

Centeron™

Flexible Probe Radar Monitor

Instruction Manual

Model: RM Series

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1.0 Introduction

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

This guide does not describe how to install, test, maintain or troubleshoot the Centeron® Controller 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® Radar Monitor is a member of Robertshaw's Spread Spectrum Radio Frequency (RF) family of products. This Monitor detects level, temperature within the Monitor housing, battery condition, and error codes and broadcasts this information to the system's Controller.

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

2.2 Operation

The Radar Monitor consists of a sealed Polypropylene housing with external pipe threads which installs in a 1 ½" or 2" National Pipe Thread (NPT) bung. The housing protects the Monitor's electronic circuitry and supports the long flexible probe that extends down into the tank. The Radar Monitor measures liquid level by detecting the vertical position of a float that rides on the probe at the top of the liquid. The Monitor's electronic circuitry measures the time that it takes for an electromagnetic pulse to travel to the float and back to the Monitor. Travel time for the electromagnetic pulse is proportional to distance, allowing the Monitor to calculate fluid level. This level information is transmitted to the Controller using a spread spectrum radio signal in the 902–928 MHz ISM band. Level information transmitted by the Monitor is in tenths of an inch measured from the level output reference line on the Monitor lower housing (see Figure 3) to the surface of the fluid.

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

transmit more frequently than once every four hours and Monitors that are subjected to prolonged exposure to extreme temperatures will exhibit reduced battery life.

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)
- The Monitor housing is designed to meet or exceed NEMA 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 Centeron® Radar Monitor is designed for use in water, ethylene glycol, oil, and common hydrocarbon fuels such as gasoline, gasoline / ethanol blends, fuel oil, and diesel fuel. Wetted materials in this design include polypropylene, 316 series stainless steel, Nitrile rubber, brass, and FEP Teflon. For applications involving fluids other than those noted above contact the Robertshaw Industrial Products Technical Support Group (refer to Section 5.5) before installation.
- Pressure: The Centeron® Radar Monitor is designed for use on vented storage tanks only. The maximum pressure inside the tank must not exceed 5 PSI.

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 complies with the specifications in Part 15 of the 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.

CAUTION: This device is required to comply with FCC RF exposure requirements for mobile transmitting devices. The FCC requires that the antenna(s) used for this transmitter must be installed to provide a separation of at least 20 cm (8 inches) from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

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 Radar 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 Radio Installation Guidelines

The Centeron® Radar 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, concrete 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 that 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. Do not paint the Centeron® Monitor or Controller housings.

3.2 Handling Guidelines

The Centeron® Radar 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 pull on the probe cable. Do not kink or twist the probe cable. Do not attempt to disassemble the Monitor except as described in section 5.1 (Battery Replacement).

When removing the Monitor for storage or shipment insert the disable magnet securely in the magnet slot. Clean the probe, float, and anchor with a damp cloth. Secure the probe cable in a flat coil and pack the Monitor in a protective container.

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 or vapor, 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.
- Select a permanent mounting location on the top of the tank that will allow the Radar Monitor cable to hang vertically inside the tank. Verify that there is adequate clearance to prevent the float, cable, or anchor from contacting obstructions such as walls, baffles, reinforcements, and other measurement equipment inside the tank. There should be at least two inches of clearance between the probe cable and any obstructions. Remove all materials from the desired bung.
- The Monitor may be installed in a vertical standpipe if necessary. However, the standpipe must have an inside diameter of at least two inches and its length should be minimized. If the Radar Monitor is to be installed in a standpipe that is more than 6” tall, clip and remove the positive stop (wire tie) that is inserted through the probe cable about 4” below the Monitor housing. Verify that the standpipe is vertical and that the probe cable and float will not contact the sides of the pipe. If the probe cable touches the inside of a standpipe at any point because the pipe is not vertical, a Probe Centering Kit (P/N 086655A0001) should be installed.
- Measure from the top of the tank bung to the inside bottom surface of the tank. Install the float and anchor on the probe cable. Carefully slide the anchor up the cable so that it will be positioned approximately two inches above the inside bottom surface of the tank when the Monitor is installed. Tighten the cable anchor screws to approximately 10 in. lb torque and cut off any excess cable flush with the bottom of the anchor. The cable and anchor must not touch the bottom of the tank when the Monitor is installed.
- Determine the appropriate mounting O-ring to use based on the size of the tank opening. Slip the O-ring over the probe end of the Monitor and slide it past the lip at the base of the lower housing threads. Press along the O-ring circumference until it is snug.

