

ADS® RainAlert III™

Installation, Operation, and Maintenance Manual

August 2022

QR 775030 A6



**ADS ENVIRONMENTAL
SERVICES®**

340 The Bridge Street, Suite 204
Huntsville, Alabama 35806
(256) 430-3366
www.adsenv.com

© 2016 ADS® LLC. All rights reserved.

ADS®, **ADS Environmental Services®**, and **Accusonic®** are registered trademarks of ADS LLC.

RainAlert III™, **Qstart™**, and **FlowView™** are trademarks of ADS LLC.

Microsoft® and **Windows®** are registered trademarks of Microsoft Corporation.

Telit® is a registered trademark of Telit Communications PLC.

All other brand and product names are trademarks or registered trademarks of their respective holders.

Notice of Proprietary Information

The information contained herein represents the latest information available at the time of publication. ADS LLC reserves the right to make any changes or modifications to the content of this document, without notice, to reflect the latest changes to the equipment. No part of this document may be reproduced in any form without the written consent of ADS LLC.

Table of Contents

CHAPTER 1 Introduction

FCC Part 15 and Industry Canada Compliance.....	1-2
Wireless Notice	1-2
Cellular Modem Information and Compliance	1-4
Installation and Configuration.....	1-5
Product Warranty	1-6
New Product Warranty.....	1-6
Out-of-Warranty Product Repairs	1-7
Troubleshooting Fee	1-7
Shipping	1-7
Service	1-8

CHAPTER 2 System Overview

ADS RainAlert III Monitor	2-3
Printed Circuit Board	2-5
Communications	2-7
Power	2-7
Tipping Bucket.....	2-9

CHAPTER 3 Configuration and Activation

Configuring the Monitor Location	3-2
Launching the <i>Qstart</i> Software	3-2
Setting Up the <i>Qstart</i> Parameters.....	3-4
Creating a Monitor Location.....	3-7
Selecting and Editing Devices	3-9
Activating the Monitor	3-26
Configuring the Modem Power Parameters	3-28
Collecting Data from the Monitor	3-32

CHAPTER 4 Hardware Installation

Investigating Site Characteristics	4-3
Gathering the Parts and Supplies.....	4-4
Gathering the Tools and Equipment.....	4-5
Installing the Sun Shield	4-6

Securing the Sun Shield	4-6
Mounting the Sun Shield to a Pole.....	4-7
Mounting the Tipping Bucket	4-12
Leveling and Calibrating the Tipping Bucket	4-23
Leveling the Tipping Bucket.....	4-23
Performing a Tip Test	4-26
Installing the RainAlert III	4-28
Installing the Monitor in the Sun Shield	4-29

CHAPTER 5 Communication

Connecting Directly to the Monitor	5-2
Cellular-Based Wireless Communication	5-4
Setting Up Wireless Communication	5-6
Activating the SIM Card	5-7
Installing the SIM Card.....	5-9

CHAPTER 6 Modbus

Establishing a Modbus Connection.....	6-2
Setting Up a Wireless Connection	6-2
Configuring the Monitor for Modbus Applications	6-4
Modbus Data Registers	6-5
Register Addresses for Entity Data	6-5

CHAPTER 7 Maintenance and Troubleshooting

Maintaining the System Components.....	7-2
Gathering Replacement Parts and Supplies.....	7-2
Inspecting the Monitor	7-3
Checking the Tipping Bucket.....	7-11
Checking the Antenna Cable.....	7-12
Replacing the SIM Card in the Monitor.....	7-12
Interpreting the LEDs on the PCB	7-18
Viewing Monitor Activity Logs.....	7-20
Upgrading the Monitor Firmware	7-22
Upgrading Modem Firmware (p/n 9000-RA3-4VZ only)	7-24
Running Diagnostics on the Rain Device.....	7-27
Troubleshooting	7-29

General Monitor Problems.....	7-31
General Communication Problems	7-33
General Tipping Bucket Problems	7-35

APPENDIX A Specifications

ADS RainAlert III Monitor (p/n 9000-RA3-3GL, 9000-RA3-4VZ)	A-1
Printed Circuit Board (ADS p/n 9000-0001-01)	A-3
Tipping Buckets (ADS p/n 6000-0054/55/56/57/63-M/64/M).....	A-5

APPENDIX B Part Numbers

APPENDIX C External Antenna

APPENDIX D External Power

Installation.....	D-2
Mounting the Recommended Power Supply	D-3
Wiring the AC Power Source to the Recommended Power Supply	D-7
Wiring the Power Supply to the Monitor	D-10
Connecting the External Power Wires to the Monitor.....	D-13
Final Instructions	D-15

INDEX

CHAPTER 1

Introduction

The *ADS® RainAlert III™* monitor provides rainfall data acquisition and intelligent alarming to support wastewater capital improvement, operations and maintenance, and regulatory programs. Applications include infiltration and inflow studies, hydraulic modeling, and overflow response and reporting. These capabilities are essential to providing ongoing oversight and ensuring timely notification and rapid response in critical situations.

The battery-powered, microprocessor-based RainAlert III monitor displays exceptional accuracy and reliability in measuring rainfall, even under the most inclement weather conditions.

Two versions of the RainAlert III monitor are available representing different communication capabilities. The 9000-RA3-4VZ utilizes the Verizon wireless 4G LTE-M communication network over a private VPN network. The 9000-RA3-3GL utilizes the previous generation 3G wireless network.

This manual offers detailed instructions on installing and operating the RainAlert III monitor and the associated tipping bucket, providing (wireless and direct, on-site) communication with the monitor, and performing routine maintenance and troubleshooting on the system. It also includes a system overview, general information on obtaining power from an external source, detailed specifications for the system, and a list of general, optional, and replacement parts associated with the system.

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

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

Cet appareil est conforme aux limites d'exposition aux rayonnements de la IC pour un environnement non contrôlé. L'antenne doit être installée 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
<i>GSM 850/FDD V</i>	<i>5.22 dBi</i>
<i>PCS 1900/FDD II</i>	<i>3.31 dBi</i>
<i>FCC IV</i>	<i>6.45 dBi</i>

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

ME910C1-NV (4 G 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 être 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 RainAlert III and an antenna in the RainAlert enclosure. Antenna options are available through ADS for the RainAlert III with a UMTS/HSPA+/GSM modem and the RainAlert III with a 4G LTE Cat M1 modem. However, customers 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 RainAlert III communications and compliance.

Installation and Configuration

Following is the general procedure for installing and configuring a RainAlert III monitor. *Refer to Chapters 3 through 5 for more details.*

- **Investigate the Site Characteristics**
- **Set the *Qstart*™ Parameters**
- **Activate the SIM Card**
- **Install the SIM Card (9000-RA3-3GL only)**
- **Establish On-Site Communication with the Monitor**
- **Configure the Monitor (*using Qstart Software*)**
 - Create the Monitor Location
 - Select and Edit the Devices
- **Activate the Monitor (*using the Qstart Software*)**
- **Install the Tipping Bucket and the Monitor**
- **Perform Tip Test and Run Diagnostics (*using the Qstart Software*)**
- **Verify Wireless Communication with the Monitor**

Product Warranty

This section includes the warranty information for the ADS RainAlert III.

New Product Warranty

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

Out-of-Warranty Product Repairs

After the new product warranty expires, a product may be returned, at the owner's prepaid expense, to ADS for repair. The owner will pay for all parts and labor associated with the repair. Any repair part will be covered by the new product warranty for 90 days from the date of shipment from ADS.

Troubleshooting Fee

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

Shipping

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

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

Service

For ADS Customers

For service or warranty issues, please contact ADS customer support:

1-8 ADS RainAlert III Manual

Telephone: 1-877-237-9585 (U.S. Customers), 256-430-6234
(customers outside the U.S.)

Email: adssupportcenter@idexcorp.com

CHAPTER 2

System Overview

The ADS[®] RainAlert III[™] monitor measures rainfall using a tipping bucket containing a funnel and a small tipping mechanism that can collect a specific amount of rainfall. Once the tipping mechanism is full, it empties and records that a tip has occurred. Typically, each tip is equivalent to 0.01 inches (or 0.2 mm) of rainfall. The monitor records the number of tips that occur over a specified period of time to calculate rainfall amounts and to determine whether to initiate an alarm during a rain event.

The monitor records rain data at a defined time interval and/or each time a tip occurs (based on the system configuration). The monitor can store this data in memory and/or use the data to generate an alarm. The monitor memory can store approximately 2 years of data logged at a 5-minute sample rate. This data is available to the user for collection, further processing, analysis, and reporting.

The RainAlert III monitor is designed for use in indoor or outdoor environments. The monitor can be seated directly on most surfaces indoors or outdoors. The monitor also can be secured in a recommended enclosure that offers protection against the sun and inclement weather called a sun shield. The tipping bucket can be mounted on a rooftop or other structure or secured directly to the top of the sun shield protecting the monitor. The sun shield can be installed on a rooftop, the ground, or another suitable surface or mounted to a pole.

Communication between the monitor and the user's office or field computer can occur over 3G/4G cellular (remote, wireless

communication) 4G LTE-M (remote, wireless) on the ADS VPN or a direct USB connection cable (on-site communication).

ADS's **Qstart**[™] software enables the user to configure and communicate with the monitor for activation, data collection, and diagnostic purposes. Configuration involves defining the location information file (LIF) for storage in the user's local directory and building the code and variables for the site. The LIF contains information such as monitor identification, selected devices, alarm/event notification settings, data log rate, and other parameters necessary for measuring rain both accurately and efficiently.

Activation involves downloading the site-specific installation parameters from the LIF to the monitor. It also includes initiating monitor activities such as logging rain data and managing event notification and alarming.

Qstart also enables the user to process the rain data, generate graphs and tables, organize data in the user's local directory, and maintain logs of communication between the monitor and the user's PC.

Note: Refer to the **Qstart** online help for more information.

ADS RainAlert III Monitor

The ADS RainAlert III monitors (ADS p/n 9000-RA3-4VZ or 9000-RA3-3GL) are a weather-resistant, rectangular, composite enclosure housing a printed circuit board, an alkaline battery pack, and an internal antenna for wireless communication.



RainAlert III monitor

A cable gland located on the side of the RainAlert III provides entry to the enclosure for the tipping bucket/external power cable. A replacement gland also is available for offering additional access for an external antenna cable.



Cable gland for tipping bucket/external power cable

A pressure equalizing vent on the side of the enclosure allows air to pass to equalize internal pressure, while maintaining a seal to block liquid water and maintain ingress protection of the enclosure.

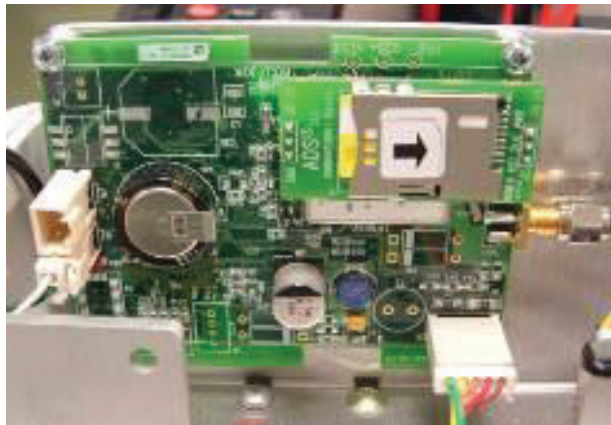


Pressure equalizing vent

Printed Circuit Board

The circuit board, secured inside the monitor enclosure, supports the following:

- Microprocessor Unit (CPU)
- Digital Counter
- UMTS/HSPA+/GSM Wireless Communications
- Voltage Regulation



Printed circuit board (PCB)

Microprocessor Unit (CPU)

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

- Scanning the tipping bucket counter to retrieve and store data
- 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™, or an FTP server
- Initiating event and alarm notification

The CPU allocates portions of memory to firmware and data storage. Light-emitting diodes (LEDs) located on the board indicate the monitor communications and operational activity. The CPU also includes the monitor clock, random access memory (RAM), and Flash. The monitor uses RAM while taking readings and processing the rain data. The RAM then downloads the data to Flash, *or non-volatile memory*, which also stores the monitor firmware and configuration information. Flash ensures the monitor maintains the data during battery pack replacement or a power failure.

Digital Counter

The digital counter on the board records the number of tips processed through contact closures from the tipping bucket. For *Synchronous* storage, the CPU requests the cumulative number of tips from the counter, calculates the number of tips that have occurred since the last reading, and stores the data in the monitor memory. For *Asynchronous* storage, the CPU logs the time at which each tip occurs (at a one-second resolution) as well as cumulative data at the synchronous storage rate.

Communications

The communications element of the board provides multi-tasking/handling of all communications processes. It interfaces with a wireless modem, as well as manages local direct connection communication requests. The communications component is also responsible for gathering real-time information from the other components on the board.

Voltage Regulator

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

Communications

The RainAlert III performs remote, wireless communication via a third-party , FCC- and carrier-approved, commercial UMTS/HSPA+/GSM modem or 4G LTE Cat M1 modem and antenna inside the RainAlert III monitor.

Local communication with all RainAlert III monitors is available by attaching a direct connection cable to a connector port on the PCB inside the monitor enclosure.

Power

The ADS RainAlert III 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.

The RainAlert III also is equipped to receive power from an external source through the tipping bucket/external power cable.



RainAlert III 9-volt battery pack

Tipping Bucket

The RainAlert III monitor uses a tipping bucket (ADS p/n 6000-0054/55/56/57/58/59/60/63/64) containing a funnel and tipping mechanism to collect rainfall. When the tipping mechanism becomes full, it empties and closes a contact to register a tip on the digital counter located in the RainAlert III monitor.



Tipping bucket

The tipping bucket attaches to the top of the ADS sun shield, which can be mounted on a rooftop or other structure or to a pole using a special flange. The RainAlert III installs inside the sun shield.



Sun shield

The RainAlert III also can support any other brand of tipping bucket that issues a contact closure to indicate rain tips. The wires included in the tipping bucket/external power cable accommodate connection of other tipping buckets to the monitor for these applications.

CHAPTER 3

Configuration and Activation

Before installing the ADS[®] RainAlert III[™] monitor and tipping bucket with the sun shield and setting up wireless communication, it is necessary to configure and activate the monitor to begin recording rain data. This chapter contains general instructions on the following activities concerning monitor configuration and activation:

- Setting the communication parameters
- Creating a monitor location
- Selecting and editing devices
- Activating the monitor

This chapter also includes the procedure for collecting data from the monitor and configuring the power savings options for the monitor.

Refer to the ***Qstart**[™] online help* for more detailed instructions on collecting monitor data and configuring, activating, and confirming the monitor.

Configuring the Monitor Location

To ensure the most accurate results for each monitor location, the user must activate the RainAlert III monitor with the proper configuration information to satisfy the specific monitoring needs of the project and to record the desired data. The configuration information includes critical details such as location description, device assignment and parameters, log rates, and other items relevant to the site and project requirements.

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

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

- Creating a monitor location in **Qstart**
- Selecting and editing devices

Note: Initial activation for a new RainAlert III monitor must occur by direct connection with the monitor. (Refer to Chapter 5, *Connecting Directly to the Monitor* for more information.) If remote communication already has been established for the location, these activities can be performed in cooperation between field and office personnel.

Launching the Qstart Software

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

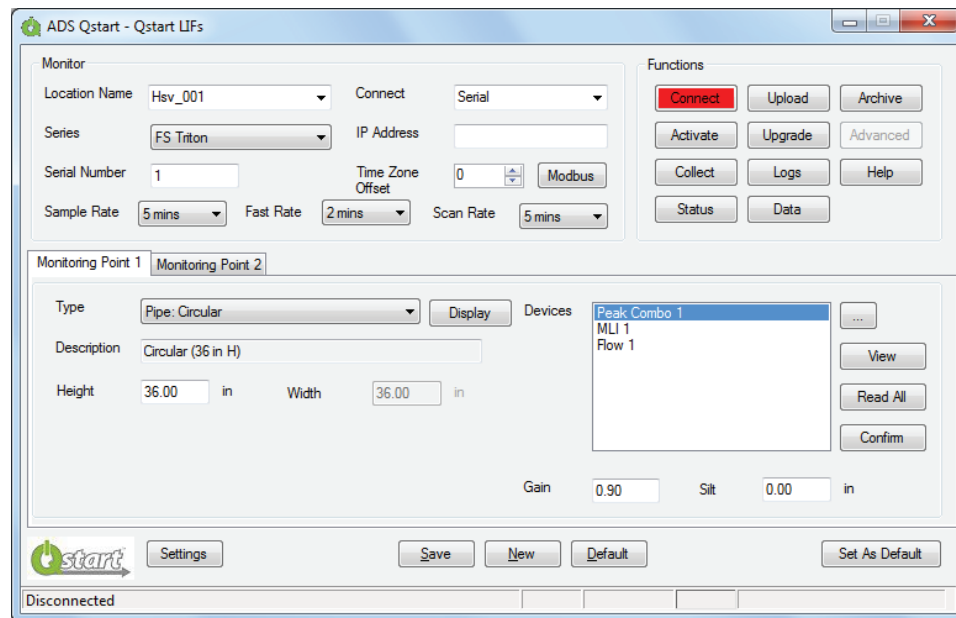
Once installed, launch the **Qstart** software from an office or field computer by selecting **Start > All Programs > ADS LLC > Qstart**

> **Qstart** from the **Microsoft® Windows®** start menu or double-clicking on the **Qstart** icon on the **Windows** desktop.



Qstart icon on desktop

The **Qstart** main screen displays.



Qstart main screen

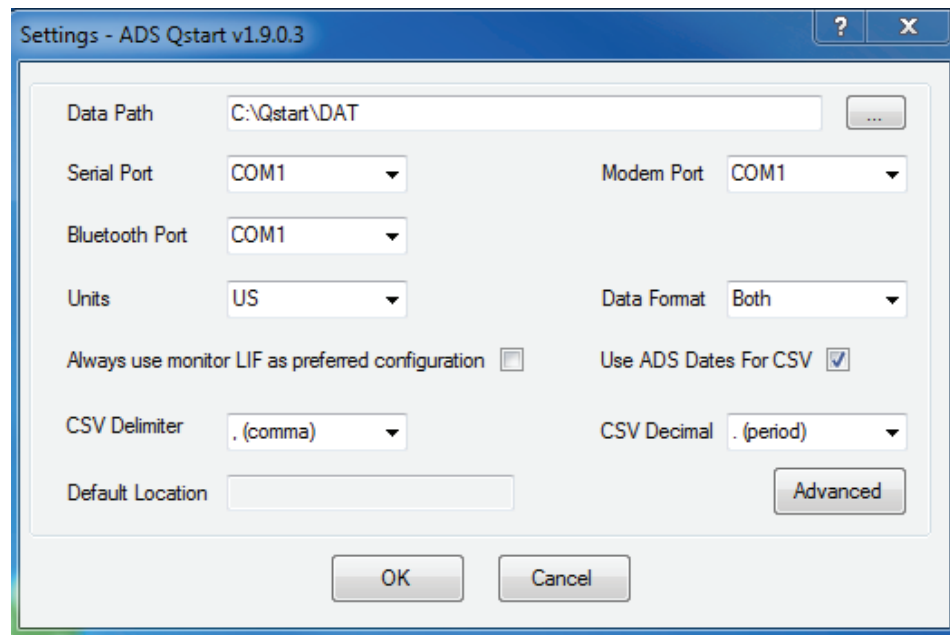
The **Monitor** section displays and allows the user to modify details related to monitor identification, communication, and sampling rate. The **Functions** section includes the capabilities for performing various operations involving the monitor as well as accessing the online help for **Qstart**. The **Monitoring Point** tabs enable the user to view and change various parameters related to rainfall monitoring location. They 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 access to the database information, saving the current parameters to the database, 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. **Qstart** updates fields on the main screen to display the current parameters for the selected location.

Setting Up the **Qstart** Parameters

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



Settings dialog

Complete the **Qstart** settings in the following way:

1. Enter the path or browse to the directory to which you want to save the LIFs and collected rain data in the **Data Path** field.
2. Select the port on your computer through which you will connect directly to the monitor using the direct connection cable from the **Serial Port** drop-down list.

3. Select the units of measure (**US** or **Metric**) you want to use throughout **Qstart** to represent the data when entering values, saving data, and displaying data from the **Units** drop-down list. The **US** units report quantity in MGD, depth in inches, and velocity in feet per second. The **Metric** units report quantity in liters per second, depth in millimeters, and velocity in meters per second.
4. Select the format in which you want 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* the **Bin** and **CSV** file formats.
5. Select the **Always use monitor LIF as preferred configuration** checkbox to ensure **Qstart** automatically overwrites the local configuration with the LIF stored in the monitor memory when an **Upload** is performed. Choosing this option also automatically updates the local serial number with the serial in the monitor (*when an inconsistency exists between the monitor and computer*) whenever communication is established with a monitor.
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, **Qstart** stores the CSV data in the local **Windows**-configured regional date format.
7. Select the appropriate CSV file *column break indicator* you want **Qstart** 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 values 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., 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 you want **Qstart** 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 **Qstart**-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 **Qstart**-generated CSV files. **Qstart** 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 the values included in their CSV files.
9. The **Default Location** field indicates the location **Qstart** will use as a template from which to create all new locations. If you have not designated a default location, clicking **New** will populate the parameters based on **Qstart's** default configuration. This field will remain blank until you designate a default location on the **Settings** dialog.
10. Click on the **OK** button to save the settings from this dialog to the designated local directory or network.

*The ADS **Qstart** main screen displays the default monitor information.*

Note: Access the data, configuration, and communication settings at any time by clicking on the **Settings** button on the **Qstart** main screen.

Creating a Monitor Location

Creating a new location includes entering and setting up the location information as follows:

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

The default parameters for a new location display on the main screen.

Note: If you have not designated or established a *default location*, clicking **New** will populate the parameter fields based on **Qstart's** default configuration.

The screenshot shows the ADS Qstart - Qstart LIFs main screen. The 'Monitor' section is active, displaying the following fields: Location Name (New_Loc), Series (FS Triton), Serial Number (1), Sample Rate (5 mins), Fast Rate (2 mins), and Scan Rate (5 mins). The 'Connect' section shows Serial as the selected connection type, IP Address, Time Zone Offset (0), and Modbus. The 'Functions' section includes buttons for Connect, Upload, Archive, Activate, Upgrade, Advanced, Collect, Logs, Help, Status, and Data. The 'Monitoring Point 1' section shows Type (Pipe: Circular), Description (Circular (36 in H)), Height (36.00 in), Width (36.00 in), Gain (0.90), and Silt (0.00 in). The 'Devices' list includes Peak Combo 1, MLI 1, and Flow 1. The 'Settings' button is visible at the bottom left, and the 'New' button is highlighted at the bottom center. The status bar at the bottom indicates 'Disconnected'.

Qstart 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, you would not use the names

ADSRain10 and ADSRain11, but you could use the names *ADS_Rain10* and *ADS_Rain11*.

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

3. Select **RainAlert III** from the **Series** drop-down list.

Note: You may notice that certain parameters no longer display on the main screen once the **RainAlert III** series is selected. The monitor type currently selected in the **Series** field configuration determines the parameters available for display and/or modification.

4. Enter the serial number for the monitor in the **Serial Number** field.
5. Verify or select the interval at which you want the monitor to log rain data from the **Sample Rate** drop-down list.
6. Select the appropriate method over which you want to communicate with the monitor from the **Connect** drop-down list.

☐ **Serial** Choose this option to communicate on site *directly* with the monitor using a *direct connection cable*.

Note: You must select the **Serial** communications option when performing the *initial* activation for a monitor that will be using wireless communication.

☐ **Wireless** Choose this option for performing wireless communication with the monitor.

7. (*applicable only to 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 not be successful.

8. Click on the **Save** button to save the current parameters to the local directory or network.

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

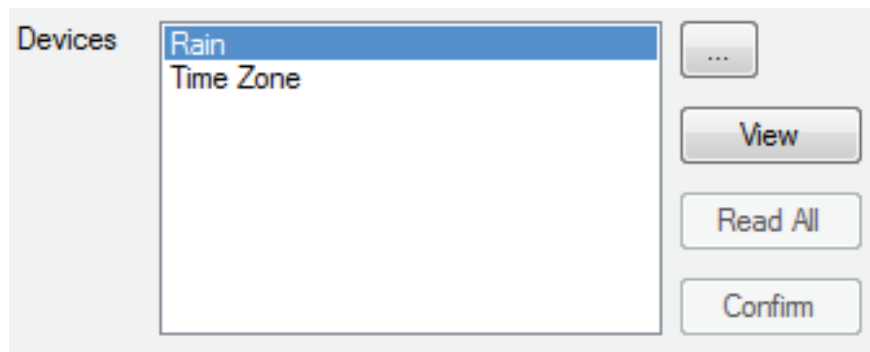
Selecting and Editing Devices

Select and edit the devices corresponding to the new monitor location to log the desired data. Editing the devices involves setting specific parameters to ensure the monitor and **Qstart** properly obtain and process the data. Perform the following steps to properly select and edit devices:

Note: For most applications, the only devices that will require editing are the *Rain* and *Time Zone* devices. The default configuration for *Rain* should suffice unless the project involves a tipping bucket designated for metric measurement or the monitor is configured for sending out alarms. The *Time Zone* device defaults to *Central Standard Time* (CST), so this setting must be adjusted for the time zone in which the RainAlert III and tipping bucket are located.

1. Select the location for which you would like to assign and edit the devices from the **Location Name** field. This process also may involve *deselecting* devices you do not want assigned to the current location.

*The **Devices** dialog displays the devices selected by default (i.e., based on **Qstart**'s or the user's designated default configuration) for a RainAlert III monitor series.*



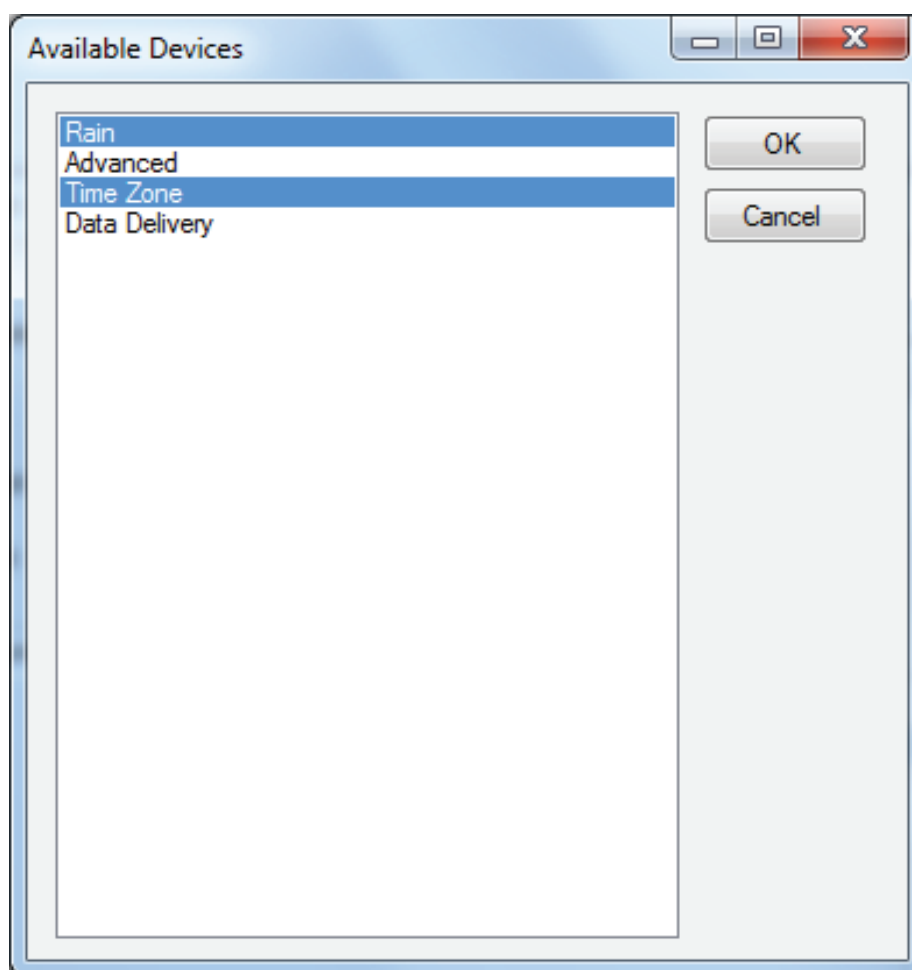
Devices section

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 a RainAlert III monitor.*



Available Devices dialog box

3. Select the devices you want to assign to the current location from the **Available Devices** dialog box. To select multiple devices, press and hold down the **Control (Ctrl)** key on your keyboard while selecting the individual devices. The device must be highlighted in the selection box to ensure **Qstart** includes the device in the LIF. You also can *deselect* the devices you want 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 you want to assign, press and hold down the Shift key, and then click on the last device in the series you want to include.

