ADS® ECHO™
Installation, Operation, and Maintenance Manual

October 2022   **QR 775031 A6**

ADS ENVIRONMENTAL SERVICES®

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Table of Contents

CHAPTER 4   Final Configuration and Confirmation 4-1

CHAPTER 5   Modbus   5-1

CHAPTER 6   Maintenance and Troubleshooting   6-1

APPENDIX A   SpecificationsA-1

APPENDIX B   Part NumbersB-1

C H A P T E R 1

Introduction and Overview

The Intrinsically Safe **ADS ECHO™** is a cost-effective, easy-to-use, level monitoring system for overflow prevention. It provides continuous collection system monitoring, from early warning of level increase, to surcharge detection. Applications include: comprehensive sewer performance monitoring, early warning and notification of sewer blockages and impending overflows, Combined Sewer Overflow (CSO) monitoring, Sanitary Sewer Overflow (SSO) monitoring, and sewer capacity studies. These capabilities are essential to providing ongoing oversight and ensuring timely notification and rapid response in critical situations.

The battery-powered, microprocessor-based **ECHO** monitor displays exceptional accuracy and reliability in measuring flow depths up to 20 feet (6.1 m) from the bottom of the reflector. Two versions of the **ECHO** monitor are available representing different communication capabilities. The 9000-**ECHO**-4VZ utilizes the Verizon wireless 4G LTE-M communication network over a private VPN. This monitor has had great success being installed in areas where wireless signal strength is low and additionally can often have the antenna installed inside the manhole. The second **ECHO** monitor, the 9000-**ECHO** utilizes the 3G wireless network. The antenna for this monitor is typically installed outside the manhole.

This manual offers detailed instructions on installing and operating the **ECHO** monitor, providing (remote wireless and on-site Bluetooth®) communication with the monitor, and performing routine maintenance and troubleshooting on the system. It also includes detailed specifications for the system and a list of general, optional, and replacement parts associated with the system.

Monitor labels for a 9000-**ECHO** (top) and a 9000-**ECHO**-4VZ (bottom)

System Component Overview

ADS ECHO Monitor

ADS ECHO Monitor

The **ECHO** measures depth of flow using proven ADS echo ranging technology with advanced digital signal processing. A single, high-powered transducer housed inside a tuned parabolic reflector reliably reads up to 20 feet (6.1 m) from the bottom of the reflector.

The monitor records data at a defined time interval based on system configuration. The monitor can store this data in memory and use the data to generate an alarm. The monitor memory can store approximately 18 months of data logged at a 5-minute sample rate. This data is available to the user for collection, further processing, analysis, and reporting.

The all-in-one **ECHO** monitor requires no separate sensors or cables, and is designed to be mounted near the top of manhole frame.
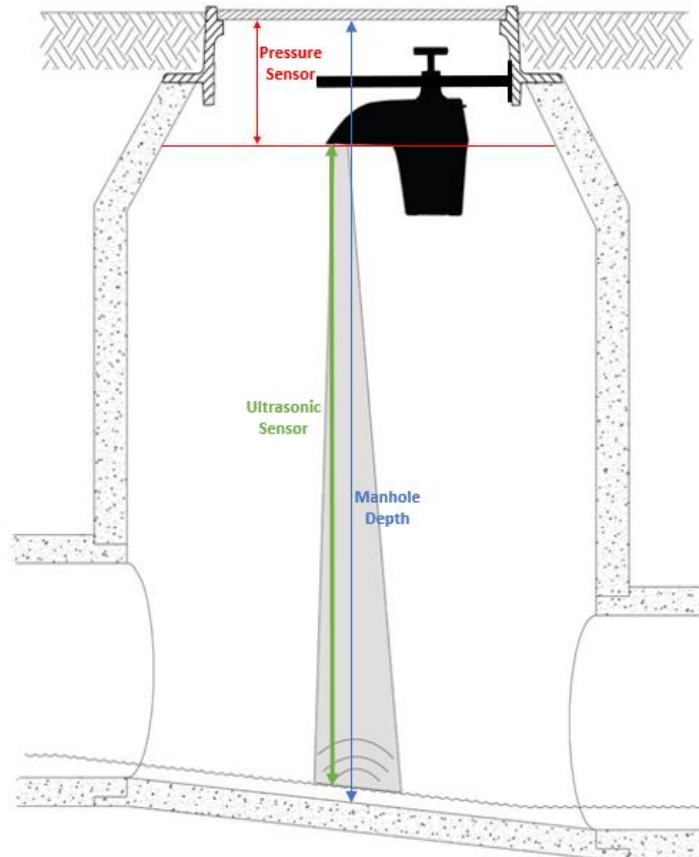
ECHO Monitor Mounted in Manhole

Microprocessor Unit (MPU)

The Microprocessor Unit (MPU) is the source of all monitor activity and is responsible for all of the monitor's high-level functions, including:

- Maintaining the monitor time and date

- Measuring the wireless signal strength

- Performing power management

- Transmitting the stored and current data to the user's PC, **ADS FlowView™**, a user's email address, or an FTP Server

- Initiating event and alarm notification

The MPU allocates portions of memory to firmware (permanently stored software) and data storage. Light-emitting diodes (LEDs) indicate the monitor communications and operational activity. The MPU also includes the monitor clock, random access memory (RAM), and Flash memory. The monitor uses RAM while taking readings and processing 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 power failure.

Communication Elements

The **ECHO** performs remote wireless communication over the cellular network. Two **ECHO** models available utilize either 3G HSPA/HSPA+ (Evolved High-Speed Packet Access) or 4G LTE-M (Long Term Evolution, category M1) through the modem in the monitor. Both **ECHO** models facilitate low-cost, efficient TCP/IP communication in areas with wireless coverage.

Local communication with the **ECHO** monitor is available by Bluetooth connection and direct serial connection (which requires opening the enclosure and should rarely be needed).

Voltage Regulator

The voltage regulator regulates and distributes power from the battery pack to the analog, communications, and MPU components on the board.

Battery

The **ECHO** monitor is powered by an internal 9-volt alkaline battery pack (ADS p/n 9000-0004) mounted inside the enclosure. This battery pack provides the power for operating the monitor, handling communication, and sustaining the monitor wake-up circuitry. The monitor measures the battery voltages and signals a warning when the available power is low.

The battery voltage is logged and available on demand when performing diagnostics.

FCC Part 15 and Industry Canada Compliance

This device complies with Part 15 of the FCC Rules and Industry Canada license – exempt RSS standard(s). Operation is subject to the following two conditions:

- This device may not cause interference.

- This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- *L'appareil ne doit pas produire de brouillage.*

- *L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

Wireless Notice

HE910 (HSPA/HSPA+) Modem

This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with a minimum distance of 20 cm between the radiator and your body. The antenna gain must be as following:

Frequency Band	HE910, HE910-D
GSM 850/FDD V	5.22 dBi
PCS 1900/FDD II	3.31 dBi
FCC IV	6.45 dBi

Cet appareil est conforme aux limites d'exposition aux rayonnements de la IC pour un environnement non contrôlé. L'antenne doit être installé de façon à garder une distance minimale de 20 centimètres entre la source de rayonnements et votre corps. Gain de l'antenne doit être ci-dessous:

Bande de fréquence	*HE910, HE910-D*
GSM 850/FDD V	*5.22 dBi*

PCS 1900/FDD II	*3.31 dBi*
FCC IV	*6.45 dBi*

L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur.

ME910C1-NV (4G LTE-M) Modem

This device complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS 102 of the ISED radio frequency (RF) Exposure rules.

Antenna gain must be as follows:

Frequency Band	ME910C1-NV
FDD 4	6.00 dBi
FDD 2	-
FDD 12	-
FDD 13	6.94 dBi

Le présent appareil est conforme à l'exposition aux radiations FCC / ISED définies pour un environnement non contrôlé et répond aux directives d'exposition de la fréquence de la FCC radiofréquence (RF) et RSS-102 de la fréquence radio (RF) ISED règles d'exposition.

Gain de l'antenne doit étre ci-dessous :

Band / *Bande*	ME910C1-NV
FDD 4	6.00 dBi
FDD 2	-
FDD 12	-
FDD 13	6.94 dBi

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur.

Cellular Modem Information and Compliance

Wireless telemetry is provided via a third-party, FCC- and carrier-approved, commercial UMTS/HSPA+/GSM modem or 4G LTE Cat M1 modem, inside the **ECHO** and an external antenna. Antenna options are available through ADS for the **ECHO** with a UMTS/HSPA+/GSM modem and the **ECHO** with a 4G LTE Cat M1 modem. Customers using the 9000-**ECHO** may obtain their own antennas to accommodate specific needs or requirements. If a customer-supplied antenna is preferable or required, consult an ADS representative prior to installing the antenna to ensure it will adequately support **ECHO** communications and compliance. If using the 9000-**ECHO**-4VZ, customers must use the ADS supplied antenna (9000-0080) if installing the antenna in the manhole.

Intrinsic Safety

Intrinsic Safety is an electronic hardware protection concept that ensures there are no conditions under which the equipment can operate that would 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 its deployment in hazardous areas. Areas where hazardous conditions can be expected to be present on a constant basis are classified (rated) as Zone 0 (equivalent to Class I, Division 1, Groups C & D, in North America).

The **ECHO** has been certified under ATEX European Intrinsic Safety standards for Zone 0 rated hazardous areas.

The **ECHO** has also been certified under IECEx (International Electrotechnical Commission Explosion Proof) Intrinsic Safety standards for use in Zone 0 (equivalent to Class I, Division 1, Groups C & D) rated hazardous areas.

The **ECHO** monitor has been CSA certified to: **CLASS – C225803 – PROCESS CONTROL EQUIPMENT** – Intrinsically Safe – For Hazardous Locations – Certified to Canadian Standards; **CLASS – C225883 – PROCESS CONTROL EQUIPMENT** – Intrinsically Safe – For Hazardous Locations – Certified to US Standards; Class I, Division 1, Groups C and D, T3 (152°C); Ex ia IIB T3 (152°C) Ga; Class I Zone 0 AEx ia T3 (152°C) Ga.

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

ECHO System Certification

The **ECHO** monitor is certified for use only with approved ADS battery packs and communication cables. Connection of any non-approved devices could result in unsafe operation and will immediately void the warranty and IS certification.

The sensors housed in the **ECHO** monitor are approved IS sensors.

Power

The **ECHO** is powered by an internal 9-volt battery pack (ADS p/n 9000-0004).

> **Note:** Using a battery pack that is *not* ADS p/n 9000-0004 will void the warranty and IS certification of the monitor.

Telemetry

Wireless communication is available to the **ECHO** monitor through an antenna and internal Telit® UMTS/HSPA+/GSM modem; or Telit® 4G LTE Cat M1 modem.

Installation and IS Considerations

When installing the **ECHO** monitor, carefully follow any local regulations for installing IS equipment. For example, many clients only allow the use of special hazardous area tools (flashlights, radios, etc.) in manholes. Some clients will not allow the use of an electric drill, either battery-powered or AC-powered, in a manhole. In this case, air (i.e. pneumatic) tools must be used. When in doubt as to the applicable regulations, check with the client or the client's designated safety representative.

Special Conditions for Safe Use

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

Under certain extreme circumstances, exposed plastic and unearthed metal parts of the enclosure may store an ignition capable level of electrostatic charge. Therefore, the user/installer shall implement precautions to prevent the build-up of electrostatic charge, e.g. locate the equipment where a charge-generating mechanism (such as wind-blown dust) is unlikely to be present and clean with a damp cloth.

Maintenance Restrictions

All **ECHO** monitors are manufactured to meet IS standards. ***The monitor's IS certification can be voided instantly if proper maintenance and service procedures are not followed.*** ADS must restrict certain maintenance tasks to ADS IS-certified technicians.

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

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

- Installing and/or swapping the monitor

- Installing and/or swapping the battery pack

- Swapping fuses on the monitor's PCB

- Installing and/or swapping SIM card in the monitor

If there are any questions about the procedures, warranty information, or level of service that can be performed on a monitor, please contact ADS through the contact information listed at the end of this chapter.

European ATEX Hazardous Area Compliance

The following instructions apply to equipment covered by the certificate numbered Sira 16ATEX2112X. Reference European ATEX Directive 2014/34/EU, Annex II:

- The equipment may be used with flammable gases and vapors with apparatus group IIB and with temperature class T3 (152°C).

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

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

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

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

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

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

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

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

- **ECHO** monitors delivered outside the United States must bear the following label to substantiate conformance to ATEX and CSA standards as certified through Sira Certification Services:

Sira **ECHO** Certification Label

- EC Type Examination Certificate Sira 16ATEX2112X can also be used to substantiate conformance to applicable EU laws for IS equipment.

  Note: To access the latest version and entire content of the certificate, please contact ADS.

IECEx (International Electrotechnical Commission Explosive) Hazardous Area Compliance

The **ECHO** is covered by certificate IECEx SIR 16.0043X. Reference IECEx standards IEC 60079-0 : 2011 and IEC 60079-11 : 2011. This IECEx certificate can also be used to substantiate conformance to applicable international standards for IS equipment. The following page is a copy of the first page of the certificate.

  Note: This copy was current at the time of publication of this manual. To access the latest version and entire content of the certificate, please contact ADS.

IECEx Certificate of Conformity

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

Certificate No.:	IECEx SIR 16.0043X	Issue No.:1	Certificate history: Issue No. 1 (2016-10-4) Issue No. 0 (2016-4-28)
Status:	Current		
Date of Issue:	2016-10-04	Page 1 of 5	

Applicant: **ADS Environmental Services**
340 The Bridge Street
Suite 204
Huntsville
Alabama 35806
United States of America

Equipment: **Model 9000-ECHO Level Monitor**
Optional accessory:

Type of Protection: **Intrinsically Safe**

Marking: Ex ia IIB T3 (152°C) Ga
Ta = -20°C to +60°C

Approved for issue on behalf of the IECEx   N Jones
Certification Body:

Position: Certification Manager

Signature:
(for printed version)

Date: 2016-10-04

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

Certificate issued by:
SIRA Certification Service
CSA Group
Unit 6, Hawarden Industrial Park
Hawarden, Deeside, CH5 3US
United Kingdom

First Page of the **ECHO** IECEx Certificate of Conformity

EMC (Electromagnetic Compatibility) Compliance

The **ECHO** is tested and certified to comply with US, Canadian, and other international standards for Electromagnetic compatibility. The **ECHO** bears the CE mark.

Certificate of Conformity
issued by Curtis-Straus LLC, a wholly owned subsidiary of BV CPS

Company: ADS Environmental Services
Product Tested: 9000-ECHO
Testing Date: June 20-21, 2016
Report No.: EQ1816-1

A sample of the product as configured in the accompanying test report has been found to comply with the following standards:

EMC Emissions:
- EN 55022:2010/AC:2011 Class A ITE emissions requirements (EU)
- ICES-003 Issue 5 Class A Digital Apparatus emissions requirements (Canada)
- CFR 47 FCC Part 15 Subpart B Class A emissions requirements (USA)
- VCCI:V-3/2015.04 Class A ITE emissions requirements (Japan)
- AS/NZS CISPR 22:2009/A1:2010 Class A ITE emissions requirements (Australia)

EMC Immunity:
- EN 61000-6-1: 2007 Immunity for residential, commercial and light-industrial environments - Generic

Attested to by the hands and seals:

For Curtis-Straus LLC

9/1/2016
EMC Coordinator IV   Date

9/1/2016
EMC Project Manager   Date

For the Manufacturer or Importer

J. Danilczik   Date 9/7/2016
HW Eng. Manager

ECHO EMC Certificate of Conformity

CSA Hazardous Area Compliance

The **ECHO** is covered by CSA certificate under project number 70086801. Reference Canadian requirements **C22.2 No. 60079-0:2015; C22.2 No. 60079-11:2014; C22.2 No. 61010-1-12**; and US requirements **ANSI/UL 913-2015; UL 61010-1:2012; UL 60079-0:2013; UL 60079-11:2014.**

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

Note: To access the latest version and entire content of the certificate, please contact ADS.

Declaration of Conformity

For European (EU member country) applications, a Declaration of Conformity (DoC) must be kept on file at the facility responsible for repair and maintenance of this equipment. A copy of the relevant DoC must also be shipped with each product. If you have any questions about the DoC, please contact ADS LLC by telephone at 1-877-237-9585 or email at adssupportcenter@idexcorp.com.

PRODUCT SERIAL NUMBER: _____

Declaration of Conformity

ADS LLC Document Control Number: 9000AE0051 Rev A2, Page 1 of 2

We: ADS LLC

Located at: 340 The Bridge Street. Suite 204, Huntsville, AL 35806

Phone:(800)633-7246   ●   FAX:(256)430-6633

declare under our sole responsibility that the product:

Model Number 9000–ECHO Level Monitor

*to which this declaration relates is in conformity with the following
standards or other normative documents.*

EN 60079-0:2012 + A11:2013   EN 60079-11:2012

Following the provisions of **ATEX Directive 2014/34/EU** and certificate number

Sira 16ATEX2112X issued by Sira Certification Service

Notified Body Number 0518

Hawarden Industrial Park, Hawarden, CH5 3US, UK +440 1244 670 900

Therefore this product is excluded from the scope of **Directive 2014/35/EU**

Electromagnetic Compatibility (Light Industrial Emissions and Immunity)

EN 55022:2010/AC:2011   EN 61000-6-1:2007

Following the provisions of **Directive 2014/30/EU**

RoHS2 Compatibility

Following the provisions of **Directive 2011/65/EU,** and in conformance with
current harmonized standards **EN 50581:2012   EN 62321:2009**

Proper use and handling information is found in the associated product manual(s).
Special Conditions for Safe Use are included with the above products. The
undersigned hereby declares that the equipment listed above conforms to the above
Directives and Standards.

Authorized: _____ Date: 05/08/2018

Jos Dominguez – ADS LLC, ATEX/Ex Authorized Person, Huntsville, AL
The undersigned (Nextek, Inc., 201 Next Technology Dr., Madison, AL 35758 USA
(256)772-1995) hereby declares that the product listed above was built and tested
(where required) in accordance with drawings, BOMs and other manufacturing
documentation provided by ADS LLC.

Authorized: _____   Date: _____
Name: _____ Nextek, Inc., VP Quality Management Rep,

Sample **ECHO** Declaration of Conformity – Page 1

Special Conditions for Safe Use

ADS LLC Document Control Number: 9000AE0051 Rev A2, Page 2 of 2

NOTE – READ THIS BEFORE INSTALLATION OF PRODUCT IN HAZARDOUS AREA

Under certain extreme circumstances, exposed plastic and unearthed metal parts of the enclosure may store an ignition-capable level of electrostatic charge. Therefore, the user/installer shall implement precautions to prevent the build-up of electrostatic charge, e.g. locate the equipment where a charge-generating mechanism (such as wind-blown dust) is unlikely to be present and clean with a damp cloth.

Sample **ECHO** Declaration of Conformity – Page 2

Product Warranty

This section includes the warranty information for the **ECHO** monitor.

New Product Warranty

All new products manufactured by ADS will be free from defects in material and workmanship for up to two (2) years 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.

Service

For service or warranty issues, please contact ADS customer support:
Email: adssupportcenter@idexcorp.com
Telephone: 1-877-237-9585 (U.S. Customers), 256-430-6234 (customers outside the U.S.)

C H A P T E R 2

Initial Configuration and Activation

For the most streamlined setup process, ADS recommends that communication with the **ADS ECHO™** monitor be established in the office prior to leaving for installation. This chapter will cover all the initial steps for configuration and activation of the monitor, and preparing the monitor for installation:

- Activating the ADS Installed SIM Card
- Downloading the QstartXML Software and Bluetooth® Driver
- Installing the Bluetooth Driver
- Installing the QstartXML Software
- Creating and Configuring the Monitor Location
- Activating the Monitor
- Configuring the Modem Power Parameters
- Verifying Wireless Communication
- Saving the Configuration and Creating New Default Location

Activating the ADS Installed SIM Card

ECHO monitors include a pre-installed SIM card which must be activated to allow for wireless communication. Request the activation **within 48 hours** of monitor installation and **before** heading to the field to install the **ECHO**.

Use the following to activate the ECHO SIM card:

1. Request activation of the SIM card by emailing ADSEODIP@idexcorp.com. Include the serial number of the specific **ECHO** monitor and the last four digits of the SIM card number (the 20 digit number found on the attached SIM punch-out card) as well as the name of the municipality or company requesting the activation. ADS employees should also include the project name and job number as part of the request.

SIM Punch-out Card AT&T (top) and Verizon LTE-M (bottom)

2. Wait for a return email from ADS. The email will contain the IP address of the SIM card and its associated phone number. Using a permanent marker, write the IP address and its associated phone number on empty space on the card and save the card for future reference, as needed. For further information, see the Text Messaging Commands section of *Chapter 6*.

