MRI-3000

Remote Meter Reading Interface

Installation Manual

CT1001-015

Version 0.1

25 February 2010

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Introduction

Scope

This document describes the installation and checkout procedures for the MRI-3000 antennas and cables.

Revision History of Installation Guide

Rev No.	Date Issued	Comments
0.1	2 July 2010	First Cut Draft
0.2	19 August 2010	Second Draft

Contact Information

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Safety Information

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.

DANGER! Avoid Power Lines!	When following instructions in this guide to install and connect the antenna and connections, take extreme care to avoid contact with overhead power lines, lights, and other power circuits. Contact with these items may be fatal.

Product Description

The MRI-3000 system provides a satellite-based path to communicate with Ethernet equipped remotely installed metering / logging equipment. (see Figure 1) The system consists of an Antenna mounted high to provide an unobstructed view of the sky, the MRI-3000 Controller Unit, and interconnection cabling.

The MRI-3000 Controller Unit provides a single point to attach the Ethernet cable from the metering equipment, as well as 110vac to power the system. Two coax cables connect the MRI-3000 Controller Unit to the Antenna.

An external system, such as an MV-90 server, can retrieve meter information by connecting to an IP address representing the remote metering equipment. When satellite coverage is established, a TCP/IP connection is established between the remote metering equipment and the external system as if the meter was connected directly to the external system.

This product is designed for use with Globalstar-approved antennas only. As of the publication date of this manual, approved antennas include the Globalstar Active Magnetic Patch Antenna (GAT-17MP), Globalstar Passive Patch Antenna (GAT-17PP), and Globalstar Maritime Mount Antenna (GAZT-17MR). Note that the antenna cables provided with this product are specifically tuned for the MRI-3000. Please contact CornerTurn if you would like to use a different antenna or antenna cables different than those available with the product. Failure to do so will void the warranty. Contact information is provided on the front of this manual.
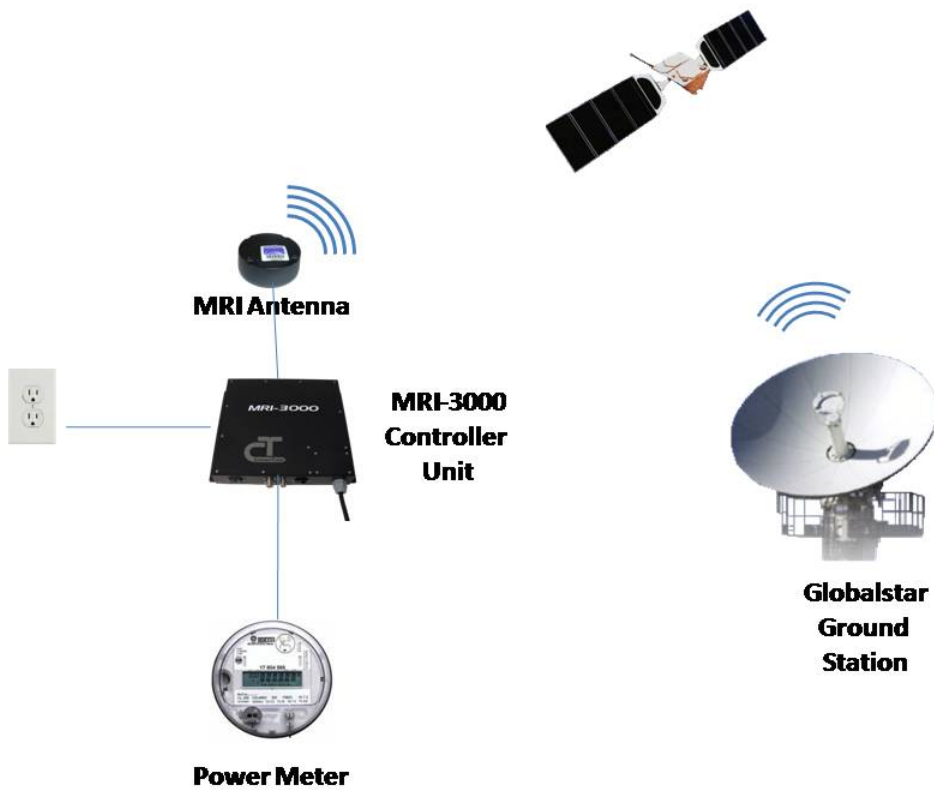
Figure 1 - MRI-3000 System Block Diagram

MRI-3000 Installation Overview

This procedure covers the installation of the Antenna, MRI-3000 Controller Unit and interconnecting cables. It can be easily adapted to different types of installation sites.

This procedure assumes the system will be installed in accordance with all local electrical and building codes, including requirements for grounding and lightning protection.

