

Document #5

Centeron™ Ultrasonic Monitor Instruction Manual

Model: UM Series

Document # 039935A0001

Revision # C

Dated 11/07/2000



Robertshaw
INDUSTRIAL PRODUCTS DIVISION
AN INVENSYS COMPANY

Invensys

U.S.A. – Robertshaw Industrial Products Division, 1602 Mustang Drive, Maryville, Tennessee 37801
865-981-3100 • Fax: 865-981-3168
www.Centeron.net

The product described within contains RF technology licensed through Axonn Corp.
under the following patents: 5,067,136 5,095,493 5,457,713



Notice

The information contained in this document is current as of the date of publication but is subject to change without notice. ***Robertshaw makes no warranty, expressed or implied, with regard to this material, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.*** Robertshaw shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Robertshaw assumes no responsibility for the use or reliability of its products or equipment other than that for which it is intended or for use other than in the manner prescribed herein.

This document is protected by copyright. All rights reserved. No part of this document may be reproduced, copied, photographed, electronically scanned, or translated into another language without the prior written consent of Robertshaw.

The **Centeron™** logo is a trademark of Robertshaw Controls. Other manufacturer or service names mentioned in this publication are trademarks, service marks, or registered trademarks of their respective holders.

© 2000 Robertshaw Controls. All Rights Reserved.

List of Acronyms

Acronym	Defined
ANSI	American National Standards Institute
DSP	Digital Signal Processor
ETL	Edison Testing Laboratories
FCC	Federal Communications Commission
GPS	Global Positioning System
Hz	Hertz
MHz	Megahertz
NEMA	National Electric Manufacturers Association
NPT	National Pipe Thread
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch, Gauge
RF	Radio Frequency
UL	Underwriters Laboratories
UV	Ultraviolet
V	Volts

1.0 Introduction

This manual describes how to install, test, and service the Centeron™ Ultrasonic Monitor. The Centeron™ Ultrasonic Monitor is part of the Centeron™ Level Monitoring System that includes the Data Collection System and Controller(s).

This guide does not include how to install, test, maintain or troubleshoot the Controller(s) or Data Collection System. Refer to these products' respective instruction manuals.

The description herein is based on a standard installation.

2.0 Product Overview

2.1 Description

The Centeron™ Ultrasonic Monitor is a member of Robertshaw's Spread Spectrum Radio Frequency (RF) family of products. This Monitor detects level, temperature, low battery, and system status and broadcasts this data to the system's Controller.

The Monitor is pre-programmed at the factory with the Transmitter ID, Property Code, and Transmission Frequency. No field programming of the Monitor is required.

2.1.1 Product Markings

Included on the housing of the Monitor is a label that contains important information about the product.

Figure 1. Centeron™ Monitor Label Product Markings**2.1.1.1 Product and Customer Identification Field**

This field is used to identify the product or customer depending on application.

2.1.1.2 Serial Number Field

This field displays the seven character alphanumeric I.D. which uniquely identifies the Monitor (and tank) to the Centeron™ system. This number is programmed into the unit at the factory and remains resident in the EEROM of the device even if the battery is removed. This number can currently only be re-programmed at the factory. The serial number is also bar coded in standard 128 Auto-switching Format for easy reading with bar code devices.

2.1.1.3 Model Number Field

This field displays the current model number and revision of the device. Please be sure to identify this number when contacting service or technical support personnel.

2.1.1.4 FCC I.D., Logo, and Text Field

The FCC requires certification information and identification to appear on product labels. See Section 2.4.1 for more information on FCC certification.

2.1.1.5 Product Safety Markings and Text Field

The commercial and industrial markets require products to meet certain safety requirements and to be marked appropriately. See Section 2.4.2 for more information on safety certifications.

2.1.1.6 Manufacturing Location and Patent Listing Field

This field identifies the location of manufacturing and all patents that apply to the product.