3. Wait at least 15 minutes from receipt of email before initializing modem with the magnet.

4. Hold the Blue ADS magnet (ADS p/n 8000-0460) on the **WAKE** activation point for 25 to 30 seconds until the **SENSE** LED illumines magenta. Hold the magnet for an additional 1 to 2 seconds, then quickly remove the magnet. The **SENSE** light will begin to rapidly flash a green light and the **COMMS** LED will be a solid green until connected to the network. Once the green light is flashing, wireless communications will be enabled.

> **Note: The SIM card should not be activated more than 48 hours before the modem is initialized.**

Downloading the Q*start*XML Software and Bluetooth® Driver

The **ECHO** monitor requires the use of a Bluetooth dongle with driver and ADS **Q*start*XML** software. The Bluetooth driver and **Q*start*XML** software can be downloaded from the ADS website at [Software Downloads - ADS (adsenv.com)](). Also download the **Q*start*XML Installation Guide** while on the software downloads page.

> **Note:** Download the zipped folder, "**CDM21228_Setup.zip**" from the ADS website ([Software Downloads - ADS (adsenv.com))]() onto the computer which will be used for the **ECHO** communication.

Installing the Bluetooth Driver

Bluetooth activation is the recommended method of establishing initial communication with the monitor. Bluetooth requires near proximity (roughly 8 feet or 2.5 m) to the monitor.

1. Extract the files to a folder on the desktop. Run the **"CDM21228_Setup.exe"** installer application, making sure to use the appropriate version for 64-bit systems versus 32-bit systems. To determine if the system is a 64-bit or 32-bit, open Windows Explorer. Right click the Computer icon and select properties to view the system type.

2. Insert the ADS-supplied Bluetooth dongle (P/N ADS 9000-0061) into a USB port. The first time the Bluetooth dongle is inserted, it may take several minutes for Windows to complete the driver update.

Installing the Q*start*XML Software

Follow the instructions in the **Q*start*XML Installation Guide** downloaded from the ADS website ([QstartXML-Installation-Guide.pdf (adsenv.com))]() to install the **Q*start*XML** software.

> **Note: Q*start*XML** can only be installed on a Microsoft Windows computer with a Windows 7 or higher operating system.

Creating and Configuring the Monitor Location

To ensure the most accurate results for each monitor location, the user must activate the **ECHO** monitor with the correct configuration information in order to satisfy the specific monitoring needs of the project and to record the desired data. The configuration information includes the location description, device assignment and parameters, log rates, and other items relevant to the site and project requirements.

The configuration information is stored in an Extended Markup Language (XML) in the user's local directory or network drive. Certain elements of the XML 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 **Q*start*XML**
- Selecting and editing devices

Note: Initial activation for a new **ECHO** monitor can occur via Bluetooth or a wireless connection. ADS recommends using the Bluetooth connection for initial configuration and activation of the monitor.

Launching the Q*start*XML Software

Launch the **Q*start*XML** software by selecting **Start > All Programs > ADS LLC > Q*start*XML > Q*start*XML** from the **Microsoft® Windows®** start menu or double-clicking on the **Q*start*XML** icon on the **Windows** desktop.
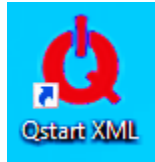

Q*start*XML Icon on Desktop

If **Q*start*XML** settings have already been configured, proceed to *Creating a Monitor Location*.

Setting Up the Q*start*XML Parameters

Q*start*XML stores and displays data, directs configuration, and performs communication based on certain parameters designated through the **Q*start*XML** settings. This **Settings** dialog containing these parameters is available the first time the **Q*start*XML** software is run following installation and through the main screen by clicking on the **Settings** button.
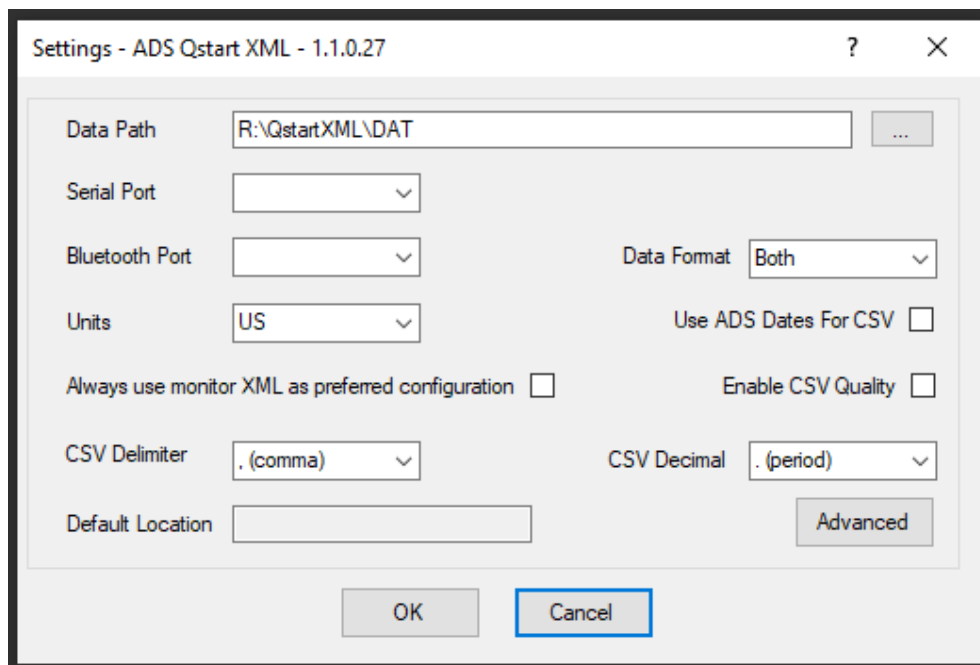
Settings Dialog

1.   Enter the path or browse to the directory to which you want to save the XMLs and collected flow data in the **Data Path** field.

2. The **Bluetooth Port** will automatically update to the correct port designation once the Bluetooth dongle has been inserted. No user entry should be required. If there is any question as to whether the correct Bluetooth Port is displayed, go to the Control Panel > Device Manager > Ports and verify the correct port for the Silicon Labs UART to USB Bridge port and enter this port into the **Q***startXML* Settings page.

3. Select the desired units of measurement (**US** or **Metric**) to be used throughout **Q***startXML* to represent the data when entering values, saving data, and displaying data from the **Units** drop-down list. The **US** units report depth in inches and temperature in Fahrenheit. The **Metric** units report depth in millimeters and temperature in Celsius.

4. Select the format in which to save data collected from the monitor from the **Data Format** drop-down list:

    -   **ADS** – Choose this option to save the data in ADS's proprietary **Bin** file format.

    -   **CSV** – Choose this format to save the data in a comma-separated value format, which is typically compatible with most spreadsheet applications, such as **Microsoft**® **Excel**®.

    -   **Both** – Choose this option to save the data in both formats described above.

5. If desired, select the **Always use monitor XML as preferred configuration** checkbox to ensure **Q***startXML* automatically overwrites the local configuration with the XML stored in the monitor memory when an **Upload** is performed. The ADS default is to leave this unchecked.

    Note: The user will not be notified of differences in the XML before the overwrite occurs.

6. Select the **Use ADS Dates for CSV** checkbox to store collected data in CSV files using the ADS date format. When this option is not selected, **Q***startXML* stores the CSV data in the local **Windows**-configured regional date format.

7. Select the appropriate CSV file column break indicator for **Q***startXML* to use in all CSV files from the **CSV Delimiter** drop-down. The default setting should be appropriate for the current **Windows** regional setting on a local computer. A CSV file is sometimes called a character-separated file because the field separators used to organize the data into columns is not always a comma (commas indicate the columns are separated by commas). For example, users with the regional setting of English (e.g., the United States) will use the default (**, (comma)**). However, users located in other regions of the world (e.g., Germany, Spain, Portugal, or Russia) will choose **. (period)** or **; (semicolon)** to conform to the CSV format of their regions.

8. Select the CSV decimal placeholder for **Q***startXML* to use in all CSV files from the **CSV Decimal** drop-down. The default should be appropriate for the current **Windows** regional setting on a local computer and will be used in all **Q***start*-generated CSV files to indicate the appropriate decimal placeholder for numerical values. For example, users with the English (e.g. United States) regional setting will use the default (**. (period)**) to ensure a period symbol will be used for decimal placeholders (e.g. 123.45) in number values included in their **Q***start*-generated CSV files. **Q***startXML* users in other regions of the world (e.g., Germany, Spain, Portugal, or Russia) can choose **, (comma)** to use a comma (e.g., 123,45) for decimal positions in values included in their CSV files.

9. The **Default Location** field indicates the location **Q***startXML* will use as a template from which to create all new locations. If you have not designated a default location, clicking **New** on the **Q***startXML* main screen will populate the parameters based on **Q***startXML*'s default configuration. The **Default Location** field will remain blank until you designate a default location on the **Q***startXML* main screen on the **Settings** dialog.

10. Click on the **OK** button to save the settings from this dialog to the designated local directory or network.

    Note: Access the data path, CSV file configuration, and communication settings at any time by clicking on the **Settings** button on the **Q***startXML* main screen.

Q*start*XML Main Screen

Once the settings have been configured, launching the **Q*startXML*** software will open the main screen.

Q*start*XML Main Screen

The **Monitor** section displays and allows the user to modify details related to monitor identification, communication, and sampling rate. The **Functions** section includes the capabilities for performing various operations involving the monitor as well as accessing the online help for **Q*startXML***. The **Monitoring Point** tabs enable the user to view and change various parameters related to the flow monitoring location. The tabs also display the devices currently assigned to the location, as well as provide access to the device parameters for viewing and modification, as necessary.

The buttons along the bottom of the main screen offer specific capabilities, such as configuring data path and communication port information, saving the current parameters, creating a new location, and resetting the main screen to display the default parameters.

Select the **Location Name** drop-down list to view the parameters for a particular monitor location. **Q*startXML*** updates fields on the main screen to display the current parameters for the selected location.

Creating a Monitor Location

1. Select the **New** button at the bottom of the main **Q*startXML*** screen.

   Note: If a default location has not been designated or established, clicking **New** will populate the parameter fields based on **Q*startXML***'s default configuration.

QstartXML Main Screen Showing the New Default Location

2. Enter a name for the new location in the **Location Name** field. This associated drop-down list contains all the locations available in the local network designated previously on the **Settings** dialog as the **Data Path**. A location name may be up to 19 characters in length. However, do not duplicate more than the first 7 characters of another location's name, unless the 8th or a later character is followed by an underscore (_) and a unique character(s). For example, the names ADSECHO10 and ADSECHO11 are not usable, but ADS_ECHO10 and ADS_ECHO11 are. Do not put a space in the location name.

    Note: A user can click on the **Default** button to update the parameters for the current location on the *QstartXML* main screen based on the **Default Location** (designated on the **Settings** dialog), without changing the location name.

3. Select **ECHO** from the **Series** drop-down list.

4. Enter the serial number for the specific monitor in the **Serial Number** field.

5. Verify or select the desired interval at which the monitor will collect data from the **Sample Rate** drop-down list.

6. Verify or select the desired interval at which the monitor will collect data during alarm conditions from the **Fast Rate** drop-down list.

7. Select the desired method with which to communicate with the monitor from the **Connect** drop-down list. Initial communication with the **ECHO** will be via Bluetooth.

8. For wireless communication involving a static IP address, enter the **IP Address** for the wireless connection.

    Note: When entering an IP address, do not include leading zeroes in the address. For example, an IP address of 166.219.008.063 should be entered as 166.219.8.63. If leading zeroes are included in the address, monitor communications will be unsuccessful.

9. Under *Monitoring Point 1*, select the type or shape of the pipe or channel that the **ECHO** will be monitoring.

10. For **Height**, enter the distance from the bottom of the pipe to the crown (top or peak) of the pipe. For **Width**, enter the horizontal distance across the widest portion of the pipe (this is disabled for circular installations).

    Note: The **Height** and **Width** can be approximations since the installation of the **ECHO** requires no manhole descent.

The new monitor location now exists. The next step involves selecting and editing the devices associated with the new location.

Selecting and Editing Devices

Select and edit the devices corresponding to the new monitor location to log the desired data. The default devices for the **ECHO** are **Long Range Depth**, **Time Zone**, **Advanced**, **Alarms**, and **Data Delivery**. Editing the devices involves setting specific parameters to ensure the monitor and Q*start*XML properly obtain and process the data.

1. In the **Location Name** field, select the desired location to assign and edit devices. This process may also involve deselecting devices that are not desired to be assigned to the current location.

The **Devices** dialog displays the devices selected by default (i.e. based on Q*start*XML's or the user's designated default configuration) for the **ECHO** monitor series.
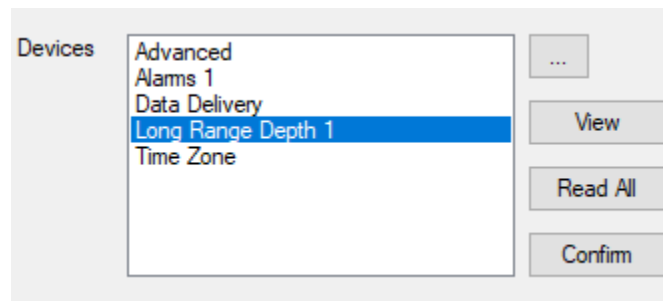

Devices Section

2. Click on the *Browse* button to the right of the list of **Devices** to assign any additional devices that are not currently displayed in the box.

Browse Button

The **Available Devices** dialog box displays the devices available for selection and assignment to an **ECHO** monitor.

Note: Currently, all available devices for the **ECHO** monitor are default devices.
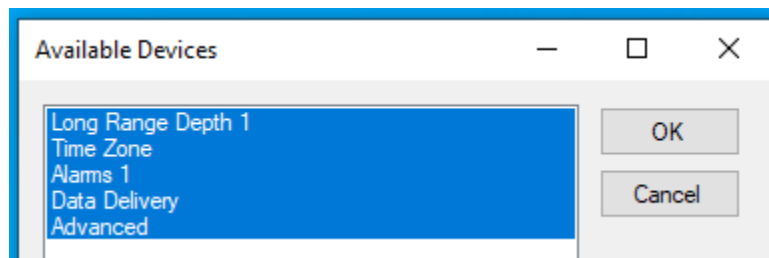

Available Devices Dialog Box

3. Select the devices that are desired to assign to the current location from the **Available Devices** dialog box. To select multiple devices, press and hold down the **Control (Crtl)** key on your keyboard while selecting the individual devices. The device must be highlighted in the selection box to ensure **Q*start*XML** includes the device in the XML. The user can also deselect devices to remove from association with the selected monitor from this selection box in the same way. To choose consecutive devices in the list, select the first device that is desired to be assigned to the monitor, press and hold down the Shift key, and then click the last device in the series to be included.

4. Click on the **OK** button in the **Available Devices** dialog box. The selected devices will display in the **Devices** list box on the main screen.

5. To edit the parameters associated with a device, select the desired device to view or modify from the **Devices** list and click the **View** button. The **Location Name** and **Device Name** are displayed at the top of the dialog. Edit or modify the device parameters as necessary, and then click on the **OK** button when complete. Refer to the following sections for details concerning the parameters for each specific device.

6. Repeat step 5 for each additional device that requires modification of the parameters, and then click the **Save** button to save the devices with any parameter modifications to the local directory or network.

Editing the Long Range Depth Device


Long Range Depth Dialog

- **Manhole Depth** – Enter the distance (in inches or millimeters) from the manhole rim to the center of the invert. If the manhole depth is not yet known, the default manhole depth can be used for the initial configuration.

- **Physical Offset** – Enter the distance (in inches or millimeters) from the manhole rim to the bottom of the parabolic reflector. If the installed physical offset of the **ECHO** is not yet known, the default physical offset can be used for the initial configuration.
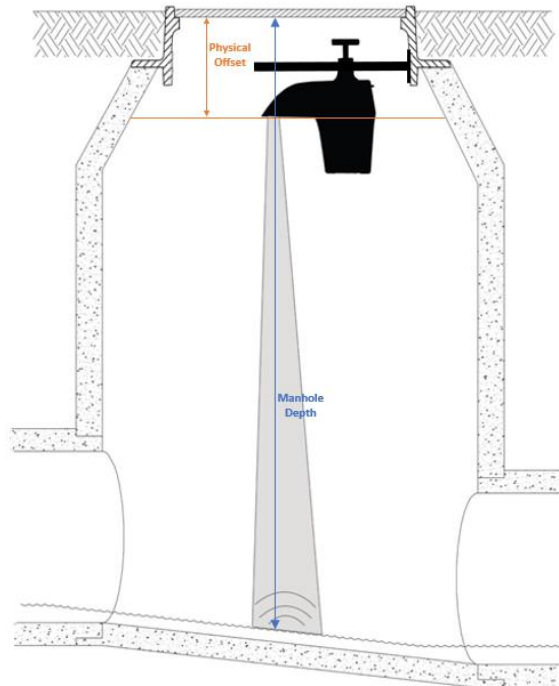
Manhole Depth and **Physical Offset** Measurements

- **Store** – Leave this checkbox selected to ensure the monitor logs the depth data to memory.

- **Advanced** – Select this button to access the Advanced Parameters dialog.

    Note: Modifications to the **Advanced Parameters** should only be performed by ADS personnel or under their guidance. Therefore, ADS recommends leaving the default settings in place.
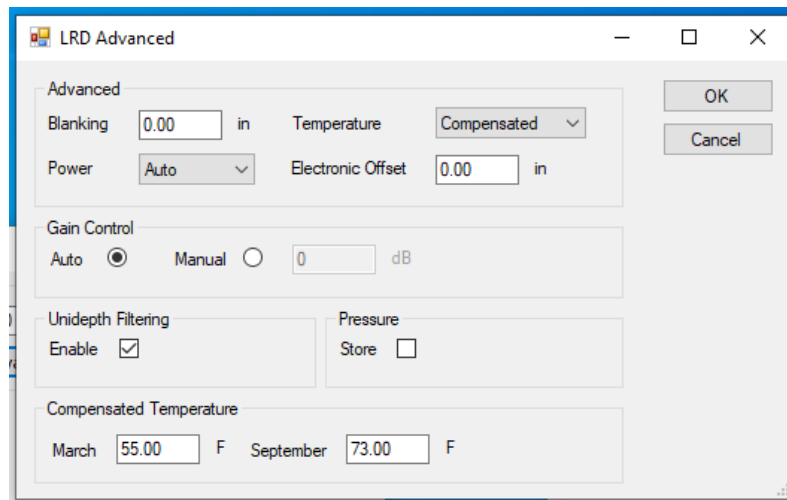
Advanced Parameters Dialog

- **Blanking** – This parameter helps prevent pops in installations where there are problems with the sensor reading near-ranges (i.e. nearly full manhole depths). Leaving **Blanking** at the default value of 0.00 allows the monitor to use a built-in function of the manhole depth. A **Blanking** value other than 0.00 represents the distance (in inches or millimeters) from the face of the sensor which will be used to calculate those ranges the monitor should ignore while the sensor is firing. For example, choosing a value of 10 will cause all ranges measured within 10 inches (254 millimeters) from the face of the sensor to be ignored.

- **Temperature** – Choose the method for computing the air temperature in the manhole as it relates to sensor signal. ADS recommends leaving this at the default *Compensated* setting.

    o **Compensated –** Select this option to use a normalized temperature setting to approximate the difference between the top and bottom of the manhole. This setting is the default setting and is sufficient in most cases.

    o **Sensor –** Select this setting in cases where the temperature is uniform throughout the manhole and where the **ECHO** temperature is representative of the entire air column temperature in the manhole shaft.

- **Power** – Choose the level of power supplied to the sensor.

    o **Auto** – Select this option to allow the monitor firmware to determine the amount of power supplied to the sensor. This option is a function of the total range (manhole depth) and is sufficient in most cases. This option is selected by default.

    o **1 to 11** – Select 1 for the lowest power setting, which would be most useful in short range installations with no interference. Select 11 for the highest power setting, which would be most useful in long range installations with interference.

- **Electronic Offset –**If there is a difference between the **Long Range Depth** sensor readings (*LRDEPTH*) and manually measured invert depths, and the manhole depth and physical offset measurements have been confirmed, the user can apply an offset to the **ECHO** *LRDEPTH* readings. A positive offset will cause the **ECHO** to read higher, a negative offset lower. If the adjustment necessary to have the **ECHO** *LRDEPTH* readings match the manually measured depth readings is greater than 1-2 inches (25 to 50 mm), ADS recommends reconfirming manual measurements and/or adjusting the March and September temperatures.

- **Gain Control** – Choose the method for managing the amplification of the analog signal that returns to the sensor.

    o **Auto** – Select this option to allow the monitor to automatically optimize the amplification of the signal. This is the recommended option.

    o **Manual** – Select this option to enter a fixed value between -12 dB (lower amplification) and +12 dB (higher amplification) at which to amplify the signal.

- **Unidepth Filtering** – Select this option to allow filtering of *UNIDEPTH* data as compared to *LRDEPTH* data. The goal of Unidepth filtering is to minimize false alarm notifications caused by a pop in the *LRDEPTH* data. *UNIDEPTH* will hold onto the last valid *LRDEPTH* reading. *LRDEPTH* will always be the raw reading recorded by the **ECHO** with no filtering applied. Disabling this option copies *LRDEPTH* to *UNIDEPTH*, which may be helpful in installations where depths are known to rise very quickly, such as CSO sites. Unidepth filtering is enabled by default.