Table 1: MRI-3000 Components

Item	Description
MRI-3000 Controller Unit	

Globalstar Antenna
   GAT-17MP – Active Magnetic Patch Antenna
   GAT-17PP – Passive Patch Antenna
   GAZT-17MR – Maritime Mount Antenna	

Coax Antenna Cable Sets
 	
  1' Xmit & Rcv cables (passive antenna only)
     -or-
  36' Xmit & Rcv cables
     -or-
  66' Xmit & Rcv cables
     -or-
  contact CornerTurn for other lengths	

Ethernet cable to user metering equipment (<100 meters long)	
Optional Items	**Description**
USB Null Modem Cable	Used for System Verification at time of installation.
Antenna Mount (various configurations)	

Supplies and Equipment Needed for MRI-3000 Installation

We recommend the installer bring the following additional items to the installation site to carry out the installation:

REQUIRED

· Tools

- o (2) 5/16" open end wrench for SMA connectors on cables
- o Cordless drill with screwdriver attachment
- o Drill bits (various sizes for wood and/or concrete)
- o Caulking gun
- o Fish tape
- o Side cutters
- o Screwdriver, phillips head #2
- o Adjustable crescent wrench (opens to 1")

· Material

- o Mounting screws or other fasteners (qty 6) for MRI-3000 box
- o Mounting screws or other fasteners (qty 4) for Globalstar antenna
- o Caulking Compound

RECOMMENDED

· Support Equipment

- o Printout of **Globalstar Call Times** for the installation site (within 200 miles) Obtain from http://calltimes.globalstar.com
- o Globalstar GSP-1600 Mobile Satellite phone
- o Laptop with available USB port and Terminal SW (WinTerm, PuTTY, or equivalent)

- o Obtain PuTTY software from http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html
- o USB Null Modem Cable, Type A to Type A (CAUTION: DO NOT use a standard USB Type A to Type A cable to connect to the MRI-3000 Controller Unit. Equipment damage may occur.)
- o Camera (phone camera is okay)

· Tools

- o Electric drill
- o Screwdriver, Phillips #1
- o Torque wrench for SMA connector, 5/16" open end (3-5 in/lbs)
- o Marking pen
- o Extension ladder
- o Step ladder, 6 foot
- o Utility knife
- o Cable stripper 16 awg
- o Tape measure
- o Cable tie tension tool
- o Extension cord
- o Drop Light
- o Flash Light

· Material

- o Electrical Tape
- o Butyl Rubber Sealing Tape
- o Concrete anchors
- o Drywall anchors
- o Cable tie mounts
- o Cable ties
- o EMT conduit
- o Conduit clamps
- o Caulking compound
- o Wire nuts (Required if replacing supplied power cord)
- o 16 awg, 3 conductor power cable (Required if replacing supplied power cord)

Safety Considerations

When mounting the antenna or junction box, take extreme care to avoid contact with overhead power lines, electric lights, and power circuits. Contact with power lines, electric lights, or power circuits can be fatal. It is recommended to mount the antenna at least 10 feet away from any overhead power lines.

DO NOT connect a standard USB cable to the MRI-3000 Controller Unit Test port for any purpose. Use only a USB Null Modem Cable when connecting to the Test port. Connecting any USB cable other than the one specified in Table 1 may damage the MRI-3000 Controller Unit.

Installation Plan

Complete Site Survey

Conduct a site survey and determine the optimal mounting location for the antenna and the MRI-3000 Controller Unit. The antenna needs to be mounted to provide the best, unimpeded view of the entire sky down to an elevation of 10 degrees above the horizon. The antenna performance will be the best from higher elevation angles and progressively worse toward the horizon. It should be at least 5 feet away from other transmitting antennas. Trees, leaves, limbs, hills, and walls are all obstructions that will block the antenna signal. The selected antenna mounting location should be high enough to provide a clear line of sight above those obstructions.

The MRI-3000 Controller Unit is not waterproof and must be mounted in an enclosed area. The Ethernet cable that connects the Controller Unit to the user equipment must be less than 100 meters in length. The MRI-3000 Controller Unit must also be mounted close enough to the antenna, to safely run the RF cables (36 or 66 feet) that were ordered with the system. The MRI-3000 Controller Unit requires a 110VAC input. The Unit comes with an attached 6 foot power cord with a NEMA 5-15 plug. If a longer power cord is required, one can be easily installed to replace the supplied cable. This procedure is discussed in greater detail in Step 4, Attaching Input Power.