2.1.1.7 Warning Label

This label provides important information concerning Intrinsic Safety and battery replacement. Refer to Section 5.1 for specific battery replacement instructions.

2.2 Operation

The Monitor consists of a hermetically sealed housing with external pipe threads which installs in a 1 ½" or 2" National Pipe Thread (NPT) bung. The housing contains an ultrasonic transducer and electronic circuitry. The transducer broadcasts an ultrasonic sound wave and receives the echo of that wave off the surface of the liquid in the tank. The electronic circuitry measures the travel time of the sound wave and calculates the distance from the transducer to the liquid level. This level information is transmitted to the Controller using a spread spectrum radio signal in the 902–928 MHz bandwidth. Level information transmitted by the monitor is in tenths of an inch measured from the level output reference line on the Monitor lower housing to the surface of the fluid (see Figure 7 in Appendix C: Product Drawing).

The Monitor is powered by a replaceable 3-Volt battery that is designed to provide at least two (2) years life in normal service.

2.3 Environmental Specifications

The following environmental specifications should be observed when installing the Monitor:

- Operating Temperature Range: -40°C to +80°C (-40°F to +176°F)
- Sealed housing meets or exceeds Enclosure Type 3.
- UV life: 10 years exposure to direct sunlight.
- Shock: The unit will withstand a one meter drop test per UL 913.
- Chemical Exposure: The unit is hermetically sealed and designed for outdoor service. The housing material of the Monitor is Polypropylene which has very good chemical resistance to most fuels, oils, and acids.
- Maximum Pressure Differential: -13 PSIG to 5 PSIG.

2.4 Certifications

2.4.1 FCC Notice—Radio Frequency Communications

The Monitor generates and uses radio frequency energy. If not installed and used in accordance with the manufacturer's instructions, it may cause interference to radio and television reception. The Monitor board has been tested and found to comply with the specifications in Part 15 of Radiators and FCC Rules for Class B Computing Devices.

CAUTION: Robertshaw Industrial Products Division does not support field changes or modifications to any of the Centeron™ Level Monitoring System equipment unless they are specifically covered in this manual. All adjustments must be made at the factory under the specific guidelines set forth in our manufacturing processes. Any modification to the equipment will void the manufacturer's warranty and could void the user's authority to operate the equipment and render the equipment in violation of FCC Part 15, Subpart C, 15.247.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.4.2 Safety and Regulatory

The Monitor is designed to comply with UL Standards for Intrinsically Safe Apparatus for use in Class I, Division 1, Group D locations. The Monitor conforms to UL 913 and has been certified to CAN/CSA Standard C22.2 No. 157 and Standard C22.2 No. 94.

WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SÉCURITÉ INTRINSÈQUE.

3.0 Installation

A Quick Installation Guide which provides an overview of the Ultrasonic Monitor installation procedure was included with this product.

The following sections of this manual explain in detail the site selection and installation process:

3.1 RF Site Guidelines

The Centeron™ Ultrasonic Monitor contains sensitive measurement circuitry and a radio transmitter. Large metal objects such as buildings and vehicles may affect the transmission of radio signals. Electrical equipment may produce electronic noise that could adversely affect signal quality.

- Direct line of sight between the Centeron™ Monitor and Controller will provide optimum radio reception.
- The Centeron™ Monitor and Controller can communicate at distances up to one mile under optimum line-of-sight conditions.
- When obstructions such as walls, buildings, and vehicles exist between the Centeron™ Monitor and Controller the distance between these units should be limited to less than 500 feet.
- Multiple obstructions (such as two or more walls or a tank and a wall) between the Monitor and Controller should be avoided, if possible.
- Electrically conductive objects such as metal buildings, reinforcement rods, tanks, silos, and vehicles reflect radio signals. This reflection can be either an advantage or disadvantage to good radio reception at a particular installation site:
 1. Metal objects between the Monitor and Controller may reflect and scatter RF energy and reduce radio signal strength at the Controller.
 2. Metal objects behind the Monitor or Controller may increase the radio signal strength at the Controller by reflecting radio signals toward the Controller.
- Even small metal objects such as tank vents or toolboxes between the Monitor and Controller can significantly reduce radio signal strength if they are within a few feet of the Monitor or Controller. These objects can reflect radio signals and cause a RF "shadow" which may prevent radio signals from reaching the Controller.
- Objects which are not electrically conductive such as wooden or fiberglass buildings, non-reinforced masonry, trees, plastic, and glass have less effect on radio signals than metal objects.