- Lower the anchor, probe, and float into the tank while being extremely careful not to nick the cable insulation on the tank threads. Verify that no twists or kinks are allowed to remain in the cable. Imperfections in the cable such as these must be straightened by hand as the cable is lowered into the tank.
- Carefully screw the Monitor into the tank opening by hand tightening it 1/8 turn clockwise past engaging the O-ring. Assembly requires only a snug fit. Do not over-tighten.
- When installation is complete the probe cable should hang straight and vertical in the tank. The float should rest on the liquid surface and move freely on the cable.

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.

Repeat these steps for additional Monitors.

Warning: For maximum Monitor reception, mount the Monitor within 500 feet of the Controller, avoid mounting the Monitor or Controller inside a fully closed metal building or in a metal enclosure, and avoid close proximity to large electrical equipment. Do not paint the Centeron® Monitor or Controller housings.

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 (see figure 3). This will activate the Monitor to make measurements and burst transmissions on a factory-programmed interval.
- 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.*
- When the disable magnet is removed from the upper housing slot the Monitor will immediately make a level measurement and transmit this information. The Monitor then waits for three minutes and then makes transmissions every thirty seconds for the next four minutes. The Controller will flicker the green “Test” LED each time it successfully receives a Monitor transmission. After this initial activation routine the Monitor reverts to its factory programmed transmission interval.

Note: The installer can verify radio reception at the Controller by watching the “Test” LED during the Monitor’s activation sequence.

To activate multiple Monitors, repeat these steps.

3.5 Site Survey

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

Record the following information on the 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, width, etc.)
- Tank Contents (diesel fuel, gasoline, etc.)

4.0 Troubleshooting and Testing

This section contains procedures for testing the Centeron® Radar Monitor and provides information for troubleshooting the Monitor installation.

4.1 Troubleshooting

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

Question	Solution
Has the Monitor ever reported into the Data Collection System?	<p>If Never:</p> <p>Verify that the Controller is properly installed. Refer to the Controller Instruction Manual for installation verification.</p> <p>Perform the Monitor test in Section 4.2 with the Monitor installed. If this test is unsuccessful, perform the same test with the Monitor near the Controller installation location. If successful only at bench testing, re-evaluate the installation site for RF interference problems and refer to</p>

Question	Solution
	<p>Section 5.5 for technical support. If not successful at either test, continue with troubleshooting.</p> <p>Replace the 3 VDC 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.</p>
Does the Monitor occasionally miss scheduled report times	<p>If Yes:</p> <p>The most likely cause is RF interference problems. Re-evaluate the installation site per Section 3.1 for RF interference problems and refer to Section 5.5 for technical support.</p>
Does the Monitor ever report a low battery status?	<p>If Yes:</p> <p>Replace the 3 VDC 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.</p>
Does the Monitor ever report error codes?	<p>If Yes, find the error code below:</p> <p>Code ER00: Indicates an EEPROM memory failure</p> <p>Code ER01: Indicates a RAM memory failure</p> <p>Code ER04: Indicates that the Monitor did not receive a return pulse within the expected amount of time</p> <p>Code ER05: Indicates that the measured distance to the liquid surface is greater than the stored probe length</p>

Question	Solution
	Record the code number that is reported and refer to Section 5.5 for technical support.
Does the Monitor report significantly more or less liquid than is actually present in the tank?	<p>If Yes:</p> <p>Obstructions in the tank such as baffles, reinforcing rods, other level sensors, pipes, etc. can cause the Monitor to report a false level. Obstructions can cause the float to become stuck or can cause erroneous radar reflections. Verify that the float is freely riding on the liquid surface and that the probe cable is clean, straight, and not touching any objects in the tank. If necessary, carefully clean the cable with a damp rag and straighten any kinks or twists in the cable.</p> <p><i>Warning: Do not pull on the probe cable.</i></p>

4.2 Monitor Test

The Monitor is designed to wake up, take a measurement, and transmit RF data every time that it is activated. The Monitor is activated by inserting and then removing the disable magnet (see figure 3). At the same time that the Monitor transmits its RF data, the Controller will acknowledge receipt of the transmission by blinking the green “Test” Light Emitting Diode. If the Controller has never received data from this particular Monitor (this is the case during initial installation or after the Controller has been reset), it will then initiate a call to the Data Collection System to report a “new Monitor” and request configuration data. With this in mind, use the following steps to verify installation and troubleshoot system communication problems.

1. Reset the Controller by following the guidelines under the Controller test section of the Controller Instruction Manual. Proceed to the next step only if this step is successful.
2. Insert the disable magnet into the slot of the Monitor’s upper housing until snug.
3. Activate the Monitor by completely removing the disable magnet from the upper housing. The Monitor will immediately make one transmission. Three minutes after this initial transmission the Monitor will make a series of transmissions (one every thirty seconds) for the next four minutes.