- **Pressure** – Select the **Store** option so that the raw data entities of *PDEPTH* and *PRESSVOLT* are stored. These entities are more for troubleshooting and this feature is disabled by default.

- **Compensated Temperature** – The listed values for March and September represent the average winter and summer temperatures, respectively, lower in the manhole (approximately 2 feet, or 610 millimeters, above the crown of the pipe). Using the default values of 55 degrees Fahrenheit (12.78 degrees Celsius) for March, and 73 degrees Fahrenheit (22.78 degrees Celsius) should be sufficient in most instances in the Northern Hemisphere. The values should be reversed for the Southern Hemisphere. These default values will use a standardized curve for temperature compensation, while altering the values will create a customized relational curve using the entered values. Adjusting the temperatures higher will result in shorter depth measurements, while adjusting them lower will result in higher depth measurements.

Editing the Time Zone Device

Time Zone Device Dialog

- **Time Zone** – Select the time zone in which the selected **ECHO** monitor is located. **Time Zone** is a required device and must be configured before monitor activation.

- **Daylight Saving Rule** – Deselect the **Enable** checkbox to disable the Daylight Saving Rule, if Daylight Saving is not applicable to the region where the **ECHO** will be installed. Note that the content of the text box is not editable. It is populated on the selected time zone.

Editing the Alarms Device

The **Alarms** device allows the user to enable/disable alarms and define alarm thresholds.

Note: The **Alarms** device only needs to be configured if the user wishes to receive notifications when a threshold is crossed.

Alarms Device Dialog

- **Unidepth Averaging** – Select the number of consecutive *UNIDEPTH* readings for the monitor to average to minimize the potential for false alarms due to erroneous depth readings. **ECHO** alarms are generated from *UNIDEPTH* rather than raw *LRDEPTH* readings.

- **Low Level** – Define the depth at which the monitor will trigger a **Low Level** alarm.   This event indicates that the flow depth measured at a location has fallen below a predefined threshold. This depth should be lower than the lowest depth that typically occurs at the location.

- **Full Pipe** – The depth, taken from the defined pipe height, will trigger a full pipe alarm. This monitor event indicates that the flow depth in the manhole is greater than or equal to the pipe height as measured by the **ECHO** monitor.

- **High Level** – Define the depth at which the monitor will trigger a **High Level** alarm.

- **High High** – Define the depth at which the monitor will trigger a **High High** alarm. This value must be zero when this feature is not in use, or greater than the value entered for the **High Level** alarm when it is in use. ADS recommends setting this value at least 2 inches higher than the value designated for **High Level**.

- **Overflow** – This event indicates that the **ECHO** monitor's internal pressure sensor has detected the site is experiencing overflow conditions, where the flow is above the manhole rim.

- **Tilt** – Define the change in angle or orientation, in degrees, that will trigger a **Tilt** alarm. This event indicates that the accelerometer (level) sensor for the monitor is out of level. Until a **Tilt** return-to-normal event for the **ECHO** monitor has been recorded, the only alarms that will be initiated are **Low Battery**, **Overflow**, or **Tilt** return-to-normal. *UNIDEPTH* holds the last reading value until the **Tilt** return-to-normal event occurs. ADS recommends leaving the **Threshold** at the default value.

- **Battery Low** – Define the voltage at which the monitor will trigger a battery low alarm. ADS recommends leaving the **Threshold** at the default value.

Editing the Data Delivery Device

By default, the **ECHO**'s modem is in the *Always Off* mode to conserve battery power. Therefore, it is recommended that the **Data Delivery** device be configured to upload data stored in the monitor memory to ADS **PRISM** and/or an FTP server at an interval designated by the user. To upload data to **PRISM** and/or an FTP server, you must know the IP address or DNS of the server. FTP servers also require the username and password the monitor must use to access the server, and when applicable, the name of the folder on the server in which the monitor is to place the data.

Data Delivery Device Dialog

- **PRISM**

  o **Server** – Enter the ADS **PRISM** server address where the monitor will deliver data (13.82.147.226). This address may change in the future. If the **ECHO** does not deliver data as expected, contact ADS Client Services to verify the IP address.

  o **Normal** – Select the interval at which the monitor will deliver data under normal conditions. Determine the appropriate interval based on the sample rate for the monitor and the number of entities for which the monitor records data. A faster sample rate and/or a greater number of entities may require a more frequent interval for data delivery.

  o **Fast** – Select the increased interval at which the monitor will deliver data under alarm conditions. This feature can also be turned off.

- **FTP Setup 1**

  o **Mode** – Select the appropriate port assignment (**Active** or **Passive**) for the FTP server. **Passive** is the recommended **Mode** for file transfers.

  o **Normal** – Select the interval at which the monitor will deliver data under normal conditions. Determine the appropriate interval based on the sample rate for the monitor. A faster sample rate may require a more frequent interval for data delivery.

  o **Fast** – Select the increased interval at which the monitor will deliver data to the FTP server under alarm conditions.

  o **Server** – Enter the numeric IP address for the FTP server to which the monitor will deliver data. The ADS FTP server numeric IP address is 64.14.232.6. This FTP server is for internal ADS use only. Customers wishing to use the ADS FTP server should contact ADS Client Services to see what arrangements can be made.

  o **Folder (optional)** – Enter the name of the desired folder at the FTP site in which the monitor will upload the data.

> **Note:** **Q***start***XML** will not create a folder on the FTP server automatically. Therefore, if it is desired that the monitor deliver data to a specific folder, create the folder through the FTP server manually before the monitor begins uploading data to the server. If a specific folder is not designated, the monitor will upload data to the FTP server's root directory.

- o **Username** – Enter the username the monitor must use to access the FTP server.

- o **Password** – Enter the password associated with the username the monitor must use to access the FTP server.

- o **CSV Format** – Select the option corresponding to the type and format of the data the monitor will upload to the FTP server.

    - – **ADS** – Choose this option to deliver all the entity data from the monitor to the designated FTP server.

    - – **GE** – Choose this option to deliver the data in GE CSV format, which will group readings and their corresponding quality values in rows rather than displaying all stored values in column format.

- o **Enable FTP Operations** – This checkbox enables data delivery to an FTP Operations folder, created by the user. Indirect communication can occur through the **FTP Operations** function. Using this function enables the user to activate the monitor, upgrade the firmware, and upload data through the **Q***start***XML** software.   The **ECHO** will deliver data files, daily check-in and diagnostic logs, and waveform files (if configured to store). **Q***start***XML** will post activation files and firmware upgrade files to the **FTP Operations** folder for the **ECHO** to download on the next scheduled data delivery after the files are posted. This feature is primarily used when the **ECHO** has a dynamic IP SIM card where direct wireless communication with the monitor is not possible. If configured and enabled, FTP will appear as a **Connect** type that can be selected on the **Q***start***XML** main screen.

- • **FTP Setup 2** – Refer to the instructions for the **FTP Setup 1** parameters to set up an additional FTP server to which the monitor can deliver data.

Editing the Advanced Device

The **Advanced** device includes three tabs representing parameters related to diagnostic information, modem setup, and alarm notification.

> **Note:** No changes are necessary to the **Advanced** device unless using a non-ADS supplied AT&T public, static IP SIM card or the **ECHO** needs to be configured to deliver notifications directly from the monitor. The instructions for setting up notifications are included below.

Diagnostic Tab
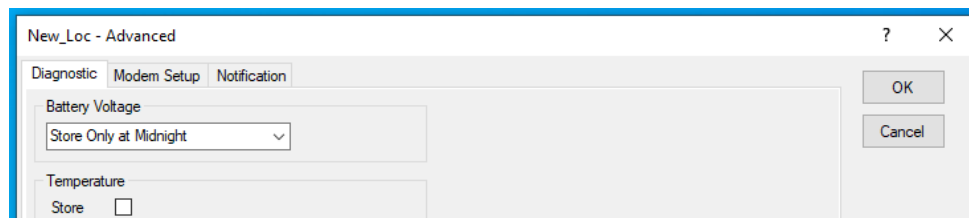
Diagnostic Tab of **Advanced** Device Dialog

- • **Battery Voltage**

    - o **Store** – Select this option to log the monitor's battery voltage at the designated sample rate.

    - o **Store Only at Midnight** – Select this option to log the monitor's battery voltage at midnight. This option is selected by default and should be sufficient for most applications.

- **Temperature**
  - o **Store** – Select this checkbox to store the temperature of the monitor at the designated sample rate.

Modem Setup Tab

> **Note:** The following **Modem Setup** process only applies to monitors with ADS supplied AT&T private static or customer supplied SIM cards. Monitors using ADS supplied AT&T public static or Verizon LTE-M SIMs already have the identifying information necessary for wireless communication.

Each carrier requires the user to configure the monitor modem with the appropriate APN (Access Point Name) information corresponding to the carrier's SIM card to ensure access to the provider's network. The roaming SIM cards provided by these carriers enable the monitor to perform wireless communication through multiple carrier networks in the vicinity of the monitor location. The **Modem Setup** feature allows the user to designate the associated APN information, identify the providers that support the SIM card and offer service in your area, and prioritize the order in which the monitor should attempt to communicate through each provider's network. Priority should reflect the availability, strength, reliability, and consistency of the carrier's signal to ensure communication.

Modem Setup Tab of **Advanced** Device Dialog

- **Provider** – Select the APN corresponding to the SIM card in the modem. The **Username** and **Password** fields should automatically populate with the information associated with the selected APN. However, if the APN associated with the carrier's SIM card is not available on the list, or the username and password require modification, click on the **Edit** button and complete the **Edit Wireless Parameters** dialog.

Edit Wireless Parameters Dialog

  - o Select **APN** from the **Type** drop-down list. If an existing APN requires modification, select the appropriate APN from the **Type** column in the table of available APNs and providers.

  - o Enter the proper APN for the carrier or edit the existing APN as necessary.

  - o Enter or edit the username corresponding to the APN in the **Value 1** field.

o   Enter or edit the password corresponding to the APN in the **Value 2** field.

o   Click the **Add** button to add the APN or modifications to the table, and then click on the **OK** button. The new APN should be available for selection from the **Provider** drop-down list on the **Modem Setup** tab or the modified information should display in the **Username** and/or **Password** fields once the corresponding provider/APN is selected.

- **Username** – This read-only field displays the username associated with the selected provider (APN).

- **Password** – This read-only field displays the password associated with the selected provider (APN).

- **Authentication** – Select **PAP** (Password Authentication Protocol) in which the **Username** and **Password** are used for communication authentication. Select **CHAP** (Challenge Handshake Authentication Protocol) in which a challenge string is used for authentication. Select **None** in cases where the authentication protocol is unknown or not required. This information will be provided by the wireless SIM provider. The default selection, **None**, should be sufficient in most cases.

Notification Tab

> **Note:** The following email and text options of the **Notification** tab **do not apply** to the **ECHO**-9000-4VZ as the SIM cards in these monitors currently do not support email and text directly from the monitor.

The **Notification** tab enables the user to configure the **ECHO** monitor to provide alarm and event (i.e., low battery voltage) notification to up to five (5) email recipients and/or up to 5 mobile phones with text messaging (SMS) capability. The **ECHO** can also check-in daily with the designated recipients to provide the current battery voltage and other monitor status information.

Notification Tab of **Advanced** Device Dialog

- **Check In**

  o   **Enable** – Select this checkbox to ensure the monitor sends a daily email and/or text message to the designated recipients that includes status information about the monitor, such as the monitor name, date and time, battery voltage, and wireless signal strength.

  o   **Hour** – Select the time each day at which the monitor will deliver the monitor status information via email or text message to the designated recipients.

- **SMTP Information**

    o **SMTP Server** – Enter the name of the server through which the monitor will send notification to the recipient(s). The associated IP address of the SMTP server used by ADS is 64.14.232.5.

      Note: The IP address could change in the future. Contact ADS Client Services to verify the IP address, as needed.

      Note: If the **ECHO** is not using an ADS AT&T public, static or private, static SIM card, and needs to be able to send emails through the ADS SMTP server, please provide the external static IP address to ADS Client Services. They will see if the IP address can be added to the permitted list of IP addresses supported by the server.

    o **SMTP Username** – Enter the username for the server through which the monitor will send notification to the recipient(s). No username is required for the ADS SMTP server.

    o **SMTP Password** – Enter the password for the server through which the monitor will send notification to the recipient(s). No password is required for the ADS SMTP server.

    o **Sender Address** – Enter the designated email address for the monitor from which notification will originate. The default address is *Echo@adsmonitors.com*.

- **Email**

    o **Recipient 1 through 5** – Enter the email address for each contact (up to 5) that will receive the monitor notifications when an event and/or alarm occurs. The contact designated as **Recipient 5** will receive data automatically from the monitor based on the interval set up for data delivery. Data is included in an attachment presented in .CSV format.

    o **Normal** – Select the interval at which the monitor will deliver data to **Recipient 5** under normal conditions.

    o **Fast** – Select the increased interval at which the monitor will deliver data to **Recipient 5** during active alarm conditions.

  Note: If **Normal** and **Fast** intervals are set to OFF, **Recipient 5** will become a recipient of monitor notifications like **Recipient 1-4**.

- **SMS**

    o **Recipient 1 through 5** – Enter the mobile phone number for each contact (up to 5) that the monitor will notify through a text message when an event and/or alarm occurs.

    o **Start Hour** – Enter the time during the day at which the server can begin sending text messages to the corresponding recipient when an alarm and/or event occurs.

    o **End Hour** – Enter the hour during the day up to which the server can continue sending text messages notifying the corresponding recipient that an alarm and/or event has occurred. Alarms or events that occur after this hour up to the designated **Start Hour** on the next day will not be delivered to the corresponding user. For example, setting a **Start Hour** of **8AM** and an **End Hour** of **4PM** will ensure the server sends a message to the corresponding recipient when an alarm and/or event occurs only between 8:00 in the morning and 4:59 in the afternoon.

  Note: The **Start** and **End Hour** designation for text message notification may be beneficial for organizations that want their recipients to only receive notification during designated shift or work hours. To ensure 24-hour notification to a recipient, choose **12AM** for the **Start Hour** and **11PM** for the **End Hour**.

Activating the Monitor

Initial configuration of the monitor is now complete, and the **ECHO** is ready for activation. Monitor activation involves generating the activation data using the **Q***start***XML** software, downloading this data to the monitor, and initiating data measurement and logging. The activation data includes relevant portions of

the LIF and other configuration parameters necessary to ensure measurement activities reflect the specific site conditions and project requirements. The monitor requires these files and information to properly measure and record data. Monitor activation occurs through the **Diagnostics** tool in **Q*start*XML** using a Bluetooth connection.

1. Insert the Bluetooth dongle.

2. In **Q*start*XML**, verify the configuration parameters are correct, select the desired **Location**, and select Bluetooth for the **Connect** type.

3. Hold the blue ADS Magnet (P/N 8000-0460) on the Bluetooth activation point on the **ECHO** monitor. Hold it until the **COMMS** LED (closest to the T-handle) begins flashing deep blue. This should take approximately 5-10 seconds. Remove the magnet after the **COMMS** LED is flashing deep blue.

Bluetooth Activation Point

4. Click on the **Activate** button in the **Functions** section. **Q*start*XML** initiates and establishes communication with the monitor and then downloads the appropriate information and files. Once the activation is complete, the status bar displays an **Activate Successful** message. **Q*start*XML** generates an activation event log that is available for viewing through the log viewer within **Q*start*XML**.

> **Note:** Some of the measurements input into **Q*start*XML,** such as the manhole depth and physical offset, will have to be updated after installation to reflect the actual values of the site.

Increasing Bluetooth Dongle Signal Strength

If a better signal is needed for the Bluetooth dongle, particularly to keep the computer a safe distance away from the manhole after installation, a USB extension cable can be purchased. Further information can be found under .
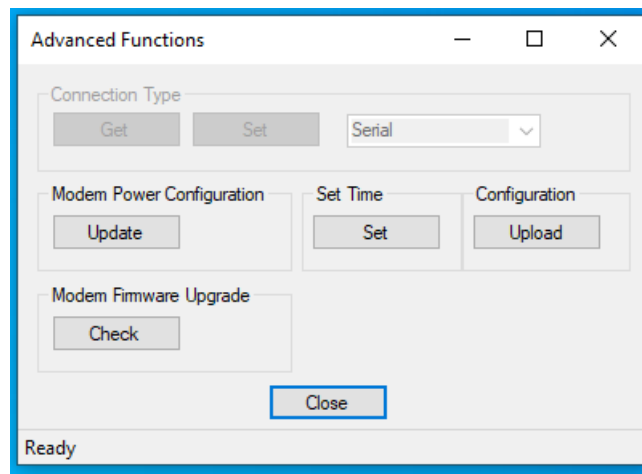
Configuring the Modem Power Parameters

Qstart**XML** enables the user to configure the monitor for uninterrupted modem communications or for modem downtime during specific periods throughout each day of the week. Using the **Modem Power** option in **Q**start**XML** to configure the monitor to power down the wireless modem during specific hours of the day conserves battery power. The monitor automatically powers up the wireless modem each day between 11AM and 12PM to receive incoming calls.

> **Note:** In order to maximize battery life, the **Modem Power** default is set to *Always Off* and the **ECHO** should be configured to deliver data to **PRISM** or an FTP at the desired interval. Data delivery files and alarm notifications will still be delivered to **PRISM** and/or an FTP server when the modem is in the *Always Off* configuration.

> **Note:** If it is desired to have two-way communications with the **ECHO**, then **Modem Power** needs to be updated to turn the modem on during specific times of the day. See below for instructions.

Setting up the power saving option occurs through the **Advanced** function while communicating with the monitor.

1. Click on the **Advanced** button in the **Functions** section. This will display the **Advanced Functions** dialog.

Advanced Functions Dialog

2. Click on the **Update** button. The **Modem Power Configuration** dialog displays the current power saving parameters in the monitor configuration.
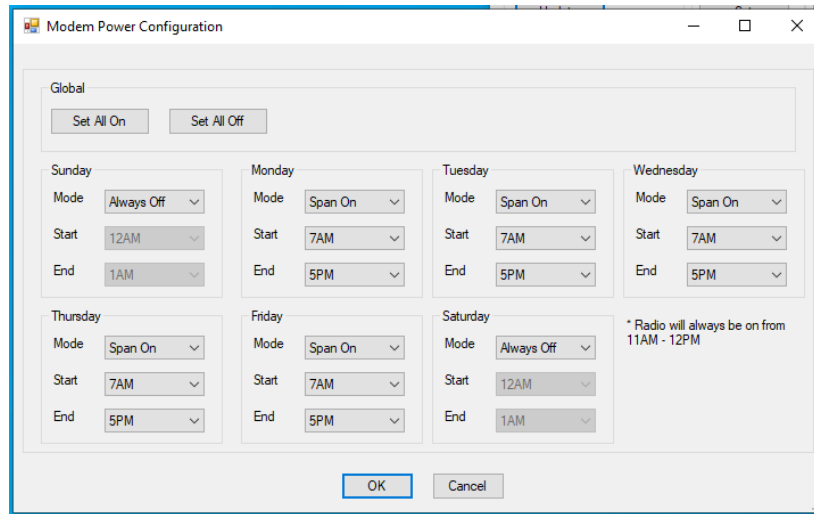
Modem Power Configuration Dialog

3. Click on one of the following buttons in order to apply power saving settings for all seven days of the week:

  o **Set All On** – Choose this button to configure the monitor to provide uninterrupted power to the modem 24 hours a day, 7 days a week. Choosing this setting will cause the *Always On* option to display for the **Mode** on all 7 days, resulting in no power saving to the monitor.

  o **Set All Off –** Choose this button to configure the monitor to provide power to the modem only from 11AM to 12PM each day of the week. The monitor will withhold power from the modem at all other times. This option offers the greatest power saving to the monitor. Choosing this setting will cause the *Always Off* option to display for the **Mode** on all 7 days.

4. Select one of the following methods to apply power saving settings for each individual day of the week from the **Mode** drop-down list. This step must be completed for each day of the week. Some modes may require designating a corresponding time range.

  o **Always On** – Choose this option to configure the monitor to provide uninterrupted power to the monitor for the entire day, resulting in no designated power saving to the monitor on that day.

  o **Always Off** – Choose this option to configure the monitor to provide power to the modem only from 11AM to 12PM on that day, offering the most significant power saving available within that day.

  o **Span On** – Choose this option to configure the monitor to provide uninterrupted power to the modem for the time period designated in the **Start** and **End** fields. Select the time at which the monitor will begin powering on the modem on the corresponding day from the **Start** drop-down list. Then select the time at which the monitor will discontinue powering the modem on that day from the **End** drop-down list.

  o **Span Off** – Choose this option to configure the monitor to withhold power from the modem for the time period designated in the associated **Start** and **End** fields. Select the time at which the monitor will discontinue powering the modem on the corresponding day from the **Start** drop-down list. Then select the time at which the monitor will resume powering the modem on that day.