<u>Antenna Installation</u>

Table 2: Mounting Antenna on a Pole

Procedure	Comments
1. Select a mounting location on the pole so that the antenna will be clear of any obstacles and power lines.	In general, mounting the antenna as far up the pole as possible will minimize obstructions.
2. Select the mounting hardware to be used to mount the bracket to the pole.	
3. Using a template or the bracket, mark the hole locations on the pole where the bracket will be mounted.	For wood poles, drill pilot holes for the lag bolts. For concrete poles, appropriately sized concrete anchors should be used.
4. Drill the holes for the mounting bolts/hardware.	
5. Anchor the bracket into the pole with the mounting hardware that was selected in step 2.	

Table 3: Mounting Antenna on a Wall

Procedure	Comments
1. Select a mounting location on the building wall so that the antenna will be above the roof line and provide a clear view of the sky down to 10 degrees above the horizon in all directions.	On buildings with flat roofs, any wall can be used. On buildings with gabled roofs, the antenna must be mounted near the top of the gabled wall.
2. Select the mounting hardware to be used to mount the bracket to the wall.	
3. Using a template or the bracket, mark the hole locations on the wall where the bracket will be mounted.	For wood walls, drill pilot holes for the lag bolts. For concrete walls, appropriately sized concrete anchors should be used.
4. Drill the holes for the mounting bolts/hardware.	
5. Anchor the bracket into the wall with the mounting hardware that was selected in step 2.	

Procedure	Comments
6. Caulk all wall penetrations to prevent water intrusion.	

Table 4: Mounting Antenna on a Roof

Procedure	Comments
1. Select a mounting location on the roof so that the antenna will have a clear view of the sky down to 10 degrees above the horizon in all directions.	
2. Select the mounting hardware to be used to mount the bracket to the roof.	
3. Using a template or the bracket, mark the hole locations on the roof where the bracket will be mounted.	For wood roofs, drill pilot holes for the lag bolts. For concrete roofs, appropriately sized concrete anchors should be used.
4. Drill the holes for the mounting bolts/hardware.	
5. Anchor the bracket into the wall with the mounting hardware that was selected in step 2.	
6. Caulk all roof penetrations to prevent water intrusion.	

MRI-3000 Controller Unit Installation

Table 5: Mounting MRI-3000 Controller Unit

Procedure	Comments
1. Determine mounting location for MRI-3000 Controller Unit in the enclosed area.	The MRI-3000 is not weatherproof and must be mounted in an enclosed area. The unit can be mounted horizontally on a flat surface or vertically on a wall.
2. Mark the mounting hole locations of the Controller Unit on the mounting surface.	
3. Drill holes for mounting screws or anchors.	
4. Mount the MRI-3000 and secure with screws and appropriate anchors where required.	Use concrete anchors in concrete and drywall anchors if mounting to drywall between studs.

Table 6: Attaching RF Cables

Procedure	Comments
1. Connect and hand tighten the N male connector of the transmit cable to the TX connector on the MRI-3000 Controller Unit.	The transmit cable has a type N male connector on one end and an SMA male connector on the other end.
2. Connect and hand tighten the TNC male connector of the receive cable to the RX connector on the MRI-3000 Controller Unit.	The receive cable has a TNC male connector on one end and SMA female connector on the other end.
3. Drill a hole where you plan to run the RF cables out of the enclosed area.	If using conduit, drill the hole large enough for the conduit to penetrate the enclosed area. If not using conduit, drill the hole just large enough to feed the cables through.
4. If conduit is required, make your conduit run from the antenna into the wall penetration.	If weatherproof RF cabling is being used, conduit may not be required.

5. From the antenna end, feed fish tape through the conduit back to the exposed RF cables. NOTE: If conduit is not used, feed the fish tape through the hole in the enclosed area.	
6. Tape the cables to the fish tape so that the strain is not directly on the connectors when pulling the cables through.	
7. Pull the RF cables through the conduit or the opening and up to the antenna.	NOTE: The antenna cables are connected to the MRI-3000 Controller Unit. Be careful not to pull them too far and damage the cables or the connectors.
8. Connect the transmit cable (male SMA) connector to the antenna's SMA female connector.	NOTE: SMA connectors should be tightened to 3-5 in/lbs Do not over tighten
9. Connect the receive cable (female SMA) connector to the antenna's SMA male connector.	NOTE: SMA connectors should be tightened to 3-5 in/lbs Do not over tighten
10. If the cable connections will be exposed to the weather, wrap them with butyl rubber sealing tape.	
11. Go to the outside of the enclosed area where the RF cable penetration was made and caulk the opening to prevent water intrusion.	
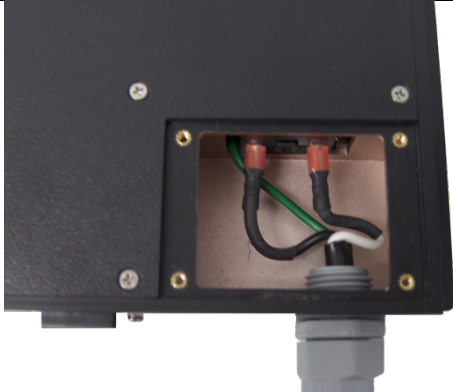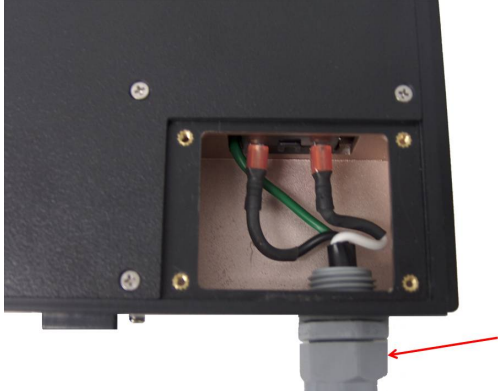
Attaching Input Power