- Windows and wooden doors can provide radio signals access into otherwise closed metal buildings. However, "low-E" window glass may have a thin metallic coating which can reflect radio signals.
- Strong electromagnetic fields such as those found in close proximity to power lines, large electric motors, generators, electric fences, and transmitter antennas may interfere with the radio signals received by the Centeron™ Controller.
- The Centeron™ Controller should be mounted as high as is reasonably possible to improve its ability to receive radio signals. For example, placing the Controller on a high shelf would be preferable to setting the unit on a floor near ground level. Installing the Controller on the second floor of a two-story structure would be more desirable than installing it on the ground floor. Installing the Controller in an underground basement should be avoided.

Warning: For maximum Monitor reception, mount the Monitor within 500 feet of the Controller, avoid mounting Monitor inside a fully closed metal building, and avoid close proximity to large electrical equipment.

3.2 Handling Guidelines

The Centeron™ Ultrasonic Monitor is designed to provide many years of reliable service in demanding outdoor environments. However, the Monitor contains sensitive measurement circuitry and should be handled carefully. Do not throw or drop the Monitor. Do not insert objects into the cylindrical end of the Monitor lower housing. Do not attempt to disassemble the Monitor except as described in section 5.1 (Battery Replacement).

3.3 Mounting

After the Controller has been successfully setup, the Monitor can be mounted to the tank by following these instructions:

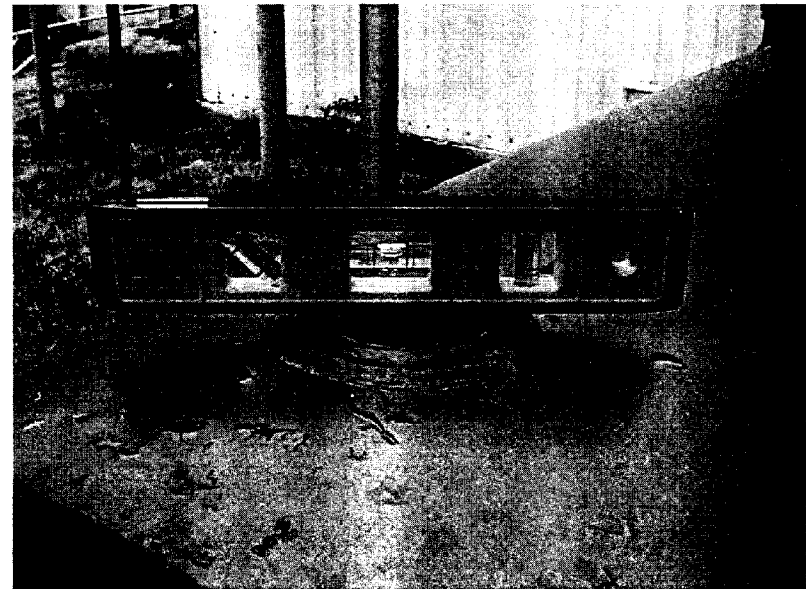
Warning: If the tank contains flammable liquid, extinguish all flames and smoking material before performing the Monitor installation procedure.

- Remove the Monitor from its protective packaging. Along with the Monitor, there will be two O-rings in the package, one 1.5" and the other 2" in diameter.
- Determine the appropriate O-ring to use based on the size of the tank opening.

- Slip the appropriate size O-ring over the end of the Monitor and slide it past the lip at the base of the threads. Press along the O-ring circumference until it is snug.
- Remove the existing plug from one of the threaded openings on top of the tank. Insert the monitor into this opening.