5. Click the **OK** button to save the power saving parameters to the monitor. This will again cause the **Advanced Functions** dialog to display.

6. Click on the **Close** button to exit the **Advanced Functions** dialog.

7. Click on the **Hangup** button in the **Functions** section on the **Q*start*XML** main screen.

> **Note:** For all future communications following the initial activation, change the **Connect** designation to **Wireless** to perform remote communications if the **ECHO** has a public static or private static SIM card installed.

Verifying Wireless Communication

It is recommended that wireless communication be verified before installation of the monitor.

1. Ensure an antenna is attached to the **ECHO**.

2. Hold the magnet on the **Wake** activation point for 25 to 30 seconds until the **SENSE** LED illumines magenta. Hold the magnet in place for another 1 to 2 seconds once this light illumines, then quickly remove the magnet. The **SENSE** light will begin to rapidly flash a green light and the **COMMS** LED will be a solid green until connected to the network. Once the green light is flashing, wireless communications will be enabled.

3. Change the connection type to *Wireless* and verify the IP address is correct.

4. Verify the **COMMS** LED is a slow flashing green light.

5. Attempt communication with the monitor by clicking the **Status** button.

6. If the monitor status information is displayed, wireless communication has been verified.

```
Monitor Status: ECHO_35470
Current Host Time: 9/23/2022 12:26:41 PM
Current Monitor Time: 9/23/2022 12:26:40 PM
Oldest Entry Time: 5/3/2021 3:05:00 AM
Newest Entry Time: 9/14/2022 6:54:00 PM
Scan Interval: 1800
Monitor Temperature: 72.61 F
Firmware Version: V8.11
Multi-block Modem Attached: Yes
Model Number: X900
BASIC Code Program Status: OK
BASIC Code Fault: 0
Events Pending Status: 0
Abnormal Resets: 0
Battery Voltage: 7.3 V
```

Monitor Status

7. Close the print preview of the status screen and click on the **Hangup** button in the **Functions** section on the **Q**start**XML** main screen.

Saving the Configuration and Creating New Default Location

1. Save the configuration by clicking the **Save** button at the bottom of the **Q**start**XML** main screen.

2. Clicking on the **Set as Default** button will update the default new location parameters to match how the **ECHO** was just configured. This will allow the user to create a configuration template for all subsequent **ECHO** monitor location. Clicking **New** will then populate the configuration with the template parameters.

C H A P T E R 3

Hardware Installation

This chapter covers the basic procedure for installing the **ADS ECHO™** monitor.

> **Note:** ADS recommends establishing communication with the **ECHO** *before* installation. Initial communication must occur over a local Bluetooth connection. For instructions on monitor configuration and activation, refer to *Chapter 2*, *Initial Configuration and Activation*.

The procedure includes:

- Investigating Site Characteristics

- Gathering Parts and Supplies, as needed

> **Note:** The Blue ADS Magnet is safe to use around computers, cellular phones, and other electronic devices. It is not powerful enough to risk negatively affecting or damaging devices.

- Gathering Tools and Equipment

- Measuring Manhole Depth

- Installing the Mounting Bar, Installing the Stainless Steel Wall Mount, or Installing Wall Mount Bar

- Installing the Antenna

- Installing **ECHO** onto Mounting Bar

- Measuring Physical Offset of **ECHO**

> **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 safety regulations concerning confined space entry when installing this equipment. 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, ensure the site meets the following criteria:

- Manhole depth is between 5 feet (1.5 m) and 21 feet (6.4 m)

- Manhole has rungs (manholes without rungs are acceptable, but will require special mounting)

- For ease of installation, an iron manhole frame with a diameter between 20.5 inches (520 mm) and 31 inches (787 mm) and a frame depth of 3 inches (76 mm) or more (frames out of this specification are acceptable, but installation will require special mounting)

- No drop connection is present in the manhole. A drop connection can interfere with the **ECHO**'s ability to accurately measure flows below the level of the drop connection.

Gathering Parts and Supplies

Obtain the following parts and supplies before installing the ECHO. When ordering, specify the mounting and antenna option supporting the monitor.

Quantity	Description	ADS Part Number
1	**ECHO** monitor	9000-ECHO or 9000-ECHO-4VZ
1	Special Allen Wrench (provided with **ECHO** monitor)	509063
1 per field computer	Bluetooth Dongle, as needed	9000-0061
1 per field crew	Blue ADS Magnet, as needed	8000-0460
1	Antenna (**ECHO**-9000 or **ECHO**-9000-4VZ)	9000-0080
1	Antenna Extension Cable, 16FT, as needed (for 9000-0080 antenna)	509154
1	Antenna Extension Cable, 49FT, as needed (for 9000-0080 antenna)	509155
1	Antenna (9000-**ECHO** only)	3800-0162 (ATI Slim), 3800-0163 (SMARTEQ Mini-Wing), or 3800-0193 (ATI-Mini-Wing)
1	Antenna Extension Cable, as needed (for 3800-0162, 3800-0163, or 3800-0193)	507165 (15FT / 4.6m) 507168 (50FT / 15.2m)
1	Scotch 130C Linerless Rubber Splicing Tape	145-0001
1	Mounting Bar, as needed	8000-0450 or 9000-0097-S
1	Wall Mount, as needed	8000-0484

Note: The Blue ADS Magnet is safe to use around computers, cellular phones, and other electronic devices. It is not powerful enough to risk negatively affecting or damaging devices.

Gathering Tools and Equipment

The following tools and equipment will be needed to install the **ECHO** monitor:

- Grade Pole

- DOF stick

- Carpenter's rule or tape measure

- Drill and bolts, if necessary, to mount Wall Mount to manhole wall

- Laptop with **Q*start*XML 1.1.027** or higher installed

Tools and Equipment for Antenna Installation

Determine the tools and equipment needed for the antenna installation using the following lists for in-manhole and out-of-manhole antenna installations. See *Installing the Antenna* for more information on determining whether to perform an in-manhole or out of manhole antenna installation.

Note: If the antenna is to be installed outside the manhole, ADS recommends the antenna be installed prior to installing the **ECHO** monitor into the manhole.

Tools and Equipment for Outside the Manhole Antenna Installation

Listed below are the tools and equipment required for the installation of an antenna outside the manhole structure.

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

- Masonry drill bits for drilling through manhole wall, corbel, and other materials:

    o 0.5 inch (13 mm) diameter (minimum) x 12 inch (305 mm) long (minimum) bit

    o 0.5 inch (13 mm) diameter x 36 inch (914 mm) long (minimum) bit

    o 1.25 inch (32 mm) diameter x 12 inch (305 mm) bit

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

- If no hammer/drill mode is available on the demolition hammer, a medium- to heavy-duty hammer drill

- Trowel or putty knife for scooping asphalt

- Hammer

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

- Shop vacuum

- Wire brush

- Alcohol wipes

- Leather work gloves

- Protective goggles

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

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

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

- Cable ties for securing cable coils

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

- Dry sand

- Commercial asphalt cold patch compound (approximately 1 cup)

Tools and Equipment for Inside Manhole Antenna Installation

Listed below are the tools and equipment required for the installation of an antenna inside the manhole structure:

- Cable ties are only needed when the antenna can be installed flat on the mounting bar or rung.

- Lag bolt, L-bracket and masonry drill bits for drilling through manhole wall, corbel, and other materials when there is no bar or rung from which to hang the antenna.

Measuring Manhole Depth

Measure and record the manhole depth, which is the distance from the rim of the manhole to the bottom of the invert. Be sure to measure all the way to the invert, not just to the bench.
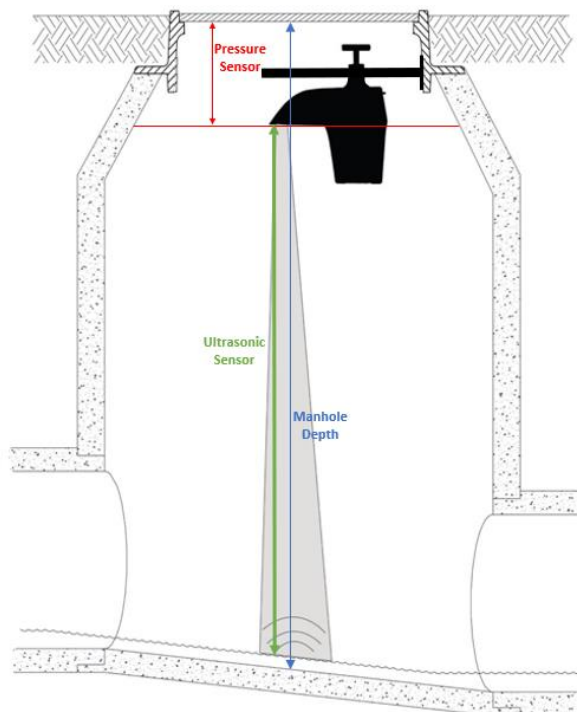
Manhole Depth and Physical Offset Measurements

Installing the Mounting Bar

The Mounting Bar can be installed in a standard manhole frame that is between 21 inches (533 mm) and 28 inches (711 mm).

1. Hang a large loop from the Mounting Bar tether behind the top rung of the manhole.

Passing Mounting Bar Tether Behind Top Rung

2. Use the J-Hook to pull the large loop under the rung and upward.

Using J-Hook to Pull Tether Up From Top Rung

3. Pass the untethered end of the Mounting Bar through the large loop, "tying" the tether to the rung.

Passing Untethered End Through Large Loop

Cinching Tether to the Top Rung

Note: If the manhole location does not have rungs, install the tether using anchor bolts. Install a ¼-inch x 2 ¼-inch anchor bolt and secure the tether using an anchor cable tie. Then, attach to the Mounting Bar.

4. Select the proper positioning for the Mounting Bar in the manhole frame, so that the sensor has a clear view of the manhole invert. This will be dependent on the positioning of the invert.

   a) The **ECHO** reading is taken near the front of the sensor, so it is important that this portion of the sensor has a clear view of the manhole invert.

Point of Measurement

   b) If the invert runs through the center of the manhole, the mounting bar should be installed parallel to the flow, as shown in the diagram below.
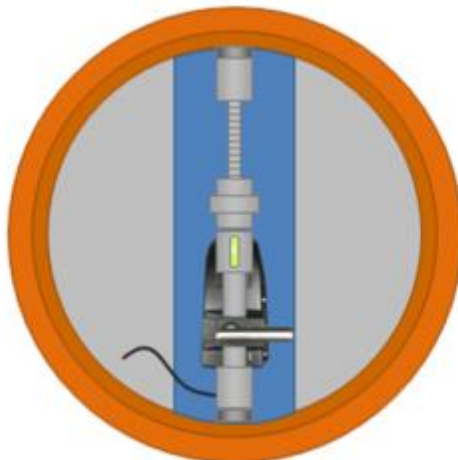
Parallel Mount

c)   If the invert is offset from the center, rotate the Mounting Bar appropriately so the sensor housing can be pointed directly into the invert, as shown in the diagram below.
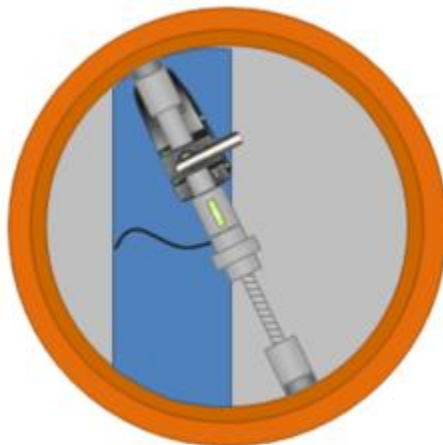
Mount Rotation to Accommodate Offset

d)   If the invert takes a bend as it runs through the manhole, rotate the Mounting Bar appropriately to accommodate the bend, as shown in the diagram below.

Mount Rotation to Accommodate Bend

5. With the Mounting Bar in the proper orientation regarding the invert, turn the knob to extend the rod to just short of the manhole frame walls. The Mounting Bar should be installed a minimum of 14 inches (355.6 mm) below the rim of the manhole, which minimizes the risk that the bar would be struck when opening the manhole lid. When possible, install the bar on the manhole frame so that it is installed on a solid, vertical surface. While less ideal, it is acceptable to place the bar below the frame, as long as the bar is mounted securely.

6. Reference the bubble level while tightening the knob on the Mounting Bar in the manhole frame to ensure that the bar will provide a level sensor mounting surface. Tighten the knob by hand to extend the bar and provide as tight of a fit as possible within the frame. Grip the bar firmly and pull forcefully to confirm that the bar will not move, slip, shift, or drop.

Bubble Level

Confirming Secure Positioning

Installing the Stainless Steel Wall Mount Bar

The Stainless Steel Wall Mount Bar is designed as an alternative method of securely positioning the ECHO in the manhole over the flow.

Perform the following procedure to install the Mounting Bar:

1. Position the bracket on the manhole wall, such that the ECHO will overlook the flow. Refer to "Installing the Mounting Bar", Step 4, for additional configurations to accommodate alternative flow paths.
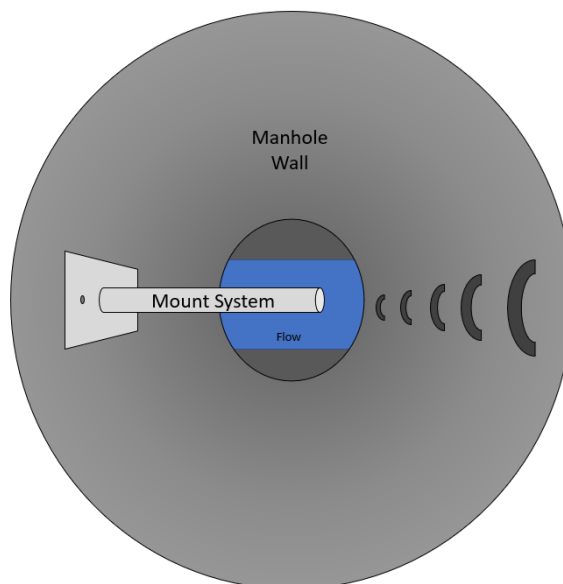
Stainless Steel Mount Bar Over the Flow

2. Drill a 3/8-inch (0.95cm) diameter hole through the top mounting hole, into the manhole wall. The hole must have a minimum depth of 1 ¼ inches (3.18 cm).
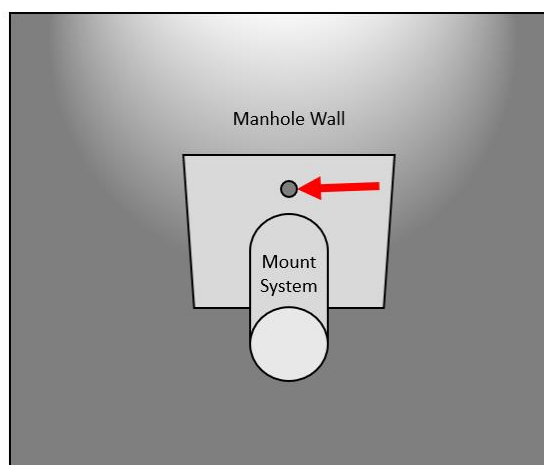
Drilling the First Hole

3. With the anchor nut threaded to approximately one thread from the end of the stud (to protect the threads), hammer one of the anchors from the mounting kit (included) into the drilled hole until seated, then remove the nut.
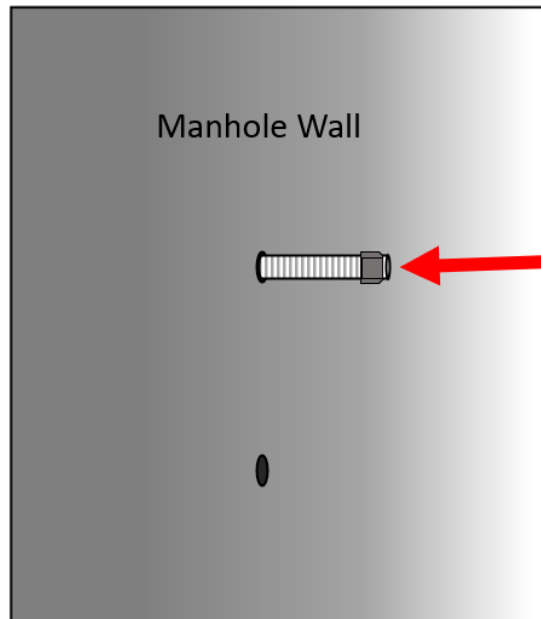
Installing the First Anchor Bolt

4. Place the top mounting hole of the bracket over the anchor stud and thread and tighten the nut.
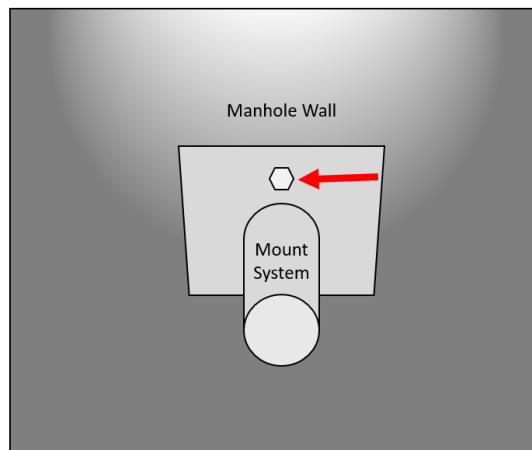
Securing the Stainless Steel Wall Mount With the First Nut

5. With the wall plate vertical, drill through the lower bracket hole, into the wall. Again, the hole must have a minimum depth of 1 ¼ inches (3.18 cm).
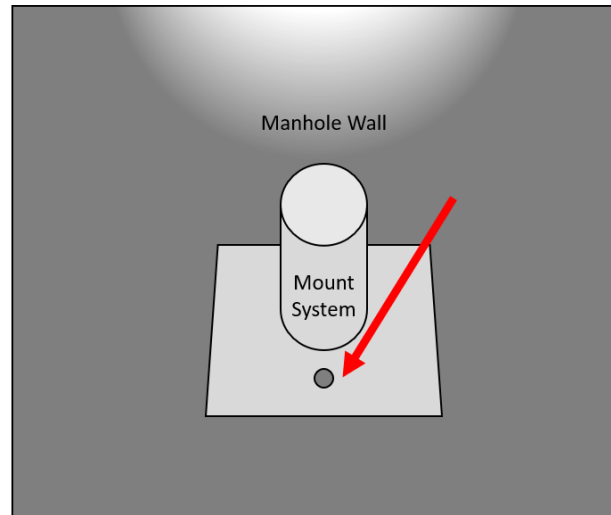
Drilling the Second Hole

6. As in Step 4, drive the remaining anchor stud through the bracket, into the drilled hole, until seated. Then thread and tighten the nut.
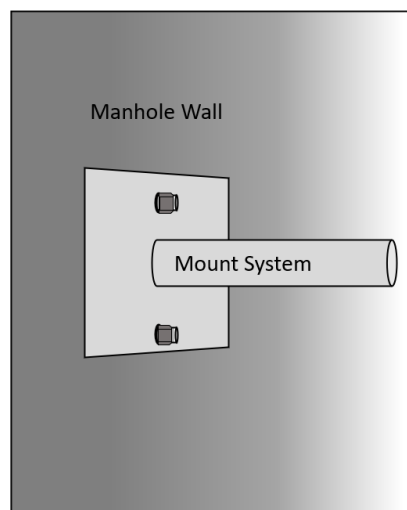
Securing the Stainless Steel Wall Mount With the Second Nut

7. Use a torpedo level (or similar) to verify the pipe portion of the Stainless Steel Wall Mount is horizontally level.
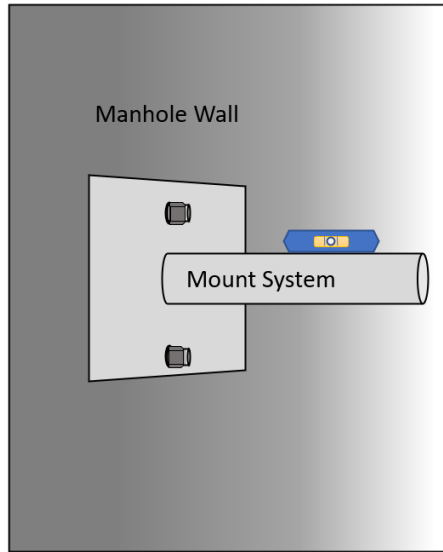
Checking Horizontal Alignment

8. If the Mount System is not completely level (due to the wall not being completely vertical), remove the nuts and bracket, then add a nut and flat washer from the mounting hardware kit to the uneven anchor stud before reinstalling the bracket. Recheck with the torpedo level and adjust the nut until the bracket is level.
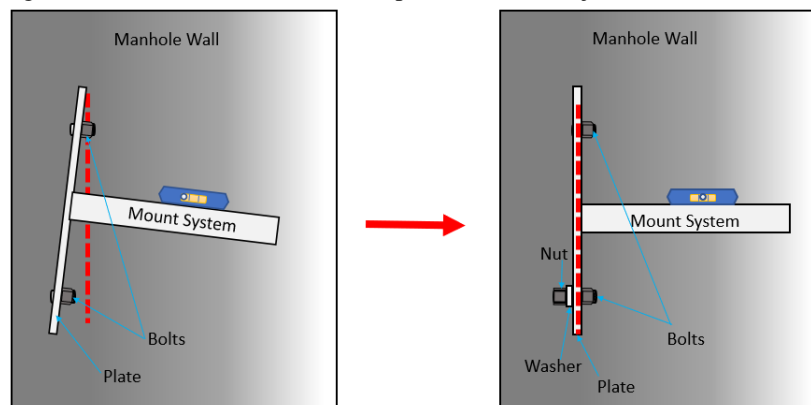
Leveling the Stainless Steel Wall Mount Bar

Adding Extension Rods to the Mounting Bar

If the manhole is larger than standard-sized openings, utilize one Mounting Bar Extension Rod (ADS p/n 8000-0481) for frames extending 28 inches (711 mm) to 36 inches (914 mm), and two Mounting Bar Extension Rods for frames 36 inches (914 mm) to 44 inches (1118 mm).