4. Verify that the Controller successfully receives RF transmissions from the Monitor by watching the green “Test” LED flicker.
5. Verify that the Controller initiates a phone call 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.

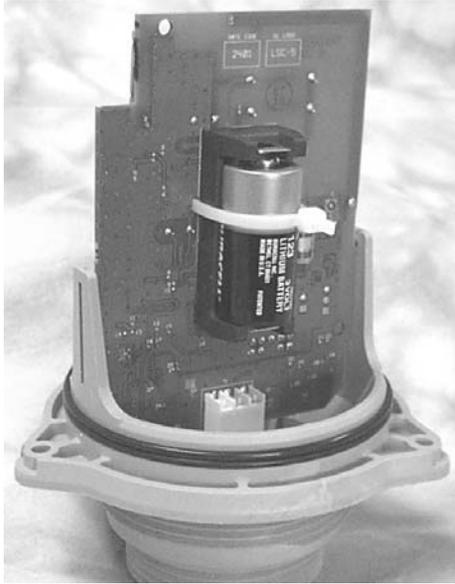
AVERTISSEMENT: AFIN DE PRÉVENIR L’INFLAMMATION D’ATMOSPHÈRES DANGEREUSES, NE CHANGER LE BATTERIE QUE DANS DES EMBLEMES DÉSIGNÉS NON-DANGEREUX.

Caution: When performing this procedure be extremely careful not to disturb the two wires that connect the probe to the circuit board.

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. Carefully remove Monitor from the tank by reversing the mounting procedure (see section 3.3 of this manual). Transport the monitor out of the hazardous area before proceeding with the battery replacement procedure.
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 wire tie that secures the old battery (see Figure 1).

Figure 1. Radar 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 wire tie through the circuit board slots and secure it around the battery. Trim the free end of the wire tie leaving at least ¼" of un-trimmed material.
8. Ensure that both upper housing O-rings are properly positioned on the lower housing O-ring shelf (see Figure 1).
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 Monitor housing to 10+/- 2 inch pounds. Do not over tighten.
11. Reinstall the Monitor on the tank (refer to section 3.3 of this manual).
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 plastic parts of the Monitor housing are marked for recycling purposes. An approved battery recycling center must dispose of the battery.

5.4 Service Parts List

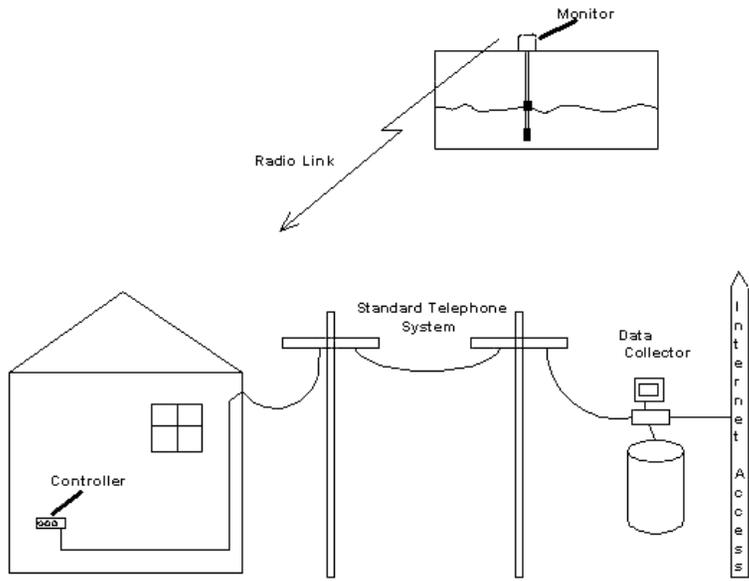
Robertshaw Part Number	Description	Quantity
040070A0001	Instruction Manual	1
040069A0001	Quick Installation Leaflet	1
039912A0001	Upper Housing Screw	3
039911A0001	Battery	1
039898A0001	Wire Tie (To Retain Battery)	1
086607A0001	Disable Magnet Assembly	1
036240N0039	Upper Housing O-ring	1
036240N0229	2" Mounting O-Ring	1
036240N0225	1 ½" Mounting O-Ring	1
040066A0001	Anchor Plate (Brass)	2
033713H1304	Anchor Screw (Brass)	4
086653A0001	Float Assembly	1
086655A0001	Probe Centering Block Kit	1

5.5 Service and Technical Support

For service and technical support, contact Robertshaw Industrial Products Service Center at (865) 981-3118.

Appendix A: Monitoring System

Figure 2. Centeron® Level Monitoring System



Appendix C: Site Survey Form

Figure 4. Site Survey Form

Robertshaw Centeron® Level Monitoring System 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:	



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