Note: For maximum Monitor performance, adjust the tank so that the top mounting surface of the tank opening is level to within +/- 5 degrees. A bubble level may be used for this task (see Figure 2).

Figure 2. Adjusting Surface of Tank Opening using Bubble Level



- Carefully screw the Monitor onto the tank by hand tightening it 1/8 turn past engagement of the O-ring. Assembly requires only a snug fit. Do not over-tighten.

Repeat these steps for additional Monitors. Figure 6 in Appendix B shows a monitor installed on a fuel tank.

3.4 Activation

After Monitor mounting, follow these steps to activate the unit(s):

- To activate the Monitor, pull the disable magnet completely out of the top of the Monitor housing. This will activate the Monitor to make measurements and burst transmissions on a factory programmed interval.

Note: The installer can limit the number of Controller calls during multiple Monitor installs by removing each additional Monitor magnet within 30 seconds of the last one.

Note: Do not discard the magnet completely—keep it accessible for future use if needed. Do not store the magnet in the monitor upper housing slot since this will de-activate the monitor.

- Once the disable magnet is removed from the Monitor (see Figure 7 in Appendix C), the Controller should flicker one green light to indicate that it successfully received a Monitor transmission.

Note: A second installer could verify this by watching the Controller during Monitor activation.

- The Controller will then wait 30 seconds to receive additional Monitors before calling the Data Collection System.

To activate multiple Monitors, repeat these steps.

3.5 Site Survey

Appendix D contains a Site Survey Form, which should be filled out by the installer.

Supply the following information:

- Contact Name
- Contact Address
- Contact Telephone Number
- GPS Location (latitude/longitude)
- Product Name
- Product ID
- Tank Orientation (horizontal/vertical cylinder, oblong, etc.)
- Tank Geometry (diameter, length, width, etc.)
- Tank Contents

Figure 3 shows an example of a completed Site Survey form.

Figure 3. Example Completed Site Survey Form

Robertshaw Centeron™ Level Monitoring System UltraSonic Monitor Site Survey Form	
Contact Name:	John Smith
Contact Address:	12345 Elm Street Anywhere, USA 12345
Contact Telephone Number:	(123) 456-7890
GPS Location (latitude/longitude):	35° 57' 12" North - 83° 56' 44" West
Product Name:	Centeron™ Ultrasonic Monitor
Product ID:	U000001
Tank Orientation (horizontal/vertical cylinder, oblong, etc.):	Horizontal cylinder
Tank Geometry (diameter, length):	50" outside diameter X 63" outside length
Tank Contents:	Diesel fuel

4.0 Troubleshooting and Testing

This section contains procedures for testing the Centeron™ Ultrasonic Monitor and provides information troubleshooting the monitor installation.

If the Monitor is not operating properly, try to locate the solution below:

Question

Has the Monitor ever reported into the Data Collection System?

Solution

If Never:

Verify that the Controller is properly installed. Refer to the Controller Instruction Manual for installation verification.

Perform the Monitor test in Section 4.1 with the Monitor installed. If this test is unsuccessful, perform the same test

Question**Solution**

with the Monitor end resting on a flat surface near the Controller installation location. If successful only at bench testing, re-evaluate the installation site for RF interference problems per Section 3.1 and refer to Section 5.5 for technical support. If not successful at either test, continue with troubleshooting.

Replace the 3 VDC (DL123 Size 2/3A) LiMnO₂ battery by following Section 5.1 and repeat the above tests. If still having problems, refer to Section 5.5 for technical support.

Does the Monitor occasionally miss scheduled report times (i.e., The Controller reports "lost Monitor" to the Data Collection System)?

If Yes:

The most likely cause is RF interference problems. Re-evaluate the installation site for RF interference problems and refer to Section 5.5 for technical support.

Does the Monitor ever report a low battery status?