Note: **Qstart** selects the **Rain** and **Time Zone** devices by default for the RainAlert III monitor.

4. Click on the **OK** button in the **Available Devices** dialog box.

*The selected devices display in the **Devices** list box on the main screen.*

5. Edit the parameters associated with a device in the following way:
 - ☐ Select the device containing the parameters you want to view or modify from the **Devices** list, and then click on the **View** button.

The [location name] – [device name] dialog corresponding to the selected device displays.

- ☐ 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 specific to each device.*
6. Repeat step 5 for each additional device for which you want to modify the parameters, and then click on the **Save** button to save the devices with any parameter modifications to the local directory or network.

Editing the Rain Device

Edit the parameters for rain device in the following way, and click on the **OK** button once complete:

Hsv_009 - Rain

Parameters

Rain Per Tip in

Data Log Mode

Log Intensity ☒

Rain Intensity Interval min

Log UK Intensity ☐

OK

Cancel

Alarm

☐ Enable

Threshold in

Return To Normal in

[location name] - Rain dialog

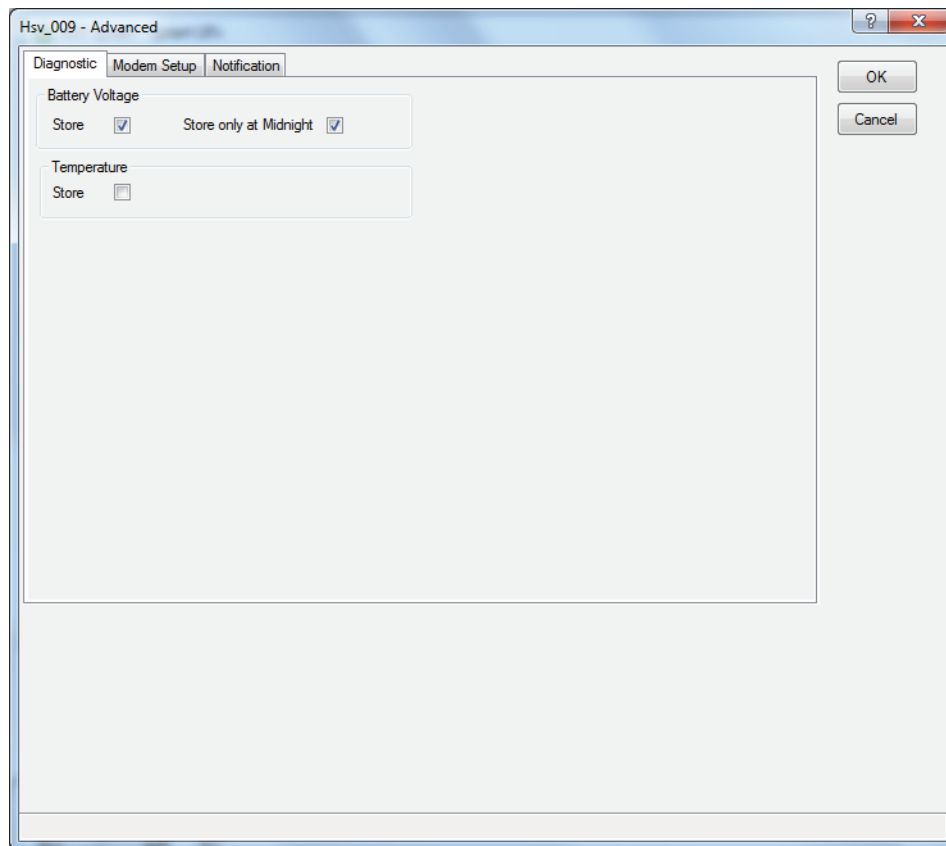
- **Rain Per Tip** Enter the amount of rain that must accumulate in the tipping bucket to initiate one tip of the tipping mechanism. *The default setting is **0.01** inches per tip.*
- **Data Log Mode** Select the method by which the monitor records the rain data.
 - ☐ **Synchronous** Choose this option to ensure the monitor records data based on the sample rate designated on the *Qstart* main screen.
 - ☐ **Asynchronous** Choose this option to ensure the monitor records data each time a tip occurs.

- **Log Intensity** Select this checkbox to ensure the monitor logs the amount rainfall that occurs with the amount of time designated as the **Rain Intensity Interval**.
- **Rain Intensity Interval** Enter the amount of time within which the amount of rain specified as the **Threshold** must fall to initiate a *rain alarm*.
- **Log UK Intensity** Select this checkbox to log the amount of rainfall that occurs over a specified time period based on the standards identified in the United Kingdom.
- **Enable** Select this checkbox to activate the options to edit parameters and to ensure **Qstart** configures the monitor to initiate and terminate an alarm under the rain conditions designated in the **Rain Alarm** section.
- **Threshold** Enter the amount of rainfall that must occur within the amount of time designated as the **Rain Intensity Interval** to initiate an alarm and contact ADS **FlowView™**, an email recipient, and/or a cellular telephone that receives text messages.
- **Return to Normal** Enter the amount of rainfall that cannot be exceeded over the amount of time designated as the **Rain Intensity Interval** to discontinue an existing rain alarm. Under this scenario, the monitor also contacts ADS **FlowView**, an email recipient, and/or a cellular telephone that receives text messages to indicate that conditions have *returned to normal*.

Editing the Advanced Device

Edit the parameters for *Advanced* device in the following way, and click on the **OK** button once complete. This device includes three tabs representing parameters related to diagnostic information, modem setup, and alarm notification.

Diagnostic Tab



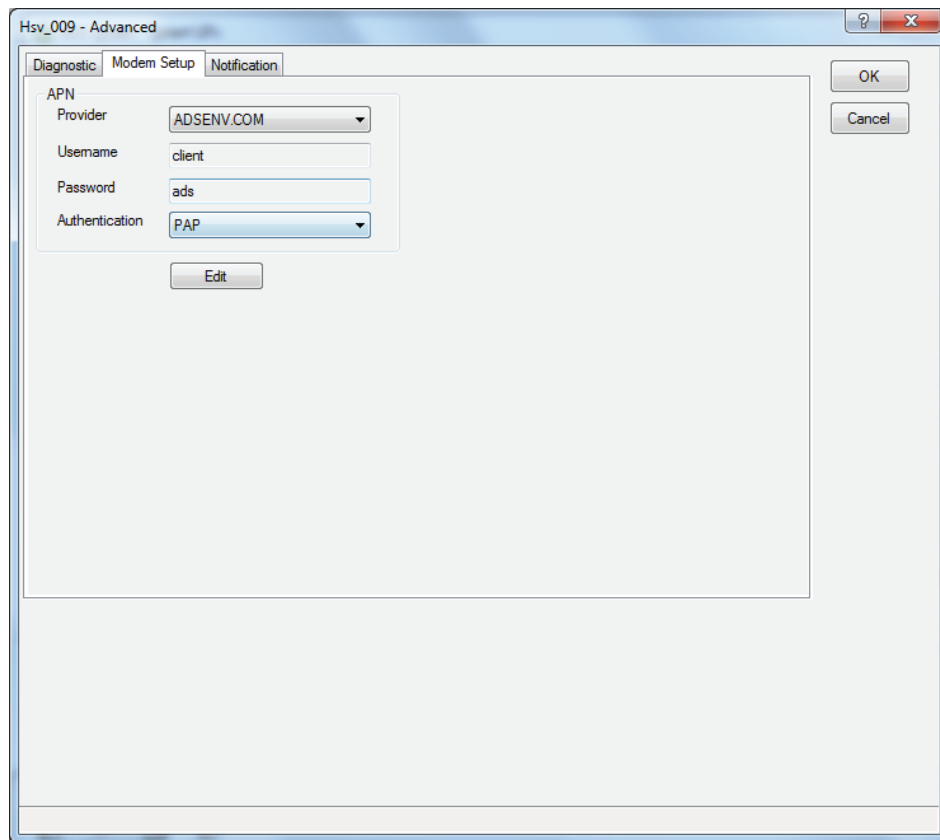
Diagnostic tab on the **[location name] – Advanced** dialog

- **Battery Voltage**
 - ☐ **Store** Select this checkbox to log the monitor's battery voltage at the designated sample rate.
 - ☐ **Store only at Midnight** Select this checkbox to log the monitor's battery voltage at midnight. This option is *selected* by default and should be sufficient for most applications.
- **Temperature**
 - ☐ **Store** Select this checkbox to store the temperature at the monitor location 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 you 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 you 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 on the **[location name] – Advanced** dialog

- **Provider** Select the APN (access point name) 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 your 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 in the following way:
 - ☐ 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.
 - ☐ Enter the proper APN for the carrier *or* edit the existing APN as necessary.

- ☐ Enter or edit the username corresponding to the APN in the **Value 1** field.
- ☐ Enter or edit the password corresponding to the APN in the **Value 2** field.
- ☐ Click on 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 non-editable field displays the username associated with the selected provider (APN).*
- **Password** *This non-editable 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 given to you by your wireless SIM provider. The default selection, **None**, should suffice in most cases.

Notification Tab

Note: The following email and text options of the **Notification** tab **DO NOT** apply to the 9000-RA3-4VZ RainAlert III as the SIM cards in these rain gauges currently do not support email and text directly from the monitor.

The *Notification* device enables the user to configure the RainAlert III monitor to provide rain alarm and event (i.e., low battery voltage) notification for up to 5 email recipients and/or up to 5 cellular phones with text messaging (SMS) capability. The

RainAlert III also can check-in daily with the designated recipients to provide the current battery voltage and other monitor status information.

Edit the **Notification** tab to set up alarm and/or event notification in the following way:

Hsv_009 - Advanced

Diagnostic Modem Setup Notification

Check In
Enable ☐ Hour 12AM

SMTP Information
SMTP Server
SMTP Username
SMTP Password
Sender Address RainAlert@adsmonitors.com

SMS
Recipient 1 Start Hour 12AM End Hour 11PM
Recipient 2 Start Hour 12AM End Hour 11PM
Recipient 3 Start Hour 12AM End Hour 11PM
Recipient 4 Start Hour 12AM End Hour 11PM
Recipient 5 Start Hour 12AM End Hour 11PM

Email
Recipient 1
Recipient 2
Recipient 3
Recipient 4
Recipient 5
Recipient 5 will receive data delivery on the specified intervals
Normal 1 hr Fast 15 min

OK Cancel

Notification tab on the [location name] – Advanced dialog

- **Check In**

- ☐ **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.
- ☐ **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**

- ☐ **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.

- ☐ **SMTP Username** Enter the user name for the server through which the monitor will send notification to the recipient(s). Contact ADS Client Services for the username associated with the ADS SMTP server, as necessary.
- ☐ **SMTP Password** Enter the password for the server through which the monitor will send notification to the recipient(s). Contact ADS Client Services for password associated with the ADS SMTP server, as necessary.
- ☐ **Sender Address** Enter the designated email address for the monitor from which notification will originate. The default address is *RainAlert@adsmonitors.com*.

- **Email**

- ☐ **Recipient 1 through 5** Enter the email address for each contact (*up to 5*) you want the monitor to notify when an event and/or alarm occurs. The contact designated as **Recipient 5** will receive rain and/or other data automatically from the monitor based on the interval set up for data delivery. Data is included in an attachment and presented in CSV format.
- ☐ **Normal** Select the interval at which you want the monitor to deliver data to **Recipient 5** under normal conditions.
- ☐ **Fast** Select the *increased* interval at which you want the monitor to deliver data to **Recipient 5** following an alarm.

- **SMS**

- ☐ **Recipient 1 through 5** Enter the cellular phone number for each contact (*up to 5*) you want the monitor to notify through a text message when an event and/or alarm occurs.
- ☐ **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.

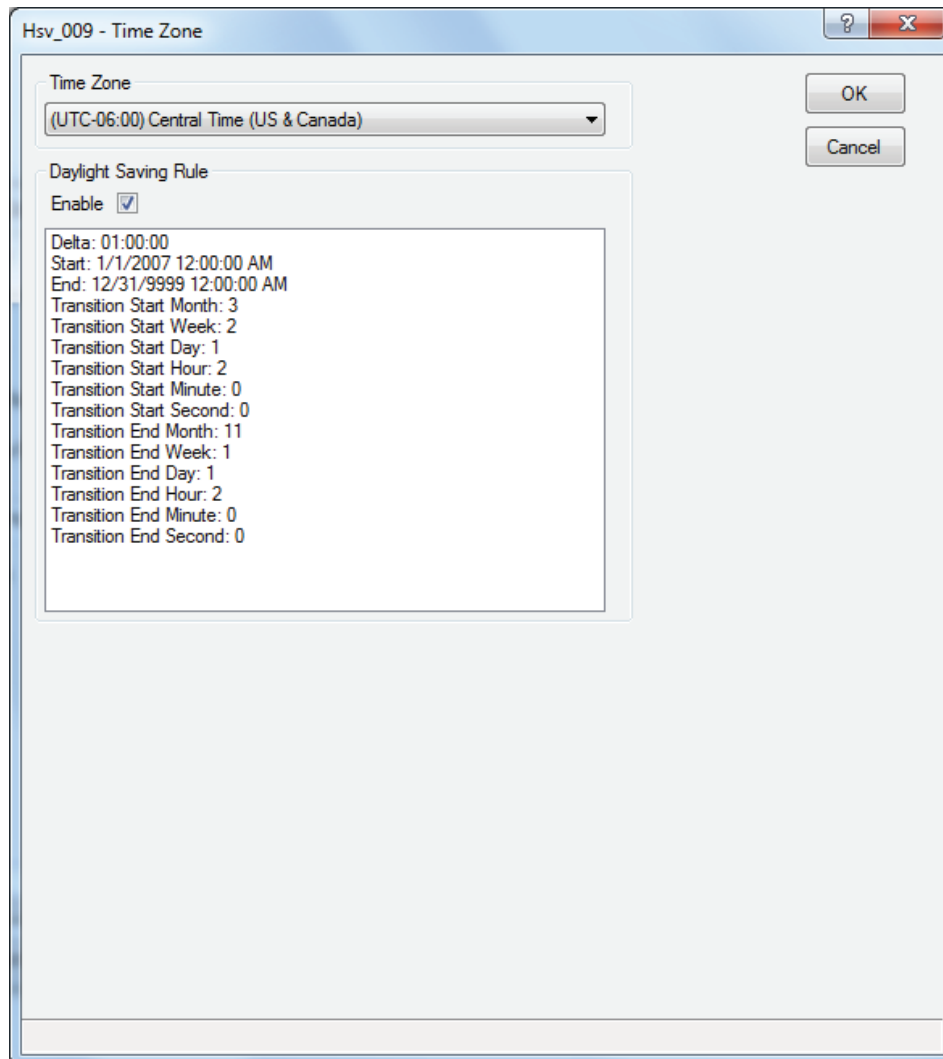
Note: The **Start** and **End Hour** designation for text message notification may be beneficial for organizations that only would want their recipients to receive notification during designated shift or work hours.

- ☐ **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: To ensure 24-hour notification to a recipient, choose **12AM** for the **Start Hour** and **11PM** for the **End Hour**.

Editing the Time Zone Device

Edit the parameters for *time zone* device in the following way, and click on the **OK** button once complete:



[location name] – Time Zone device dialog

- **Time Zone** Select the time zone in which the selected RainAlert III monitor is located.
- **Daylight Saving Rule** Select the **Enable** checkbox to ensure the internal clock in the monitor adjusts throughout the year to account for daylight savings time, based on the details displayed in the text box. *The content in this box is not editable.* It is populated based on the selected time zone.

Editing the Data Delivery Device

The data delivery device enables the monitor to upload rain data stored in the monitor memory to ADS **FlowView** or an FTP server at an interval designated by the user. To upload data to **FlowView** or an FTP, you must know the IP address. To upload data to 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 you want the monitor to place the data.

Edit the parameters for *data delivery* device in the following way, and click on the **OK** button once complete:

The screenshot shows a Windows-style dialog box titled "Hsv_009 - Data Delivery". It contains three distinct configuration sections. The first section, "FlowView", has a "Server" text field, "Normal" and "Fast" interval dropdowns (set to "1 hr" and "15 min" respectively), and a "Mode" dropdown set to "Active". The second section, "FTP Setup 1", includes "Normal" and "Fast" interval dropdowns, a "Mode" dropdown set to "Active", and text fields for "Server", "Folder", "Username", and "Password". It also has a "CSV Format" dropdown set to "ADS". The third section, "FTP Setup 2", mirrors the structure of "FTP Setup 1" with identical field types and values. On the right side of the dialog, there are "OK" and "Cancel" buttons. The dialog box has a standard Windows title bar with a question mark icon and a close button.

[location name] – Data Delivery device dialog

- **FlowView**

- ☐ **Server** Enter the ADS **FlowView** server address where the monitor will deliver data (13.82.147.226). This address may change in the future. If the monitor does not deliver data as expected, contact ADS Client Services to verify the IP address.
- ☐ **Normal** Select the interval at which you want the monitor to deliver the 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.
- ☐ **Fast** Select the *increased* interval at which you want the monitor to deliver the data under *alarm* conditions.

- **FTP Setup 1**

- ☐ **Mode** Select the appropriate port assignment (**Active** or **Passive**) for the FTP server. Contact the *FTP server administrator* for assistance in determining the proper status.
- ☐ **Normal** Select the interval at which you want the monitor to deliver data to the FTP server 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.
- ☐ **Fast** Select the *increased* interval at which you want the monitor to deliver data to the FTP server under *alarm* conditions.
- ☐ **Server** Enter the address for the FTP server on which you want the monitor to deliver the data.
- ☐ **Folder (optional)** Enter the name of the folder at the FTP site in which you want the monitor to upload the data.

Note: *Qstart* will not create a folder on the FTP server automatically. Therefore, if you want the monitor to deliver the data to a specific folder, you must create the folder through the FTP server manually before the monitor begins uploading the data to the server. If you do not designate a specific folder for the data, the monitor will upload the data to the FTP server's root directory.

- ☐ **Username** Enter the username the monitor must use to access the FTP server.
- ☐ **Password** Enter the password associated with the username the monitor must use to access the FTP server.
- ☐ **CSV Format** Select the option corresponding to the type and format of the data you want the monitor to upload to the FTP server.
 - **ADS** Choose this option to deliver *all* of the entity data from the monitor to the designated FTP server.
 - **ADSCore** Choose this option to deliver *all* of the entity data from the monitor to the designated FTP server.

Note: Although the **ADS** and **ADSCore** options currently deliver essentially the same entity data, ADS recommends choosing the **ADSCore** option to receive *all* entity data.

- **GE** Choose this option to deliver only *rain* entity data in the *GE CSV format*.
- **FTP Setup 2** Refer to the instructions for the **FTP Setup 1** parameters to set up an *additional* FTP server (**2**) to which the monitor can deliver data.

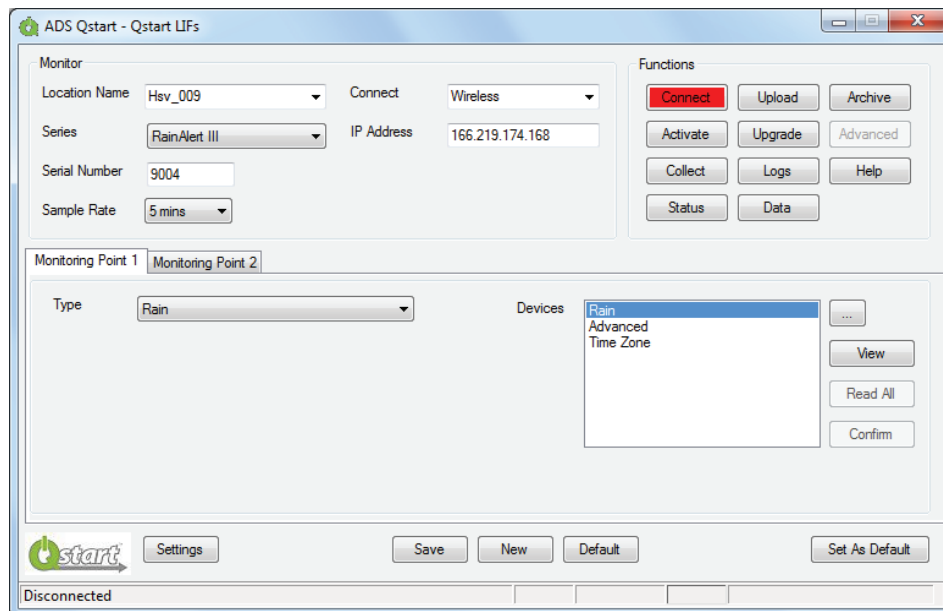
Activating the Monitor

Note: The *initial* activation of a monitor must occur through a direct connection with the monitor. Designate the **Serial** option in **Qstart** for the **Connect** parameter. See *Connecting Directly to the Monitor* in *Chapter 5* for more information.

After configuring the monitor, *activate* the monitor to initiate the rainfall measurement process based on the monitor configuration. Monitor activation involves generating the activation data using the **Qstart** software, downloading this data to the monitor, and initiating rain data measurement and logging. The activation data includes relevant portions of the LIF and other configuration parameters necessary to ensure rain measurement activities reflect the specific site conditions and project requirements. The monitor requires these files and information to properly measure and record rainfall.

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

1. Select the monitor you want to activate from the **Location Name** drop-down list in the **Monitor** section on the **Qstart** main screen.



Qstart main screen

2. Verify that the configuration parameters and communication method (i.e., designated for **Connect**) for the monitor and modify the parameters as necessary.
3. Click on the **Activate** button in the **Functions** section.

***Qstart** initiates and establishes communication with the monitor and then downloads the appropriate information and files. Once activation is complete, the status bar displays an **Activate successful** message. **Qstart** generates an activation event that is available for viewing through the log viewer in **Qstart**.*

4. Continue other activities that require active communication with the monitor *or* disconnect from the monitor by clicking on the **Hangup** button in the **Functions** section.

The local computer disconnects from the monitor.

Note: For all future communications following the initial activation, change the **Connect** designation to **Wireless** to perform *remote* communications.

Configuring the Modem Power Parameters

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

Note: The monitor can continue to issue alarms even when the modem is in *Power Saving* mode.

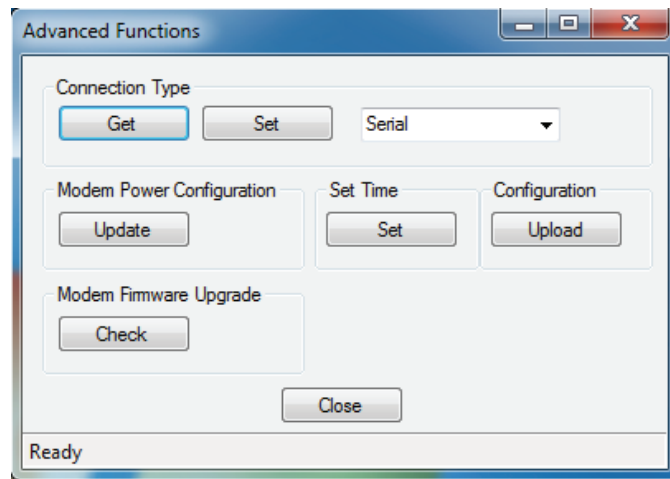
Setting up the modem power option occurs through the **Advanced** function while communicating with the monitor. Configure the modem power parameters for the monitor in the following way:

1. Select the monitor location for which you want to configure the power savings option from the **Location Name** drop-down list, and then click on the **Connect** button in the **Functions** section.

***Qstart** initiates and establishes communication with the monitor. The status bar at the bottom of the **Qstart** main screen indicates **Ready** once a successful connection has been made.*

2. Click on the **Advanced** button in the **Functions** section.

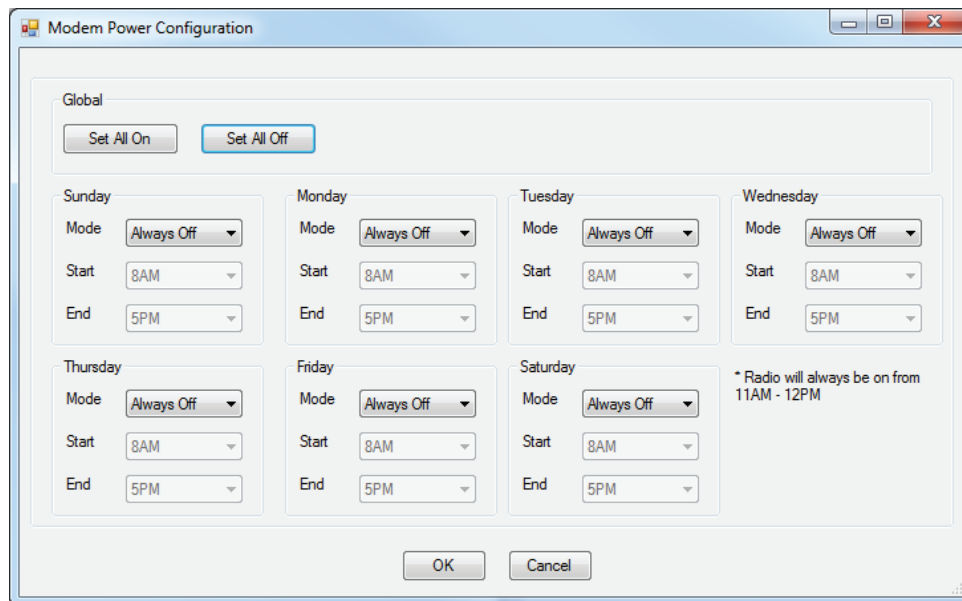
*The **Advanced Functions** dialog displays.*



Advanced Functions dialog

3. Click on the **Update** button for the **Modem Power Configuration**.

*The **Modem Power Configuration** dialog displays the current modem power parameters in the monitor configuration.*



Modem Power Configuration dialog

4. (applicable only when configuring modem power parameters for the entire week at one time) Click on one of the following buttons to represent the setting you want the monitor to apply for power saving for all seven days of the week:

- ☐ **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.

*The **Always On** option displays for the **Mode** on all 7 days, resulting in no designated power saving to the monitor.*

- ☐ **Set All Off** Choose this button to configure the monitor to provide power to the modem *only* from 11:00am to 12:00pm each day of the week. The monitor will *withhold* power from the modem at *all other times*.

Note: This option offers the *greatest* power savings to the monitor.

*The **Always Off** option displays for the **Mode** on all 7 days, resulting in significant power saving to the monitor.*

5. (applicable only when configuring different modem power parameters for each day of the week) Select one of the following methods you want the monitor to use when applying power saving for each individual day of the week from the **Mode** drop-down list. You must complete this step for each day of the week. *Some modes may require designating a corresponding time range.*

- ☐ **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.
- ☐ **Always Off** Choose this option to configure the monitor to provide power to the modem *only* from 11:00am to 12:00pm on that day, offering the most significant power saving available within that day.
- ☐ **Span On** Choose this option to configure the monitor to provide *uninterrupted* power to the modem for the time period designated in the associated **Start** and **End** fields. Select the time at which you want the monitor to *begin* powering the modem on the corresponding day from the **Start** drop-down list. Then, select the time at which you

want the monitor to *discontinue* powering the modem on that day.

