Material	Polycarbonate
Rating	NEMA 4X
Mounting	Panel mounting via four 0.175-inch holes
Input Voltage	100-240VAC, 50/60Hz
Output Voltage	12V DC, 1.2A
Connection	AC: Supplied 6-foot line cord (U.S.) or hardwire to AC input terminals DC: Hardwire to DC output terminals

IS PC Communication Interface Cable (106227A-xxx, where xxx represents length)

Size	Jacket - 0.318 inches (8 mm) in outside diameter
Construction	8- to 20-gauge and 4- to 18-gauge conductors inside heavy-gauge polyurethane direct-burial jacket
Connections	Factory-fitted, potted connector on monitor end; field-terminated strip connection at EMU
Length	Maximum 300 feet (91.4 m)

Intrinsically-Safe Sensors

IS Ultrasonic Depth Sensor (106186A-30)

Housing	Marine-grade aluminum/epoxy
Dimensions	7.13 inches (18.11 cm) long x 4.20 inches (10.67 cm) wide x 0.86 inches (2.19 cm) high
Accuracy	0.125 inches (3.2 mm)
Deadband	Less than 1 inch (25 mm)
Frequency	40 kHz
Range	0.5 inches to 12.5 feet (1.27 cm to 3.8 m)
Resolution	0.01 inches (0.25 mm)
Drift	0.0 inches
Cable	Standard size: 30 feet (9.1 m) long x 0.50 inches (13 mm) diameter OD polyurethane jacket Extension cables available up to 300 feet (91.4 m)

IS Pressure Depth Sensor (3754-0001-40)

Enclosure	Solid machined PVC/stainless steel
Dimensions	5.25 inches (13.34 cm) long x 1.40 inches (3.56 cm) wide x 1.15 inch (2.92 cm) high
Range	0.0 to 5.0 psi: up to 11.5 feet (3.5 m) 0.0 to 15.0 psi: up to 34.5 feet (10.5 m) 0.0 to 30.0 psi: up to 69.0 feet (21.0 m)
Accuracy	<u>0.50% of full scale for these ranges:</u> 0.1-5.0 psi: 0.25-11.5 feet (0.08-3.5 m) 0.1-15.0 psi: 0.25-34.5 feet (0.08-10.5 m) <u>0.75% of full scale for these ranges:</u> 1.0-30.0 psi: 2.3-69.0 feet (0.7-21.0 m)
Resolution	0.025% of full scale
Cable	Standard size: 40 feet (10.7 m) long x 0.29 inches (7.4 mm) OD (outside diameter) polyurethane jacket Extension cables available up to 300 feet (91.4 m)

IS Doppler Velocity Sensor (106194A-35)

Enclosure	Solid machined PVC/epoxy
Dimensions	2.35 inches (5.97 cm) long x 1.13 inches (2.87 cm) wide x 0.49 inches (1.25 cm) high
Accuracy	± 0.2 feet per second (0.06 mps) or 4% of actual peak velocity (whichever is greater) in flow velocities from -20 .0 to 20.0 fps (-6.10 to 6.10 mps)
Resolution	0.04 feet per second (0.01 m/s)
Cable	Standard size: 35 feet (10.7 m) long x 0.25 inches (6.4 mm) diameter OD polyurethane jacket Extension cables available up to 300 feet (91.4 m)

APPENDIX B

Part Numbers

This appendix contains a list of the part numbers for the most commonly used and ordered ADS[®] FlowShark[®] IS parts.

Monitors	
5000-IS1	MON, 5000, IS1, EXT PWR, EU, SERIAL
5000-IS1-01	MON, 5000, IS1, BAT PWR, EU, SERIAL
5000-IS1-US	MON, 5000, IS1, EXT PWR, US, SERIAL
5000-IS1-US-01	MON, 5000, IS1, BAT PWR, US, SERIAL
EMUs	
3800-0148	ASSY, FS IS EMU, WIRELESS, BAT PWR (ANTENNA INCLUDED)
3800-0148 EP	ASSY, FS IS EMU, WIRELESS, EXT PWR (ANTENNA INCLUDED)
507181	SIM CARD, AT&T, FIXED IP
3800-0181	KIT, EXT POWER, IS FS EMU
Sensors and Cables	
106227A-xxx	CABLE, COMM, MONITOR TO EMU, (<i>xxx represents the length in feet; various lengths are available</i>)
106186A-30	SENSOR, 106, IS, ULTRASONIC, 30'
106194A-35	SENSOR, 106, IS, VELOCITY, 35'
3754-0001-40	SENSOR, PRESSURE, IS, 5PSI, 40'

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3754-0002-40	SENSOR, PRESSURE, IS, 15PSI, 40'
3754-0003-40	SENSOR, PRESSURE, IS, 30PSI, 40'
106228A	CABLE, COMM, 106 MON, DIRECT CONECT
3800-0147	CABLE, COMM, RS232, REG/PRT PCB TO PC
3704-0032	REPLACEMENT VENT DRYER TUBE
901-11055-00	DESICCANT, INDICATING BEADS
Monitor Replacement PCBAs	
5000-0636	PCB, ASSY, DSP, 5000 IS
5000-0637	PCB, ASSY, ANALOG PROCESSOR, 5000 IS
5000-0638	PCB, ASSY, REGULATOR, 5000 IS
5000-0661	PCBA, V TO F, 5000IS
EMU Replacement PCBAs	
3800-0143	PCBA, PRT, SPIDER, 5000IS
106124D	PCB, ASSY, COMM INTERFACE
106251B	PCB, ASSY, COMM BARRIER {used on 106124D}
Monitor Replacement Battery Packs	
106152A	BATTERY PACK, IS, 9V
5000-0780-01	KIT, 12V IS BATTERY PACK, LONG CAN <i>(includes 12-volt battery pack with PCB, longer can, and retainer plug)</i>
8000-0043-01	BATTERY PACK, IS, 12V, UNPOTTED with PCB
8000-0043-02	BATTERY PACK, IS, 12V, UNPOTTED without PCB
8000-0042-01	PCB, BATTERY, w/CABLE
8000-0141	RETAINER PLUG, URATHANE, 12V IS BATTERY PACK

EMU Replacement Battery Pack	
5000-0557	BATTERY PACK, 24-CELL, ADS5000
EMU Replacement Modem	
507209	MODEM, GPRS, QUAD-BAND

Note: In all applications, only ADS IS-certified service technicians are authorized to swap FlowShark IS boards and/or perform component-level repair.

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