If Yes:

Replace the 3 VDC (DL123 Size 2/3A) LiMnO₂ battery by following Section 5.1 and repeat the above tests. If still having problems, refer to Section 5.5 for technical support.

Does the Monitor ever report error codes?

If Yes, find the error code below:

Code 00: This is a checksum error. Try inserting and removing the magnet on the Monitor to cycle its power. If the problem still occurs, refer to Section 5.5 for technical support.

Code 01-04: DSP not responding. Try

Question**Solution**

re-inserting and removing the magnet on the Monitor to cycle its power. If the problem still occurs, refer to Section 5.5 for technical support.

Code 05: Power does not turn off in sleep cycle. Refer to Section 5.5 for technical support.

Code 06-09: Reserved for Test Diagnostics only. If these codes are reported, refer to Section 5.5 for technical support.

Code 10-11: Acoustic search error. Signal strength is low. Check to make sure the sensor is level to within 5 degrees. If not, use a bubble level to level the tank. Check to make sure the tank is not completely empty or that the level is further then 72 inches. If problems still occur, refer to Section 5.5 for technical support.

4.1 Monitor Test

The Monitor is designed to wake up, take a measurement, and transmit RF data every time the power is cycled by inserting and then removing the disable magnet used for shipping. At the same time that the Monitor transmits its RF data, the Controller will acknowledge the receipt of the transmission by blinking the top right green LED light. If the Controller has never received data from this particular Monitor (this is the case during initial install or after the Controller has been reset), it will then initiate a call (within 30 seconds) to the Data Collection System to report a "new Monitor" and request set-up data. With this in mind, use the following steps to verify installation and troubleshoot system communication problems.

1. Re-set the Controller by following the guidelines under the Controller test section of the Controller instruction manual. Proceed to the next step only if the above is successful.

2. Insert the disable magnet into the slot of the Monitor's upper housing until snug.
3. If testing with the Monitor at the location site, it will be necessary to have one person activate the Monitor while another watches for a response at the Controller. If bench testing, the same person can locate the Monitor close to the Controller in order to watch for a response. Activate the Monitor by completely removing the disable magnet from the upper housing.
4. Verify that the Controller received the RF data transmission by watching the top right green led light turn off and on.
5. Verify that the Controller initiates a phone call after 30 seconds and returns to ready mode (see Controller Instruction Manual on how to recognize Ready mode).

Repeat the above test as necessary, using the guidance of Section 4.0 to determine the cause of communication problems.

5.0 Servicing

5.1 Battery Replacement

If it becomes necessary to replace the battery in the Monitor, follow these steps:

WARNING: TO PREVENT IGNITION OF A HAZARDOUS ATMOSPHERE, THE BATTERY MUST ONLY BE CHANGED IN AN AREA KNOWN TO BE NONHAZARDOUS.

AVERTISSEMENT: AFIN DE PRÉVENIR L'INFLAMMATION D'ATMOSPHÈRES DANGEREUSES, NE CHANGER LE BATTERIE QUE DANS DES EMBLEMES DÉSIGNÉS NON-DANGEREUX.

Caution: When performing this procedure be extremely careful not to disturb the three wires that connect the probe, reference cell, and shield to the circuit board. Relocating these wires can significantly affect calibration of the Monitor.

Warning: Use Duracell Ultra DL123A Lithium Manganese Dioxide 3 volt battery only.

Warning: If the tank contains flammable liquid or vapor, extinguish all flames and smoking material before performing the battery replacement procedure.

1. Remove monitor from the tank and transport it out of the hazardous area.
2. Ground yourself by either wearing an anti-static wrist strap or by touching a grounded metal object (such as a copper water pipe).
3. Remove the Monitor's upper housing by removing the 3 Phillips head screws and carefully lifting the upper housing off of the lower housing.
4. Cut and discard the tie wrap that secures the old battery (see Figure 4).