- ☐ **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 you want the monitor to *discontinue* powering the modem on the corresponding day from the **Start** drop-down list. Then, select the time at which you want the monitor to *resume* powering the modem on that day.

6. Click on the **OK** button to save the modem power parameters to monitor.

*The **Advanced Functions** dialog displays.*

7. Click on the **Close** button to exit the **Advanced Functions** dialog.
8. Click on the **Hangup** button in the **Functions** section on the **Qstart** main screen.

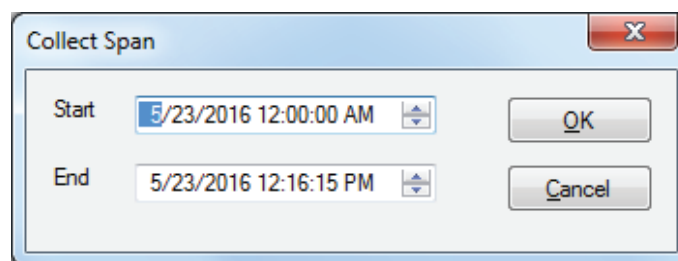
Collecting Data from the Monitor

Qstart enables you to collect data from the monitor on demand or on a schedule based on the available hardware and communication configuration. *On-demand* data collection is available from monitors equipped with SIM cards having *static* IP addresses through *wireless, remote communication* or monitors equipped with SIM cards having either *static or dynamic* IP addresses *on-site* through a direct connection cable (ADS p/n 9000-0028). Collecting data *remotely* from monitors using SIM cards with *dynamic* IP addresses occurs through an FTP server at a pre-defined interval using the Data Delivery device.

The procedure described in this section applies only to data collection occurring on-demand. Collect data in the following way:

1. Select the monitor from which you want to collect data from the **Location Name** drop-down list in the **Monitor** section on the **Qstart** main screen.
2. Click on the **Collect** button in the **Functions** section.

The **Collect Span** dialog displays.



Collect Span dialog

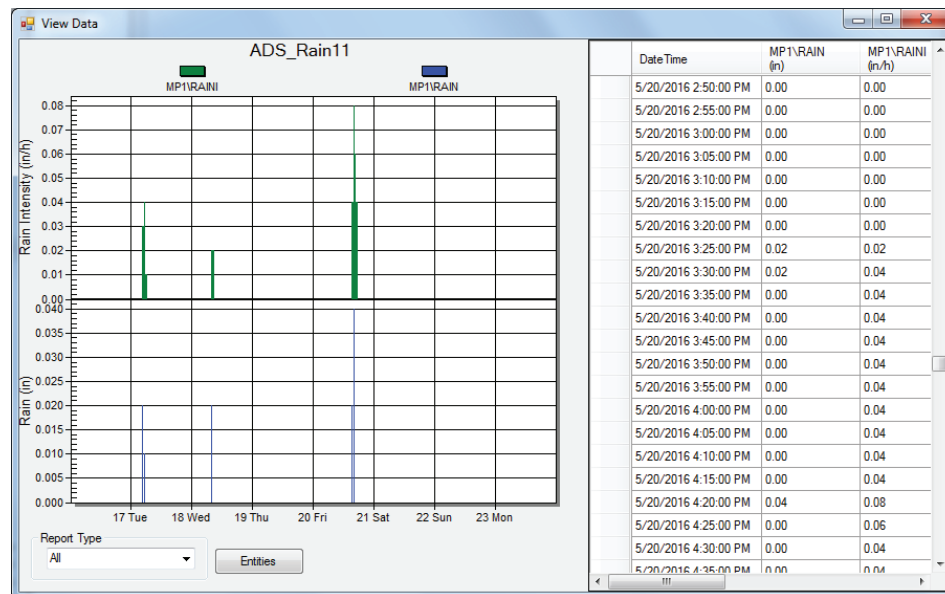
3. Designate the date and time from which you want to begin collecting data from the monitor in the **Start** field. **Qstart** defaults to a start date and time one second past the last data point stored in the local or network directory for the current location. Edit a particular value in the **Start** 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.

4. Designate the date and time up to which you want to begin collecting data from the monitor in the **End** field. **Qstart** 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.
5. Click on the **OK** button.

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

Note: You can discontinue the data collection process at any time by clicking on the **Abort** button.

The **View Data** dialog displays.



View Data dialog

6. View the data in tabular or graphical format on the **View Data** dialog. Modify the graph based on the time period and entities in the following way:
 - ☐ Select the amount of data you want to display on the graph at one time by selecting the appropriate option from the Report Type drop-down list (**All**, **Day**, **Week**, or **Month**).
 - ☐ Limit the entities that display on the graph by clicking on the **Entities** button, selecting the entities you want to display, and clicking on the **OK** button. To select multiple entities, press and hold down the control (**Ctrl**) key while selecting the individual entities. To choose consecutive entities on the list, select the first entity you want to display, press and hold down the **Shift** key, and then click on the last entity you want to include.
 - ☐ 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 data you want to view on the graph to the bottom, right boundary of the data, and then releasing.
 - ☐ Use the scroll bars on the table to navigate to the specific data you want to view. Sort the data in the table by clicking on the heading corresponding to the data you want to sort. Clicking on the **DateTime** heading enables you to switch between viewing the most recent and the oldest data collected from the monitor. Clicking on an entity heading allows you to alternate between viewing the readings in *descending* order (beginning with the highest value) and in *ascending* order (beginning with the lowest value).
7. Close the **View Data** dialog when you are finished viewing the data by clicking on the **x** button at the top, right corner of the dialog.
8. Click on the **Hangup** button in the **Functions** section to discontinue communication with the monitor.

***Qstart** 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. You can view the contents of the entry through the log viewer in **Qstart**. Refer to Viewing Monitor Activity Logs in Chapter 6, Maintenance and Troubleshooting, for more information.*

CHAPTER 4

Hardware Installation

The ADS[®] RainAlert III[™] monitor and tipping bucket can be installed together or separately based on the location and project requirements. Using the ADS sun shield, they have been designed for installation on a rooftop, in an open field, or on any other unobstructed surface. ADS recommends all outdoor installations use the sun shield to maximize the life of the monitor enclosure. The sun shield may be seated on or secured to an appropriate flat surface or secured to a pole. The monitor also may be placed indoors on a flat surface.

Following is the basic procedure for installing the RainAlert III monitor, tipping bucket, and a sun shield at a location. The order of these steps may vary based on the location and application.

Note: ADS recommends establishing communication with the RainAlert III and configuring and activating the monitor before installing the monitor and tipping bucket. Initial communication must occur over a direct connection. For instructions on monitor configuration and activation, refer to *Chapter 3, Configuration and Activation*.

- **Investigate the Site Characteristics** This involves investigating and selecting the appropriate location to install the tipping bucket and monitor.
- **Gather the Parts and Supplies**
- **Gather the Tools and Equipment**

- **Install the Sun Shield** This process involves properly placing the sun shield, securing it to an appropriate structure or surface, or mounting it to a pole, as applicable.
- **Mount and Connect the Tipping Bucket** This step involves mounting the tipping bucket on the sun shield at the designated rainfall collection location and connecting the wires from the monitor to the tipping bucket.
- **Level and Calibrate the Tipping Bucket** This process involves testing and adjusting the tipping bucket and internal tipping mechanism to ensure it accurately measures rainfall amounts.
- **Install the Monitor** This step involves installing the monitor indoors or outdoors using the sun shield at the appropriate location.

Note: Installation may require using ladders to access rooftops and other elevated areas. Therefore, installers and technicians must comply with all federal, state, municipal, and building owner safety regulations 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 activities, conduct a thorough investigation of site conditions to determine the appropriate location to place the tipping bucket and mount the monitor.

Several factors contribute to determining the most practical and appropriate location to mount the equipment. Therefore, consider the following when selecting the most suitable site:

Note: When site investigations require accessing rooftops, always consult with the property owner before accessing the rooftop. You must obtain written permission from the owner or be accompanied by an owner's representative before accessing a rooftop.

- **Communications** When applicable, make sure that wireless communication is available or accessible at the site. Verify the signal strength to ensure a strong, consistent signal.
- **Security** Try to locate the equipment in a location that will prevent or limit easy public access. Consider fenced/secured areas, public buildings, or rooftops. Examples of these may include pump station facilities, wastewater treatment plants, fire/police stations, libraries, or municipal complexes.
- **Accessibility** While some locations, such as rooftops, may be good for security, they may not provide adequate accessibility for installation, calibration, and maintenance activities. Therefore, select a location offering a reasonable level of accessibility.
- **Weather Patterns and Obstructions** Select a location for the tipping bucket that will ensure it can receive rainfall unobstructed, away from any structures or trees that may cause interference. When investigating locations on the ground or open fields, consider the effects of air turbulence on rainfall patterns and any security concerns. For rooftop applications, choose a flat roof, the highest level of a structure, and an elevation that will not be influenced by other nearby structures.

Gathering the Parts and Supplies

Obtain the following parts and supplies for most applications before installing and calibrating the RainAlert III, tipping bucket, and sun shield to prevent any costly delays. When ordering, specify the tipping bucket supporting the RainAlert III monitor.

Quantity	Description	ADS Part Number
1	RainAlert III monitor	9000-RA3-3GL or 9000-RA3-4VZ
1	8-inch tipping bucket	6000-0054 (TB6, standard) 6000-0064-M (TB6, metric) 6000-0055 (TB4, siphoning) 6000-0056 (TB3ST, standard) 6000-0057 (TB3, siphoning) 6000-0063 (TB3, siphoning, metric)
1 or 2	sun shield	9000-0043
1	direct connection cable	9000-0028
1	Pole-mount kit (<i>when securing the sun shield to a pole</i>)	9000-0042
1	Calibration kit (<i>for the tipping bucket</i>)	508139 (314 mls) 508140 (653 mls)

Gathering the Tools and Equipment

Gather the following tools and equipment required to install and calibrate the RainAlert III and an associated tipping bucket:

- 24-inch carpenter's level
- Open-end wrench set (including 1/2- and 3/4-inch sizes)
- Small adjustable crescent wrench
- Flathead and Phillips head screwdrivers (assorted sizes, including 1/8-inch tip flathead)
- Diagonal wire cutters and strippers
- Ladder (*when applicable*)

Installing the Sun Shield

A sun shield (ADS p/n 9000-0043) may be used to install the RainAlert III and tipping bucket together or for installing the equipment at separate locations. The installation procedure may vary based on the equipment that will be installed or secured to the sun shield and whether the installation will involve securing the sun shield to a pole.

For standard applications in safe locations that do not require securing the sun shield to an object, structure, or pole, simply place the sun shield directly on an appropriate surface once the tipping bucket is attached to the sun shield. Select a suitable location to place the sun shield with the monitor and tipping bucket so they will not be adversely affected by existing or potential conditions inherent to the location, such as high winds or vandalism.

For applications that require securing the sun shield to an existing structure, object, or pole, follow the corresponding instructions included in one of the following sections.

Note: 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.

Securing the Sun Shield

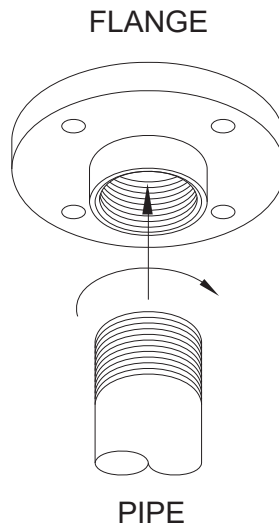
For locations that may experience excessive winds or other elements that could increase the potential for the sun shield to move or fall over once the equipment is installed, ADS recommends securing the sun shield to an existing structure or solid object of substantial weight, such as a brick paver. The object or structure to which the shield will be secured will determine the appropriate fastener to use.

Simply place the sun shield in the desired location or on the appropriate surface, and run the fasteners through the pre-drilled holes in the legs extending from the bottom of the sun shield into the object or structure. Secure the fasteners as recommended by the manufacturer.

Mounting the Sun Shield to a Pole

Pole-mounted applications require a Pole-Mount Kit (ADS p/n 9000-0042) and a 2-inch (51-mm) threaded galvanized pipe (i.e., 2 MPT) of appropriate length. Mount the sun shield to a pole in the following way:

1. Thread the pipe flange (threaded plastic collar) from the Pole-Mount Kit onto the threaded end of the galvanized pipe until it is secure. *Hand-tightening is sufficient.*



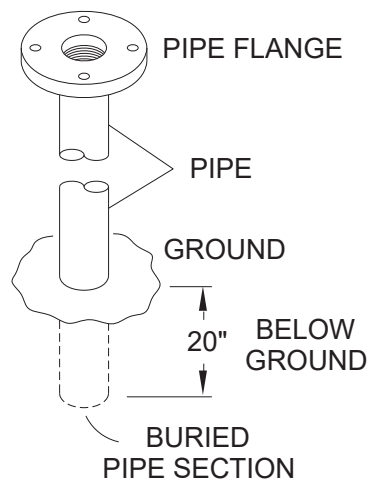
Threading the pipe flange onto the pipe

2. Set the opposite end of the galvanized pipe into the ground with concrete. The pipe should be installed at an elevation to ensure that, once the sun shield is mounted to the pipe and the tipping bucket is attached to the sun shield, the rim of the bucket will be approximately 3 feet (914 mm) above ground level. In addition, the pipe should extend approximately 20 inches (508 mm) into the ground to ensure the stability of the installation

and for protection against high winds. Perform the following before the concrete sets:

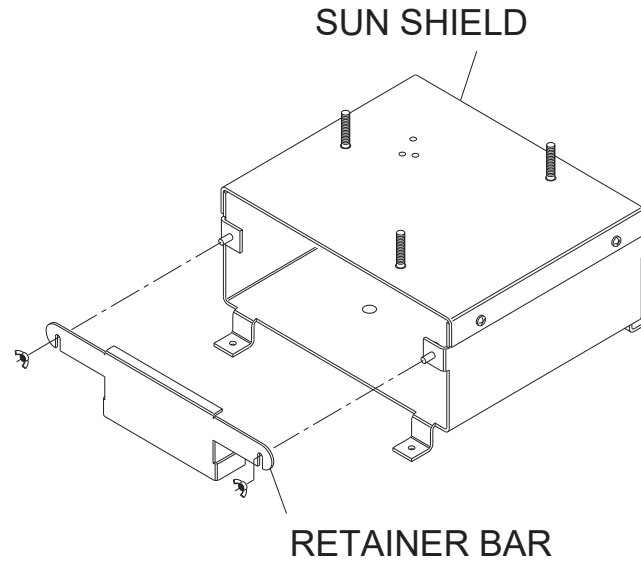
- ❑ Rotate the pipe until the holes in the flange are positioned for the desired placement of the sun shield.
- ❑ Use a carpenter's level to verify the level of the top of the flange. This will expedite the process for leveling the tipping bucket once installed on the pole.

Note: Allow adequate time for the pipe to set in the concrete before attempting to attach the sun shield to the flange.



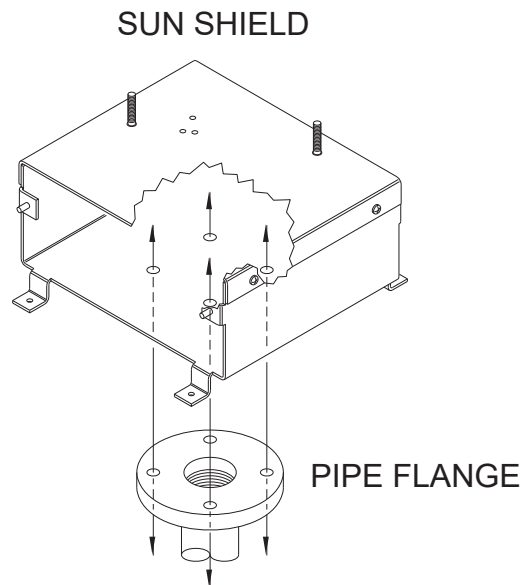
Pole with pipe flange installed in the ground

3. Loosen or remove the wing nuts securing the retainer bar to the front of the sun shield, and then slide the bar off the threaded posts. Lay the retainer bar aside.



Sliding the retainer bar off the front of the sun shield

4. Set the sun shield on top of the pipe flange, aligning the four pre-drilled holes on the bottom of the shield with those in the flange.

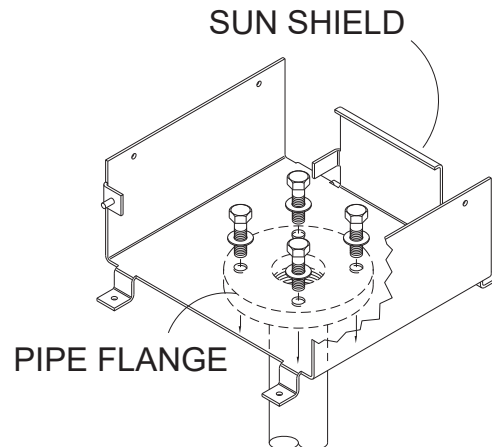


Aligning holes of pipe flange with holes in bottom of sun shield

5. Slide a flat washer onto each of the bolts and insert each bolt from the inside of the sun shield down through one of the four

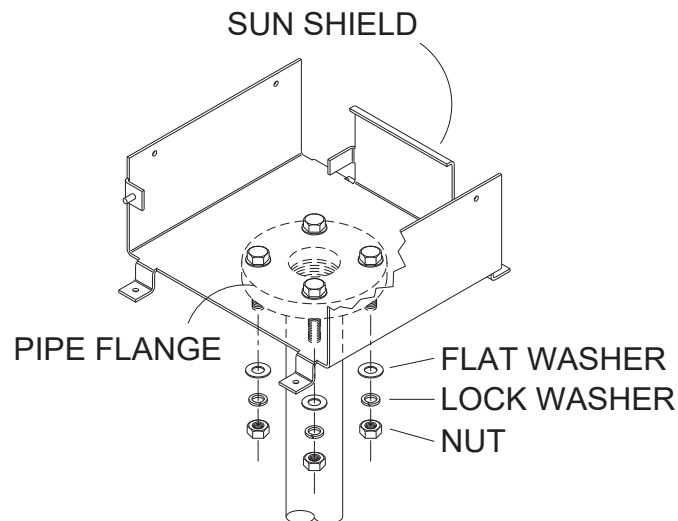
pre-drilled holes in the bottom of sun shield and the pipe flange.

Note: The nuts, bolts, and washers referenced in this and the following step are included in the *Pole-Mount Kit*.



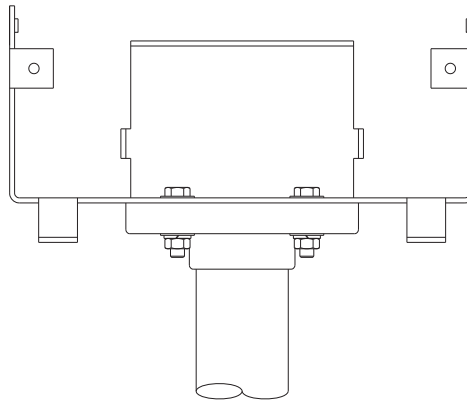
Inserting the bolts with washers through the bottom of sun shield and pipe flange

6. Slide a flat washer and a split lockwasher and thread a nut onto each of the four bolts now extending down from the flange.



Using flat washers, lock washers, and nuts to secure the sun shield to the pipe flange

7. Tighten the nuts using a $\frac{3}{4}$ -inch wrench until snug. *Do not overtighten.*



Sun shield secured to pipe flange (front view)

Mounting the Tipping Bucket

Once the sun shield is installed, the next step involves mounting the tipping bucket to the sun shield. This section primarily includes instructions for a *standard* installation in which the hardware has been obtained through ADS and the RainAlert III and tipping bucket are installed using the sun shield at the same location. For *non-standard* installations that may involve alternative installation methods, equipment provided through other vendors, or hardware installed at separate locations, consider the following when performing the installation:

- **Legacy or Vendor-Supplied Tipping Buckets** Some installations may involve tipping buckets offered previously through ADS or from other vendors. Consult ADS or the tipping bucket manufacturer for instructions on installing tipping buckets other the buckets currently available through ADS. In addition, connecting the tipping bucket previously available through ADS (p/n 103202x) to the RainAlert III requires a special kit (ADS p/n 9000-0045) that includes a cable that runs between the tipping bucket/external power cable and the older tipping bucket.
- **Alternative Mounting Methods** Although ADS offers a sun shield with the necessary hardware to secure the tipping bucket, you also can implement your own tipping bucket mounting scheme, when necessary. Tipping bucket vendors offer several different options for securing their buckets to walls, poles, and other surfaces. Please consult ADS for further guidance when considering other mounting options.
- **Separate Hardware Installation Locations** When the application involves installing the tipping bucket and monitor at different locations, the monitor must be retrofitted with a longer cable (available through ADS) and a proper route must be established for running the cable to the tipping bucket to the monitor location. Consider the following for the cable route:

- ❑ Always obtain permission for the cable route from the property owner, when applicable.
- ❑ Prepare the route and run the cable according to the property owner's specifications.

Note: 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.

For a standard installation, mount the tipping bucket and connect the tipping bucket/external power cable (from the monitor) to the tipping bucket in the following way:

1. Thread a ½-inch nut (*included with the sun shield*) onto each of the threaded studs extending up from the top of the sun shield until they are within ¼ inch of the top of the sun shield. Then, place a washer (*also included with the sun shield*) onto each of the studs so that they are seated on top of the nuts.



Nuts with washers threaded onto studs on top of the sun shield

2. Loosen or remove the wing nuts securing the retainer bar to the front of the sun shield, and then slide the bar off the threaded posts.



Loosening wing nut on front of sun shield



Sliding the retainer bar off the front of the sun shield

3. Run the tipping bucket/external power cable (coming from the RainAlert III) from the inside of the sun shield up through the appropriate pre-drilled hole on the top of the sun shield (i.e., the hole that exists toward the rear left). Pull enough of the cable through the hole (approximately 8 to 9 inches (203 to 229

mm)) to have adequate slack to secure the cable to the sun shield with a cable tie and run the tipping bucket wires (i.e., the green and white wires) up through the bottom of the tipping bucket to the terminal block for connection.

Note: When installing the RainAlert III and tipping bucket in the same location using the pole mount option, consider placing the monitor inside the sun shield before inserting the cable through the sun shield. This will prevent you from having to balance or hold the monitor while running the cable, which could result in damage to the monitor. Refer to *Installing the Monitor in the Sun Shield* on page 4-29 for detailed instructions.



Running tipping bucket/external power cable up through top of sun shield

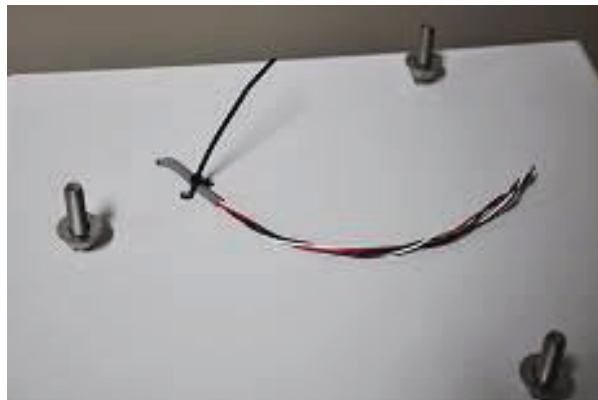
4. Secure the cable to the top of the sun shield by running a cable tie through the two remaining predrilled holes and around the gray-colored cable jacket. About 3 inches (76 mm) of the cable should extend beyond the cable tie. *Do not use the cable tie to secure the loose wires!* Snip off any excess cable tie length once secured.



Running cable tie through remaining holes in top of sun shield



Laying tipping bucket/external power cable between holes



Cable tie securing the tipping bucket/external power cable to the sun shield



Excess cable tie length removed after securing cable

Note: When the RainAlert III will be installed in the same location as the tipping bucket, consider placing the monitor into the sun shield for safe-keeping while you complete the installation of the tipping bucket. Refer to *Installing the Monitor in the Sun Shield* on page 4-29 for detailed instructions.

5. Loosen the three hex screws securing the top (funnel portion) of the tipping bucket to the base using the hex wrench (included with the tipping bucket), and then remove the top from the base of the tipping bucket.



Loosening hex screws on tipping bucket



Top of tipping bucket (right) removed from the base (left)

6. Insert the green and white wires from the cable up through the hole in the base of the tipping bucket. The wires should exit the top of the base just below the terminal block.

Note: The red and black wires are for external power. If the monitor will not be operated by external power, consider looping and taping these wires back or cutting them off completely down to the gray cable jacket.



Feeding green and white tipping bucket wires up through base



Green and white wires extending up through base of the tipping bucket

7. Mount the tipping bucket base onto the top of the sun shield by sliding the three holes in the base over the threaded posts on the sun shield. Orient the base so that the hole through which the wires entered the base is in the closest proximity to the hole through which the cable extends from the top of the sun shield.



Tipping bucket base seated on threaded posts on top of sun shield

8. Connect the wires to the terminal block in the following way:
 - ☐ Use a small flathead (1/8-inch tip) screwdriver to loosen the two terminal screws on the left end of the terminal block.



Terminal block on the tipping bucket



Loosening the terminal screw

Note: When necessary, may strip some additional insulation from the end of the wires to ensure successful contact in the terminal block.

- ☐ Insert the green wire into the hole on the bottom of the far left terminal, and tighten the corresponding terminal screw.

- ❑ Insert the white wire into the hole on the bottom of the other terminal, and tighten the corresponding terminal screw.



Wires properly secured to the terminal block

Leveling and Calibrating the Tipping Bucket

After installing and connecting the wires to the tipping bucket at the location, level and calibrate the tipping bucket and perform a tip test. Leveling the tipping bucket ensures the funnel on the bucket captures the rainfall directly and the tipping mechanism properly receives and holds the correct amount of moisture before tipping.

ADS recommends verifying the calibration of the tipping mechanism using a field calibration device. Two of these devices are available through ADS (p/n 508139 and 508140). Refer to the calibration specifications and procedures provided with the tipping bucket and field calibration device from the manufacturer for instructions on properly calibrating the tipping bucket.

ADS also recommends performing a *tip test* to verify that the monitor is recording the tips that occur from the tipping mechanism in the tipping bucket.

Leveling the Tipping Bucket

Leveling the tipping bucket primarily involves adjusting the nuts on which the tipping bucket is seated based on a bubble level located on the top of the tipping bucket base.

Note: Although not required, ADS recommends installing the RainAlert III monitor into the sun shield before leveling the tipping bucket to compensate for any shifting of weight that may occur once the monitor is installed.

Level the tipping bucket on the sun shield in the following way:

1. If necessary, remove the top (funnel portion) of the tipping bucket from the base of the tipping bucket.

2. View the bubble level on top of the base of the tipping bucket. The bubble should be located in the center circle of the bubble level.



Level on top of tipping bucket base

3. Adjust the level, as necessary, by threading the nuts on the three posts holding the base up or down.



Leveling the tipping bucket by adjusting the nuts under the feet of the base

4. Place a washer and thread a nut onto each of threaded posts holding the base. Handtighten each nut, and then use a $\frac{1}{2}$ -inch wrench to tighten each nut an additional $\frac{1}{4}$ turn. *Do not overtighten the nuts!*



Nuts and washers securing the base to the sun shield

5. Place the top (funnel portion) of the tipping bucket back onto the base, and use a hex wrench to tighten the three hex screws securing the top to the base. *Do not overtighten the screws!*



Tipping bucket mounted securely to sun shield

Performing a Tip Test

Conducting a tip test simply involves manually tipping the tipping mechanism on the base back and forth to simulate rainwater filling the cups and tipping once filled to the designated amount. After doing this several times, verify the number of tips through the diagnostics function in the **Qstart** software. Refer to *Running Diagnostics on the Rain Device* in Chapter 6, *Maintenance and Troubleshooting*, for more information.