Extension Rod

1. From the untethered end of the Mounting Bar, carefully remove the black rubber foot off the end of the gray threaded plug.

Removing the Black Rubber Foot

2. Unscrew and remove the gray threaded plug.

Removing the Gray Threaded Plug

3. Screw and hand-tighten the Extension Rod onto the end of the Mounting Bar.

Screwing the Extension Rod onto the Mounting Bar

4. Screw and tighten the gray threaded plug onto the end of the Extension Rod.

Screwing the Gray Threaded Plug onto the Extension Rod

5. Replace the black rubber foot.

Replacing the Black Rubber Foot

Note: When adding two Extension Rods, repeat the process on the tethered end, ensuring that the Mounting Bar tether remains secured at the end after the Rod is added.

Installing Wall Mount Bar

Wall Mount Bar with Bracket

If the manhole or manhole frame will not accommodate a standard Mounting Bar with or without extensions, utilize the Wall Mount Bar (ADS p/n 8000-0484) for installation.

1. Select location of Wall Mount Bar installation. Make sure the sensor will have a clear view of the invert. Refer to Step 4 of *Installing the Mounting Bar* to ensure proper sensor positioning.

2. Place the Wall Mount Bar bracket on selected location, ensuring the bar will be level, and mark screw holes for drilling or screwing in anchor points.

3. Secure the Wall Mount Bar bracket to the manhole wall with anchor screws for each of the bracket holes.

Securing Bracket to the Manhole Wall

4. Screw the Wall Mount Bar into the bracket secured to the wall.

Screwing Wall Mount Bar into Installed Bracket

Note: The extension rods are to be used with the Mounting Bar only, and not for the Wall Mount. If the Wall Mount is not sufficient in length, purchase a longer rod, making sure that it will not bend under the weight of the **ECHO**.

Installing the Antenna

Depending on the 9000-**ECHO**-4VZ monitor's wireless signal strength at the install site, the antenna may or may not need to be installed outside of the manhole. If the wireless signal strength is between -50dB and -85dB, then the 9000-**ECHO**-4VZ monitor's antenna may not need to be installed outside the manhole. In

those instances, the antenna can possibly be installed inside the manhole. The following sections detail the tools and equipment needed for an antenna installation outside the manhole and an antenna installation inside the manhole.

> **Note:** Wireless monitor communications will not occur if the antenna is underwater. Therefore, consider whether the monitor needs to communicate during surcharge conditions when deciding on the antenna placement.

> **Note**: If the antenna is to be installed outside the manhole, it is recommended that the antenna be installed prior to installing the **ECHO** monitor into the manhole.

Use the following detailed instructions when performing an *outside the manhole* antenna installation or an *in-manhole* antenna installation.

In-Manhole Antenna Installation Instructions

The **ECHO**-9000-4VZ using Verizon LTE-M communications can often provide enough wireless signal strength to install the antenna inside the manhole with the monitor. The following installation instructions are applicable for installing the antenna inside the manhole when the monitor wireless signal strength is between -50dB and -85dB while the antenna is inside the manhole with the manhole lid closed.

> **Note**: In cases where the **ECHO** monitor is installed well-below the manhole rim, the antenna should be installed as close to the manhole lid as possible.

In-manhole antenna installed to mounting bar

1. If a rung or mounting bar exists in the manhole, use a cable tie to secure the antenna. Position the antenna as flat and parallel to the manhole lid as possible with the ADS logo facing up.

2. If no mounting bar or rung exists or if the **ECHO** monitor has been installed well-below the manhole rim, install an L-bracket (using a lag bolt) to the manhole wall just below the manhole rim and secure the antenna to the L-bracket. Ensure the antenna is positioned as flat and parallel to the manhole lid as possible with the ADS logo facing up.

3. Proceed to *Connecting the Antenna to the Monitor*.

Outside Manhole Antenna Installation Instructions

These installation instructions will be applicable for installing the antenna in the road, in the ground, or under other paving materials. Antenna options are shown below.

ADS 9000-0080 over-molded multi-band antenna for 9000-**ECHO** and 9000-**ECHO**-4VZ

Slim (left), Mini-Wing (right) antennas for 9000-**ECHO** only

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

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

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

    - Avoid locations at which cars will remain parked over the antenna for extended periods, as this will interfere with the signal strength.

    - Select a location that drains well so water will not collect over the antenna, interfering with the signal.

    - Choose a location that is as flat as possible with a stable base material. For optimum operations, the 9000-ECHO-4VZ (9000-0080) antenna must be installed as flat as possible and parallel to the ground with the ADS logo facing up.

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

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

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

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

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

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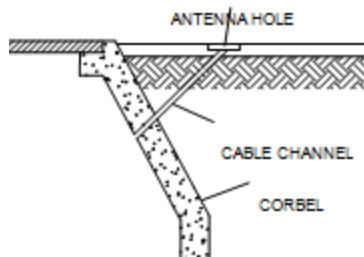
Hole from Antenna Installation Location to Manhole

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

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

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

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

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

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

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

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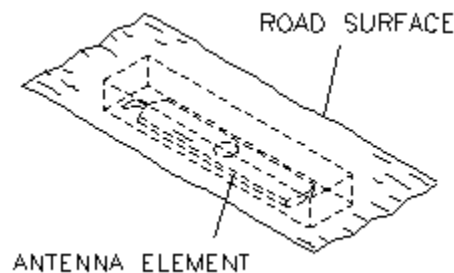
Antenna in Cavity with Patch

13. Coil the slack antenna cable and secure it away from the other cables in the manhole. Slack enables the technicians to remove the monitor from the manhole for maintenance or service activities with the antenna cable still connected.

Note: Do not bundle the antenna and sensor cables together. This can significantly diminish antenna and sensor signal strength, disrupting communications and limiting sensor accuracy.

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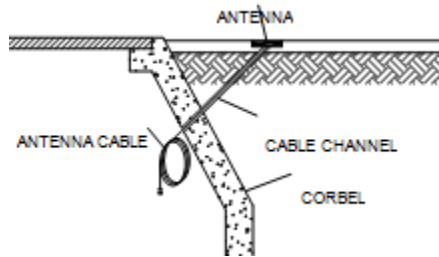
Installation with Antenna Cable Coiled in Manhole

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

15. Proceed to Connecting the Antenna to the Monitor.

Connecting the Antenna to the Monitor

1. Place the monitor upright on the ground surface beside the manhole where the antenna cable is temporarily coiled. Ensure there is no risk of the monitor falling into the manhole while connecting the antenna.

2. Attach the antenna cable connector to the antenna port on the back of the **ECHO** (first removing the electrical tape from the cable end, when applicable). Ensure the connector is secure.

3. Wrap rubber splicing tape around the entire cable connection, extending onto the cable approximately 2 inches (50 mm) beyond the connection with the antenna cable. This will ensure no water ingress into the antenna connection or degradation of the antenna connector itself.

Antenna Cable Connected to Port with Rubber Splicing Tape Applied

4. Carefully coil and secure the remaining slack antenna cabling as necessary.

Note: The user must maintain a distance of 9 inches (229 mm) from the antenna whenever the modem is in operation.

Installing ECHO onto Mounting Bar

1. ADS recommends placing and securing a temporary tether on the **ECHO** prior to installation in the manhole to prevent it from falling into the manhole while in the process of installing onto the Mounting Bar.

Example of Temporary Tether

2. While holding the T-handle, lower the **ECHO** into the manhole, making sure the monitor is oriented so that the sensor will have a clear line of sight to the manhole invert.

Placing Monitor on Mounting Bar

3. Place the clamp over the Mounting Bar and gradually tighten the T-handle, keeping the bubble level on the **ECHO** in the center of the bull's-eye as much as possible.

ECHO Bubble Level in Center of Bull's Eye

4. Fully tighten the handle, such that the **ECHO** monitor does not move on the Mounting Bar (either sliding forward or backward, or moving side to side), again ensuring the **ECHO** stays level during its final tightening. Remove the temporary tether.

> **NOTE: DO NOT** over-tighten the **ECHO** handle. Over-tightening can compromise the strength of the handle.

ECHO Fully Installed

Measuring Physical Offset of ECHO

After installation of the **ECHO** is complete, be sure to note the physical offset measurement that will be used for monitor activation and data collection in **Qstart**XML.

Measure and record the physical offset, which is the distance from the rim of the manhole to the bottom of the parabolic reflector.
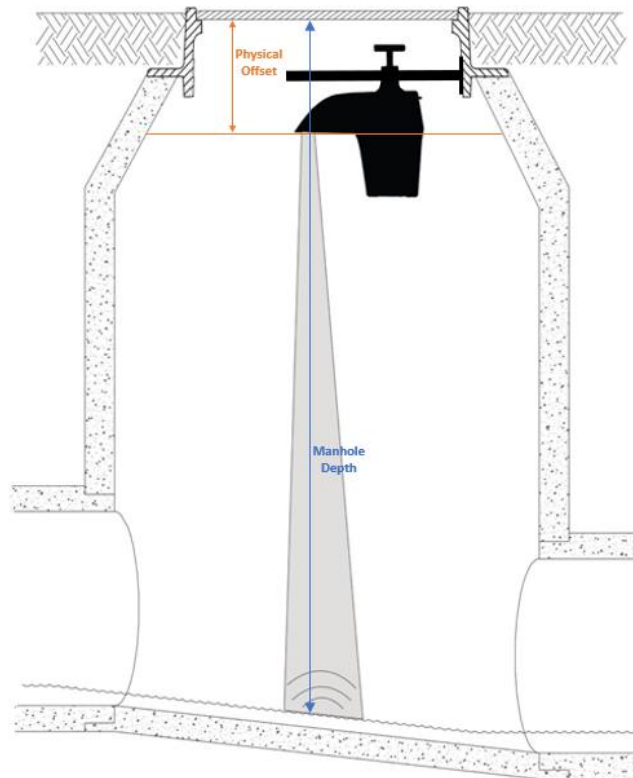
Manhole Depth and Physical Offset Measurements

C H A P T E R 4

Final Configuration and Confirmation
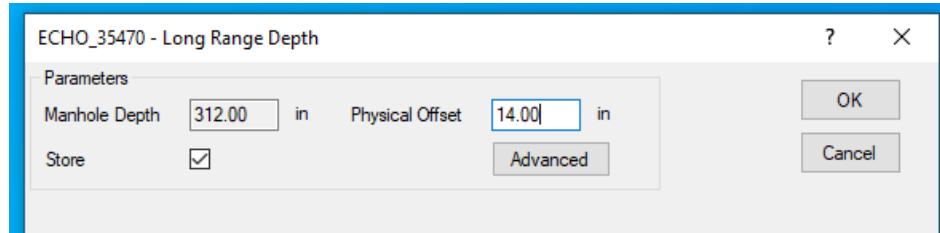
After installation of the **ADS ECHO™** monitor and setting up communication, it is necessary to update the installation parameters and reactivate the monitor for it to begin recording accurate data.

This chapter includes the procedure for final configuration and monitor activation, as well as verification of the monitor readings. Also included are instructions on how to collect data from the **ECHO**.

Refer to the **Q*start*XML™** online help for more detailed instructions on collecting monitor data and configuring, activating, and confirming the monitor.

Updating to Final Configuration

After the **ECHO** has been installed in the manhole, the monitor's configuration in **Q*start*XML** must be updated to reflect the actual measurements from the site. The **Long Range Depth** device must be reconfigured. Input the measured values for **Manhole Depth** and **Physical Offset**.

Long Range Depth Dialog

- **Manhole Depth** – Enter the distance (in inches or millimeters) from the manhole rim to the center of the invert.

- **Physical Offset** – Enter the distance (in inches or millimeters) from the manhole rim to the bottom of the parabolic reflector.
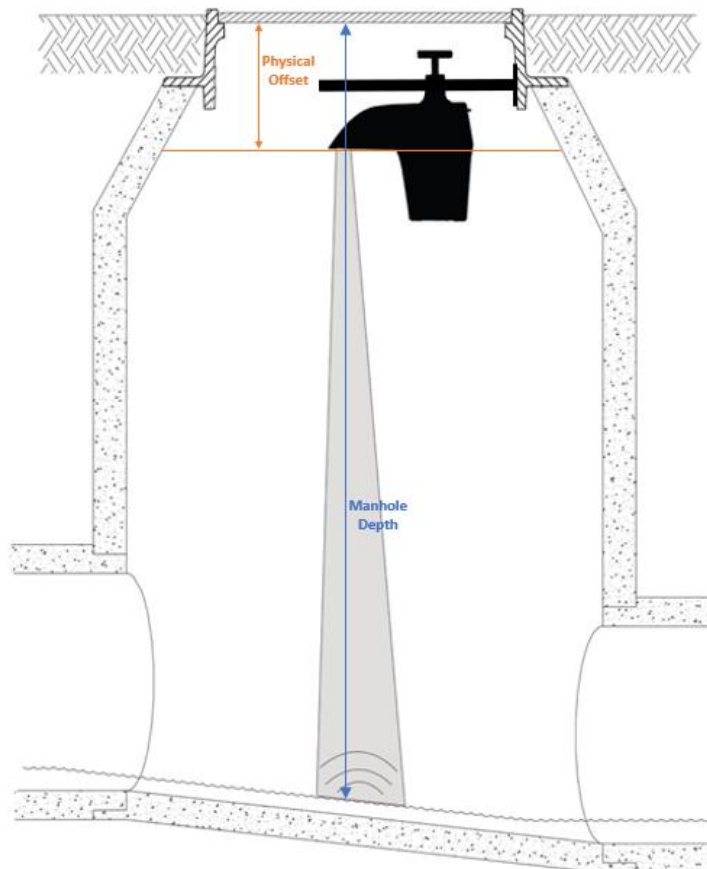
Manhole Depth and **Physical Offset** Measurements

Reactivating the Monitor

When the final configuration settings are complete, the user will need to reactivate the monitor. The process will be the same as the *Activating the Monitor* section in *Chapter 2*, with the addition of setting the Accelerometer and performing a test of the LRD sensor.

1. Select the monitor that will be activated from the **Location Name** drop-down list in the **Monitor** section on the **Q***start***XML** main screen.

2. Verify the configuration parameters and communication method (i.e. designated for **Connect**) for the monitor and modify the parameters as necessary. If the **ECHO** modem is on (**COMMS** light is a slow flashing green), the activation can be done wirelessly. If not, activate the **ECHO** using the Bluetooth dongle as instructed in *Chapter 2*.

3. Click on the **Activate** button in the **Functions** section. **Q***start***XML** initiates and establishes communication with the monitor and then downloads the appropriate information and files. Once the activation is complete, the status bar displays an **Activate Successful** message. **Q***start***XML** generates an Activation log that is available for viewing through the log viewer within **Q***start***XML**.

4. While still online with the **ECHO**, select the **Advanced** device. Under the **Diagnostics** tab, the **Accelerometer** must be set to establish a baseline against which it will compare later readings to check for a **Tilt** alarm. Click the **Set** button to set the initial values. This will display reference values for the X, Y, and Z. The **Read** button will display a comparison between current values and the initial base values.
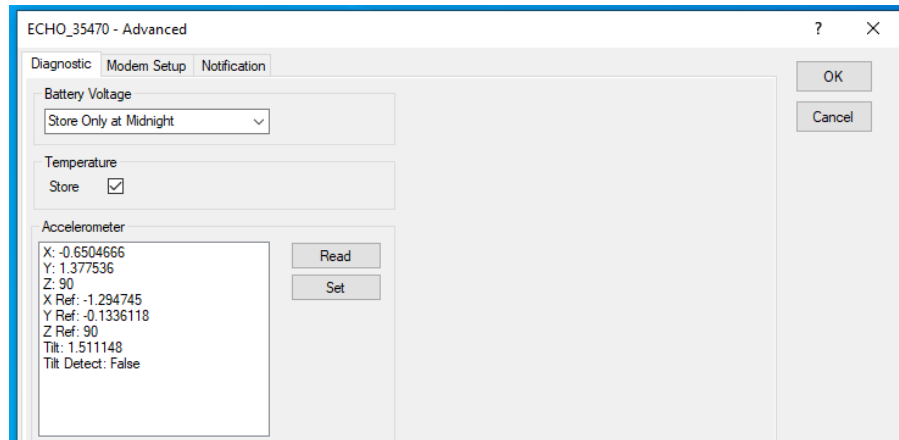
Setting the **Accelerometer**

5. Continue other activities that require communication with the monitor or disconnect the monitor by clicking on the **Hangup** button in the **Functions** section. This will cause the local computer to disconnect from the monitor.

6. To ensure all settings have been configured properly, perform a test fire of the **Long Range Depth** sensor. If still online with the **ECHO**, open the **Long Range Depth** device dialog. Otherwise, reconnect with the **ECHO** by selecting **Connect**, then open the **Long Range Depth** device dialog. When online with the monitor, the dialog will change to allow the user to take readings. Click on the **Read** button to initiate the test. Observe the results to confirm proper sensor performance. The sensor may need to be read several times for the readings to settle in after initial installation. If it appears that the readings are too high and may be measuring the depth of the manhole bench rather than the depth of flow in the invert, consider rotating the **Mounting Bar** slightly to provide the **ECHO** a more direct line of sight to the invert. Get back online and repeat the **Long Range Depth** firing to verify that the **ECHO** is now reading correctly.

Long Range Depth Dialog – Test

Collecting Data from the Monitor

Q*start*XML enables the user to collect and review data from the monitor on demand when the **ECHO** modem is not in the **Power Saving** mode. On-demand data collection is available from monitors equipped with SIM cards with static IP addresses through wireless, remote communication or monitors equipped with SIM cards having either static or dynamic IP addresses on-site through Bluetooth communication. **ECHO** monitors with dynamic IP addresses cannot be collected on-demand and must be configured to deliver data to an FTP server or **PRISM** at a pre-defined interval using the **Data Delivery** device.

The procedure described in this section applies only to data collection occurring on-demand.

1. Select the monitor from which data will be collected from the **Location Name** drop-down list in the **Monitor** section on the **Q*start*XML** main screen.

2. Verify **Connection** type.

3. Click on the **Collect** button in the **Functions** section. This will cause the **Collect Span** dialog to display.

Collect Span Dialog

4. Designate the date and time from which to begin collecting data from the monitor in the **Start** field. **Q*start*XML** defaults to a start data and time one second past the last data point stored in the local or

network directory for the current location. Edit a particular value in the **Start** date or time field by selecting the existing value and entering a new value or using the up/down arrows to scroll to the desired value.

5. Designate the date and time up to which to begin collecting data from the monitor in the **End** field. **Qstart**XML defaults to the end date and time on the local computer. Edit a particular value in the **End** date or time field by selecting the existing value and entering a new value or using the up/down arrows to scroll to the desired value.

6. Click on the **OK** button. **Qstart**XML initiates and establishes communication with the monitor and initiates the data collection process. Refer to the status bar at the bottom of the **Qstart**XML main screen to view the progress of the collection. The **View Data** dialog displays once data collection is complete.