Figure 4. Ultrasonic Monitor without Cover (Replacing the Battery)



5. Remove the old battery.
6. Insert the new battery (observing polarity markings molded into the battery holder).
7. Carefully install a new zip tie through the circuit board slots and secure it around the battery.
8. Ensure that the upper housing O-ring is properly positioned on the lower housing O-ring shelf.
9. Firmly reinstall the Monitor's upper housing.

Note: The mounting screws are not evenly spaced around the upper housing in order to insure that the housing will only fit in the proper orientation.

10. Using a Phillips screwdriver, gently tighten the 3 screws on the Ultrasonic Monitor housing to 10+/- 2 inch pounds. Do not overtighten.
11. Re-install the monitor on the tank.
12. Follow the battery manufacturers' safety and disposal guidelines.

5.2 Warranty

Seller warrants title and that products sold to Buyer shall be free from defects in material and workmanship and shall conform to specifications for a period of one (1) year from purchase for complete units and parts and subassemblies. Warranties on goods sold but not manufactured by the seller are expressly limited to the terms of warranties of the manufacturer of such goods.

Seller makes no representation or warranty of any kind, express or implied, as to merchantability, fitness for particular purpose or any other matter. Upon receipt of definite shipping instructions, Buyer shall return, transportation prepaid, all defective material, or material not conforming to specifications, to Seller, after inspection by Seller, or at Seller's election, subject to inspection by Seller. Material returned by Buyer must be returned in same condition as when received by Buyer. Defective material, or material not conforming to specifications, so returned shall be replaced or repaired by Seller and returned, freight prepaid, without any additional charge, or in lieu of such replacement or repair, Seller, may, at Seller's option, refund the purchase price applicable to such material. Seller agrees to pay return freight charges not exceeding the lowest rail or truck rate which would apply from the original destination on all defective material, or material not meeting specifications. However, Seller shall not be obligated for such charges when material returned proves to be free from defect and to meet specifications. Material that proves to be free from defect and to meet specifications shall be held by Seller for shipping instructions and Buyer shall furnish such instructions promptly upon request. Seller's liability shall be limited solely to the replacement or repair or to refunding the purchase price applicable to the defective material or material not meeting specifications. Seller shall not be liable for any consequential damages nor any loss, damages or expenses directly or indirectly arising from the use of the material.

5.3 Unit Disposal

The U.S. Environmental Protection Agency regulates the disposal of waste products in the United States. The EPA Regulations are listed in the "Code of Federal Regulations," CFR40, entitled "Protection of Environment." Individual

states and local communities also may establish regulations covering the disposal of waste products. These may be more stringent than the federal regulations and may cover the disposal of household waste, which is not included in the federal regulation. Thus, state and local agencies should be contacted for their disposal guidelines.

The plastic parts of the external housing unit are marked for recycling purposes. The battery must be disposed of by an approved battery recycling center.

5.4 Service Parts List

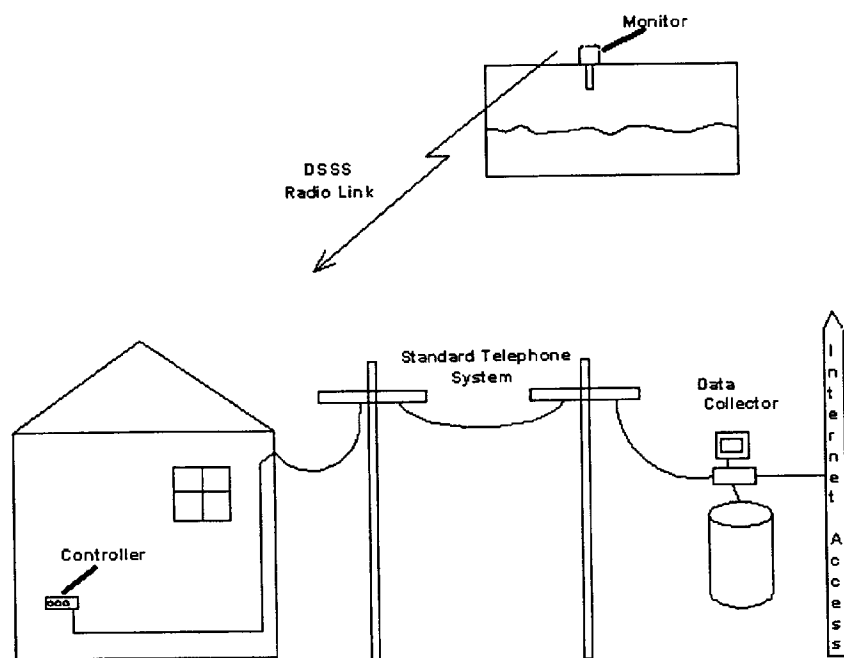
Robertshaw Part Number	Description	Quantity
039935A0001	Instruction Manual	1
039934A0001	Quick Installation Leaflet	1
039912A0001	Upper Housing Screws	3
039911A0001	Battery	1
039898A0001	Tie Wrap	1
086607A0001	Magnet Assembly	1
036240N0039	Upper Housing O-ring	1
036240N0229	2" Mounting O-Ring	1
036240N0225	1 ½" Mounting O-Ring	1