Tipping the tipping mechanism back and forth to register tips in the monitor

Installing the RainAlert III

The RainAlert III monitor is designed for indoor or outdoor installation and can be set indoors on any flat surface or installed outdoors in the sun shield in the same or a separate location from the tipping bucket.

The following procedures for monitor installation apply to most sites. However, some sites may require the installer to implement slight modifications to the standard installation technique.

Before installing the monitor in the sun shield, activate the monitor to verify that the monitor is configured correctly for the application and that the battery pack (or external power) is operating at an adequate voltage. Refer to *Chapter 3, Configuration and Activation*, for more information. ADS recommends making any necessary changes to the configuration *before* installing the unit. Refer to *Chapter 6, Maintenance and Troubleshooting*, for information on replacing the battery pack, if necessary.

Warning: Using a battery-powered, wireless monitor without connecting an antenna will significantly decrease the life of the battery pack.

Note: ADS does not recommend installing the monitor outdoors without the sun shield. Locating the monitor on a flat surface indoors does not require the sun shield.

Note: Installers and technicians must comply with all federal, state, and municipal safety regulations. 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.

Installing the Monitor in the Sun Shield

The sun shield available through ADS (p/n 9000-0043) is designed to house the RainAlert III for outdoor installations. The monitor fits securely inside the sun shield and is easily accessible through an opening in the front of the shield.

Install the monitor in the sun shield in the following way:

1. Remove the retainer bar attached to the front of the sun shield by loosening or removing the two wing nuts securing the bar and sliding the bar off the threaded posts.



Loosening wing nut on front of sun shield



Removing the retainer bar from the front of the sun shield

2. Insert the narrow end of the RainAlert III into the opening in the front of the sun shield and slide the monitor back until it contacts the rear wall of sun shield.



Sliding the monitor into the sun shield

3. Keep the following in mind when inserting the monitor:
- ☐ Orient the monitor so that the tipping bucket/external cable is facing the left side of the sun shield.
 - ☐ Make sure the monitor is seated between the two retainer clips at the rear of the sun shield. These clips and the clips on the retainer bar keep the monitor stationary when housed inside the shield.
 - ☐ Be careful to avoid pinching the tipping bucket/external power cable between the rear wall of the shield and the monitor.



RainAlert III seated inside the sun shield

4. Make sure any excess cabling from the monitor is coiled inside the sun shield enclosure.
5. Slide retainer bar back onto the threaded posts on the front of the sun shield, and retighten or replace the wing nuts.



Completed installation

CHAPTER 5

Communication

Communication with the ADS® RainAlert III™ monitor must be established in order to activate and collect data from the monitor, run diagnostics, perform firmware upgrades, and conduct other activities. Communication can occur through wireless communication or a direct connection. However, *initial* communication for monitor configuration and activation must occur over a direct connection before wireless communication is available. (See *Chapter 3, Configuration and Activation* for more information). This chapter contains instructions on using the direct connection cable to communicate with the monitor on-site and establishing wireless communication at the monitor location for communicating with the monitor remotely. Establishing wireless communication primarily involves installing a SIM card in the monitor.

Note: Installers and technicians must comply with all federal, state, and municipal regulations to ensure all safety precautions are in place and exercised. 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.

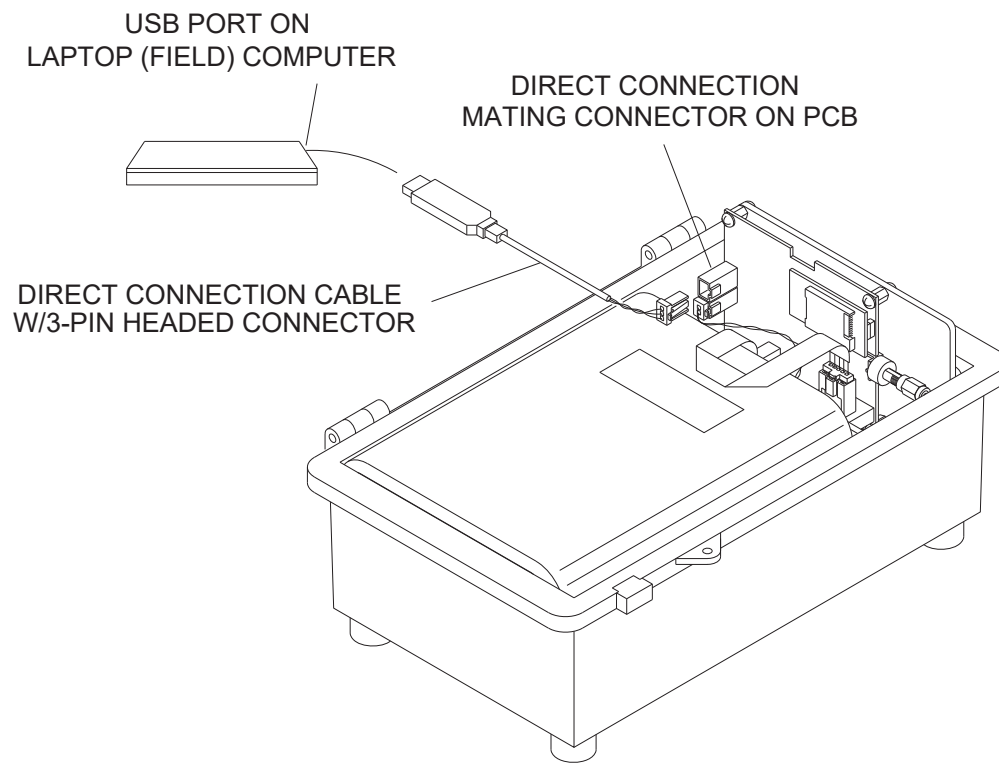
Connecting Directly to the Monitor

Communicating directly with the monitor requires a direct connection cable (ADS p/n 9000-0028) and a **Windows® 7** computer running the **Qstart** software. The direct connection cable provides communication between the user's computer's USB port and the monitor without requiring an antenna or telemetry. Initial communication with the monitor must occur through a direct connection.

Using the direct connection cable first requires downloading a driver to the user's computer. Download the driver in the following way:

1. Go to www.ftdichip.com.
2. Click on **Drivers > VCP Drivers**.
3. Click on the **setup executable** link under the **Comments** column in the table corresponding to a **Windows** operating system.
4. Click **Run**.

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 on the top left side of the PCB. Refer to the *online help* in **Qstart** for instructions on designating the appropriate local port for direct communication.



Connecting the field (laptop) computer to the monitor in the field

Cellular-Based Wireless Communication

The two ADS RainAlert III monitor models support either wireless 4G LTE-M communication network over a private VPN (9000-RA3-4VZ) or global 3G cellular wireless communication through an internal Telit[®] UMTS/HSPA+/GSM modem using static or dynamic IP address network services (9000-RA3-3GL). Any location considered for wireless communication installation must have access to 800/850, 900, AWS1700, 1900, or 2100 MHz service and B1, B2, B4, B5, B8, and B13 (for Verizon LTE-M) operating bands. The wireless carrier requires the user to fit the wireless device with a SIM (Subscriber Identity Module) card provisioned with specific account and network information.

Wireless communication and the quality of service depend on local conditions and service providers. An optimal location for rain measurement may not offer the best wireless network coverage. The user is responsible for finding the most reliable network for the project area. Do not rely solely on coverage maps. These can provide misleading information for specific areas. Perform a signal survey to ensure that the measurement location has adequate reception for wireless communications. Consider consulting local wireless providers for assistance.

Certain static IPs may be used for communicating wirelessly through the **Qstart**[™] software platform or networks supporting ADS hosted system software. The service must support Mobile Terminated service as well as Mobile-Originated (for alarm cryout) functionality. Remote communication with a RainAlert III requires entering the IP address for the location in the **Qstart** 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 Qstart, provided the location has been

properly configured. Consult *Chapter 3, Configuration and Activation*, and the **Qstart** online help for further information on wireless setup and use.

Currently, dynamic IPs may be used only for uploading data wirelessly from the monitor to an FTP server or to the ADS **FlowView**[™] software. Communicating directly through ADS software to set up and activate monitors equipped with dynamic IPs must occur on-site using a direct connection cable (ADS p/n 9000-0028).

Setting Up Wireless Communication

The RainAlert III monitor models ADS p/n 9000-RA3-3GL or 9000-RA3-4VZ come equipped for wireless communication with an integrated, internal antenna. This configuration should function well under most circumstances and requires no additional setup.

However, if the internal antenna does not provide an adequate signal strength or consistency, ADS offers an external antenna kit (p/n 9000-0044) for implementing wireless communication using an external antenna. Refer to *Appendix C, External Antenna*, for instructions on connecting the external antenna available through ADS to the monitor.

Note: Other external antennas may be available and compatible for use with the monitor through third-party vendors. However, please contact your ADS representative for guidance and verification when choosing other antenna options.

Performing wireless communication requires:

- Activating the SIM Card (all RainAlert III models)
- Installing the SIM Card (9000-RA3-3GL only)

The modem in the 9000-RA3-4VZ RainAlert III monitor supports wireless communications over the Verizon LTE-M network using a VPN network. The 9000-RA3-4VZ RainAlert III comes with the Verizon LTE-M SIM card already installed. (The SIM card is paired to the modem and should not be removed for any reason.)



Red label identifies the 9000-RA3-4VZ RainAlert III

The modem in the 9000-RG3-3GL RainAlert III monitor supports global 3G network services and requires a standard SIM card for wireless communication. This card must be installed in the monitor before wireless communication can occur. 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 RainAlert III monitor or on procuring SIM cards for use in a specific geographic area.

Activating the SIM Card

Use the following to activate the RainAlert III SIM card:

1. Request activation of the SIM card by emailing ADSEODIP@idexcorp.com. Include the serial number of the

5-8 ADS RainAlert III Manual

specific RainAlert III 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. (Open the monitor enclosure to get the last four digits of the SIM card number.) ADS employees should also include the project name and job number as part of the request.



SIM Punch-out Card AT&T



SIM Punch-out card Verizon LTE-M

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.

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

Installing the SIM Card

Note: The RainAlert III model #9000-RA3-4VZ is shipped with the SIM card pre-installed.

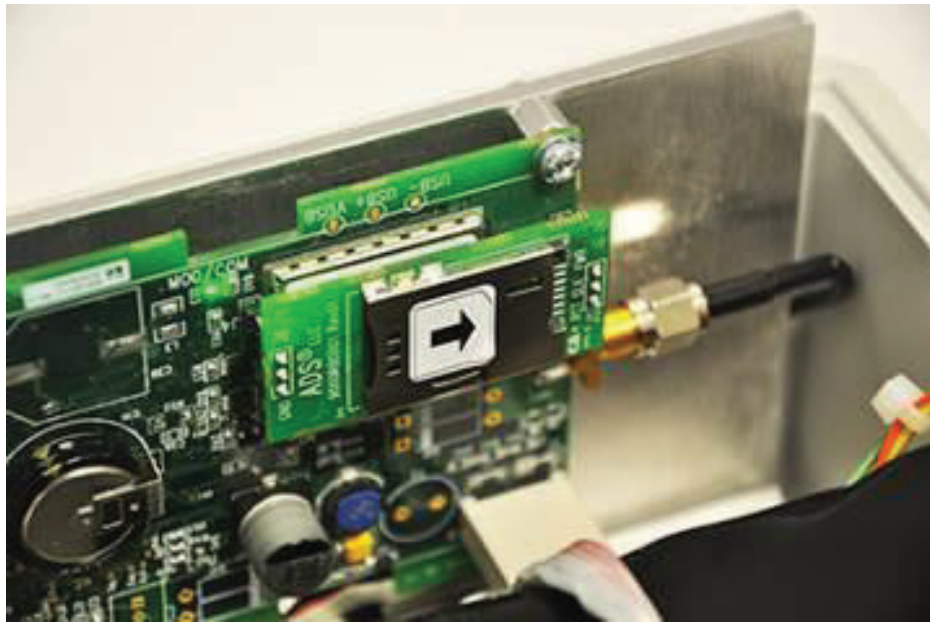
Install the SIM card in the monitor in the following way:

Note: Locate the monitor in a dry, clean area before installing the SIM card.

1. (*applies only to static IP SIM cards*) Record the IP address of the SIM card on the site report. This address is required when setting up the LIF in the **Qstart** software. On SIM cards supplied through ADS, this IP address is printed directly on the SIM card or on a label affixed to the card.
2. Remove the monitor from the sun shield, if necessary.
3. Undo the latches on the right side of the monitor, and carefully open the door.

Note: Opening the door to the enclosure and accessing the printed circuit board increases the risk of damaging or introducing debris or moisture to the board. Make every effort to prevent water, dirt, and debris from contacting the monitor's printed circuit board when opening or working within the enclosure. Wipe away any debris or moisture from the top of the monitor.

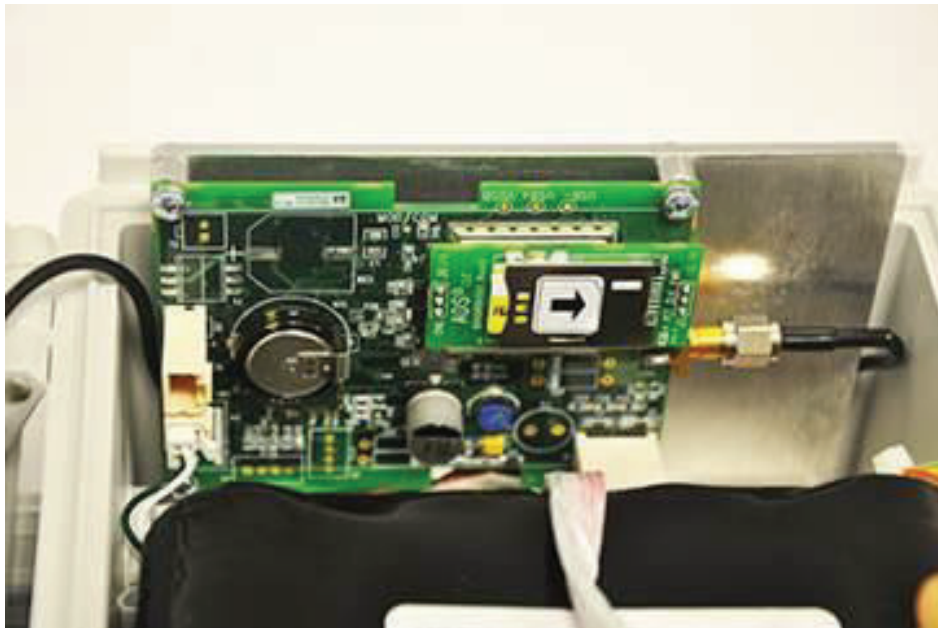
4. Insert the SIM card into the holder on the circuit board, notched edge first with the contacts facing the printed circuit board. Slide the SIM card *all the way* (i.e., past the point of resistance) into the holder to lock it into place. The holder has a spring mechanism that secures the card in the holder.



SIM card holder



Inserting SIM card into holder



SIM card securely seated in holder

5. Close the door to the enclosure, and redo the latches to the door.
6. Verify wireless communication with the monitor after setting up the location through **Qstart** and configuring the monitor using the proper serial number and IP address. Refer to *Chapter 3, Configuration and Activation*.

CHAPTER 6

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[®] RainAlert III[™] 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 RainAlert III model #9000-RA3-4VZ using Verizon LTE-M communications does not support Modbus communications through the ADS 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 RainAlert III through a cellular wireless modem in the monitor using Modbus TCP.

Note: The RainAlert III model #9000-RA3-4VZ using Verizon LTE-M communications does not support Modbus communications through the ADS VPN.

Note: The RainAlert III monitor only supports Modbus TCP/IP connections.

Setting Up a Wireless Connection

Establishing a wireless Modbus connection enables the RainAlert III 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 *Qstart*.
- 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 RainAlert III.
- Once both systems are configured and activated, verify that the process control system is receiving the appropriate Modbus register values.

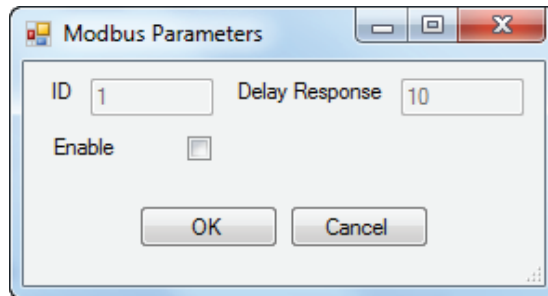
Note: If the RainAlert III is configured for Modbus TCP/IP, it will not be possible to communicate remotely with the monitor unless the Modbus polling system hangs up between poll attempts.

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 **Qstart** 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 RainAlert III and SCADA system. For the RainAlert III, 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 RainAlert III 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.

6-6 ADS RainAlert III Manual

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 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	Qstart Entity	Standard Units of Measure	Registers
Rain Tips (All)	RAINTIPS	N/A	40001-40002
RainAlert III Monitor Temperature	TEMP	°F	40003-40004
Rain Intensity	RAINI	Inches/Hour	40005-40006
Rain Intensity UK	RAINI_UK	Inches/Hour	40007-40008
Rain Alarm	RAIN_ALERT	N/A	40011-40012
Total Rain Yesterday	N/A	Inches	40013-40014
Total Rain Today	N/A	Inches	40015-40016
Battery Voltage	BTYVOLT	Volts	40021-40022
Cellular Signal Strength	N/A	dBm	40023-40024

CHAPTER 7

Maintenance and Troubleshooting

While the ADS[®] RainAlert III[™] monitor, sun shield, and tipping bucket are designed for dependability and durability, all electronic devices are vulnerable to wear, malfunction, or failure, particularly when certain components remain in an outdoor environment. However, many system problems can be avoided altogether by performing routine maintenance and inspections. The design of the monitor enables the user to perform general diagnostics and troubleshooting to prevent, isolate, and correct many problems easily. These serve to minimize unnecessary monitor downtime and data loss.

This chapter provides routine maintenance instructions as well as general diagnostic and troubleshooting guidelines for isolating and correcting monitoring system problems. It also includes instructions on how to use the **Qstart**[™] software to run diagnostics on the rain device, upgrade the firmware in the monitor, and view logs documenting various kinds of monitor activities.

Maintaining the System Components

The RainAlert III monitor, sun shield, and the tipping bucket 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 rain gauge does not appear to be accurately recording rainfall.

Note: The only service or maintenance activities ADS permits within the monitor chassis are battery pack, SIM card, and tipping bucket/external power cable replacement. ADS also allows installation of an external antenna, when necessary, to improve remote communications. Therefore, please do not handle, alter, modify, remove, or replace any other components inside the monitor. This may void the monitor warranty agreement.

Gathering Replacement Parts and Supplies

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

- Battery pack
- Paper towels
- Compressed air
- Flat head screwdriver of various sizes, including a 1/8-inch tip flathead for connecting/disconnecting the tipping bucket wires to the terminals on the tipping bucket
- Assorted wrenches

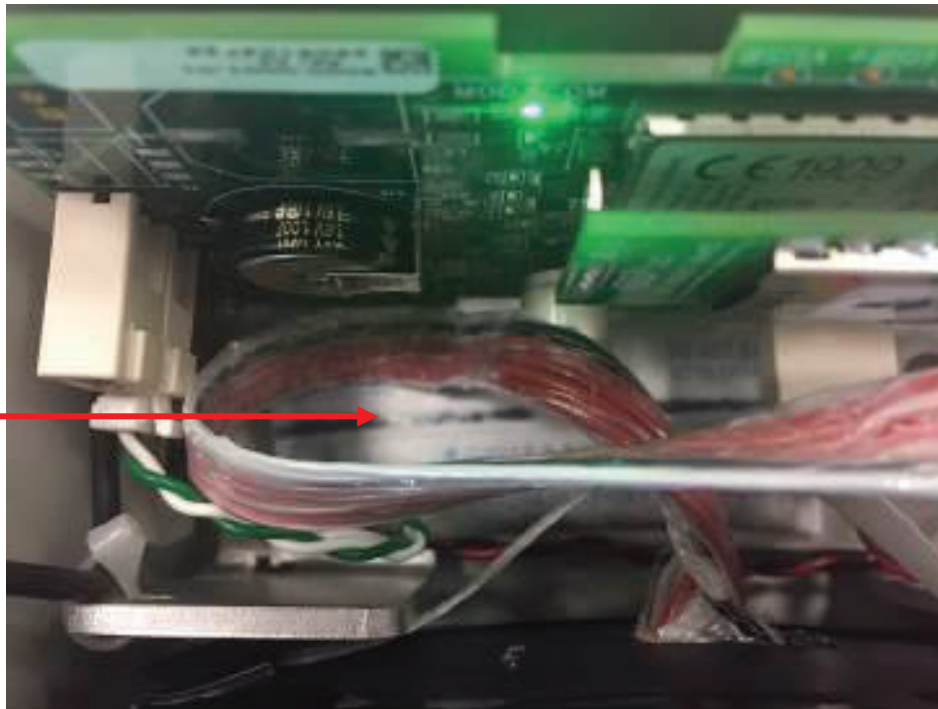
Inspecting the Monitor

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

- Inspect the monitor mounting hardware to verify that it is free of heavy corrosion (when outdoors) and is tightened and secure.
- Open the monitor enclosure to inspect the desiccant pack. If the contents of the pack are blue, it is still functional. If the contents of the pack are pink, a new pack is needed. Close the monitor after the desiccant has been inspected and/or replaced.
- Inspect the monitor for general integrity. Verify that the cover to the enclosure is tightly closed, latched, and sealed and that the monitor has no obvious mechanical defects.
- Perform monitor data confirmations to test the tipping bucket. These should occur from a remote location where wireless communication is available. However, they also can be accomplished locally through a serial connection.
- Review the applicable logs in **Qstart™** 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!*

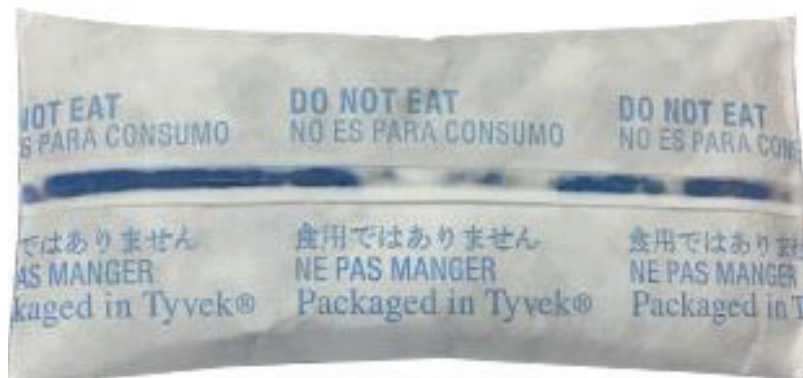
Placing a New Desiccant Pack

To determine if the desiccant pack is functional or not, inspect the pack, shown in the picture below.



Desiccant Pack Location within the Enclosure

If the contents of the original desiccant pack are blue, the pack is still functional. If the contents of the original desiccant pack are pink, a new pack is needed. Examples of the coloration are shown below.

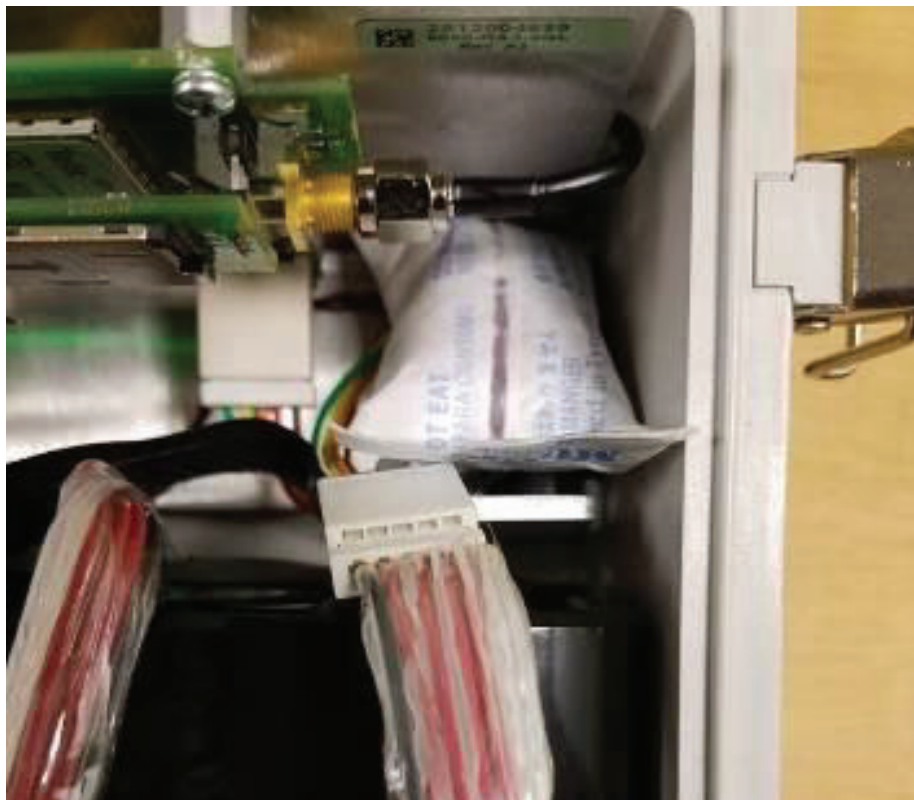


Functional (Blue) Desiccant Pack



No Longer Functional (Pink) Desiccant Pack

If a new pack is needed, it is not necessary to remove the original, no longer functioning, desiccant pack. ADS recommends placing the new pack in the location shown below.



New Desiccant Pack Location

Confirming the Monitor

When performing a site visit, ADS recommends manually tipping the tipping mechanism and using the diagnostic functions in **Qstart** to confirm the RainAlert III records the number of tips accurately. ADS also recommends confirming the calibration of the tipping. *Refer to the tipping bucket manufacturer's instructions for more information.*

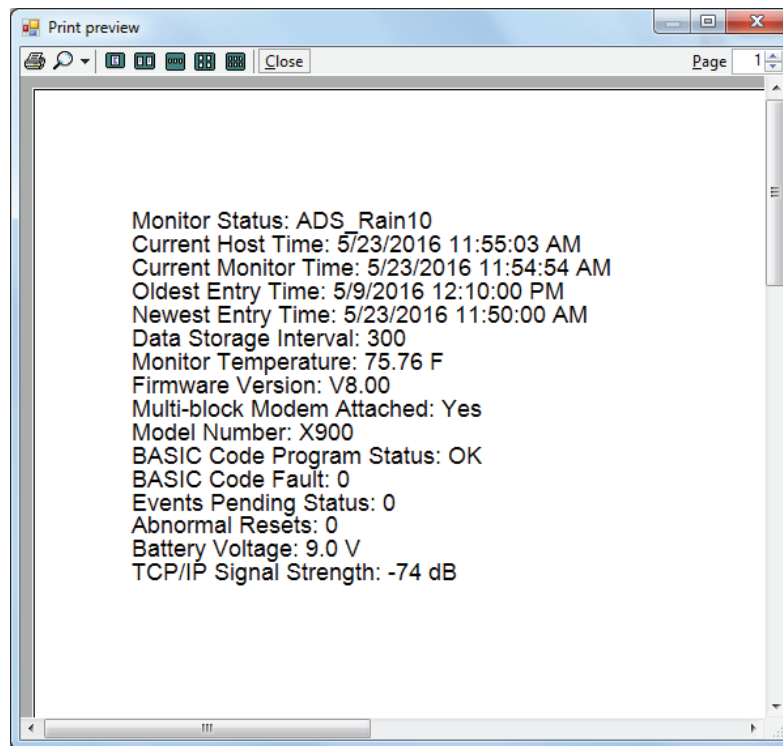
Checking the Monitor Battery Pack Voltage

Check the battery voltage using **Qstart** before installing the monitor. 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 **Qstart** provides a **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 **Qstart** 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.