   Note: The data collection process can be discontinued at any time by clicking on the **Abort** button.
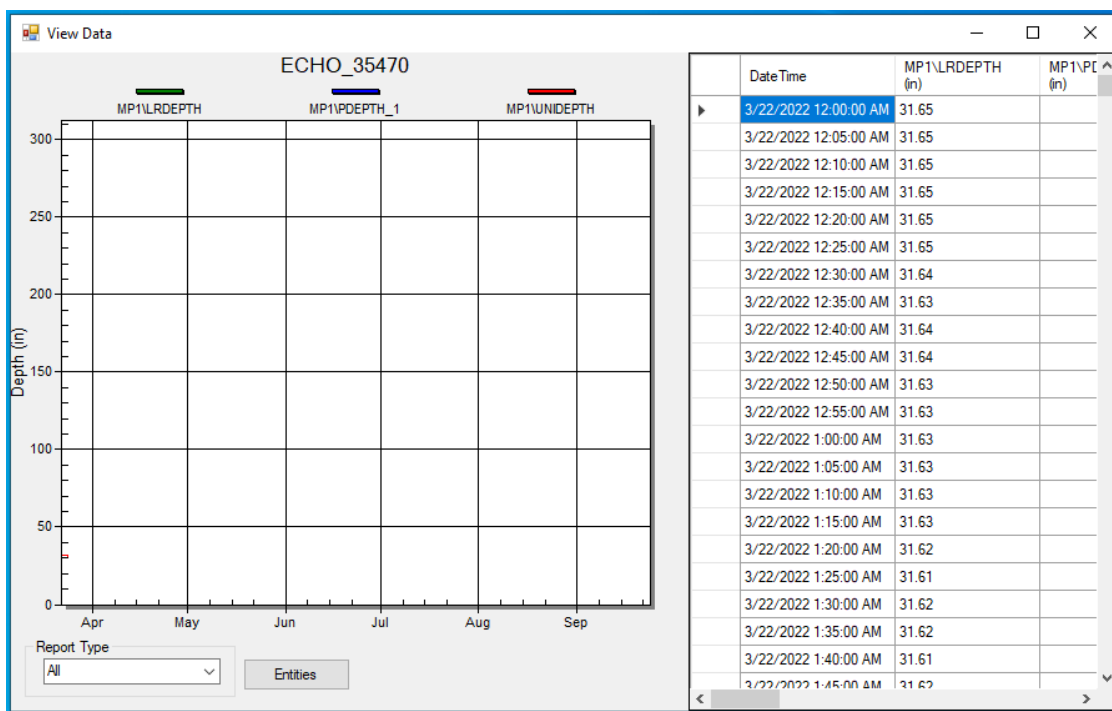
View Data Dialog

7. View the data in tabular or graphical format on the **View Data** dialog. The graph can be modified based on the time period and entities.

   o Select the amount of data to be displayed on the graph at one time by selecting the appropriate option from the **Report Type** drop-down list (**All**, **Day**, **Week**, or **Month**).

   o Limit the entities that display on the graph by clicking on the **Entities** button, selecting the entities to be displayed, and clicking on the **OK** button. To select multiple entities, press and hold down the control (**Ctrl**) key while selecting individual entities. To choose consecutive entities on the list, select the first entity to be displayed, press and hold down the **Shift** key, and then click on the last entity to be included.

   o Zoom in on a particular portion of the data on the graph by selecting the **Zoom** option from the **Report Type** drop-down list, clicking and dragging from the top left boundary of the desired data to view on the graph to the bottom right boundary of the data, and then releasing.

o   Use the scroll bars on the table to navigate to the specific data to be viewed. Sort the data in the table by clicking on the heading corresponding to the desired data to be sorted. Clicking on the **DateTime** heading enables the user to switch between viewing the most recent and the oldest data collected from the monitor. Clicking on an entity heading allows the user to alternate between viewing the readings in descending order (beginning with the highest value) and in ascending order (beginning with the lowest value).

8.   Close the **View Data** dialog when finished viewing the data by clicking on the **x** button at the top right corner of the dialog.

9.   Click on the **Hangup** button in the **Functions** section to discontinue communication with the monitor.

Note: **Q**start**XML** generates a collect log entry corresponding to this data collection activity that includes a summary of the details associated with the collect and general monitor status information at the time of the collect. The user can view the contents of the entry through the log viewer in **Q**start**XML**. Refer to *Viewing Monitor Activity Logs* in *Chapter 6, Maintenance and Troubleshooting* for more information.

C H A P T E R 5

Modbus

Many newer SCADA and process control systems connect wirelessly to measurement devices through a modem to quickly access process values. One of the industry standard protocols through which this occurs is Modbus. The **ADS ECHO**™ monitor can serve as a Modbus slave device and provides process values based on Modbus holding registers wirelessly through the internal cellular modem.

> **Note:** The 9000-**ECHO**-4VZ using Verizon LTE-M communications does not support Modbus TCP/IP unless the ADS SIM card has been replaced with a SIM card activated on the customer's Verizon VPN.

This chapter contains connection and reference information regarding Modbus wireless data exchange and Modbus data registers.

Establishing a Modbus Connection

The SCADA or process control system connects to the **ECHO** through a cellular wireless modem in the monitor using Modbus TCP.

> **Note:** The **ECHO** monitor only supports Modbus TCP/IP connections.

> **Note:** The 9000-**ECHO**-4VZ monitor does not support Modbus communications through the ADS VPN**.**

Setting Up a Wireless Connection

Establishing a wireless Modbus connection enables the **ECHO** to provide the updated Modbus registers to the SCADA or process control system.

Consider the following when using a wireless connection:

- Establishing wireless TCP/IP communication may take several minutes. Therefore, consider this initial delay in communication when setting up the host program.

- Verify that the monitor has been configured for Modbus output through **Q*start*XML.**

- Verify that the process control system has the proper Modbus slave ID, is configured for wireless TCP communication, and has the correct IP address for the **ECHO**.

- Once both systems are configured and activated, verify that the process control system is receiving the appropriate Modbus register values.

> **Note:** If the **ECHO** is configured for Modbus TCP/IP, it will not be possible to communicate remotely with the monitor unless the Modbus polling system hangs up between poll attempts.

> **Note:** Continuous Modbus polling will significantly reduce battery life and more battery replacements will be required.

> **Note:** The port number used for Modbus connections is 2100.

Configuring the Monitor for Modbus Applications

1. On the **Q*start*XML** main screen, click on the **Modbus** button. This will open the **Modbus Parameters** dialog.
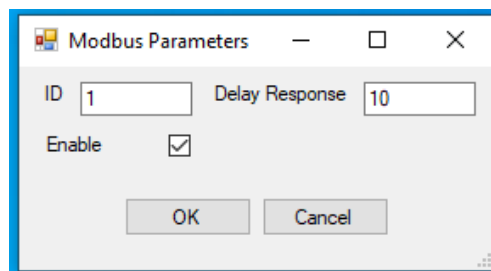
Modbus Parameters Dialog

2. Select the **Enable** checkbox.

3. Enter a slave address number in the **ID** field to be used when facilitating communication between the **ECHO** and SCADA system. For the **ECHO**, choose a number between 2 and 247, excluding 58.

4. Enter the amount of time, in milliseconds, following a request that the monitor will wait before returning the requested data to the third-party system in the **Delay Response** field. (The default value is sufficient in most cases and thus will likely not require editing.)

5. Click on the **OK** button.

6. On the main screen, click the **Save** button to save the current parameters.

Modbus Data Registers

This section contains tables providing Modbus registers. The first table lists the Modbus data register addresses corresponding to the entities for which the **ECHO** provides output data. The Modbus TCP requests data from the monitor using the designated registers, and the monitor sends the current entity data representing those registers. Therefore, the user must program the polling software with the appropriate registers based on the type of data desired.

Register Addresses for Entity Data

The following table contains the entities currently available for output and the associated register addresses.

Note: The units of measure are based on the units of measure with which the monitor was activated, except for those noted within the table.

Note: Modbus holding registers start at 40001. To address them with a Modbus Read Holding Register command, use an address of 0 (zero), which will return data for register 40001. ADS uses two Modbus registers to return one little-endian floating point number. Registers that are not updated by the monitor will contain a value of 0.0. This number represents the initialization value and indicates the register is not updated. The registers used are dictated by the monitor configuration, the type and number of sensors, and the type of processing desired.

A typical message exchange, asking for the first 10 registers, would occur as follows:

000064-Tx:3A 30 35 30 33 30 30 30 30 30 30 30 41 45 45 OD
       OA

000065-Rx:3A 30 35 30 33 31 34 30 30 30 30 43 32 43 36 30
       30 30 30 43 32 43 36 30 30 30 30 43 32 43 36 38
       45 33 39 43 32 39 31 30 30 30 30 43 32 43 36 41
       41 OD OA

Description	Q*start* Entity	Standard Units of Measure	Registers
Long Range Depth	LRDEPTH	Inches	40001-40002
ECHO Monitor Temperature	INTTEMP	°F	40003-40004
Filtered LRDEPTH data	UNIDEPTH	Inches	40005-40006
Low Level	LOW LEVEL	N/A	40011-40012
High Level	HIGH LEVEL	N/A	40013-40014
High High	HIGH HIGH	N/A	40015-40016

Description	Q*start* Entity	Standard Units of Measure	Registers
Full Pipe	FULL PIPE	N/A	40017-40018
Overflow	OVERFLOW	N/A	40019-40020
Battery Voltage	BTYVOLT	Volts	40021-40022
Cellular Signal Strength	N/A	dBm	40023-40024

C H A P T E R 6

Maintenance and Troubleshooting

While the **ADS ECHO™** monitor is designed for dependability and durability, all electronic devices are vulnerable to wear, malfunction, or failure over time. 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. It also includes instructions on how to use the **Q*start*XML™** software to run diagnostics, upgrade the firmware in the monitor, and view logs documenting various kinds of monitor activities.

- Maintaining the System Components

- Replacing System ComponentsTroubleshooting Tools

- Troubleshooting

Note: Further information on frequently asked questions pertaining to the **ECHO** can be found on the ADS website at http://www.adsenv.com/content/echo-faqs.

Maintaining the System Components

The **ECHO** should require little on-site maintenance. Reviewing Collect and Diagnostic logs from a remote location should be sufficient to verify proper operation. On-site visits should only be necessary if communication issues occur and/or the recorded data does not appear to be accurate.

> **Note:** The only service or maintenance activities ADS permits within the monitor chassis are battery pack, SIM card, and processor fuse replacement. Therefore, please do not handle, alter, modify, remove, or replace any other components inside the monitor. This may void the monitor warranty agreement.

Inspecting the Monitor

Perform the following inspections during site visits or from a remote location (when applicable):

- Inspect the monitor mounting hardware to verify that it is tightened and secure.

- Inspect the Mounting Bar tether to ensure it is still secure and will prevent loss of equipment if the bar becomes dislodged.

- Inspect the monitor for general integrity and verify that the monitor has no obvious mechanical defects.

- Review the applicable logs in **Q*start*XML™** to verify the status of the monitor clock, communications, firmware, and battery pack.

- Clean the monitor with paper towels, as necessary. *However, do not use detergent!*

Viewing Monitor Activity Logs

ADS **Q*start*XML** generates detailed logs of many activities performed involving the monitor, such as activation, data collection, and firmware downloading. These logs, contained in the local directory or network, are available immediately following the activity and for future access to historical information.

1. Select the monitor location for which you want to view a log from the **Location Name** drop-down list in the **Monitor** section on the **Q*start*XML** main screen.

2. Click on the **Logs** button in the **Functions** section. This will display the **Logs** dialog.
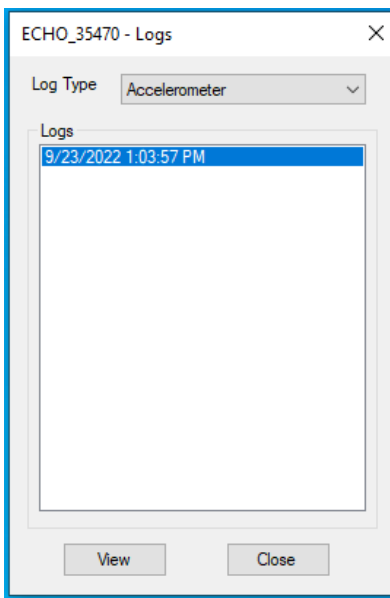
Logs Dialog

3. Select the type of log you want to view from the **Log Type** drop-down list. The **Logs** box displays all the logs available in the local directory or network for the selected location and log type.
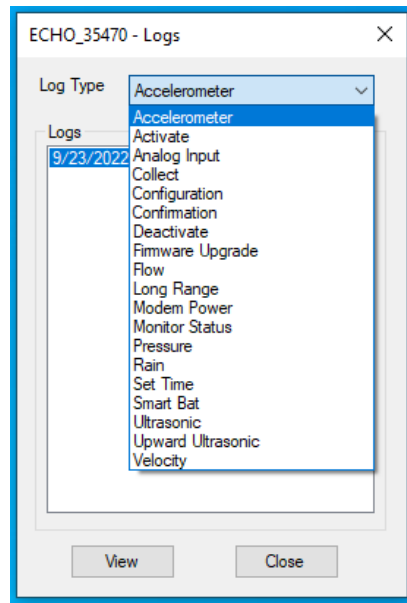
Available **Log** Types for **ECHO**

4. Select the date and time corresponding to the log you want to view from the **Logs** box, and then click on the **View** button. The selected log displays in printable format.

Sample log

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

6. Repeat steps 3 through 5 for each additional log you want to view and/or print for the selected monitor location.

7. Click on the close or **x** button to exit the window once you are finished viewing logs corresponding to the selected monitor.

Checking the Monitor Battery Pack Voltage

Check the battery voltage using **Q*start*XML**. ADS also recommends verifying the battery voltage after collecting data. Replace the battery pack (ADS p/n 9000-0004) as soon as possible whenever the voltage reads below 6.0 volts or **Q*start*XML** provides a **Battery Low** battery status.

> **Warning:** Batteries reading below 6.0 volts may prevent communication with and data collection from the monitor.

Check the current battery voltage in the monitor through **Q*start*XML** by selecting the monitor from the **Location Name** drop-down list in the **Monitor** section on the main screen and then clicking on the **Status** button in the **Functions** section.

Q*start*XML establishes communication with the monitor and displays the general status information on a new dialog. 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.

```
Monitor Status: ECHO_35470
Current Host Time: 9/23/2022 12:26:41 PM
Current Monitor Time: 9/23/2022 12:26:40 PM
Oldest Entry Time: 5/3/2021 3:05:00 AM
Newest Entry Time: 9/14/2022 6:54:00 PM
Scan Interval: 1800
Monitor Temperature: 72.61 F
Firmware Version: V8.11
Multi-block Modem Attached: Yes
Model Number: X900
BASIC Code Program Status: OK
BASIC Code Fault: 0
Events Pending Status: 0
Abnormal Resets: 0
Battery Voltage: 7.3 V
```

Print Preview dialog (see **Battery Voltage**)

Checking the Antenna Cable

Inspect the antenna cable during site visits. Check the external antenna cable for damage, kinks, or breaks. Make sure that moisture is not entering the monitor enclosure through the cable gland. If the antenna has become damaged, remove the damaged antenna and replace following the procedures outline in the *Installing Antenna section of Chapter 2*.

Replacing System Components

> **Note:** The only service or maintenance activities ADS permits within the monitor enclosure are replacement of the battery pack, SIM card, and processor fuse. Therefore, please do not handle, alter, modify, remove, or replace any other components inside the monitor. This may void the monitor warranty agreement.

Replacing the Monitor Battery Pack

If the battery has ceased working or the battery voltage has dropped below 6.0 volts, the battery must be replaced.

> **Note:** Be careful to avoid damaging or pinching the battery cable between the monitor cover and the enclosure when replacing the battery pack.

1. Collect the data from the monitor.

2. Use the enclosed Allen wrench to fully loosen the 6 screws holding the top of the enclosure to the bottom where the battery pack is housed.

3. Disconnect the battery pack cable connector from the PCB. Press and hold down the center tab on the battery pack cable connector and pull it out from the circuit board power cable connector. Place the top of the **ECHO** aside.
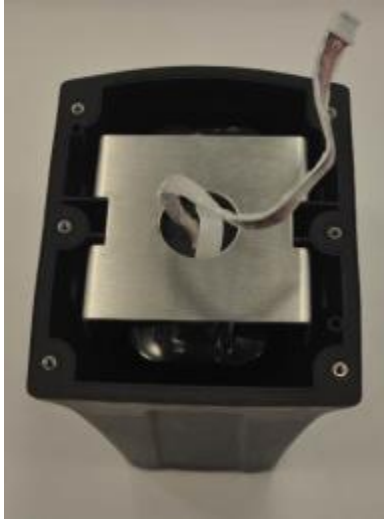
Bottom of the **ECHO** with Battery Disconnected

4. Remove the metal plate, and then carefully remove the battery pack from the cradle in the enclosure using the white strap attached to the top of the battery pack.
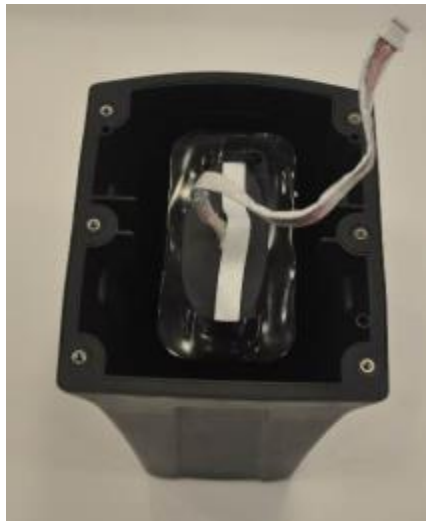
Metal Plate Removed

Battery After Removal

5. Connect the new battery and verify that a green LED light illumines. The green LED will be solid once the **ECHO** is powered on.

6. Place the top part of the **ECHO** onto the bottom part, ensuring that the curved back (non-sensor end) of the top matches with the curved back of the **ECHO** bottom.

7. Tighten the screws beginning with the middle screws on either side of the unit and tighten, not completely, until secure. Then tighten, again not completely, the remaining screws in an alternating sequence (for example: front left, back right, front right, back left). Once all screws are secure, fully tighten to complete reassembly. Tighten until they no longer turn but be sure not to over tighten. Stop tightening once there is any resistance when turning the screw.

   Note: Opening the cover to the monitor enclosure during battery pack replacement increases the risk of damaging or introducing debris or moisture to the circuit board. Make every effort to prevent water, dirt, and debris from contacting the monitor's circuit board during routine maintenance.

8. Call the monitor or connect to the monitor on site using a Bluetooth connection cable to verify communication.

Replacing the SIM Card in the Monitor

The **ECHO** monitor performs wireless communications through an internal modem that is supported by a SIM card located inside the monitor enclosure in a holder on the PCB. The SIM card typically requires replacement only upon failure, which is rare, or when a change in a wireless carrier occurs. The **ECHO** comes with a SIM card pre-installed. If a SIM card not supplied by ADS is to be used, the installed SIM card will need to be replaced.

Certain static IPs may be used for communicating wirelessly through the **Q***start***XML™** software platform or networks supporting ADS hosted system software. The service must support Mobile Terminated service as well as Mobile-Originated (for alarm cry out) functionality. Communication with an **ECHO** requires entering the IP address for the location in the **Q***start***XML** software.

When using a static IP with a *public* IP address, the PC must have internet connectivity. When using a static IP with a *private* IP address, the PC first must establish a VPN connection with the provider. (Please consult ADS Client Services for more information on using private addresses.) Then, the user can connect to the monitor through **Q***start***XML**, provided the location has been properly configured.

Currently, dynamic IPs may be used only for uploading data wirelessly from the monitor to an FTP server or to ADS **PRISM™** software. Communicating directly through ADS software to set up and activate monitors equipped with dynamic IPs must occur on-site using a local Bluetooth connection.

The modem in the monitor supporting global 3G network service requires a standard SIM card for wireless communication. This modem supports SIM cards provisioned by AT&T (ADS p/n 507181) for public, *static* IP address operation as well as SIM cards provisioned by other carriers for dynamic IP address operation. Please contact ADS for specific information about your SIM card provider and compatibility of the provider's SIM card with the **ECHO** monitor or on procuring SIM cards for use in a specific geographic area.

The modem in the monitor supporting the 4G LTE-M network requires SIM card, p/n M2MTC-2FF-HD-D. The SIM card in the 9000-**ECHO**-4VZ is specifically linked to the modem in the monitor, therefore, do not attempt to remove or swap the SIM card from one 9000-**ECHO**-4VZ monitor to another.

Refer to the steps in the following two sections for guidance on replacing the SIM card in a 9000-**ECHO** or a 9000-**ECHO**-4VZ monitor.

Replacing the SIM Card: 9000-ECHO

Note: If installing a SIM card that is not an ADS AT&T public, static SIM, first deactivate the **ECHO** before beginning the steps below. The **Modem Setup** device will need to be configured and the monitor reactivated with the new communication information before it will be able to communicate wirelessly.

1. Use the enclosed Allen wrench to fully loosen the 6 screws holding the top of the monitor enclosure to the bottom where the battery pack is housed.

Provided Allen Wrench

Note: The screws are captive, so they cannot be unscrewed completely and removed from the top part of the enclosure.

2. Disconnect the battery and place the top of the **ECHO** on an easily accessed workspace. Make a note of the IP address and then insert the SIM card. If installing a SIM card that is not supplied by ADS or is not a public, static SIM, refer to *Chapter 2* for configuration of the **Modem Setup** device prior to reactivating the monitor.

Placement of SIM Card

3. Reconnect the battery and verify that the **COMMS** LED illumines green. The green LED will be solid once the **ECHO** is powered on and will begin flashing once it is connected to the network.

4. Place the top part of the **ECHO** onto the bottom part, ensuring that the curved back (non-sensor end) of the top matches with the curved back of the **ECHO** bottom.