5.5 Service and Technical Support

For service and technical support, contact Robertshaw Industrial Products Service Center at (865) 981-3103

Appendix A: Monitoring System

Figure 5. Monitoring System



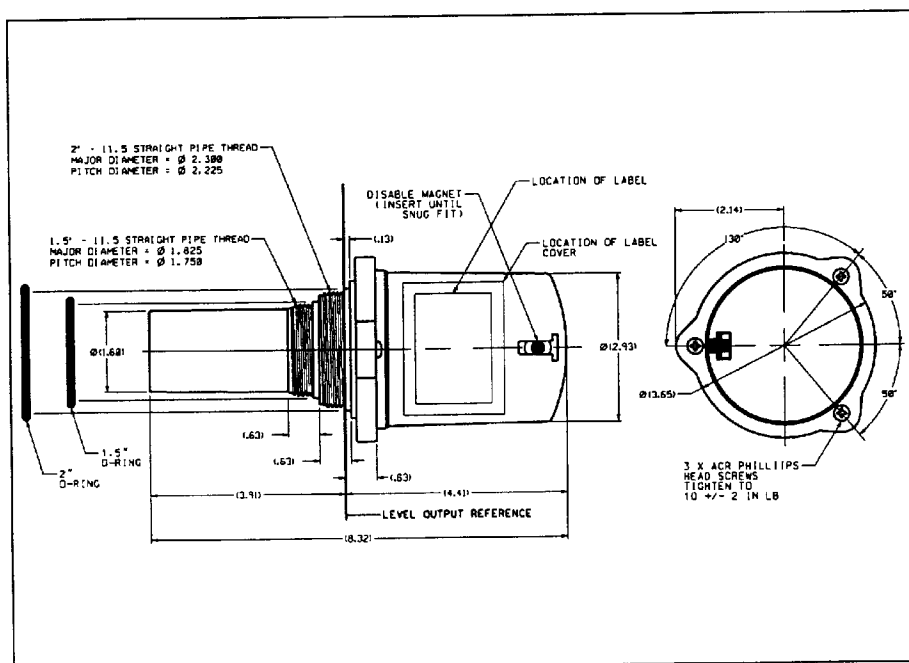
Appendix B: Monitor Installed on Tank

Figure 6. Monitor Installed on Tank



Appendix C: Product Drawing

Figure 7. Monitor Drawing



Appendix D: Site Survey Form

Figure 8. Site Survey Form

Robertshaw Centeron™ Level Monitoring System UltraSonic Monitor Site Survey Form	
Contact Name:	
Contact Address:	
Contact Telephone Number:	
GPS Location (latitude/longitude):	
Product Name:	
Product ID:	
Tank Orientation (horizontal/vertical cylinder, oblong, etc.):	
Tank Geometry (diameter, length):	
Tank Contents:	