*Qstart 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.*



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

Replacing the Monitor Battery Pack

When necessary, replace the battery pack in the monitor as follows:

Warning: Before changing a battery pack in a monitor located outdoors during rainy or snowy conditions, disconnect the tipping bucket (and external power, when applicable) wires from the monitor and move to a dry area. The circuit board is not completely sealed and must be kept dry. If the monitor is moved indoors from a cold, outdoor environment, wait for the entire chassis (inside and out) to acclimate to the inside temperature before changing the battery. Failure to do so will result in condensation damage to the board.

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

Note: The only service or maintenance activities ADS permits within the monitor enclosure are battery pack, SIM card, and tipping bucket/external power cable replacement and external antenna connection. Therefore, please do not handle, alter, modify, remove, or replace any other components inside the monitor. This may void the monitor warranty agreement.

1. Collect the data from the monitor.
2. Undo the latches on the right side of the monitor, and open the cover.

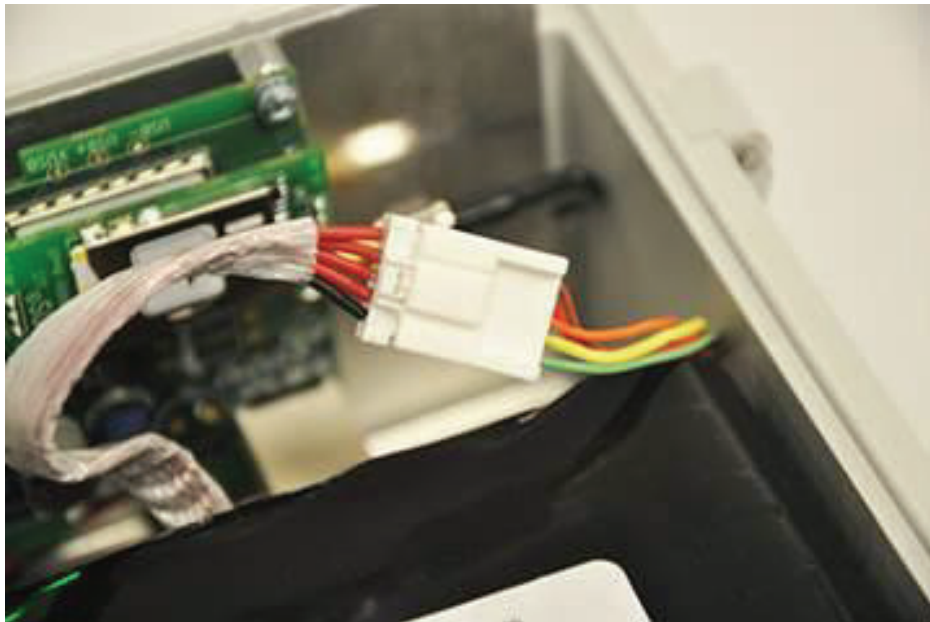


Battery pack seated in cradle in monitor

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.

3. Disconnect the battery pack cable connector from the mating connector attached to the PCB power cable. Holding one of the mating cable connectors with one hand and the other cable connector with your other hand, press and hold down the center tab on the battery pack cable connector and pull it out from the circuit board power cable connector.

Warning: Do not hold onto or pull on the wiring attached to the connectors when disconnecting the battery pack. It may become dislodged from a connector, preventing power transfer from the new battery pack to the circuit board once connected.



Battery pack cable connected to PCB power cable



Pressing center tab on battery pack cable connector



Disconnecting the battery pack cable connector from the mating PCB power cable connector

4. Carefully remove the battery pack from the cradle in the enclosure using the white strap attached to the top of the battery pack.



Battery pack removed and disconnected from the monitor

5. Carefully place the new battery pack into the cradle, with the white strap facing the metal tabs separating the battery compartment from the monitor electronics. Avoid pinching the battery pack cable under the battery pack or between the metal tabs and the battery pack. *Verify the battery pack is completely seated in the cradle.*
6. Insert the cable connector from the new battery pack into the mating connector from the PCB power cable until it clicks into place.
7. Call the monitor or connect to the monitor on-site using a direct connection cable to verify communication.
8. Carefully close the cover to the enclosure (without pinching the battery pack cable), and secure the latches.

Checking the Tipping Bucket

Perform the following tipping bucket inspections and service during site visits:

- Inspect the tipping bucket to ensure it is still tightly secured to the sun shield and free from damage.
- Remove the top portion of the bucket, and clean out the screen and funnel. Verify that the opening to the funnel is clear and that the tipping mechanism is operational.
- Clean the tipping bucket according to manufacturer's specifications.
- Calibrate the tipping bucket to ensure the accuracy of the tipping mechanism. Refer to the tipping bucket *manufacturer's* instructions for detailed information on performing calibrations.
- Confirm that the wires connecting the monitor to the tipping bucket are fastened securely at the terminal connection and free of debris, cuts, and breaks that may affect performance. Replace a damaged tipping bucket/external power cable (ADS 9000-0027), when necessary.

Checking the Antenna Cable

Inspect the antenna cable during site visits. Check the internal or external antenna cable for damage, kinks, or breaks. Make sure that moisture is not entering the monitor enclosure through the cable gland, particularly when an external antenna is in use.

Replacing the SIM Card in the Monitor

Note: DO NOT attempt to swap or replace the SIM card for the RainAlert III model 9000-RA3-4VZ as the information on the SIM card in these models is directly paired to the modem in which it is installed.

The RainAlert III monitor performs wireless communications through an internal modem that is supported by a replaceable 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 modem in the RainAlert monitor supporting the 4G LTE-M network requires SIM card, p/n M2MTC-2FF-HD-D. The SIM card in the 9000-RA3-4VZ is specifically linked to the modem in the monitor, therefore, do not attempt to remove or swap the SIM card from one 9000-RA3-4VZ to another.

Refer to the steps in the following two sections for guidance on replacing the SIM card in a 9000-RA3-4VZ or a 9000-RA3-3GL.

Replacing the SIM Card: 9000-RA3-3GL

Replace the SIM card (ADS p/n 507181 or customer-supplied) in the 9000-RA3-3GL monitor in the following way:

Warning: Before changing SIM card in a monitor located outdoors during rainy or snowy conditions, disconnect the tipping bucket (and external power, when applicable) wires from the monitor and move to a dry area. The circuit board is not completely sealed and must be kept dry. If the monitor is moved indoors from a cold, outdoor environment, wait for the entire chassis (inside and out) to acclimate to the inside temperature before changing the SIM card. Failure to do so will result in condensation damage to the board.

Note: The only service or maintenance activities ADS permits within the monitor enclosure are battery pack, SIM card, and tipping bucket/external power cable replacement and external antenna connection. Therefore, please do not handle, alter, modify, remove, or replace any other components inside the monitor. This may void the monitor warranty agreement.

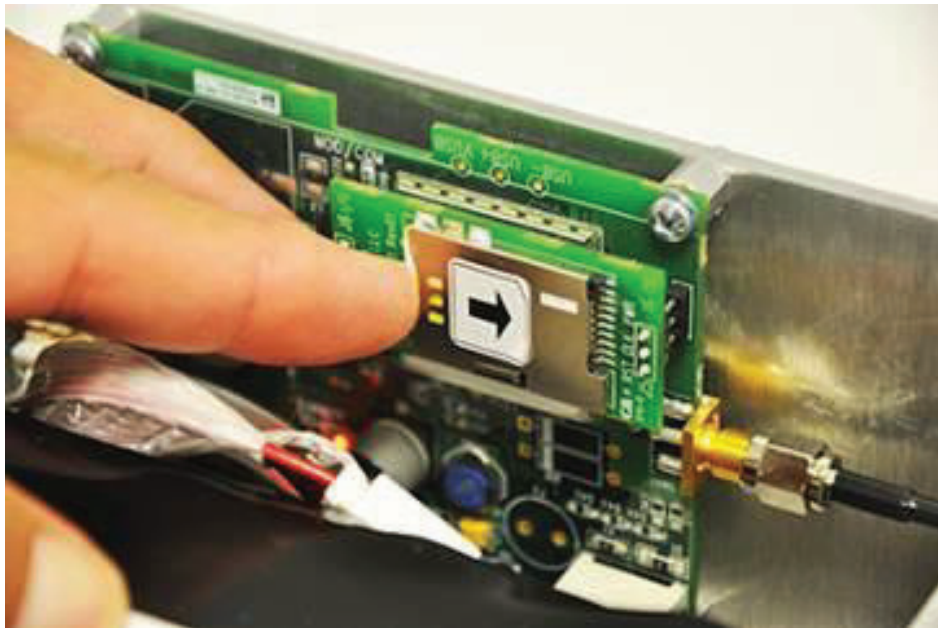
1. Deactivate the monitor through **Qstart**.
2. Undo the latches on the right side of the monitor, and open the cover.



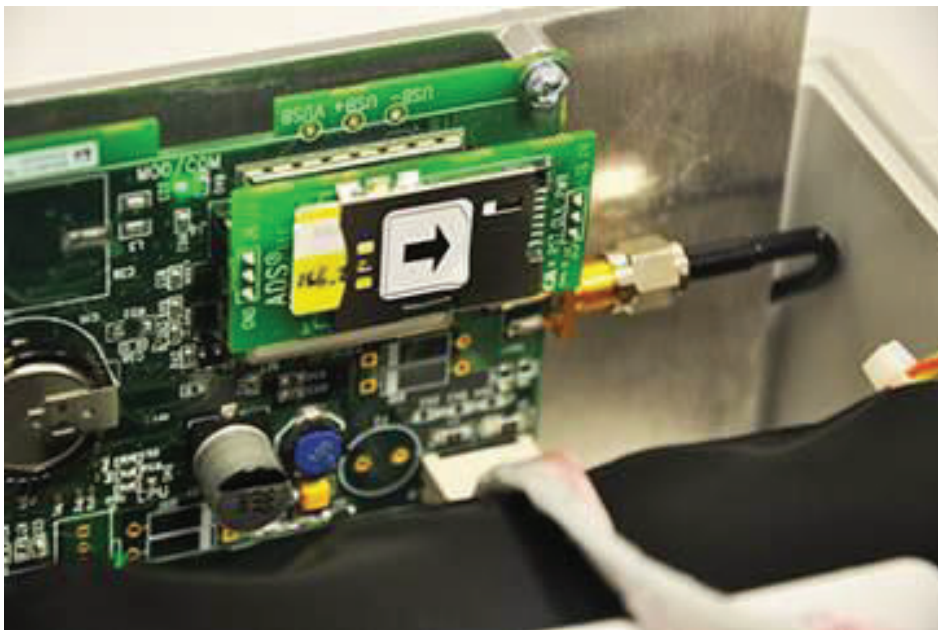
Close-up of the SIM card in the holder on the PCB

Note: Opening the cover to the monitor enclosure during SIM card 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.

3. The SIM card holder on PCB inside the enclosure functions based on spring action. Therefore, press the exposed edge of the SIM card into the holder and release. The card should pop out slightly, freed from its secured position.



Pressing SIM card further into holder

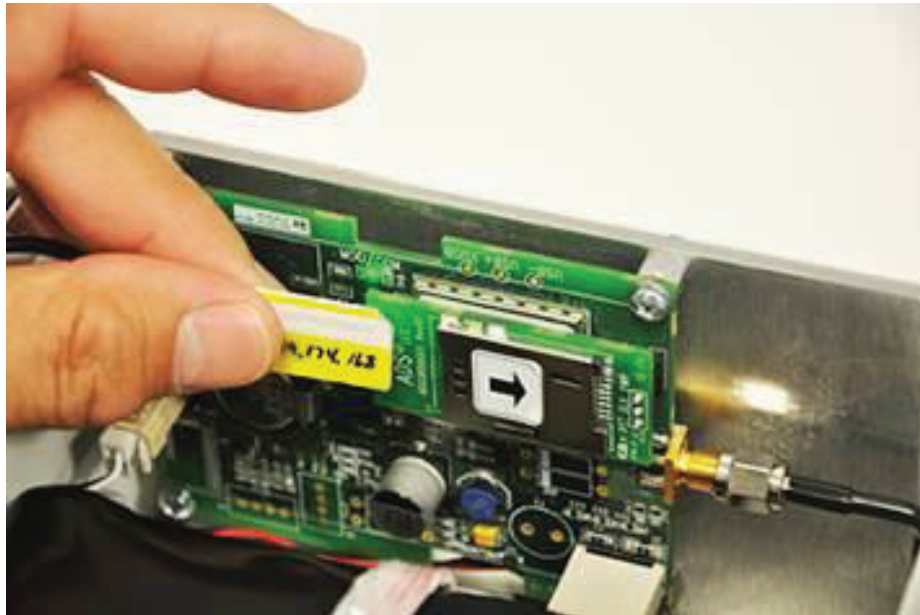


SIM card released from secured position in holder

4. Slide out the SIM card completely out of the holder.
5. (*applies only when using SIM cards with static IP addresses*)
Record the IP address of the new SIM card on the site report.
You will need this address to update the LIF in the **Qstart**

software. SIM cards provided by ADS have the IP address printed directly on the card or on a label affixed to the card.

6. Insert the SIM card into the holder, notched edge first with the contacts facing the PCB. Slide the SIM card *all the way* (i.e., past the point of resistance) into the holder to lock it into place. The holder has a spring mechanism that secures the card in the holder.



Inserting the new SIM card into the holder

7. Change the IP address (*when applicable*) and update the APN parameters for the monitor (*when necessary*) through **Qstart**. Refer to *Chapter 3, Configuration and Activation*.

Note: If entering a new 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 not be successful.

8. Connect a direct connection cable to the serial connector on the top left side of the PCB inside the monitor and a USB port on the field (i.e., laptop) computer, and reactivate the monitor through **Qstart**. Refer to *Chapter 3, Configuration and Activation*.

Note: You must reactivate the monitor through a direct (*serial*) connection before you can resume wireless communication following SIM card replacement.

9. Disconnect the direct connection cable. Wait for the first monitor wakeup, verify that the top LED begins to flash green, and then attempt to establish a wireless connection with the monitor to verify communication.
10. Close the door to the monitor enclosure, and redo the latches to the door.

Replacing the SIM Card: 9000-RA3-4VZ

Note: The SIM card in a 9000-RA3-4VZ is specifically linked to the modem in the monitor, therefore, do not attempt to remove or swap the SIM card from one 9000-RA3-4VZ monitor to another.

1. Verify the SIM replacement for the 9000-RA3-4VZ is part number M2MTC-2FF-HD-D.
2. Use *Qstart* to deactivate the 9000-RA3-4VZ.
3. Open the 9000-RA3-4VZ enclosure.



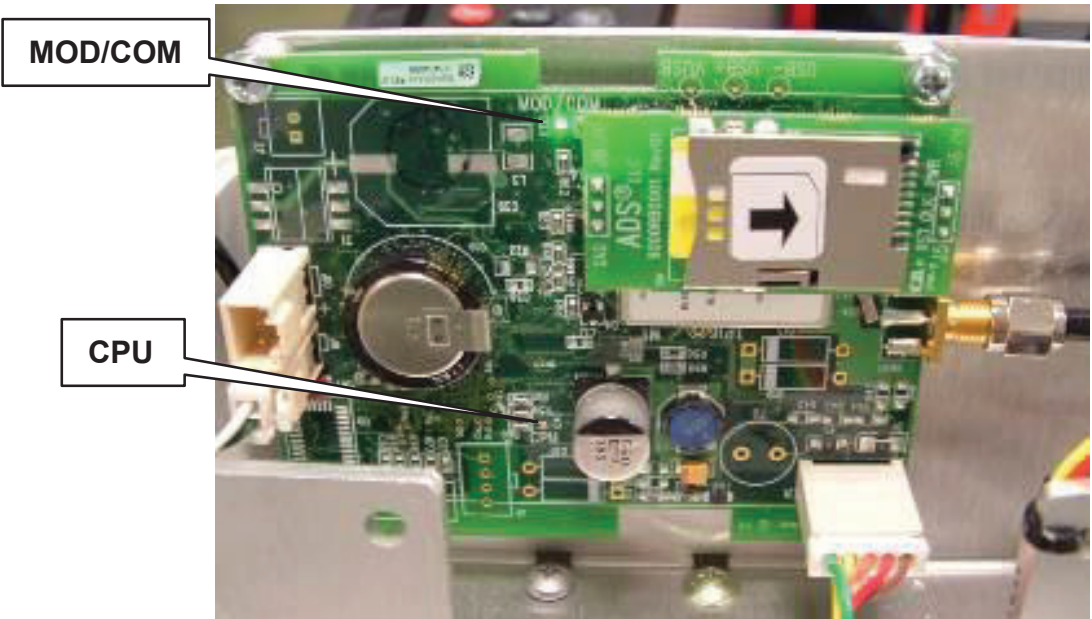
Opened 9000-RA3-4VZ showing SIM card holder

4. Disconnect the battery.
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 monitor 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 into the SIM card holder.
9. Reconnect the monitor battery.
10. Close the monitor cover.
11. Using *Qstart*, activate the 9000-RA3-4VZ. This must be done within 48 hours after receiving the SIM activation confirmation.

Interpreting the LEDs on the PCB

The PCB mounted inside the RainAlert III monitor has two tri-color LED indicators that provide status information related to activities such as monitor communications, operation, and data transfer.

- **MOD/COM** The LED at the top of the PCB (labeled **MOD/COM**) offers information corresponding to modem status and communications.
- **CPU** The LED at the bottom of the PCB (labeled **CPU**) provides information related to CPU activity, serial communication, rain tip detection, data logging, and firmware upgrading.



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.

MOD/COM		
LED Color	LED Activity	Indication
Red	OFF	Modem is not online
	Solid	Modem is online
Green	OFF	Modem power is off
	Solid	Modem power is on, but not registered
	Slow flashing	Modem power is on and registered

CPU		
LED Color	LED Activity	Indication
Green	OFF	CPU is in sleep mode
	Flashing	CPU is awake and operating
Blue	OFF	No serial communication
	Flashing	Serial communication has occurred within the last 35 seconds
Red	Flash	Rain tip detected (LED flashes once for each tip that occurs)
	Solid	Monitor is logging data
Blue/Green	Flashing alternating from blue to green	Firmware upgrade is in progress

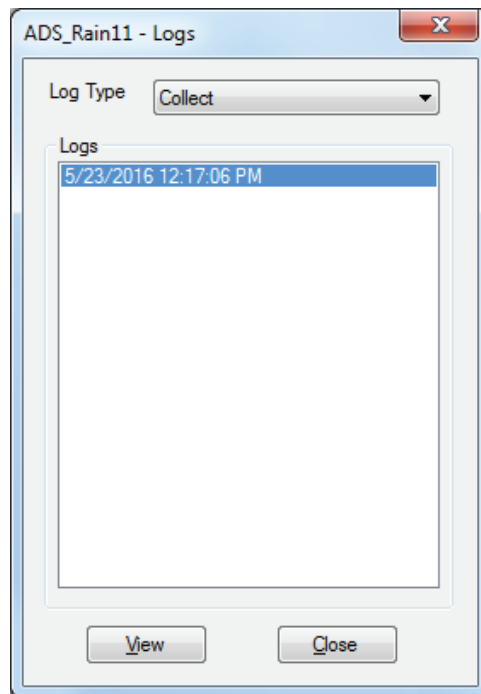
Viewing Monitor Activity Logs

The ADS **Qstart** 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.

View a log(s) corresponding to a monitor activity in the following way:

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 **Qstart** main screen.
2. Click on the **Logs** button in the **Functions** section.

The [location name] – Logs dialog displays.



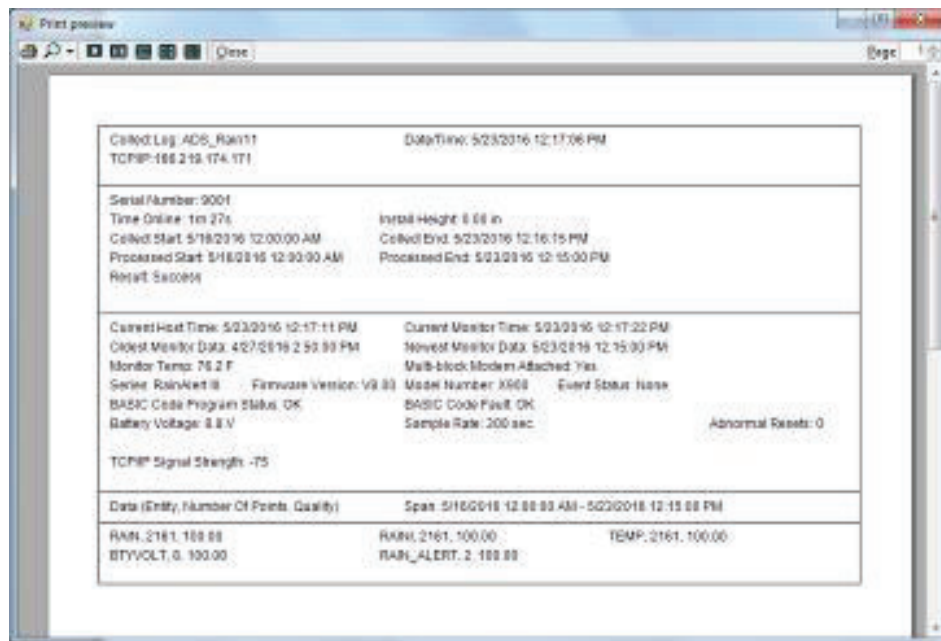
[location name] – Logs dialog

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.*

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.



Carrol Log: ADS_Rain11 TCP/IP: 188.219.174.171		DateTime: 5/23/2016 12:17:06 PM	
Serial Number: 9001 Time Online: 1m 27s Coldest Start: 5/18/2016 12:00:00 AM Processed Start: 5/18/2016 12:00:00 AM Rainfall Seconds:		Install Height: 6.66 in Coldest End: 5/23/2016 12:16:15 PM Processed End: 5/23/2016 12:15:00 PM	
Current Host Time: 5/23/2016 12:17:11 PM Coldest Monitor Data: 4/27/2016 2:59:59 PM Monitor Temp: 76.2 F Series: RainAlert III Firmware Version: V8.83 BASIC Code Program Status: OK Battery Voltage: 8.8 V TCP/IP Signal Strength: -75		Current Monitor Time: 5/23/2016 12:17:22 PM Newest Monitor Data: 5/23/2016 12:15:00 PM Multi-block Modem Attached: Yes Model Number: X500 Event Status: None BASIC Code Fault: OK Sample Rate: 200 sec Abnormal Resets: 0	
Data (Entry, Number Of Points, Quality)		Span: 5/18/2016 12:00:00 AM - 5/23/2016 12:15:00 PM	
RAIN: 2161, 100.00 BTYVOLT: 8, 100.00		RAIN: 2161, 100.00 RAIN_ALERT: 2, 100.00 TEMP: 2161, 100.00	

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.

Upgrading the Monitor Firmware

The ADS **Qstart** software enables you to download updated firmware to a RainAlert III monitor that may include new features and capabilities or performance improvements and enhancements.

Note: RainAlert III monitors using SIM cards with *dynamic* IP addresses can undergo upgrades only by direct, on-site communication.

ADS recommends collecting 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 3, Configuration and Activation* for more information. ADS also recommends reactivating the monitor *after* updating the firmware.

Upgrade the firmware in the RainAlert III monitor in the following way:

1. Select the monitor for which you want to upgrade the firmware from the **Location Name** drop-down list in the **Monitor** section on the **Qstart** main screen.
2. Click on the **Upgrade** button in the **Functions** section.

*The **Open** dialog displays.*

3. 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.

***Qstart** initiates and establishes communication with the monitor and downloads the new firmware to the monitor. The status bar indicates when the download is complete.*

4. Once the download is complete, click on the **Hangup** button in the **Functions** section to discontinue communication with the monitor.
5. Wait 30 seconds.
6. Click on the **Activate** button in the **Functions** section.

***Qstart** reestablishes communication with the monitor and downloads the appropriate information and files. Once activation is complete, the status bar indicates **Activate successful**.*

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

***Qstart** 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 *Qstart*. Refer to *Viewing Monitor Activity Logs* on page 7-20 for more information.

Upgrading Modem Firmware (p/n 9000-RA3-4VZ 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 version 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 RainAlert III monitor battery must have a voltage greater than 7.0 volts in order to perform this process.

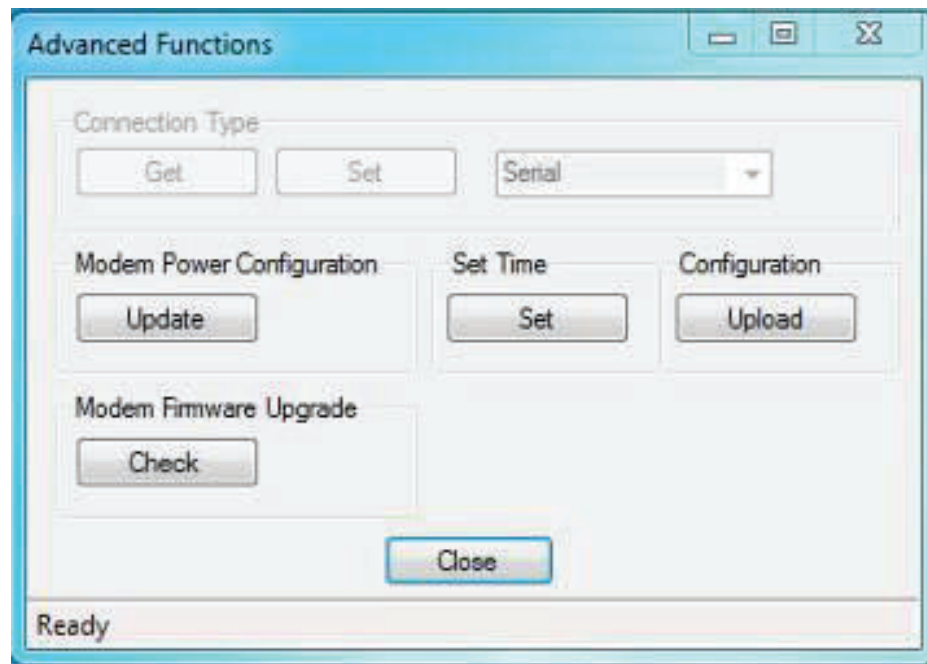
Note: ADS recommends collecting the data from the monitor before performing the modem firmware upgrade.

Use *Qstart* to perform the Verizon LTE-M modem firmware upgrade.

1. Open *Qstart*.
2. Select the monitor for which you want to upgrade from the **Location Name** field in the **Monitor** section on the ADS *Qstart* dialog.
3. Click the **Connect** button in the **Functions** section to establish wireless communications with the monitor.

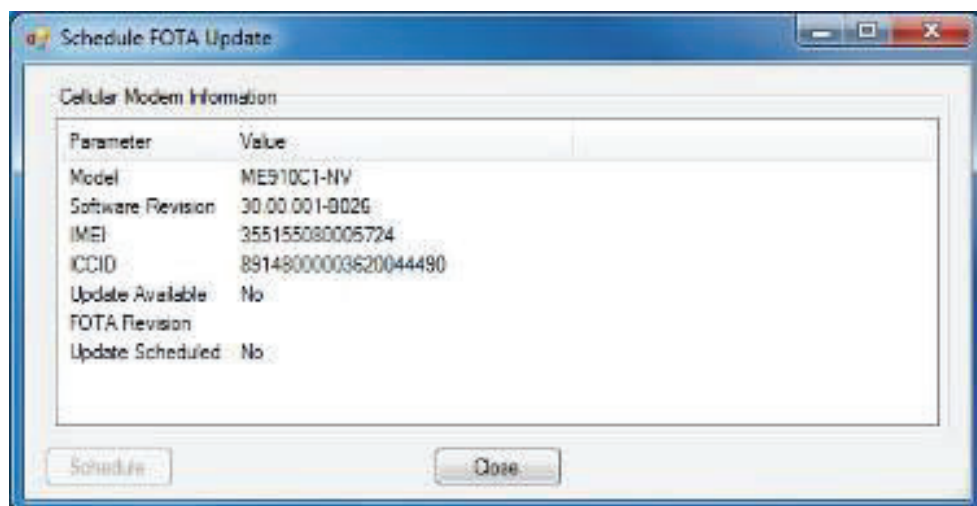
Monitor communications are established and the **Advanced** button is enabled in the **Functions** section.