5. Tighten the screws beginning with the middle screws on either side of the unit and tighten, not completely, until secure. Then tighten, again not completely, the remaining screws in an alternating sequence (for example: front left, back right, front right, back left). Once all screws are secure, fully tighten to complete reassembly. Tighten until they no longer turn but be sure not to over tighten. Stop tightening once there is any resistance when turning the screw.

Replacing the SIM Card: 9000-ECHO-4VZ

Note: The SIM card in a 9000-**ECHO**-4VZ monitor is specifically linked to the modem in the monitor, therefore, **DO NOT** attempt to remove or swap the SIM card from one 9000-**ECHO**-4VZ monitor to another.

1. Verify the SIM replacement for the 9000-**ECHO**-4VZ is part number M2MTC-2FF-HD-D.

2. Use **Q*start*XML** to deactivate the 9000-**ECHO**-4VZ.

3. Use the Allen wrench to fully loosen the 6 screws holding the top of the monitor enclosure to the bottom where the battery pack is housed.

Note: The screws are captive, so they cannot be unscrewed completely and removed from the top part of the enclosure.

4. Disconnect the battery and place the top of the **ECHO** on an easily accessed workspace.

5. Remove the existing SIM from the monitor and insert the new SIM.

6. Request a SIM deactivation for the removed SIM from ADSEODIP@idexcorp.com. Include the SIM number (from the SIM card holder) and ECHO serial number. Once the SIM card is deactivated, you may discard it.

7. Request a SIM activation of the new SIM from the service provider. Include the SIM number and modem IMEI number. Wait for confirmation the SIM has been activated.

8. Insert the new SIM card into the SIM card holder.

9. Reconnect the battery and verify that the COMMS LED illumines green. The green LED will be solid once the **ECHO** is powered on and will begin flashing once it is connected to the network.

10. Place the top part of the **ECHO** onto the bottom part, ensuring that the curved back (non-sensor end) of the top matches with the curved back of the **ECHO** bottom.

11. Tighten the screws beginning with the middle screws on either side of the unit and tighten, not completely, until secure. Then tighten, again not completely, the remaining screws in an alternating sequence (for example: front left, back right, front right, back left). Once all screws are secure, fully tighten to complete reassembly. Tighten until they no longer turn but be sure not to over tighten. Stop tightening once there is any resistance when turning the screw.

12. Using **Q*start*XML***,* activate the 9000-**ECHO**-4VZ. This must be done within 48 hours after receiving the SIM activation confirmation.

Replacing the Fuse in the Monitor

The **ECHO** monitor contains a replaceable fuse in series with the main battery supply. If a main battery supply failure occurs, it may involve a bad fuse on the **ECHO** board.

The fuse is a special ATEX/IECEx approved fuse (ADS p/n 508071) that may be replaced upon a power supply failure. The fuse must NOT be substituted with any other type of fuse.

Refer to the *Troubleshooting* section beginning on page 6-17 to identify whether the fuse may be the source of a particular problem that has occurred within the **ECHO** system.

To determine if the fuse has failed, test it with a digital voltmeter set to measure Ohms. Connect the leads to the fuse. If the voltmeter reads the fuse as open (if needed, consult the voltmeter's user manual for how this is displayed), it has failed. If the fuse provides a resistance value, it is working.

Since the fuse attaches to the board on the inside of the monitor, access to and replacement of a fuse first requires opening the monitor.

1. Remove the monitor from the manhole.

2. Disconnect the antenna cable from the port on the back of the monitor.

3. Remove the monitor from the hazardous area (i.e., at least 20 feet (6.1 m) away from the manhole), and place in a dry location.

4. Remove the six screws securing the monitor top to the battery canister using the special Allen wrench.

5. Wipe away any debris or moisture that could enter the chassis once the unit is open.

6. Remove the top of the monitor from the bottom.

7. Ensure that the monitor is not awake (taking readings or communicating) and disconnect the battery cable. The fuse will be next to where the battery cable connects to the PCB.
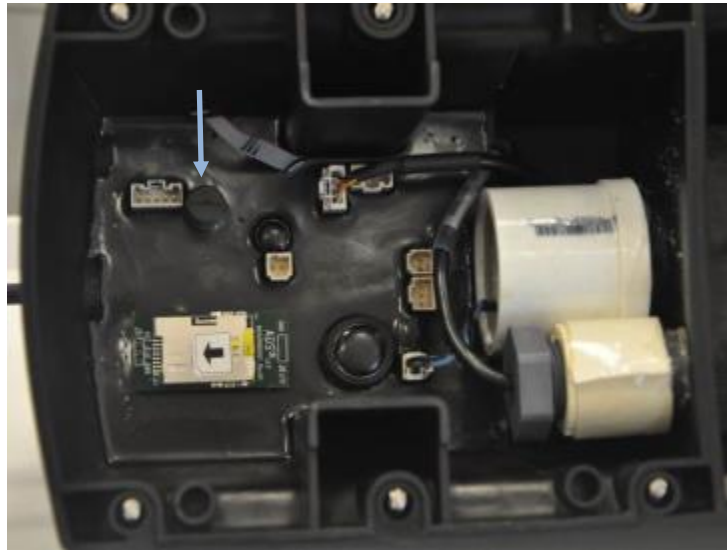
Fuse Located on the **ECHO PCB**

8. Remove the bad fuse from the PCB by gently, but firmly, pulling and lifting it straight up from the board.

9. Carefully insert the new, replacement fuse into the corresponding location on the board without bending the fuse filaments. Make sure that the fuse is seated firmly and securely.

10. Reconnect the battery cable to the PCB.

11. Reconnect the top of the monitor to the bottom and tighten the screws.

12. Once the monitor is reassembled and the battery is reconnected, follow the steps of Viewing Monitor Activity Logs.

13. The ADS **Q***start***XML** software generates detailed logs of many activities performed involving the monitor, such as activation, data collection, and firmware downloading. These logs, contained in the local directory or network, are available immediately following the activity and for future access to historical information.

14. Select the monitor location for which you want to view a log from the **Location Name** drop-down list in the **Monitor** section on the **Q***start***XML** main screen.

15. Click on the **Logs** button in the **Functions** section to display the **Logs** dialog.
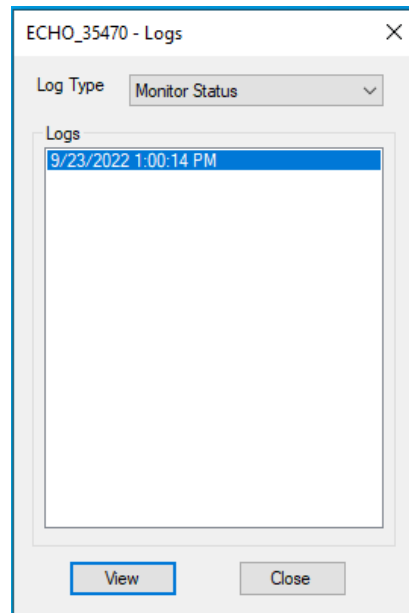
Logs Dialog

16. Select the type of log you want to view from the Log Type drop-down list. The Logs box displays all the logs available.
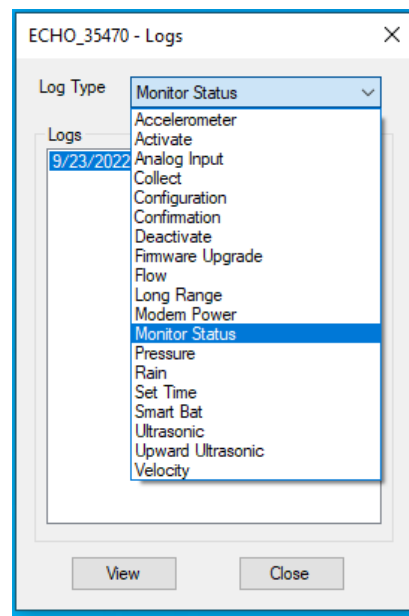
Available **Log** Types for **ECHO**

17. Select type of log, then the date and time corresponding to the desired log from the **Logs** box, and then click on the **View** button. The selected log displays in printable format.

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

19. Repeat steps 3 through 5 for each additional log you want to view and/or print for the selected monitor location.

20. Click on the close or **x** button to exit the window once you are finished viewing logs corresponding to the selected monitor

Troubleshooting Tools

Initializing Communications Using the Magnet

- **COMMS** - The LED closest to the T-handle offers information corresponding to modem status and communications.

- **SENSE -** The LED furthest from the T-handle provides information related to CPU activity, serial communication, data logging, and firmware upgrading.

ECHO LEDs

The use of the blue magnet (ADS p/n 8000-0460) influences the LEDs. These interactions are shown in the tables below.

Magnet Interactions with SENSE LED

Magnet Functions	Magnet Hold Time	LED Color
Indicate Magnet Detected	< 2 Second	**White Flashing**
Bluetooth Pairing	2-20 Seconds	**Off**
Override Power Saving for 1 Hour	21-40 Seconds	**Blue Flashing**
Data Delivery	> 40 Seconds	**Red Flashing**

Magnet Interactions with COMMS LED

Magnet Functions	Magnet Hold Time	LED Color		
		Cellular OFF	**Cellular Not Registered**	**Cellular Registered**
Indicate Magnet Detected	< 1 Second	**Off**	**Green On (Solid)**	**Green Slow Flashing**
Bluetooth Pairing	5-20 Seconds	**Blue Flashing**	**Cyan Flashing**	**Cyan/Green Flashing**
Override Power Saving for 1 Hour	21-40 Seconds	**Off**	**Green**	**Green Slow Flashing**
Data Delivery	> 40 Seconds	**Off**	**Green**	**Green Slow Flashing**

Initializing ECHO Activities with Text Messaging Commands

The monitor has the capability to receive and execute text messaging commands, shown in the table below. This allows for a way to modify some of the **ECHO** parameters and obtain a current reading from the monitor. If the modem is off, the text message command will be read when the modem is turned on next.

> **Note:** If the Power Savings are set to *Always Off*, the text message commands will be read only from 11AM to 12PM.

Command	Description
RESTART	The **RESTART** command will restart the system by performing an internal hardware reset. An abnormal reset will be recorded each time a **RESTART** command is received by the **ECHO**.
RESET	The **RESET** command reloads the XML file, clears pending alarms, and then performs a **RESTART**.
CLEAR	Reloads the XML file and clears pending alarms
MODEM-ON[=nn]	The **MODEM-ON** command turns the modem on. The modem will then stay on as long as there are no **Power Savings** parameters set. If the user only wants the modem to remain on temporarily, define the number of hours the modem will be on by sending **MODEM-ON=n**, where n represents the number of hours the modem will remain on. For example, **MODEM-ON=2** will result in the modem being turned on for two hours once it powers up and receives the message.
MODEM-OFF	The **MODEM-OFF** command sets the **Power Savings** to *Always Off*. The modem will be on from 11AM to 12PM each day.

DATA	The **DATA** command instructs the **ECHO** to deliver data on the next scheduled modem wakeup.
CONFIRM	The **CONFIRM** command instructs the **ECHO** to take a reading and send the current data as a response. For **Long Range Depth**, it sends the depth, temperature, gain, and tilt status.
HEALTH	The **HEALTH** command instructs the **ECHO** to send a shortened health check as response for the current day along with the current data as displayed in the **CONFIRM** command.

Upgrading the Monitor Firmware

The ADS **Q***start***XML** software enables you to download updated firmware to an **ECHO** monitor that may include new features and capabilities or performance improvements and enhancements. **ECHO** firmware can be downloaded from http://www.adsenv.com/content/software-downloads.

Note: ECHO monitors using SIM cards with private, static or *dynamic* IP addresses can undergo upgrades by on-site communication via Bluetooth or serial connection, or remotely if configured with FTP Operations, which are discussed in *Editing the Data Delivery Device* in *Chapter 2*.

1. Collect data from the monitor *before* updating the firmware in the monitor to ensure that you do not lose any data during the firmware upgrade process. Refer to the *Collecting Data from the Monitor* section in *Chapter 4*: *Final Configuration and Confirmation* for more information.

2. Select the monitor for which you want to upgrade the firmware from the **Location Name** drop-down list in the **Monitor** section on the **Q***start***XML** main screen.

3. Click on the **Upgrade** button in the **Functions** section. The user will be prompted with a warning to ensure data has been collected prior to the firmware upgrade. The **Open** dialog displays.

4. Browse to the file corresponding to the firmware download (.bin), and then click on the **Open** button. This program file represents the firmware containing the updated code. **Q***start* initiates and establishes communication with the monitor and downloads the new firmware to the monitor. The status bar at the bottom indicates when the download is complete.

5. Once the download is complete, click on the **Hangup** button in the **Functions** section to discontinue communication with the monitor.

6. Wait 30 seconds.

7. Click on the **Activate** button in the **Functions** section. **Q***start***XML** reestablishes communication with the monitor and downloads the appropriate information and files. Once activation is complete, the status bar indicates **Activate successful**.

8. Click on the **Hangup** button in the **Functions** section to disconnect from the monitor.

9. Reactivate the monitor *after* updating the firmware.

Note: Q*start***XML** generates a log entry of the firmware upgrade that documents the date and time at which the upgrade occurred, the result (i.e. success or failure) of the upgrade, the previous version of the firmware, and the name of the file downloaded during the upgrade. This entry is available for viewing through the log viewer in **Q***start***XML,** Refer to *Viewing Monitor Activity Logs* on page 6-2 for more information.

Upgrading Modem Firmware (9000-ECHO-4VZ only)

Note: The following firmware upgrade should only be performed in instances where ADS has notified the customer that the Verizon LTE-M modem firmware needs updating.

Note: This modem firmware upgrade process applies *ONLY* to ADS monitors equipped with a Verizon LTE-M SIM card.

Note: Prior to performing this firmware upgrade, review your monitor battery voltage. The **ECHO** monitor battery must have a voltage greater than 7.0 volts in order to perform this process.

Note: ADS recommends collecting the data from the monitor before performing the modem firmware upgrade.

Use **Q*start*XML** to perform the Verizon LTE-M modem firmware upgrade.

1. Open **Q*start*XML**.

2. Select the monitor for which you want to upgrade from the **Location Name** field in the **Monitor** section on the ADS **Q*start*XML** dialog.

3. Click the **Connect** button in the **Functions** section to establish wireless communications with the monitor.

Monitor communications are established and the **Advanced** button is enabled in the **Functions** section.

4. Select the **Advanced** button to display the **Advanced Functions** dialog.
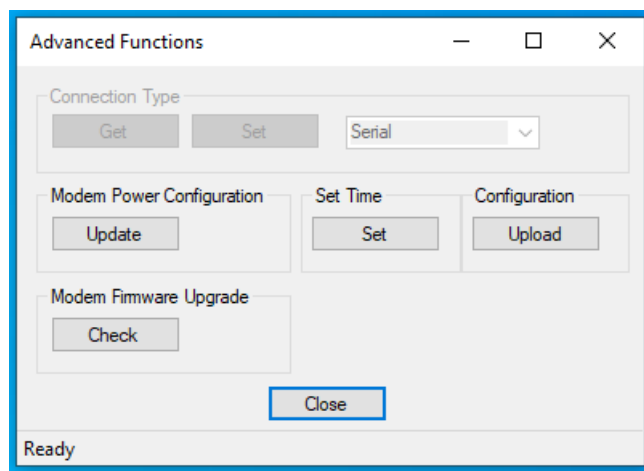
Advanced Functions dialog

5. Select the **Check** button in the **Modem Firmware Upgrade** section to display the current Verizon LTE-M modem firmware information.
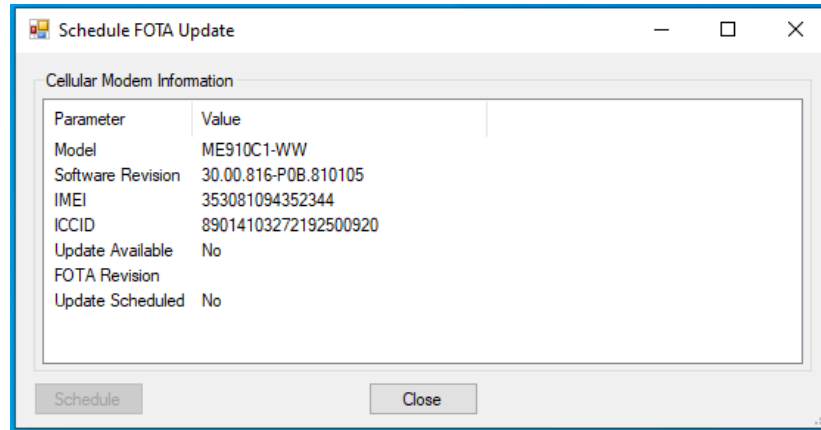
Schedule FOTA Update dialog

6. Review the **Update Available** information in the resulting **Schedule FOTA Update** window.

- If the **Update Available** value is **Yes**, the **Schedule** button is enabled. Select the **Schedule** button to initiate the automated upgrade and then **Close** the dialog and hang up. The upgrade process will perform automatically at the next monitor wakeup interval and may take several minutes.

Note: The upgrade process will not perform if the **ECHO** monitor battery voltage is below 6.8 volts.

- If the **Update Available** value is **No**, the **Schedule** button is not enabled, and a modem firmware upgrade is not necessary. Select the **Close** button and hang up.

Running Diagnostics on the Device

The two diagnostic checks that can be performed on the **ECHO** involve the Long Range Depth sensor and the Accelerometer. Steps 4 and 6 of the *Reactivating the Monitor* section of *Chapter 4* detail these steps when confirming the monitor is installed and working properly.

For the **Long Range Depth** diagnostic, ensure that the values listed under *Results* are reasonable. If the measurements do not appear reasonable, consult the *Troubleshooting* section for potential solutions.
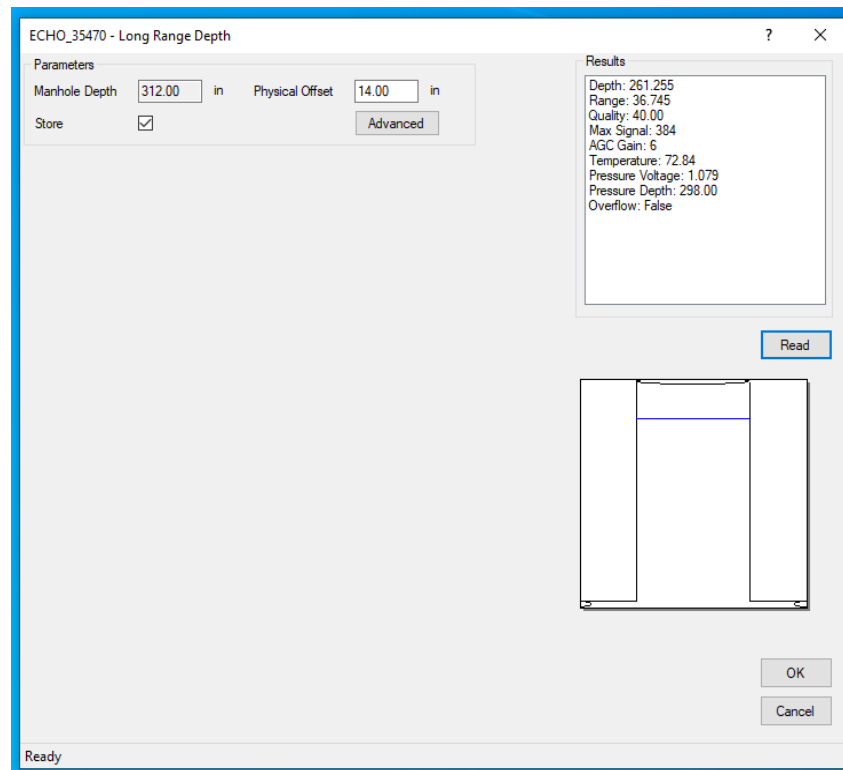
Long Range Depth Dialog – Test

For the **Accelerometer** diagnostic, click the **Read** button to display a comparison between current values and the initial base values from setting the **Accelerometer** in Chapter 4. Again, ensure the values appear reasonable, and if not, consult the *Troubleshooting* section.
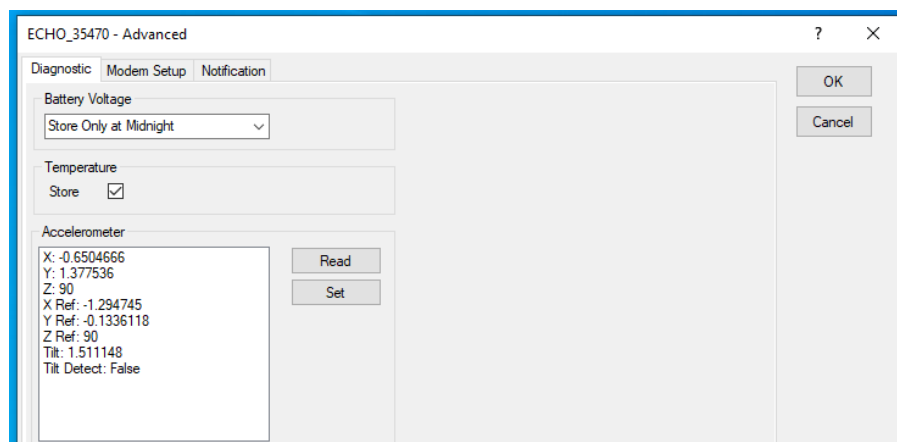
Accelerometer Dialog - Test