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 RainAlert III 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 Rain Device

The ADS **Qstart** software's diagnostics tool enables the user to verify the proper operation of the tipping bucket, obtain a current reading, adjust settings, and identify, diagnose, and troubleshoot potential problems with the tipping bucket. Run diagnostics on the *Rain* device in the following way:

1. Select the monitor for which you want to run diagnostics from the **Location Name** drop-down list in the **Monitor** section on the **Qstart** main screen.
2. Select the **Connect** button in the **Functions** section to initiate communication with the monitor.

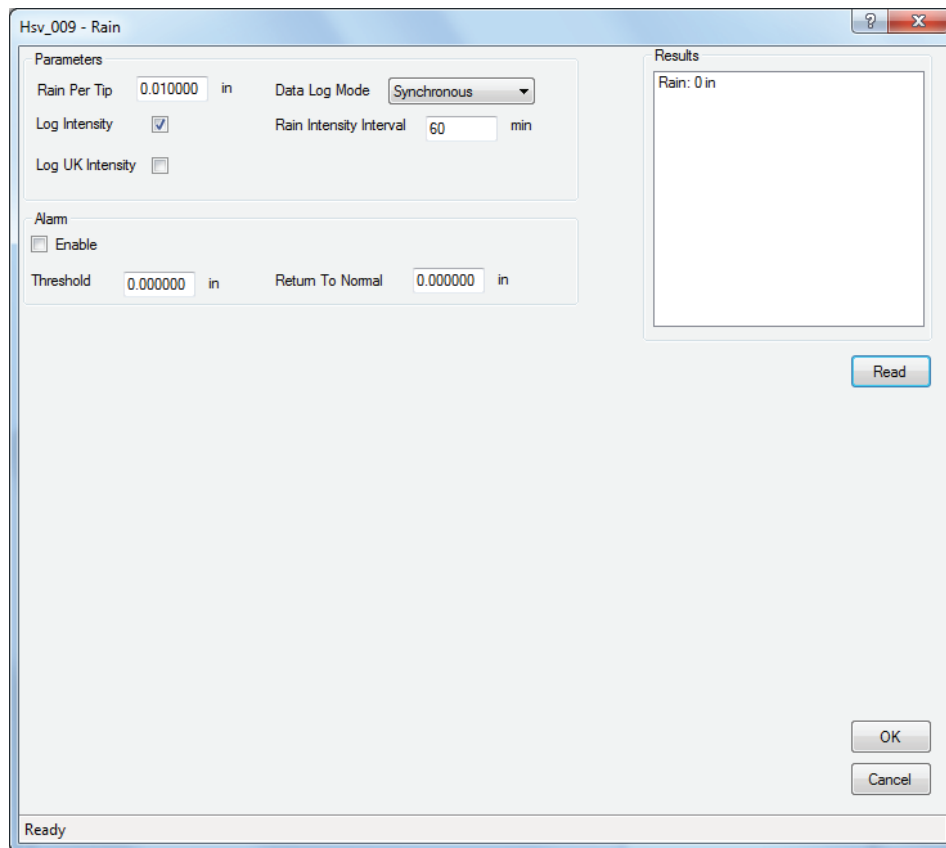
***Qstart** initiates communication with the monitor and establishes a connection. The status bar displays **Ready** once a successful connection has been made.*

3. Select **Rain** from the **Devices** selection box, and then click on the **View** button.

*The [location name] - **Rain** dialog displays the current configuration parameters stored in the LIF for the rain device.*

4. Click on the **Read** button.

*The **Results** section displays the rainfall data. **Rain** represents the amount of rainfall that has occurred (based on the value designated for **Rain Per Tip**) during the time period between initially entering the current **Diagnostics** dialog and requesting rainfall data from the monitor (i.e., clicking the **Read** button). Any additional rain amounts measured through subsequent requests made without exiting the dialog is added to the existing amount, and included in the updated total displayed for **Rain**.*



[location name] – Rain device diagnostics dialog with readings

5. View the results, and edit the configuration settings in the **Parameters** section as necessary. Refer to *Editing the Rain Device* section in *Chapter 3, Configuration and Activation*, for descriptions of the individual configuration parameters. Save any modifications to the LIF in the monitor in the following way:
 - ☐ Click on the **OK** button to save any changes made in the device parameters to the LIF in the database.
 - ☐ Click on the **Activate** button in the **Functions** section. For more information on activating a monitor, refer to *Chapter 3, Configuration and Activation*.
6. Select the **Hangup** button to discontinue communication with monitor once you are finished running diagnostics on the rain device.

Troubleshooting

The RainAlert III system contains several different components that perform many different functions. Since a malfunctioning component increases the risk of losing data, quickly isolating the part containing the problem 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, tipping bucket, or cabling.
- 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.
- Failures occurring *outside* the monitor (i.e., between the cable gland and the tipping bucket or external power source) may arise from problems with the bucket or cabling. Failures occurring on the *inside* the monitor (i.e., between the cable gland and the printed circuit board) may arise from problems with the board or its cabling.

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

If the problem is a faulty monitor and the data cannot be collected remotely, replace the monitor and arrange for the monitor to be returned to ADS for service, as necessary.

This section provides general guidelines for troubleshooting and correcting problems with the RainAlert III monitor and the tipping bucket.

General Monitor Problems

The following tables contain general techniques for troubleshooting the ADS RainAlert III 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 Qstart .
Possible Cause	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	<p>Signal strength to the modem may be insufficient.</p> <p>Battery pack may be dead or below minimum voltage requirement (5.5 volts).</p> <p>Monitor may be defective.</p> <p>Modem in monitor may be defective.</p> <p>Antenna or cable may be damaged.</p> <p>Internet connection in office or field computer may be down.</p> <p>Wireless carrier may be experiencing problems.</p> <p>Port 2100 may be blocked by IT department.</p> <p>Verify computer is using correct VPN.</p>
Possible Solutions	<p>Direct connect to monitor on site, 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.</p> <p>Replace the battery pack if below 5.5 volts.</p> <p>Replace the monitor.</p> <p>Replace antenna/cable.</p> <p>Restore Internet connection.</p> <p>Check for wireless provider outage.</p> <p>Restore/establish permission to pass TCP/IP traffic via Port 2100.</p> <p>Verify computer is using correct VPN.</p>

Problem	Monitor does not deliver alarms through emails or text messages.
Possible Causes	<p>SIM card is missing or improperly installed.</p> <p>Text message or email address entered for alarm delivery is incorrect.</p> <p>Wireless carrier account has not been activated or set up correctly.</p>
Possible Solutions	<p>Verify the presence and proper installation of the SIM card.</p> <p>Verify the correct cryout address for alarm notification through emailing or text messaging.</p> <p>Verify that wireless carrier activated and correctly set up account.</p> <p>Contact your regional ADS representative.</p>

General Tipping Bucket Problems

The following table contains general techniques for troubleshooting the tipping bucket.

Warning: Contact your regional ADS representative for further diagnosis before replacing a tipping bucket.

Problem	Monitor is not registering or recording tips.
Possible Causes	<p>Debris may be present in the funnel.</p> <p>Wires running from the monitor may be broken or loose at the terminal connection in the tipping bucket.</p> <p>Tipping bucket may not be level.</p> <p>Tipping bucket and/or tipping mechanism may be faulty.</p> <p>Circuit board is not responding or may be faulty.</p>
Possible Solutions	<p>Clean out the funnel in the tipping bucket.</p> <p>Verify the connection of the wires at the terminals in the tipping bucket.</p> <p>Check and adjust the level, and then secure the tipping bucket to the sun shield.</p> <p>Replace the tipping bucket.</p> <p>Replace the monitor if defective.</p>

APPENDIX A

Specifications

This appendix contains specifications for the ADS[®] RainAlert III[™] monitor, printed circuit board, and tipping buckets.

ADS RainAlert III Monitor (p/n 9000-RA3-3GL, 9000-RA3-4VZ)

The following table contains the specifications for the RainAlert III monitor.

Note: RainAlert III monitors are not intrinsically safe.

Enclosure	Polycarbonate enclosure reinforced with 10% glass fiber resin; NEMA Type 4X, IP67, and UL-rated; hinged access cover with stainless steel latches and a continuous gasket
Dimensions	10.63 inches (270 mm) long x 7.09 inches (180 mm) wide x 4.53 inches (115 mm) high
Weight	10 pounds (4.54 kg) with battery
Operating Temperature	-4° to 140° F (-20° to 60° C)

Power	<p>Internal: 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</p> <p>External: Customer-supplied external power supply (6- to 24-volt DC, 1A)</p>
Battery Life	<p>32 months at a 5-minute sample rate with hourly data delivery to an FTP server, when modem power is set to <i>Always Off</i>. Battery life is reduced to 5 months when modem power is set to <i>Always On</i>. These settings are discussed in <i>Configuring the Power Saving Parameters in Chapter 3</i>.</p> <p>Note: Battery life varies depending on operating temperature, modem power management settings, and frequency of communications.</p>
Connectivity	<p>Tipping bucket</p> <p>Serial communication</p> <p>External AC/DC power</p> <p>External wireless antenna</p>
Antenna	<p>Internal: Multi-band, slot type antenna.</p> <p>External option: Customer-supplied (connects to an SMA connector on the board)</p>
Tipping Bucket Cable	<p>2-conductor 22 AWG wire</p>

Printed Circuit Board (ADS p/n 9000-0001-01)

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 rain 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	728 days for 2 stored entities (<i>Rain</i> and <i>Rain Intensity</i>) plus a time stamp at a 5-minute sample rate. Refer to <i>Calculating the Total Days of Storage Available</i> on page A-4 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	Wireless modem: Third-party, FCC/IC/EC- and carrier-approved, global coverage, commercial UMTS/HSPA+/GSM modem; FCC ID R17HE910 Direct Connection: Via the ADS Direct Connection Cable (p/n 9000-0028) running between a laptop's USB port and the 3-pin headed connector on the monitor PCB

LED Indicators	<p>CPU LED: Colors indicate CPU, serial communication, tip detection, data logging, and firmware upgrade activities></p> <p>MOD/COM LED: Colors indicate modem communication, power, and registration.</p>
-----------------------	---

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 RainAlert III 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:

Data Storage Available in the Monitor (in Bytes)				=	Total Days of Storage in the Monitor Memory
Number of Readings Taken per Day for One entity	x	Memory Consumed for One Entity Reading (Date/Time Stamp)	x		
			Number of Entities Logged by the Monitor		

For example, recording rain and rain intensity data at a 5-minute sample rate offers approximately 730 days of data storage.

$$\frac{3,784,704 \text{ bytes}}{288 \text{ readings} \times 6 \text{ bytes} \times 3 \text{ entities (including 1 for the date/ time stamp)}} = 730 \text{ days (728 days when accounting for overhead)}$$

Tipping Buckets (ADS p/n 6000-0054/55/56/57/63-M/64/M)

The following table contains the specifications for the 8-inch tipping bucket (without a heater).

Note: Some specifications may vary for ADS-supplied tipping buckets of other sizes.

Enclosure	Powder-coated spun aluminum
Receiver/Bucket	Diameter: 8 inches (203 mm) nominal diameter Material: Powder-coated diecast aluminum Finger Filter: Non-hygroscopic, injection-molded ABS with a stainless steel mesh screen
Base	Non-hygroscopic, injection-molded ABS; stainless steel mesh insect screens; drain fittings; bulls-eye bubble level
Tipping Mechanism	Chrome-plated, injection-molded ABS; balanced to 0.05 grams; 0.01 inches per tip (U.S.) or 0.2 millimeters per tip (International)
Height	12.25 inches high (310 mm)
Weight	4.4 pounds (2 kg)
Contacts	Dual reed switch; potted in silicone rubber, varistor protection, 24 volts (0.5 A) max capacity; 0.1 Ω initial contact resistance

Measurement	United States: 0.01 inches (.25 mm) per tip International: 0.1, 0.2, 0.5, or 1.0 millimeters per tip
Accuracy	< ± 1% up to 2 inches per hour (50 mm/hr) ± 1% up to 3 inches per hour (75 mm/hr) ± 3% up to 4 inches per hour (100 mm/hr)
Maximum Intensity	28 inches per hour (700 mm/hr)
Minimum Alarm Threshold	0.01 inches (.25 mm) (United States) 0.1 millimeters (International)

APPENDIX B

Part Numbers

This appendix lists the part numbers for the most commonly ordered and used ADS[®] RainAlert III[™] system parts.

Monitor	
9000-RA3-3GL	MONITOR, RAINALERT III, 3G GLOBAL (WITH ANTENNA)
9000-RA3-4VZ	MONITOR, RAINALERT III 4VZ LTE-M (WITH ANTENNA)

Mounting Hardware	
9000-0043	SUN SHIELD AND BASE PLATE, RAINALERT III
9000-0042	POLE-MOUNT KIT, RAINALERT III
508138	BIRD GUARD, TIPPING BUCKET

Tipping Buckets	
6000-0054	TIPPING BUCKET, TB6, 8-INCH, STANDARD, PLASTIC BASE
6000-0064-M	TIPPING BUCKET, TB6, 8-INCH, METRIC, PLASTIC BASE
6000-0055	TIPPING BUCKET, TB4, 8-INCH, SIPHONING, PLASTIC BASE
6000-0056	TIPPING BUCKET, TB3ST, 8-INCH, STANDARD, ALUM. BASE
6000-0057	TIPPING BUCKET, TB3, 8-INCH, SIPHONING, CHROME BASE
6000-0063-M	TIPPING BUCKET, TB3, 8-INCH, SIPHONING, METRIC, CHROME BASE

B-2 ADS RainAlert III Manual

Communication and Extension Cables	
9000-0028	DIRECT CONNECTION CABLE, USB2TTL, 3.3-VOLT, 6 FEET (1.8 M)
9000-0027-25	TIPPING BUCKET/EXTERNAL POWER CABLE, 25 FEET (7.6 M)
9000-0027-50	TIPPING BUCKET/EXTERNAL POWER CABLE, 50 FEET (15.2 M)
9000-0027	TIPPING BUCKET/EXTERNAL POWER CABLE, 4 FEET (1.2 M) <i>(Replacement for standard cable)</i>
9000-0022	BATTERY CABLE, RAINALERT III <i>(Replacement cable)</i>
9000-0045	TIPPING BUCKET/EXTERNAL POWER WIRE SPLICING KIT <i>(For connecting legacy tipping buckets or external power wiring to the RainAlert III)</i>

Spare Parts	
9000-0044	EXTERNAL ANTENNA KIT, RAINALERT III <i>(includes MINI-WING, SMA/TNC, SMARTEQ)</i>
509141	4GLTE-M SIM CARD, 2FF, VZ, INDUSTRIAL (9000-RA3-4VZ only)
507181	SIM CARD, WIRELESS GSM (9000-RA3-3GL only)
9000-0001-01	PCBA, PROCESSOR, WIRELESS, RAINALERT III
9000-0004	BATTERY PACK, 9-VOLT, RAINALERT III
503293	POWER SUPPLY, 24VDC, 2.5A, 60W, DIN RAIL
9000-0045	TIPPING BUCKET/EXTERNAL POWER WIRE SPLICING KIT <i>(For connecting legacy tipping buckets or external power wiring to the RainAlert III)</i>
509120	DESICCANT, INDICATING, BAG, 3.1" x 1.5"

APPENDIX C

External Antenna

Note: This instruction applies to the 9000-RA3-3GL RainAlert only.

ADS[®] offers an external antenna kit (p/n 9000-0044) for implementing wireless communications under conditions where the internal antenna housed in the RainAlert III monitor does not provide an adequate signal strength or consistent communications. This kit includes a mini-wing antenna and a replacement cable gland designed to allow access for both the tipping bucket/external power cable *and* the antenna cable into the monitor housing through one entry point.



Mini-wing antenna (part of external antenna kit)

This appendix contains instructions on connecting the external antenna to the monitor for wireless communication at the monitor location for communicating with the monitor remotely. Other

external antennas may be available and compatible for use with the monitor through third-party vendors. However, please contact your ADS representative for guidance and verification when choosing other antenna options.

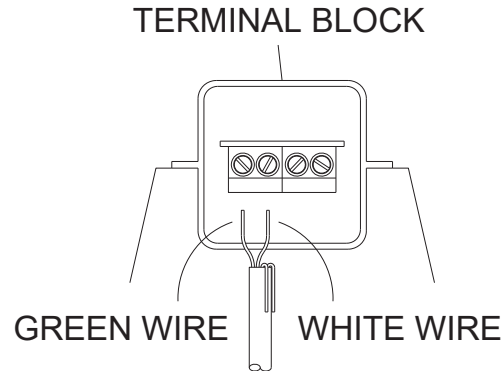
Note: Installers and technicians must comply with all federal, state, and municipal regulations to ensure all safety precautions are in place and exercised. ADS is not responsible for any injuries, damages, claims, or liability resulting directly or indirectly from the use of this installation guide or the installation of any ADS equipment.

Setting up an external antenna for wireless communication involves installing the antenna and connecting the antenna to the monitor. The following procedure is for connecting the external mini-wing antenna to the RainAlert III monitor using the kit available through ADS. Refer to the antenna manufacturer for detailed instructions on properly installing the mini-wing or other third-party external antennas.

Connecting an external antenna to the monitor primarily involves replacing the cable gland on the side of the monitor, disconnecting the existing internal antenna from the monitor, and connecting the external antenna to the monitor. Perform these activities in the following way:

Note: Disconnect power to the monitor before performing any modifications.

1. (*applicable only when tipping bucket is already connected to monitor*) Disconnect the tipping bucket/external power cable from the tipping bucket by removing the top portion of the tipping bucket from the base and disconnecting the green and white wires (from the tipping bucket/external power cable) from the terminal block in the tipping bucket.

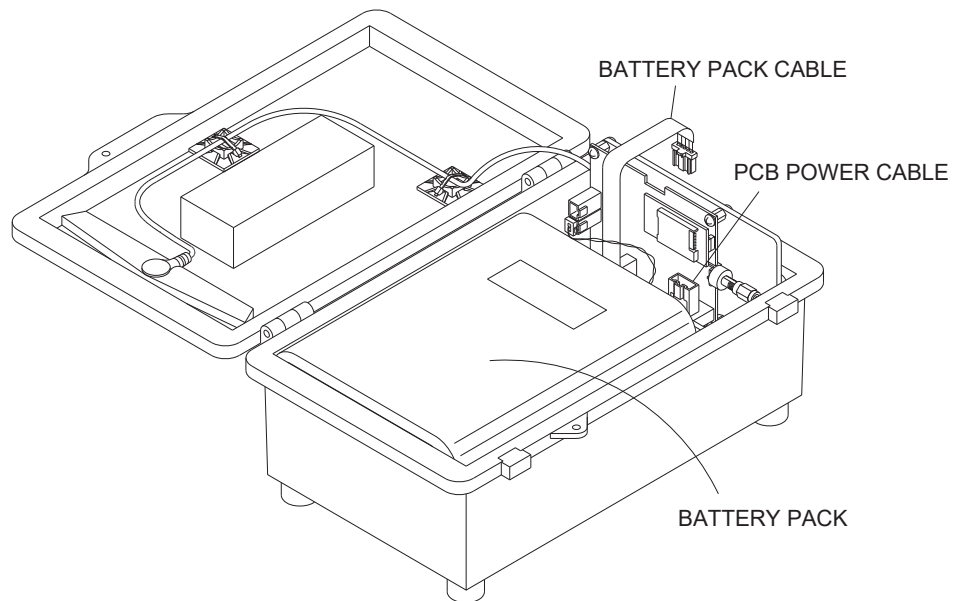


Disconnecting the wires at the terminal block in the tipping bucket

2. Undo the latches on the right side of the monitor enclosure, and open the cover.

Note: Opening the cover to the monitor enclosure to replace the cable gland and connect the external antenna increases the risk of damaging or introducing debris or moisture to the printed circuit board (PCB). Make every effort to prevent water, dirt, and debris from contacting the monitor's circuit board when opening or working within the enclosure.

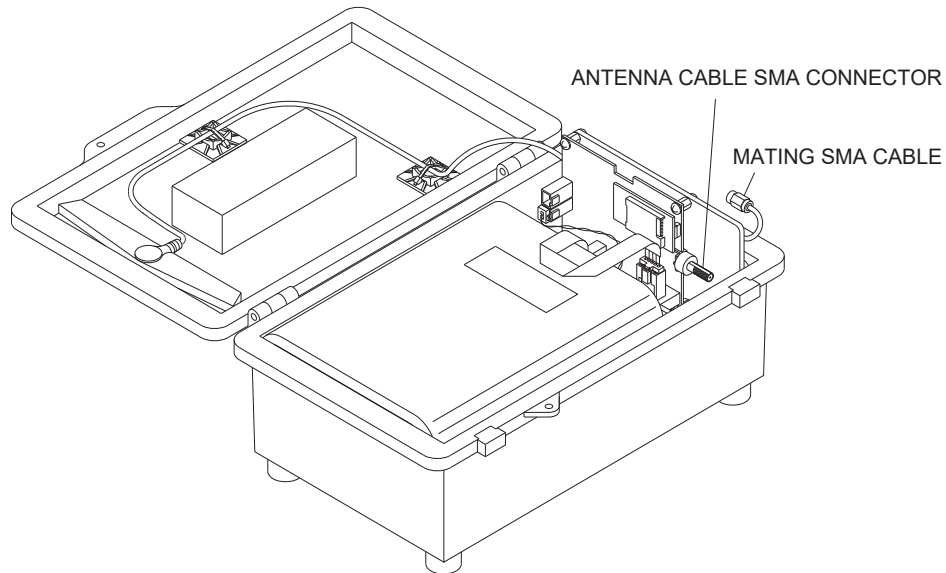
3. *(applicable only to battery-powered monitors)* Disconnect the battery pack cable from the PCB power cable.



Disconnecting battery pack cable from PCB power cable

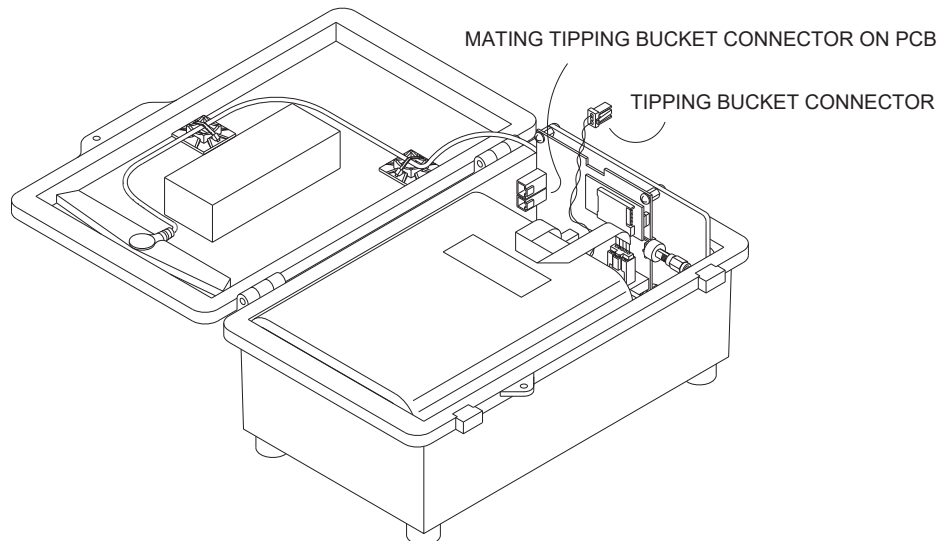
Note: Be careful to avoid damaging any of the components on the PCB while removing and replacing the cable gland.

4. Disconnect (unscrew) the *internal* antenna cable connector from the mating SMA connector on the PCB. This connection is located to the right of the PCB. Tuck the internal antenna cable behind the PCB mounting bracket.



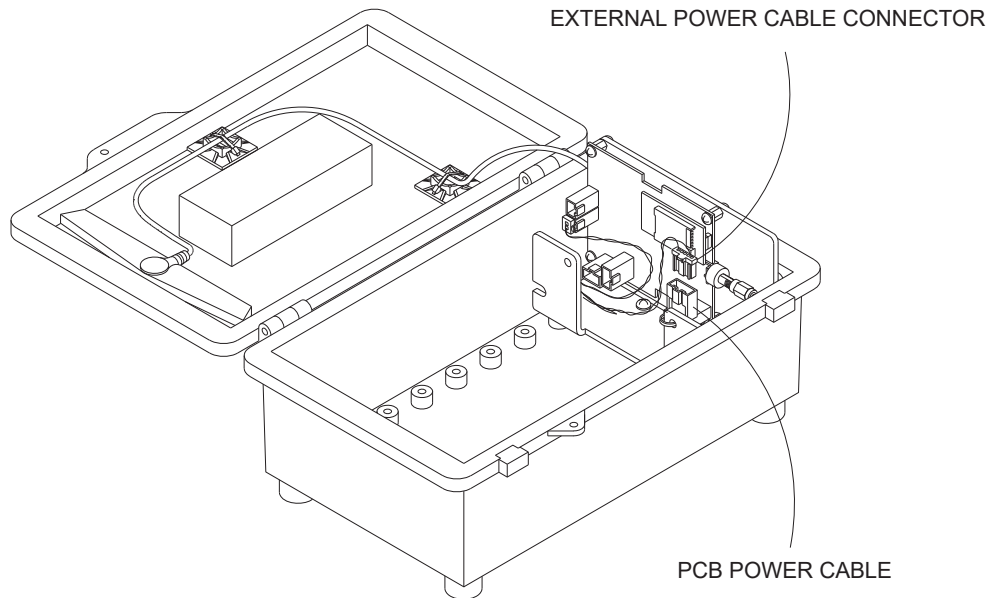
Disconnecting the antenna cable from the SMA connector on the PCB

5. Disconnect the tipping bucket connector (white connector with green and white wires) from the mating PCB connector by pressing the center tab on the tipping bucket connector and pulling the connector away from PCB connector. *Do not pull on the wires!*



Disconnecting the tipping bucket connector from the PCB connector

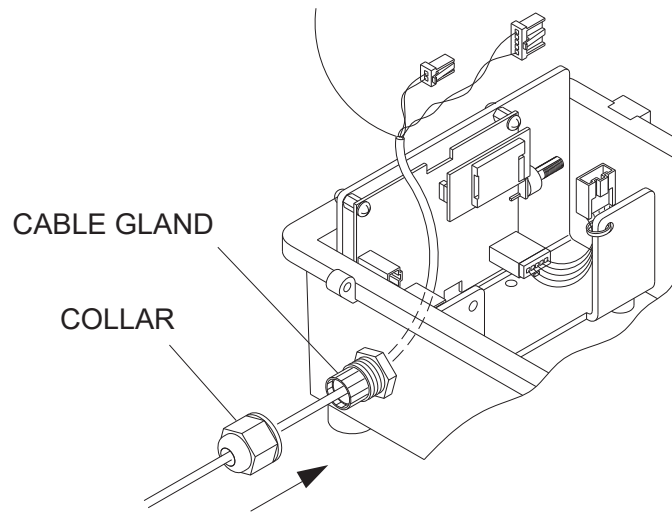
6. *(applicable only to monitors receiving power from an external source)* Disconnect the external power connector (white connector with red and black wires) from the mating PCB power cable by pressing the center tab on the connector and pulling the connector away from the external power connector. *Do not pull on the wires!*



Disconnecting the external power connector from the PCB power cable

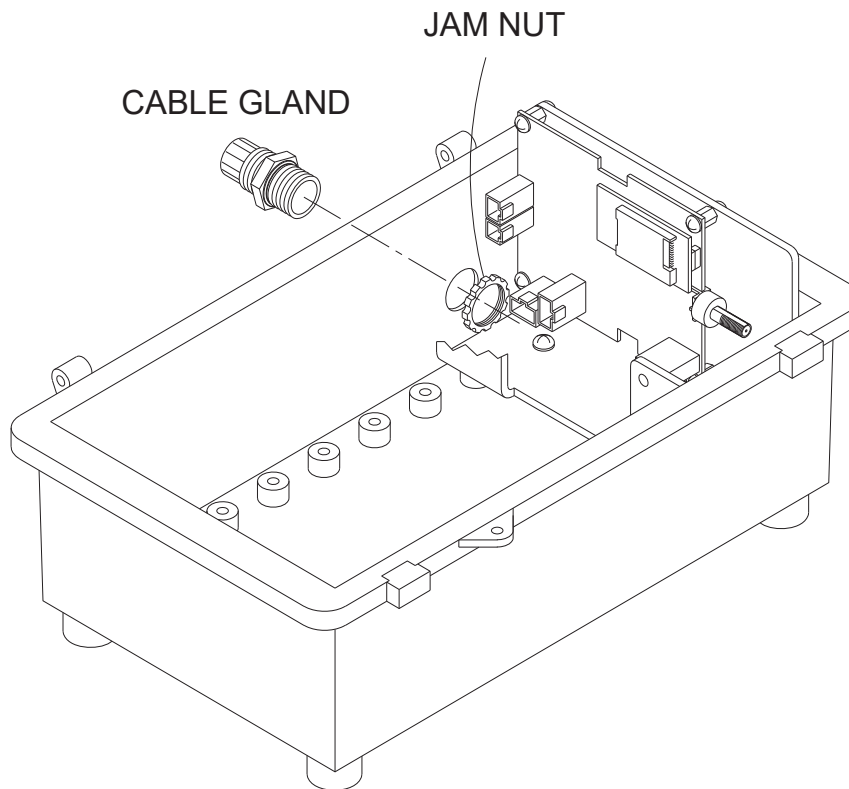
7. Loosen the collar of the cable gland on the outside of the monitor enclosure, and then pull the tipping bucket/external power cable from the inside of the monitor until it is completely through the gland. *Be sure to pull on the cable jacket, not the wires.*

TIPPING BUCKET/EXTERNAL POWER CABLE



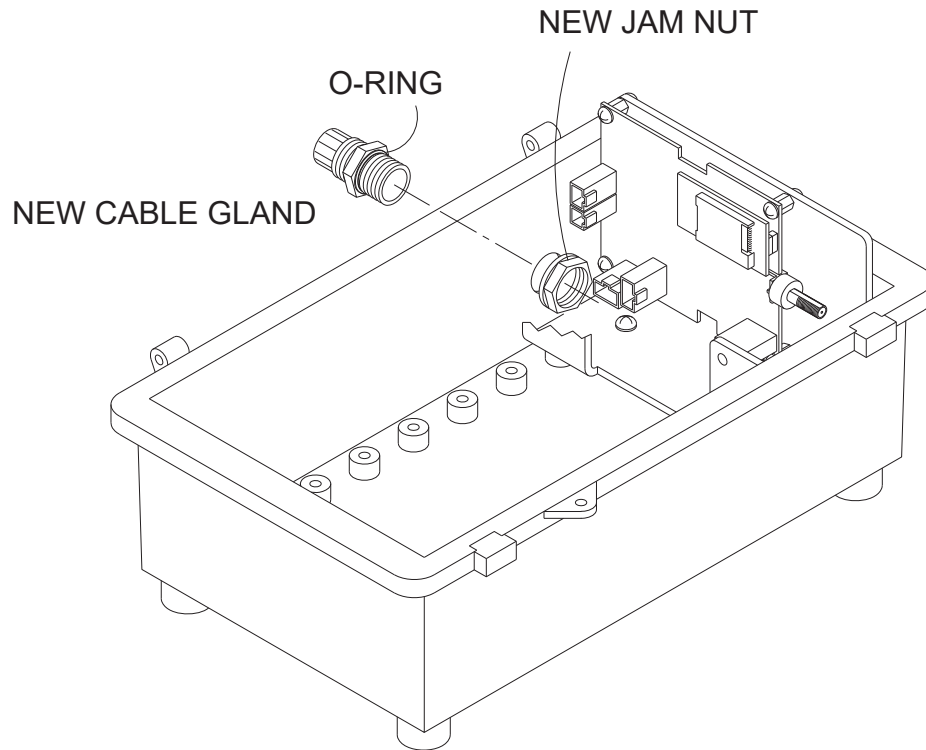
Removing the collar from the cable gland and pulling the tipping bucket/external power through the cable gland

8. While holding the cable gland from the outside of the monitor, loosen and remove the plastic jam nut from the inside of the enclosure. Discard the cable gland and jam nut.



Jam nut inside monitor enclosure

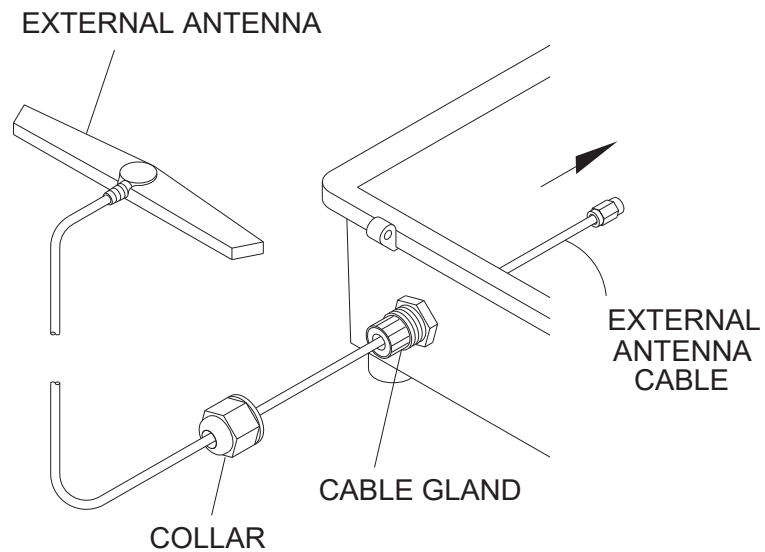
9. Verify the rubber O-ring is properly seated on the threaded end of the *new* cable gland (from the external antenna kit), and then insert the cable gland into the hole on the left side of the monitor enclosure. Thread the new jam nut (included in the kit) onto the gland from the inside of the enclosure. Tighten until it is snug. *However, do not overtighten!*



Inserting the new cable gland into the hole in the side of the monitor enclosure

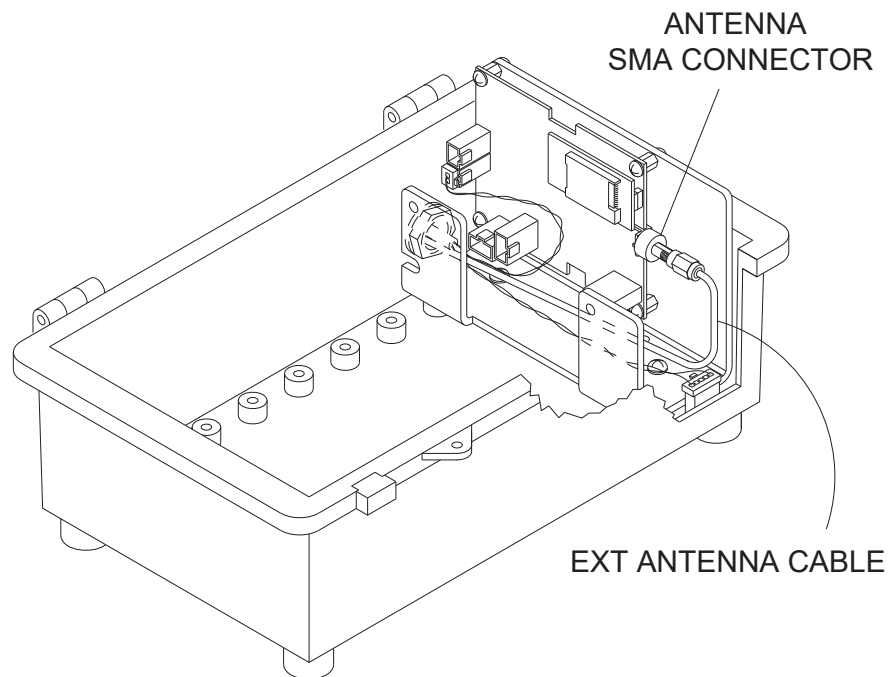
Note: Due to the limited space available within the monitor enclosure, consider holding the jam nut while turning the hex-shaped body of the cable gland.

10. Loosen the collar on the new cable gland, and then insert the SMA connector from the external antenna cable through the cable gland from the outside of the monitor enclosure. Pull an adequate amount of cable through to enable the cable to lie along the bottom of the aluminum bracket once connected to the PCB.



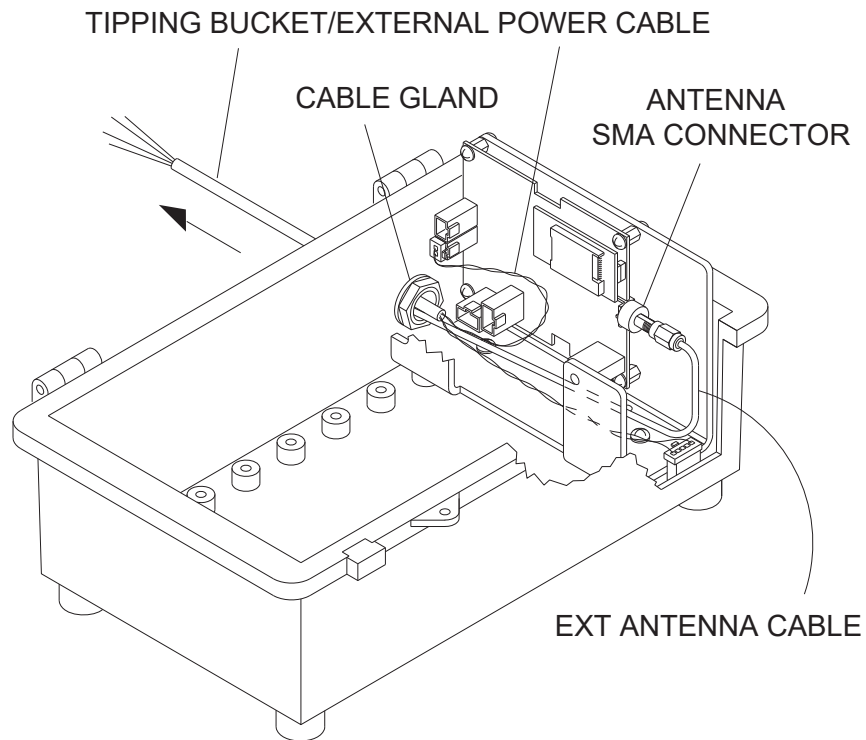
Running the external antenna cable through the cable gland into the monitor enclosure

11. Thread the antenna cable SMA connector onto the mating connector on the PCB until it is finger-tight. Use a 5/16-inch wrench to tighten the connector an additional $\frac{1}{4}$ turn.



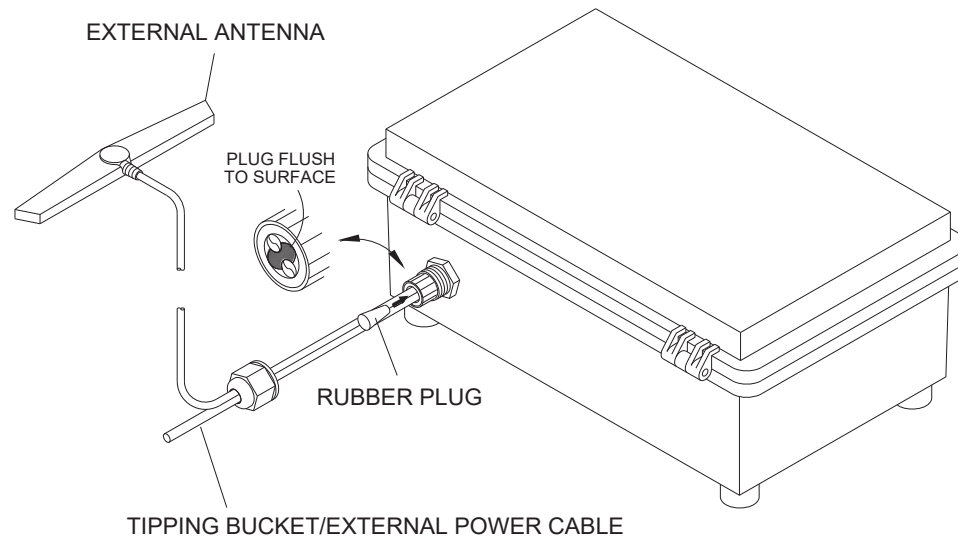
Connecting the external antenna connector to the mating SMA connector on the PCB

12. Feed the wires from the tipping bucket/external power cable through the new cable gland from the inside of the monitor enclosure until approximately $\frac{1}{2}$ inch of the gray cable jacket remains inside the enclosure.



Running the tipping bucket/external power cable out from the monitor enclosure through the new cable gland

13. Unscrew and remove the collar from the cable gland.
14. Insert the tapered end of the rubber plug (included in the external antenna kit) into the space between the cables inside the cable gland until it is flush with the gland. Be careful to avoid damaging or breaking any of the plastic fingers.



Inserting the rubber plug into the cable gland between the cables

15. Replace and tighten the collar on the cable gland.
16. Reconnect the tipping bucket connector to the mating connector on the PCB. You should hear it click when it is properly seated and secure.
17. (*applicable only to externally-powered monitors*) Reconnect the external power connector to the PCB power cable connector.
18. (*applicable only to battery-powered monitors*) Reconnect the battery pack cable connector to the PCB power cable connector.
19. Carefully close the cover to the enclosure (without pinching the wires), and secure the latches.
20. Apply stretch tape to the grommet extending at least 1" up the cables before inserting the rain gauge into the sun-shield.
21. Reconnect the green and white wires from the tipping bucket/external power cable to the terminal block on the tipping bucket base *and* the red and black wires (also from tipping bucket/external power cable) to the external power source, as applicable.

APPENDIX D

External Power

An ADS[®] RainAlert III[™] supporting wireless communication can receive power from an external DC power source.

Note: ADS recommends locating the unit in close proximity to the DC power source to maximize the net power available to the unit.

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

Installation

A typical field installation involving external power requires the following:

- An AC mains power line terminated at a pole or post close to the location at which the monitor is installed
- An AC distribution device (i.e., disconnect, fuse, or breaker box) on the pole/post
- An AC to 24-volt DC converter (i.e., power supply). ADS recommends a power supply available through ADS (p/n 508293), which works with worldwide AC power (94 – 240 VAC, 50 – 60 Hz). However, please note that the customer may use another AC-to-DC converter/power supply, if desired, provided it can supply from 9 to 24 volts of power at a minimum of 15 watts.
- A power cable running between the external DC source (i.e., power supply) and the RainAlert III. The customer must supply this cabling of the appropriate length and specifications
- A properly rated enclosure to house and protect the power supply
- A cable splicing kit (ADS p/n 9000-0045) that includes two vinyl-insulated butt splices for connecting the external power wires from the tipping bucket/external power cable to the customer-supplied wiring *and* a terminal crimping tool

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

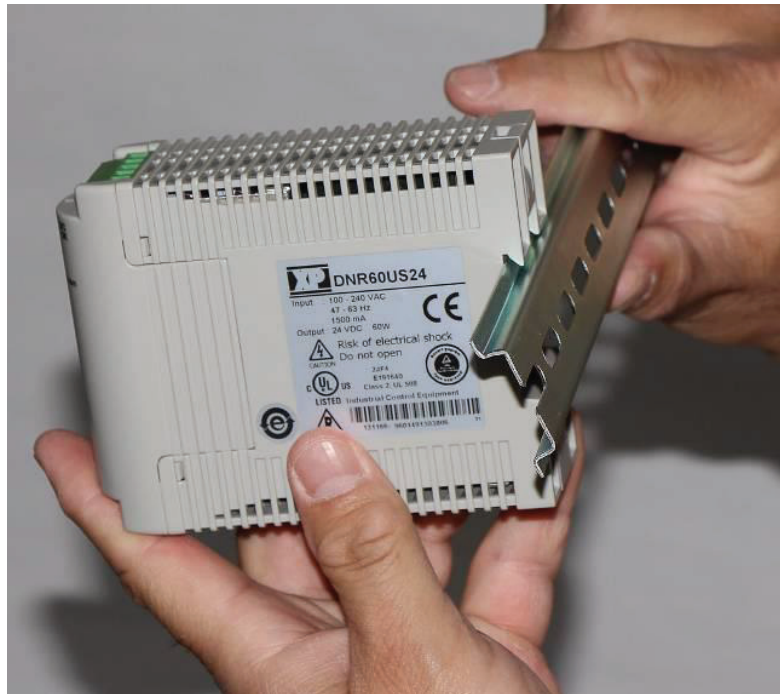
Mounting the Recommended Power Supply

Mount and secure the power supply in such a way that takes into account the specific environment in which it will be located. For *outdoor* installation, mount it inside a secure, weatherproof enclosure (minimum NEMA IP66) that will provide the best protection against the elements and excessive heat or cold. The operating temperature range for the power supply is -40° to 158° F (-40° to 70° C). Locate the enclosure under an awning or other structure to prevent direct sun exposure. For *indoor* installation, mount the power supply inside an enclosure or in a location that prevents tampering or potential damage from occurring.

Note: ADS recommends mounting the power supply and the monitor in close proximity.

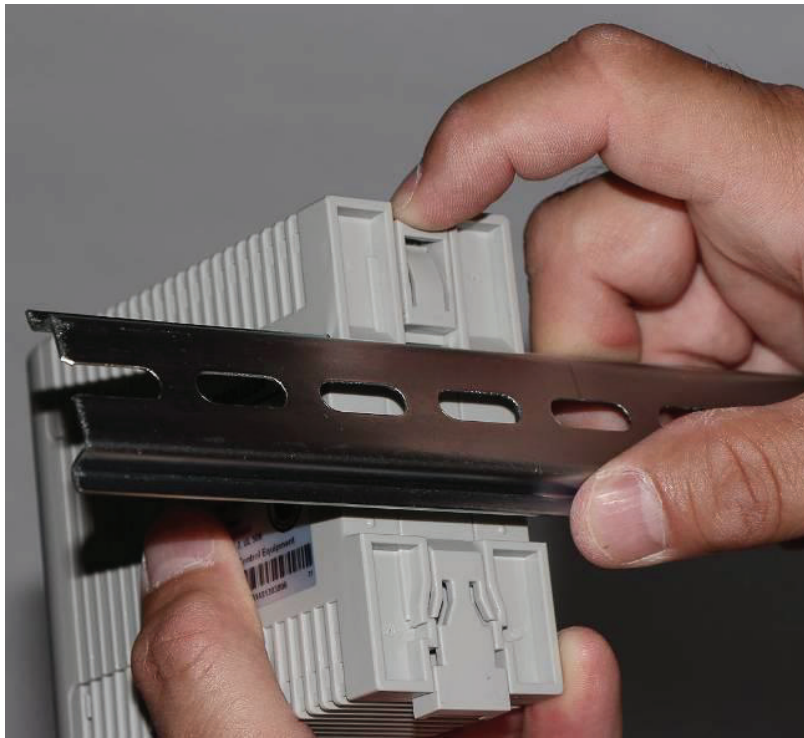
The power supply is designed for mounting on a 35- x 7.5-mm DIN rail in the following way:

1. Notice the inset on the back of the power supply that includes a wedge at the top and a small notch at the bottom to secure the power supply to the DIN rail. Slide the top edge of the DIN rail up into the top wedge on the back of the power supply.



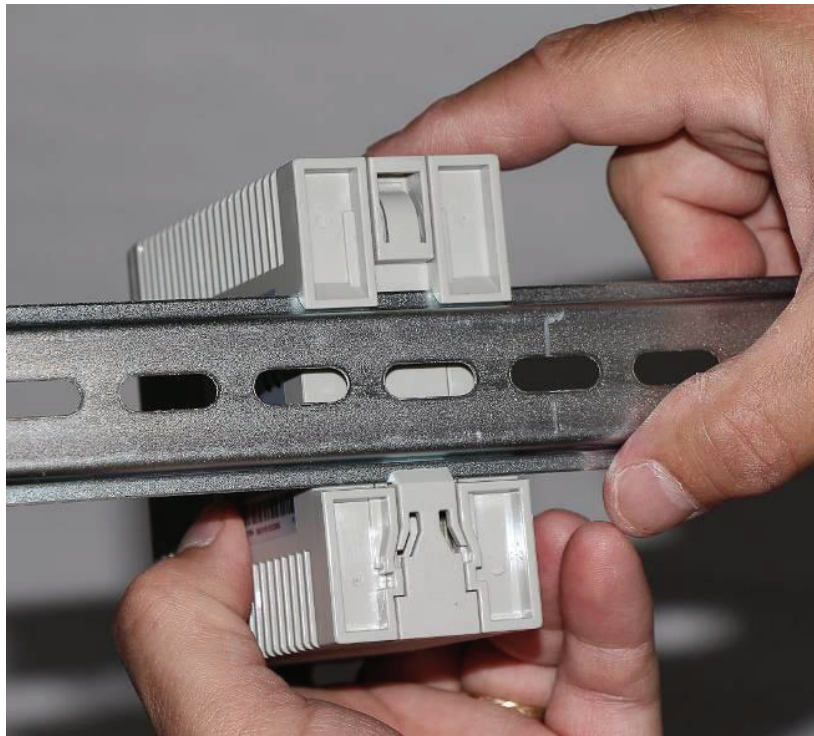
Sliding the top edge of the DIN rail into the wedge on the back of the power supply

2. Notice the sliding tab running down the middle of the back of the power supply. Press down on that tab to slide the tab down vertically. You also can slide the tab down using the end of a flathead screwdriver inserted into a slot on the tab located at the top of the power supply. Hold the tab down to prevent the notch at the bottom of the inset from blocking bottom of the DIN rail.



Pressing down the sliding tab from the top

3. Push the bottom edge of the rail into the inset on the back of the power supply and release the sliding tab. The spring mechanism will allow the notch to return to its original position, completely securing the power supply to the DIN rail.



Power supply firmly secured to the DIN rail



Front view of power supply mounted to DIN rail

Wiring the AC Power Source to the Recommended Power Supply

Note: The following instructions apply only when using the ADS XP Power power supply recommended by ADS (p/n 508293). When using another third-party power supply, refer to the vendor's instructions for the proper connection procedures.

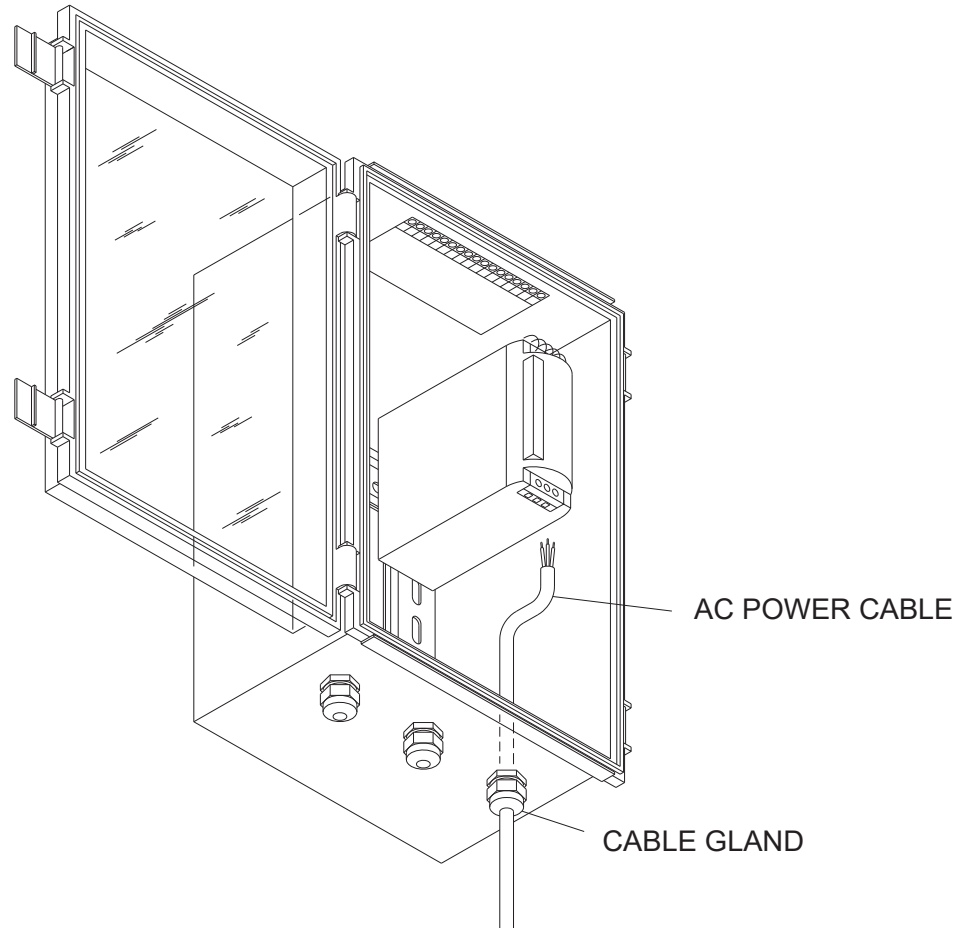
The first step in running external power to the monitor involves wiring the cable coming from the AC power source to the power supply.

Wire the AC power cable to the power supply in the following way:

1. Determine the appropriate length and construction of AC power cable required to run from the external power source to the power supply. Customer-supplied cabling may be used.

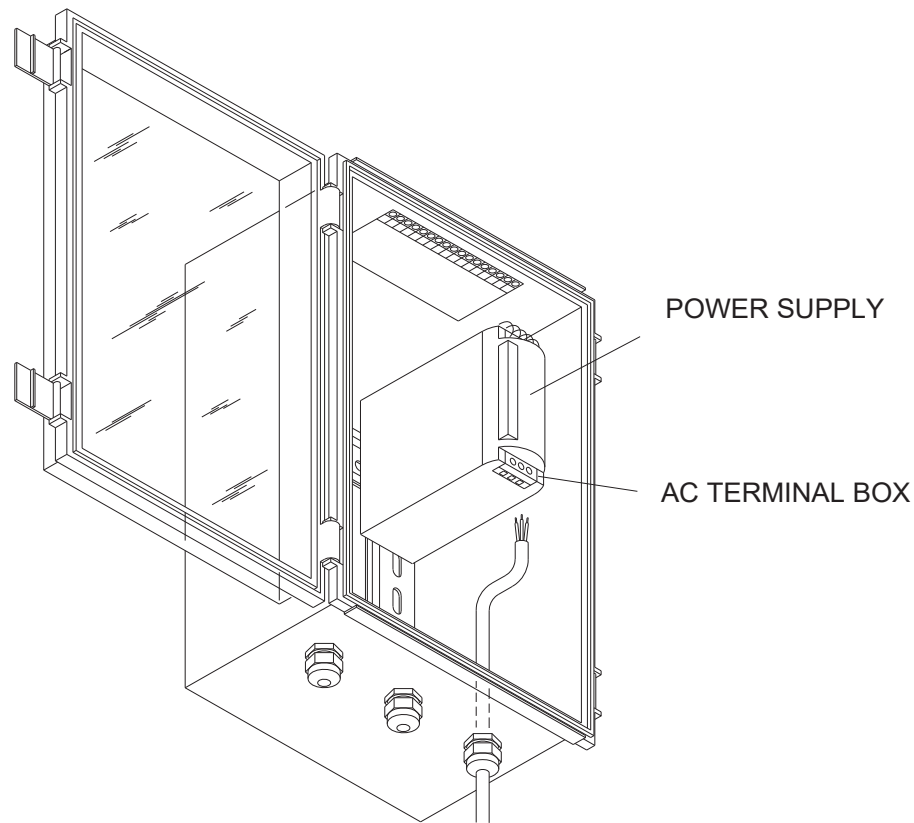
WARNING: When hard-wiring to the AC supply, ensure that the AC source is de-energized and that all applicable lockout/tagout and other electrical safety measures are followed. In addition, do not turn on power until all wiring and connections are complete, from the AC source to the RainAlert III monitor.