Increasing Bluetooth Dongle Signal Strength

If a better signal is needed for the Bluetooth dongle, particularly to keep the computer a safe distance away from the manhole after installation, a USB extension cable can be purchased. Ensure it is A Male to A Female. An example is shown below. The dongle will be inserted into the female end of the extension cable. ADS recommends securing the dongle to the cable with Scotch 130C Linerless Rubber Splicing tape

to prevent any risk of the dongle falling into the sewer. If removed for normal use, the tape will not leave any residue on the dongle.
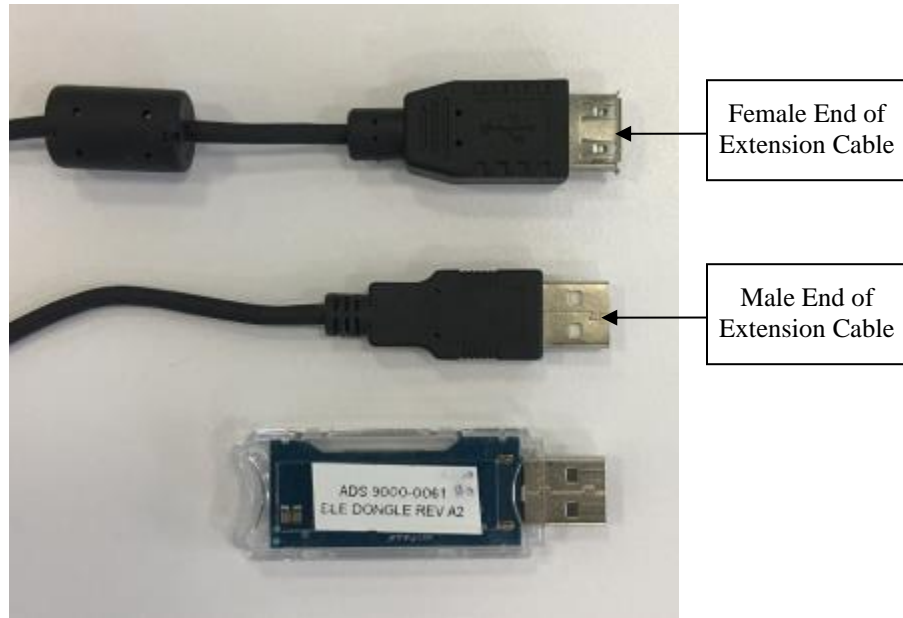
Extension Cable with Bluetooth Dongle
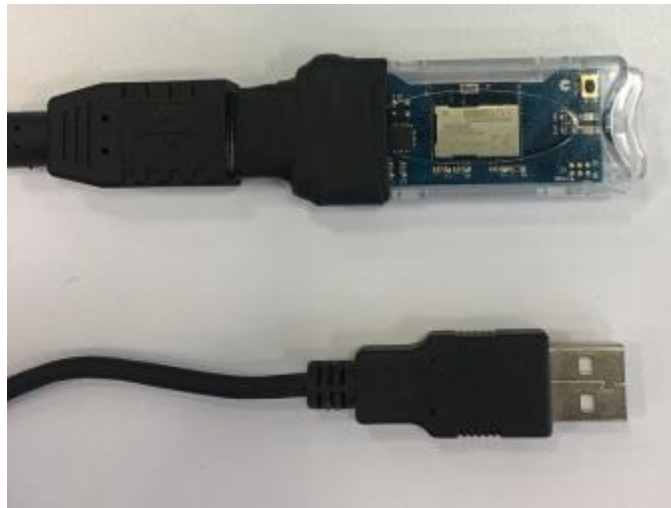
Extension Cable with Bluetooth Dongle Connected

Troubleshooting

The **ECHO** system contains several different components that perform many different functions. Since a malfunctioning component increases the risk of losing data, isolating the part containing the problem quickly is essential to performing troubleshooting activities efficiently. Minimizing monitor downtime is critical.

Consider the following when trying to isolate the component exhibiting the problem:

- Problems affecting only one of the components are usually caused by one component alone. The problem may exist in the board, communications, or antenna.

- Problems affecting more than one component usually can be traced to a problem with the processor, power source, or communication lines. Problems in one component can create problems in other components when the power source or communication lines are faulty.

- Problems with communication lines, clock readings, time stamps, and data storage intervals usually arise from faulty processors, incorrect information entered on the user's PC, or low batteries.

  Note: If possible, collect all monitor data prior to troubleshooting a monitor to prevent possible data loss. Swapping a battery pack will *not* result in stored data loss.

This section provides general guidelines for troubleshooting and correcting problems with the **ECHO** monitor.

Direct Serial Connection to the Monitor

If the Bluetooth and wireless communication methods are unsuccessful, serial connection to the monitor is available via the direct connection cable (ADS p/n 9000-0028) and a computer running the **Q***start***XML** software.

Direct Connection Cable Connected to Board

1. Go to http://www.adsenv.com/softwaredownloads.

2. Under **Software Drivers**, click on the link to download the USB driver and run the **setup executable.**

Once the driver is installed, perform direct, on-site communication by connecting the direct connection cable's USB connector to the USB port on the computer and then connecting the other end of the cable to the communication port inside the monitor enclosure. Refer to online help in **Q***start***XML** for instructions on designating the appropriate local port for direct communication.

Interpreting the Monitor LEDs

The LEDs on top of the **ECHO** monitor provide status information related to activities such as monitor communications, operation, and data transfer.

The following tables provide a description of the activities that the colors represent on the LEDs for use in ensuring proper operation, verifying communications, and performing troubleshooting. The LED colors for both COMMS and SENSE LEDs are shown with their corresponding descriptions.

COMMS LED Descriptions

LED Color	Description
Off	Cellular and Bluetooth communication are both Off
Blue Slow Flashing	Bluetooth communication is currently pairing
Blue Flashing	Bluetooth communication is online
Green On (Solid)	Cellular communication is on, but not registered
Green Slow Flashing (Modem Status)	Cellular communication is powered On and registered
Red/Yellow/Green Flashing	Cellular communication is powered On, registered, and online
Blue/Cyan Flashing	Bluetooth communication is online, and Cellular communication is powered On and registered
Magenta/White/Green Flashing	Bluetooth communication is online, and Cellular communication is powered On, registered, and online

SENSE LED Descriptions

LED Color	Description
Off	The CPU is in sleep mode
Green Flashing	The CPU is awake
Yellow Flashing	The CPU is awake and in the process of a measurement cycle
Cyan (Blue-Green) Flashing	The CPU is awake and there is an active serial connection
White Flashing	The CPU is awake, there is an active serial connection, and there is an active measurement cycle

General Monitor Problems

The following tables contain general techniques for troubleshooting the **ECHO** monitor.

Problem	Time stamp on the collected data is incorrect.
Possible Causes	PC clock may have incorrect time.
	Time Zone may be incorrect.
	Monitor clock may be faulty.
Possible Solutions	Verify the time on the PC clock and correct if necessary.
	Verify the Time Zone and reactivate the monitor, as necessary.
	Reactivate the monitor to enable the clock.
	Collect the data from the monitor and replace monitor if defective.

Problem	Time on the monitor clock is incorrect.
Possible Causes	Monitor clock may be faulty.
	Time zone may be incorrect.
	PC clock may have incorrect time.
Possible Solutions	Verify the time on the PC clock and correct if necessary.
	Verify the Time Zone and reactivate the monitor, as necessary.
	Reactivate the monitor to enable the clock.
	Collect the data from the monitor and replace monitor if defective.

Problem	You receive a **Device Time Out** message in **Q**start.
Possible Cause	Communication quality may be poor.
	Circuit board may be faulty.
Possible Solutions	Re-attempt communication with 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 or variable 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	Start time of data collect may have been incorrect.
	Monitor activation may have failed.
	Monitor time may be incorrect.
	Monitor firmware or variable file may be corrupt.
Possible Solutions	Verify the start time of the data collect and recollect.
	Verify whether the monitor has been activated, and activate if necessary.
	Check monitor time, and reset clock if necessary.
	Contact your regional ADS representative.

General Communication Problems

The following tables contain general techniques for troubleshooting communication problems.

Problem	Monitor does not answer through wireless communication.
Possible Causes	Modem may be in the Power Savings Mode Signal strength to the modem may be insufficient. Battery pack may be dead or below minimum voltage requirement (6.0 volts). Monitor may be defective. Modem in monitor may be defective or in an unresponsive state (this might be indicated by LEDs flashing rapidly). Antenna or cable may be damaged. Internet connection in office or field computer may be down. Wireless carrier may be experiencing problems. Port 2100 may be blocked by IT department.
Possible Solutions	Review Power Savings Log and verify whether modem should be on or not. Connect to monitor on site (through Bluetooth or serial connection) and request the signal strength. If the signal strength falls between -51 and -95, communication should be available. If it reads below -95, use an external antenna or relocate the existing external antenna. If relocation is not an option, perform all communications on-site. Replace the battery pack if below 6.0 volts. Cycle power to the monitor. Disconnect battery for 10 minutes, then reconnect. Replace the monitor. Replace antenna/cable. Restore Internet connection. Check for wireless carrier outage. Restore/establish permission to pass TCP/IP traffic via Port 2100.

Problem	Monitor does not deliver alarms through emails or text messages.
Possible Causes	Text message or email address entered for alarm delivery is incorrect. Wireless carrier account has not been activated or set up correctly.
Possible Solutions	Verify the correct cryout address for alarm notification through emailing or text messaging. Verify that wireless carrier activated and correctly set up account. Contact your regional ADS representative.

General LRD Sensor Problems

The following tables contain general techniques for troubleshooting communication problems.

Problem	Irregular data readings.
Possible Causes	Monitor is not level. The sensor is not oriented over the invert. A drop connection is present in the manhole. Moisture is present on the sensor in the parabolic bowl.
Possible Solutions	Level the monitor. Re-orient the sensor to be directly over the invert and/or away from the drop connection, if present. Move **ECHO** to manhole without drop connection. Clean the sensor area and wipe away any moisture. Contact your regional ADS representative.

Problem	The **ECHO** is sending false alarms.
Possible Causes	Orientation over the invert is incorrect. The alarm threshold ranges are too small. Moisture may have accumulated in the parabolic reflector.
Possible Solutions	Reorient the monitor over the invert. Increase the alarm threshold ranges. Wipe the inside of the parabolic reflector with a clean, dry cloth.

Problem	The depth measured by the monitor does not match the depth measured manually.
Possible Causes	Values for manhole depth and/or physical offset in **Q**_start_**XML** are incorrect. The temperature compensation values for March and/or September are outside of reasonable values for the site.
Possible Solutions	Verify manhole depth and physical offset values are correct. Ensure temperature compensation values for March and September are reasonable.

Problem	The monitor is recording "0" or negative depths
Possible Causes	Values for manhole depth and/or physical offset in **Q*start*XML** are incorrect. The temperature compensation values for March and/or September are outside of reasonable values for the site.
Possible Solutions	Verify manhole depth and physical offset values are correct. Ensure temperature compensation values for March and September are reasonable.

Problem	Long Range Depth data is being measured correctly, but *UNIDEPTH* data is recording a straight line
Possible Causes	A Tilt alarm is present
Possible Solutions	Correct and reset the Tilt alarm

A P P E N D I X A

Specifications

This appendix contains specifications for the both ADS **ECHO** monitors: 9000-**ECHO** and 9000-**ECHO**-4VZ.

ADS ECHO Monitor (9000-ECHO, 9000-ECHO-4VZ)

The following table contains the specifications for the **ECHO** monitor.

Enclosure	Single assembly, injection-molded, glass-filled polycarbonate meeting IP 68 standards. Measuring sensor is integral part of the monitor enclosure
Dimensions	15 inches (380 mm) long x 6 inches (152 mm) wide x 17 inches (432 mm) high
Weight	11.5 pounds (5.21 kg) with battery
Operating Temperature	-4° to 140° F (-20° to 60° C)
Power	One replaceable 9-volt 60Ah alkaline battery pack powering both the monitor and the wireless modem; power to modem can be continuous or managed via duty cycles for power saving.
Battery Life	3.5 years at a 5-minute sample rate with data delivery every four hours to an FTP server, when modem power is set to *Always Off*. Battery life is reduced to 5 months when modem power is set to *Always On*. These settings are discussed in *Configuring the Power Saving Parameters* in *Chapter 2*. **Note:** Battery life varies depending on operating temperature, modem power management settings, and frequency of communications.
Connectors	External Wireless Antenna Serial Communication (inside housing)
Antenna	ADS p/n 9000-0080 over-molded multi-band antenna with 12 ft. cable or customer supplied (connects to SMA connector on **ECHO** housing).

Approvals	Certified under ATEX European Intrinsic Safety standards for Zone 0 rated hazardous areas
	Certified under IECEx (International Electrotechnical Commission Explosion Proof) Intrinsic Safety standards for use in Zone 0 (equivalent to Class I, Division 1, Groups C & D) rated hazardous areas
	CSA certified to CLASS – C225803 – PROCESS CONTROL EQUIPMENT – Intrinsically Safe – For Hazardous Locations – Certified to Canadian Standards; CLASS – C225883 – PROCESS CONTROL EQUIPMENT – Intrinsically Safe – For Hazardous Locations – Certified to US Standards; Class I, Division 1, Groups C and D, T3 (152°C); Ex ia IIB T3 (152°C) Ga; Class I Zone 0 AEx T3 (152°C) Ga

Printed Circuit Board (ADS p/n 9000-0001)

The following table contains the specifications for the printed circuit board (PCB).

Processor	Ultralow power ARM Cortex M4
Functions	Performs and processes all requests for data, handles alarming, and performs multi-tasking monitor operations
Memory	1 megabyte non-volatile (program, configuration, and data storage) and 256 kilobytes static RAM
	Storage Memory: 8 megabytes NV flash, 32 kilobytes NV FRAM
Data Storage	545 days for 3 stored entities (*LRDEPTH* and *INTTEMP and UNIDEPTH*) plus a time stamp at a 5-minute sample rate. Refer to Calculating the Total Days of Storage Available on page A-3 for details and instructions on calculating the number of days of data the monitor can store in memory for a specific application.
Sample Rates	Minutes: 1, 2, 5, 15, 30
	Hours: 1, 2, 12, 24
Clock	Battery-backed real-time clock (RTC) module synchronized to nearest cellular tower as needed
Communications	**9000-ECHO** Wireless modem: Third-party, FCC/IC/EC- and carrier-approved, global coverage, commercial UMTS/HSPA+/GSM modem; FCC ID: R17HE910
	9000-ECHO-4VZ Verizon network approved 4G LTE Category 1 modem; FCC ID: R17ME910C1NV
	Local Connection: On-site, local wireless connection (Bluetooth technology)
	Direct Connection: Via ADS Direct Connection Cable (p/n 9000-0028) running between a laptop's USB port and the 3-pin header connector on the **ECHO** PCB.

LED Indicators	SENSE LED: Colors indicate Sensor firing, CPU serial communications, data logging, and firmware upgrade activities.
	COMMS LED: Colors indicate modem communication, power, and registration.

Calculating the Total Days of Storage Available

This section includes a special equation to use in determining the number of days of data that can be stored in the **ECHO** monitor memory based on a specific application. Consider the following when calculating the total days:

- The monitor memory holds 3,784,704 bytes of data.

- The log rate determines the number of readings taken per day. At a *5-minute* sample rate, the monitor will record 288 readings a day for a single entity. At a *1-minute* sample rate, the monitor will record 1,440 readings a day for a single entity.

- One entity reading consumes 6 bytes of monitor memory.

- The date/time stamp for a reading is also equal to one reading.

- Deduct 2 to 3 days from the total days of storage to compensate for additional overhead in memory.

Following is the equation for calculating the total days of storage available in the monitor memory:

$$\frac{\text{Data Storage Available in the Monitor (in Bytes)}}{\begin{array}{c}\text{Number of}\\\text{Readings}\\\text{Taken per}\\\text{Day for}\\\text{One entity}\end{array} \times \begin{array}{c}\text{Memory}\\\text{Consumed for}\\\text{One Entity}\\\text{Reading}\\\text{(Date/Time}\\\text{Stamp)}\end{array} \times \begin{array}{c}\text{Number of}\\\text{Entities Logged}\\\text{by the Monitor}\end{array}} = \begin{array}{c}\text{Total Days of}\\\text{Storage in the}\\\text{Monitor}\\\text{Memory}\end{array}$$

For example, recording *LRDEPTH*, *UNIDEPTH*, and *INTTEMP* offers approximately 545 days of data storage.

$$\frac{3{,}784{,}704 \text{ bytes}}{288 \text{ readings} \times 6 \text{ bytes} \times 4 \text{ entities (including 1 for the date/ time stamp)}} = 548 \text{ days } (\textit{545 days when accounting for overhead})$$

Sensor Specifications

The following table contains the specifications for measuring sensors within the **ECHO** monitor.

The Long Range Depth sensor is a long range ultrasonic sensor that measures the depth of flow at long range.

Long Range Depth (Ultrasonic) Depth Sensor	
Deadband	0.00 inches (0 mm)
Range	0.00 inches from the bottom of the parabolic reflector to 240 inches (6.1 m)
Frequency	75 kHz
Resolution	0.01 inches (0.25 mm)

Drift	0.00 inches (0 mm)
Temperature Compensation	Actual sensor temperature is used in combination with the seasonal manhole temperature to obtain the best depth accuracy and precision

The Sealed Gauge Pressure sensor is an overflow sensor that can detect surcharge levels near the manhole lid.

Sealed Gauge Pressure (Overflow) Sensor	
Deadband	0.00 inches (0 mm)
Range	100 inches (2540 mm)
Resolution	0.01 inches (0.25 mm)
Measurement Point	The pressure sensor will begin measuring when flow depths reach the manhole depth minus the physical offset (the bottom of the parabolic reflector) of the **ECHO** monitor.
Calibration	Pressure sensor is calibrated to the **ECHO Long Range Depth** sensor every monitor wakeup until the monitor detects that the ultrasonic sensor is submerged.
Overflow Detection	The pressure sensor detects when surcharge depths exceed the depth of the manhole, causing the monitor to initiate an *OVERFLOW* alarm notification.

APPENDIX B

Part Numbers

This appendix lists the part numbers for the most commonly ordered and used ADS **ECHO** system parts.

Monitor	
9000-**ECHO**	MONITOR, LEVEL, W/PRESS, IS
9000-**ECHO**-4VZ	MONITOR, LEVEL, W/PRESS, IS, VERZ, 4GLTEM

Bluetooth	
9000-0061	BLUETOOTH, DONGLE, BLE121LR, CLR HOUSING
8000-0460	KIT, MAGNET, 6LBS, BLUE

Mounting Hardware	
9000-0070	ROD, MOUNTING, EXPANDING, ECHO
9000-0097-S	ROD, MOUNTING, STAINLESS STEEL, ECHO
9000-0069	TETHER, MOUNTING BAR, ECHO
8000-0481	EXTENSION, ROD, MNTG, EXPNDG, CS6, LRD SENSOR
8000-0484	ROD, WALL-MOUNTED, CS6, LRD SENSOR
8000-0447	PAD, REPLACEMENT, END, RUBBER, XPNDG ROD,CS6 SENS

Communication Parts	
9000-0080	ANTENNA, EXT, 4G/3G, MOLDED, 12FT, SMA (9000-ECHO or 9000-ECHO-4VZ)
509154	EXTENSION, ANT, 16FT, SMA F-M, LLC200A CABLE (For 9000-0080 ANTENNA)
509155	EXTENSION, ANT, 49FT, SMA F-M, LLC200A CABLE (For 9000-0080 ANTENNA)
3800-0162	KIT, ANTENNA, ATI SLIM, SMA/TNC (9000-ECHO)
3800-0163	KIT, ANTENNA, SMARTEQ MINI-WING, SMA/TNC (9000-ECHO)
3800-0193	KIT, ANTENNA, ATI MINI-WING, SMA/TNC (9000-ECHO)
507165	EXTENSION, ANT, 15' SMA Female to SMA MALE (9000-ECHO)
507168	EXTENSION, ANT, 50' SMA Female to SMA Male (9000-ECHO)
507181	SIM CARD, WIRELESS GSM (9000-ECHO)
509141	4GLTE-M SIM CARD, 2FF, VZ, INDUSTRIAL (9000-ECHO-4VZ only)
9000-0028	CABLE, ASSY, USB2TTL, 3.3V, 6FT LONG (9000-ECHO)

Monitor Replacement Parts	
9000-0004	BATTERY PACK, 9-VOLT, RAIII/ECHO
508071	FUSE, MOLDED, 315MA, 250V, TH, SLOW BLOW
509063	TOOL, HEX KEY, T-HANDLE, 9"L, 3/32
509076	RETAINER, E-RING, HDUTY, 3/8" SHAFT

Index