2. Run the cable from the AC power source to the power supply.
3. Loosen and prepare the wires from the cable for connection to the power supply.
4. Open the door to the enclosure housing the power supply, as applicable.
5. Feed the power cable up through a cable gland in the enclosure.



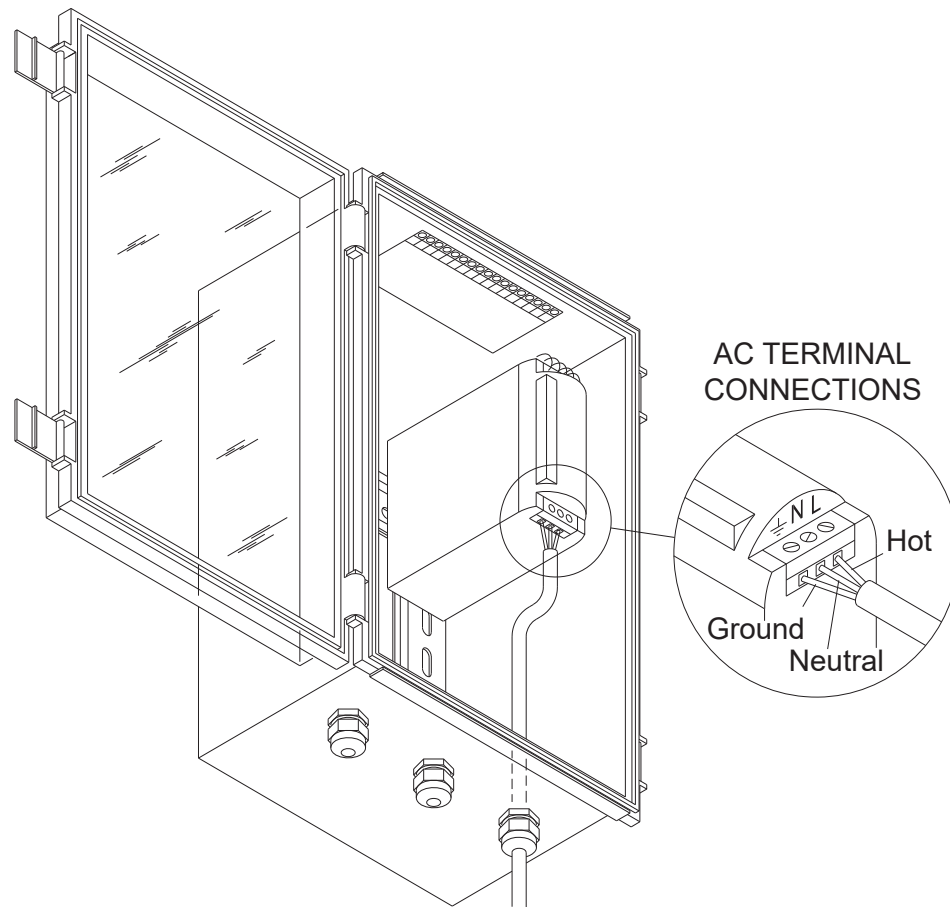
Feeding AC power cable through a cable gland in the enclosure

6. Loosen the screws on the AC input terminals at the bottom, front of the power supply.



Location of AC input terminal block on power supply

7. Connect the power cable wires to the terminals on the power supply by running each wire through the appropriate terminal hole in the bottom of the power supply and tightening the corresponding terminal screw:
 - ☐ Connect the *hot* (typically *black or red*) wire from the power cable to the *line (L)* terminal on the power supply.
 - ☐ Connect the neutral (typically white) wire from the power cable to the neutral (**N**) terminal on the power supply.
 - ☐ Connect the earth ground (typically green) wire from the power cable or electrical panel chassis to the earth ground (⏏) terminal on the power supply.



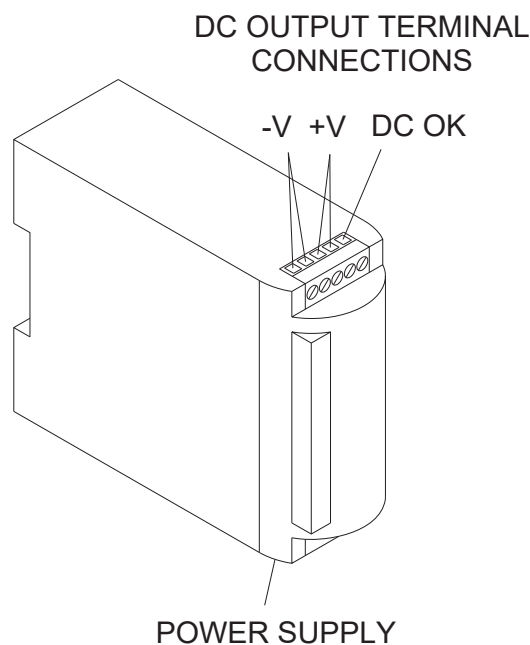
Input terminal connections on power supply for AC cable

Wiring the Power Supply to the Monitor

The next step in connecting the monitor to external power involves running two wires (supplied by the customer) between the power supply and the external power wires that are part of the tipping bucket/external power cable connected to the monitor. ADS provides a special kit containing two vinyl-insulated butt splices (p/n 9000-0045) to allow you to connect the wires from the power supply to the wires from the tipping bucket/external power cable. This splicing kit accommodates 18- to 22-gauge stranded wire. Therefore, for runs requiring wiring of a heavier gauge, obtain appropriate splicing materials.

Connect the wires to the power supply and the tipping bucket/external power cable in the following way:

1. Strip one end of each of the two customer-supplied wires to prepare for connection to the terminals on the power supply.
2. Strip approximately $\frac{1}{4}$ to $\frac{5}{16}$ inch from the other end of the two customer-supplied wires to prepare for insertion into the ADS-supplied butt splices used to connect the customer-supplied wires to the tipping bucket/external power cable.
3. Loosen the screws on one of the $-V$ and one of the $+V$ DC output terminals (front, top corner) on the power supply.

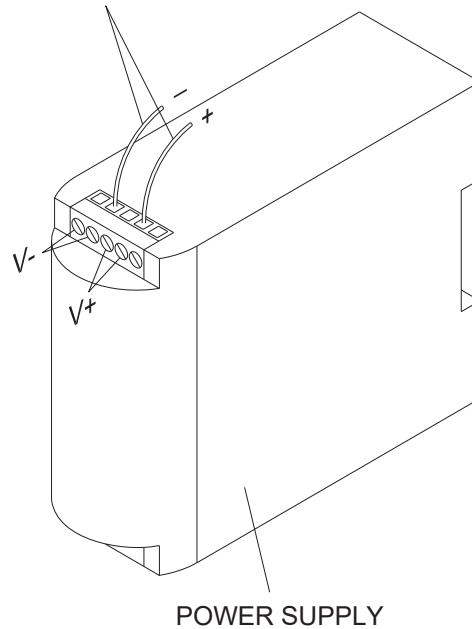


DC output terminals on power supply

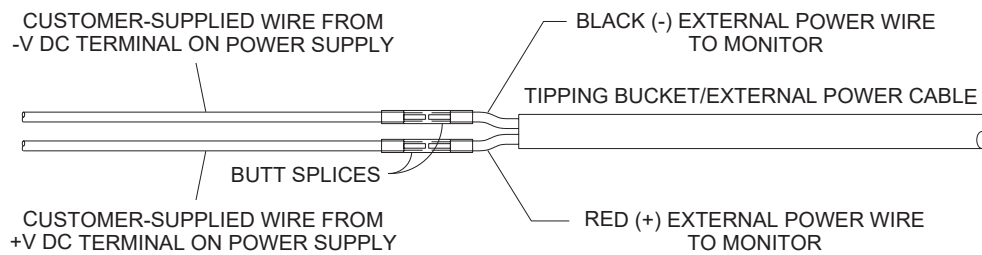
4. Connect one of the customer-supplied wires to the tipping bucket external power cable in the following way:
 - ❑ Insert the end of one of the customer-supplied wires into the hole corresponding to the $-V$ DC output terminal on the power supply, and tighten the associated terminal screw.

- ☐ Insert the other end of the same wire into one end of one of the butt splices until the wire stops, and then use the crimping tool to crimp the terminal portion of the butt splice over the inserted, stripped wire.
 - ☐ Insert the *black* wire from the tipping bucket/external power cable into the other end of the butt splice until it stops, and then use the crimping tool to crimp the terminal portion of the butt splice over the inserted, stripped wire.
5. Connect the other customer-supplied wire to the tipping bucket/external power cable in the following way:
- ☐ Insert the end of the other customer-supplied wire into the hole corresponding to the +V DC output terminal on the power supply, and tighten the associated terminal screw.
 - ☐ Insert the other end of the same wire into one end of the remaining butt splice until the wire stops, and then use the crimping tool to crimp the terminal portion of the butt splice over the inserted, stripped wire.
 - ☐ Insert the *red* wire from the tipping bucket/external power cable into the other end of the butt splice until it stops, and then use the crimping tool to crimp the terminal portion of the butt splice over the inserted, stripped wire.

TO THE TIPPING BUCKET/EXTERNAL POWER CABLE



Wires exiting DC output terminal on power supply



Customer-supplied wires connected to tipping bucket/external power cable

Connecting the External Power Wires to the Monitor

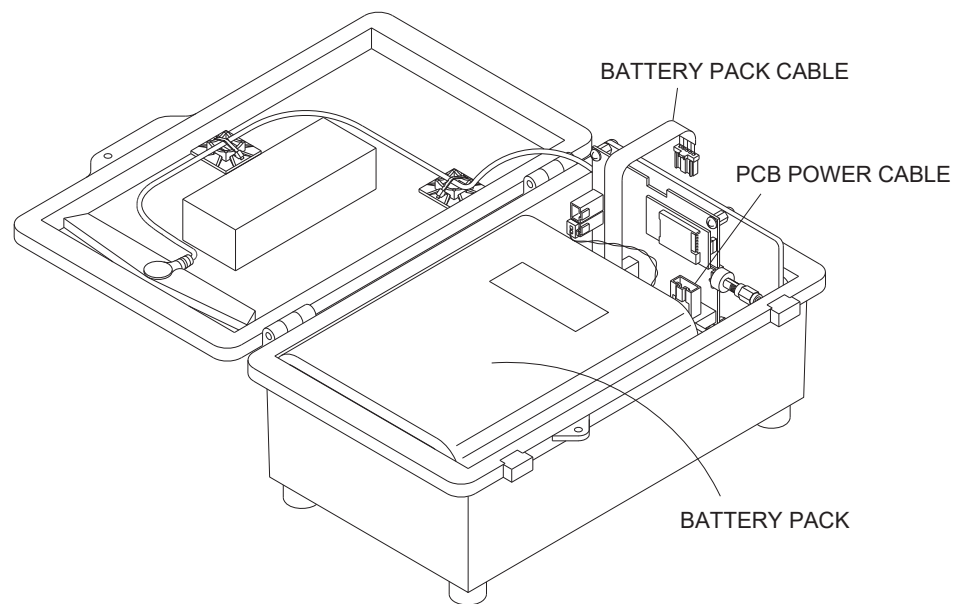
The last step in connecting the monitor to the external power source involves connecting the external power wires from the tipping bucket/external power cable to the monitor. The portion of the cable inside the monitor has a prefabricated external power connector available specifically for this purpose.

Connect the external power wires to the monitor in the following way:

1. Undo the latches on the right side of the monitor enclosure, and open the cover.

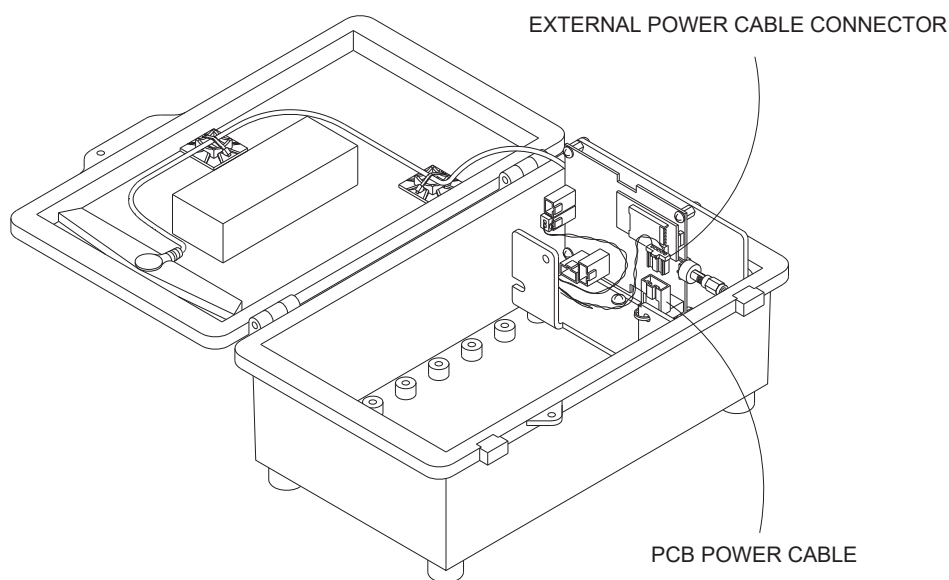
Note: Opening the cover to the monitor enclosure increases the risk of damaging or introducing debris or moisture to the printed circuit board (PCB). Make every effort to prevent water, dirt, and debris from contacting the monitor's circuit board when opening or working within the enclosure.

2. Disconnect the battery pack cable from the PCB power cable, and remove the battery pack from the monitor enclosure.



Disconnecting the battery pack cable from the PCB power cable

3. Insert the external power connector (white connector with red and black wires) from the tipping bucket/external power cable into the PCB power cable connector.



Connecting the external power connector to the PCB connector

4. Carefully close the cover to the enclosure (without pinching the wires), and secure the latches.

Final Instructions

1. Verify the following *before* connecting to the power source:
 - ☐ External power cable is connected to both the AC power source or distribution device (i.e., disconnect, fuse, or breaker box) and the power supply (when applicable)
 - ☐ Power supply (or appropriate DC power source) is connected to the RainAlert III
2. Supply power to the system.
3. Verify that the **ON** LED is *illuminated* on the power supply (*when applicable*). The CPU LED on the PCB in the monitor should also illuminate for a few seconds. For more information on locating and interpreting the LEDs on the monitor PCB, refer to *Chapter 6, Maintenance and Troubleshooting*.

Index

A

- AC power cable
 - wiring to the power supply, D-7
- activating the monitor, 3-26
- activation, 3-26
 - logs, 7-20
- advanced device
 - editing, 3-14
- alarms
 - editing the notification information, 3-19
- antenna
 - external, C-1
 - connecting to monitor, C-2
 - part number, B-1
 - inspection, 7-12
- APN, 3-16

B

- battery pack, 2-7
 - checking voltage, 7-6
 - logging voltage, 3-15
 - minimum voltage requirements, 7-6
 - part number, B-1
 - replacement, 7-7
 - voltage, 2-7
 - voltage regulator, 2-6
- board, 2-5
 - CPU, 2-5
 - part number, B-1
 - specifications, A-3
 - voltage regulator, 2-6

C

- cable gland, 2-3
- cables
 - direct connection cable
 - connecting to the monitor and field computer, 5-2
 - part numbers, B-1
- calibrating the tipping bucket, 4-23
- cellular communication, 5-4
- checking the battery voltage, 7-6
- collecting data from the monitor, 3-32
- communication, 2-7
 - board, 2-6
 - cellular, 5-4
 - connecting external antenna to monitor, C-2
 - direct, 2-6, 2-7
 - direct connection cable
 - installing the driver, 5-2
 - installing external antenna, C-1
 - LED indicators on PCB, 7-18
 - modem setup, 3-16
 - on-site, 5-2
 - PCB, 2-6
 - remote, C-1
 - setting parameters in Qstart, 3-4
 - static and dynamic IP addresses, 5-4
 - troubleshooting, 7-33
 - using the direct connection cable, 5-2
 - viewing logs, 7-20
 - wireless, 2-6, C-1

- configuring the power saving parameters, 3-28
- connecting external antenna to monitor, C-2
- installing the SIM card, 5-9
- replacing the SIM card, 7-13
- compliance
 - modem, 1-4
- Compliance
 - FCC, 1-2
 - Industry Canada, 1-2
- configuration, 3-2
 - creating a monitor location, 3-7
 - editing devices, 3-9
 - editing the advanced device, 3-14
 - editing the data delivery device, 3-23
 - editing the notification information, 3-19
 - editing the rain device, 3-12
 - editing the time zone device, 3-22
 - logging battery voltage, 3-15
 - logging temperature, 3-15
 - Modbus, 6-4
 - modem setup, 3-16
 - monitor, 3-2
 - selecting devices, 3-9
 - setting communication parameters in Qstart, 3-4
 - setting power saving parameters, 3-28
- configuring the monitor, 3-2
 - creating a monitor location, 3-7
 - editing devices, 3-9
 - editing the advanced device, 3-14
 - editing the data delivery device, 3-23
 - editing the notification information, 3-19
 - editing the rain device, 3-12
 - editing the time zone device, 3-22
 - logging battery voltage, 3-15
 - logging temperature, 3-15
 - modem setup, 3-16
 - selecting devices, 3-9

- confirmation, 7-6
- connecting to the monitor on-site, 5-2
- CPU, 2-5
 - LED, 7-18
- customer support, 1-8

D

- data collection, 3-32
 - logs, 7-20
- data delivery device
 - editing, 3-23
- data registers, 6-5
- data storage, A-4
- devices
 - selection, 3-9
- devices
 - editing, 3-9
- devices
 - editing the rain device, 3-12
- devices
 - editing the advanced device, 3-14
- devices
 - logging battery voltage, 3-15
- devices
 - logging temperature, 3-15
- devices
 - editing the notification information, 3-19
- devices
 - editing the time zone device, 3-22
- devices
 - editing the data delivery device, 3-23
- devices
 - running diagnostics on rain device, 7-27
- diagnostics
 - rain device, 7-27
- digital counter, 2-6
- DIN rail
 - mounting power supply, D-3
- direct communication, 2-6, 2-7
- direct connection cable, 5-2

installing the driver, 5-2
dynamic IP address, 5-4

E

editing the advanced device, 3-14
editing the data delivery device, 3-23
editing the notification information,
 3-19
editing the rain device, 3-12
editing the time zone device, 3-22
events
 editing the notification
 information, 3-19
external antenna, C-1
 connecting to monitor, C-2
 specifications, B-1
external power, D-1
 connecting to monitor, D-13
 installation, D-2
 power supply, D-3
 part number for kit, B-1
 supplying to the monitor, D-15
 wiring the AC power cable to the
 power supply, D-7
 wiring the power supply to the
 monitor, D-10

F

FCC Compliance, 1-2
 interference, 1-2
 part 15, 1-2
field calibration device, 4-23
firmware upgrade, 7-22
 logs, 7-20
 LTE-M modem, 7-24
 required battery voltage, 7-24

I

Industry Canada Compliance, 1-2
inspection
 antenna, 7-12

monitor, 7-3
 tipping bucket, 7-11
installation
 external antenna, C-1
 external DC power, D-2
 monitor, 4-28
 parts and supplies, 4-4
 power supply, D-3, D-7, D-10
 SIM card, 5-9
 sun shield, 4-6
 monitor, 4-29
 pole mount, 4-7
 supplying external power to the
 monitor, D-15
 tipping bucket, 4-12
 tools, 4-5
 wireless communication
 installing an external antenna,
 C-1
installing the monitor in the sun
 shield, 4-29
installing the sun shield, 4-6
 pole mount, 4-7
installing the tipping bucket, 4-12
IP address, 5-4
 dynamic, 5-4
 static, 5-4

L

launching the Qstart software, 3-2
LEDs, 7-18
leveling the tipping bucket, 4-23
logging temperature, 3-15
logs, 7-20

M

maintenance
 monitor, 7-2
 parts and supplies, 7-2
 tipping bucket, 7-2, 7-11
microprocessor unit, 2-5
MOD/COM LED, 7-18

Modbus, 6-1

- configuration, 6-4
- data registers, 6-5
- SCADA, 6-1
- setting up a wireless connection, 6-2

modem

- compliance, 1-4
- configuring the power saving parameters, 3-28
- LEDs, 7-18
- setup, 3-16
- status, 7-18

modem firmware upgrade, 7-24

monitor

- activation, 3-26
- activation logs, 7-20
- battery pack, 2-7
- battery voltage, 2-7
- board, 2-5
- cable gland, 2-3
- calculating data storage, A-4
- checking the battery voltage, 7-6
- collecting data, 3-32
- communication
 - direct, 2-7
 - wireless, C-1
- configuration, 3-2
 - creating a monitor location, 3-7
 - editing devices, 3-9
 - editing the advanced device, 3-14
 - editing the data delivery device, 3-23
 - editing the notification information, 3-19
 - editing the rain device, 3-12
 - editing the time zone device, 3-22
 - logging battery voltage, 3-15
 - logging temperature, 3-15
 - modem setup, 3-16
 - selecting devices, 3-9
 - setting power saving parameters, 3-28

confirmation, 7-6

- connecting external antenna, C-2
- connecting external power, D-13

CPU, 2-5

description, 2-3

digital counter, 2-6

external power, D-1

inspection, 7-3

installation, 4-28

parts and supplies, 4-4

pole mount, 4-7

sun shield, 4-6, 4-29

tools, 4-5

installing an external antenna, C-1

installing external antenna, C-1

LEDs, 7-18

maintenance, 7-2

Modbus configuration, 6-4

opening enclosure, 7-8, C-3

part number, B-1

PCB, 2-5

pole mount, 4-7

power, 2-7

external, D-1

replacing battery pack, 7-7

setting power saving parameters, 3-28

SIM card installation, 5-9

SIM card replacement, 7-13

specifications, A-1

static and dynamic IP addresses, 5-4

sun shield, 2-9

supplying external power, D-15

tipping bucket, 2-9

troubleshooting, 7-31

upgrading the firmware, 7-22

viewing activity logs, 7-20

voltage regulator, 2-6

wiring to external power supply, D-10

wiring to the tipping bucket, 4-18

monitor configuration, 3-2

creating a monitor location, 3-7

editing devices, 3-9

- editing the advanced device, 3-14
- editing the data delivery device, 3-23
- editing the notification information, 3-19
- editing the rain device, 3-12
- editing the time zone device, 3-22
- logging battery voltage, 3-15
- logging temperature, 3-15
- modem setup, 3-16
- selecting devices, 3-9
- mounting hardware
 - part numbers, B-1

N

- notification information
 - editing, 3-19

O

- on-site communication
 - using the direct connection cable, 5-2

P

- part numbers
 - battery pack, B-1
 - board, B-1
 - cables, B-1
 - external power, B-1
 - external wireless antennas, B-1
 - monitor, B-1
 - mounting hardware, B-1
 - SIM card, B-1
 - sun shield, B-1
 - tipping bucket, B-1
- parts, 4-4, 7-2
- PCB, 2-5
 - communications, 2-6
 - digital counter, 2-6
 - LEDs, 7-18
 - part number, B-1

- specifications, A-3
- voltage regulator, 2-6
- pole mount, 4-7
- power, 2-7
 - battery pack replacement, 7-7
 - checking the battery voltage, 7-6
 - configuring the monitor for power saving, 3-28
 - connecting external power to the monitor, D-13
 - external, D-1
 - connecting to the monitor, D-13
 - installation, D-2
 - monitor, D-10
 - power supply, D-7, D-10
 - supplying to system, D-15
 - logging battery voltage, 3-15
 - supply to the monitor, D-15
 - voltage regulator, 2-6
 - wiring the AC power cable to the power supply, D-7
 - wiring the power supply to the monitor for external power, D-10
- power supply
 - installation, D-3
 - mounting to DIN rail, D-3
 - installation and wiring, D-7, D-10
 - wiring to the AC power cable, D-7
 - wiring to the monitor, D-10
- printed circuit board, 2-5
- processor, 2-5

Q

- Qstart
 - activating the monitor, 3-26
 - collecting data from the monitor, 3-32
 - configuring the power saving parameters, 3-28
 - editing the advanced device, 3-14
 - editing the data delivery device, 3-23

- editing the notification
 - information, 3-19
- editing the rain device, 3-12
- editing the time zone device, 3-22
- launching software, 3-2
- logging battery voltage, 3-15
- logging temperature, 3-15
- modem setup, 3-16
- running diagnostics on rain device, 7-27
- selecting and editing devices, 3-9
- setting parameters, 3-4
- upgrading the monitor firmware, 7-22
- viewing logs, 7-20

R

- rain device
 - editing, 3-12
 - running diagnostics, 7-27
- rain measurement
 - calibrating the tipping bucket, 4-23
 - field calibration device, 4-23
 - installing the tipping bucket, 4-12
 - leveling the tipping bucket, 4-23
 - performing a tip test, 4-26
 - tipping bucket, 2-9
 - troubleshooting the tipping bucket, 7-35
- remote communication
 - installing an external antenna, C-1
- repair, 1-7
- replacing the battery pack, 7-7
- replacing the SIM card in the monitor, 7-13
- running diagnostics, 7-27

S

- SIM card
 - installation, 5-9
 - modem setup, 3-16

- part number, B-1
- replacement, 7-13
- site investigation, 4-3
- specifications, A-1
 - monitor, A-1
 - PCB, A-3
 - tipping bucket, A-5
- static IP address, 5-4
- sun shield, 2-9
 - installation, 4-6
 - monitor, 4-29
 - pole mount, 4-7
 - part number, B-1
- supplies, 4-4, 7-2
- support, 1-8

T

- temperature
 - logging, 3-15
- time zone device
 - editing, 3-22
- tip test, 4-26
- tipping bucket, 2-9
 - calibration, 4-23
 - confirmation, 7-6
 - description, 2-9
 - digital counter in monitor, 2-6
 - field calibration device, 4-23
 - inspection, 7-11
 - installation, 4-12
 - pole mount, 4-7
 - leveling, 4-23
 - maintenance, 7-2, 7-11
 - part numbers, B-1
 - running diagnostics on the rain device, 7-27
 - specifications, A-5
 - sun shield, 2-9
 - tip test, 4-26
 - tipping mechanism, 2-9
 - troubleshooting, 7-35
 - wiring to the monitor, 4-18
- tips, 2-9

- digital counter, 2-6
- tools, 4-5
- troubleshooting, 7-29
 - communications, 7-33
 - monitor, 7-31
 - tipping bucket, 7-35
- troubleshooting the monitor, 7-31

U

- upgrade firmware
 - LTE-M modem, 7-24
- upgrading the firmware in the monitor, 7-22

V

- voltage, 2-7
- voltage regulator, 2-6

W

- warranty, 1-6
- wireless antenna
 - specifications, B-1
- wireless communication, 2-6, 5-4
 - configuring the power saving parameters, 3-28
 - connecting external antenna to monitor, C-2
 - installation
 - SIM card, 5-9
 - installing an external antenna, C-1
 - installing external antenna, C-1
 - Modbus, 6-2
 - replacing the SIM card, 7-13
 - static and dynamic IP addresses, 5-4
 - troubleshooting, 7-33
- wiring
 - connecting the tipping bucket to the monitor, 4-18