Table 7: Using MRI-3000 Power Cord

Procedure	Comments
1. No action is necessary if the supplied power cord will reach a 110VAC receptacle.	Unit is prewired with a 6 foot power cord.

Table 8: Using Custom Length Power Cord

Procedure	Comments
1. Make sure the MRI-3000 Controller Unit is unplugged.	
2. Remove the 4 screws from the top corner access cover on the MRI-3000 Controller Unit.	
3. Remove the access cover to expose the AC input wiring.	
4. With an open ended crescent wrench, loosen the outer plastic nut on the power cord so that the cord can slide in and out of the Controller Unit.	
5. Gently push the power cord into the Controller Unit until each lead has approximately 4" of length inside the access cover.	
6. Cut the Line, Neutral, and Ground wires inside the access cover to approximately 4" in length.	
7. Remove the supplied power cord from the coupler and discard.	

8. Strip 1" off the ends of the Line, Neutral, and Ground wires that remain inside the access cover.	
9. Strip off approximately 2" of insulation from the customer supplied power cable.	
10. Strip 1" off the ends of the Line, Neutral, and Ground wires of the customer supplied power cable.	
11. Feed the power cable through the nut and into the access cover area.	
12. Twist the two ground wires (green or green & yellow) together with pliers.	
13. Trim the cable if necessary so that the wire nut will cover the exposed wire.	
14. Apply a wire nut to the grounds and tighten securely.	
15. Wrap the wire nut and wires with electrical tape.	
16. Twist the two neutral wires (white or blue) together with pliers.	
17. Trim the cable if necessary so that the wire nut will cover the exposed wire.	
18. Apply a wire nut to the neutrals and tighten securely.	
19. Wrap the wire nut and wires with electrical tape.	
20. Twist the two hot wires (black or brown) together with pliers.	
21. Trim the cable if necessary so that the wire nut will cover the exposed wire.	
22. Apply a wire nut to the hot wires and tighten securely.	
23. Wrap the wire nut and wires with electrical tape.	
24. Push the wires down into the cable access area.	
25. With an open ended crescent wrench, tighten the outer plastic nut around the power cord so that it cannot slide in and out of the Controller Unit.	

26. Insert the cable access cover and secure with the 4 screws removed earlier.	

Ethernet Installation

Note: For outside Ethernet cable runs, it is recommended to use conduit. Exterior grade or direct burial cable should be used outdoors if not using conduit. Direct burial cable should be buried 6-8 inches into the ground and at least that far away from power lines and other electrical noise sources.

Table 9: Attaching Ethernet Cable

Procedure	Comments
1. Determine where the Ethernet cable will penetrate the enclosed area.	NOTE: If the user device and the MRI-3000 Controller Unit are co-located in the enclosed area, connect the Ethernet cable between the user device Ethernet port and the Controller Unit Ethernet Port and continue to Section 6, System Power Up and Test.
2. Drill a hole in the enclosed area for the Ethernet cable.	If using conduit, drill the hole large enough for the conduit to penetrate the enclosed area. If not using conduit, drill the hole just large enough to feed the Ethernet cable through.
3. If you're using conduit between the user device and the enclosed area, install the conduit run from the user device and into the hole just drilled.	
4. Feed the fish tape through the hole from outside the enclosed area.	
5. Tape the Ethernet cable to the fish tape so that the strain is not directly on the connector when pulling the cable through.	
6. Pull the Ethernet cable to the user device and attach it to the user device Ethernet port, leaving an 8-12 inch service loop.	If you need to terminate the cable with an RJ-45 connector, wire it straight-through using either the T-568A or T-568B standard. The same standard must be applied to each end.
7. If you're using direct burial cable, bury it in the ground at the recommended depth.	

8. Go back to the enclosed area and connect the Ethernet cable to the Ethernet port on the MRI-3000 Controller Unit.	
9. Go to the outside of the enclosed area where the Ethernet cable penetration was made and caulk the opening to prevent water intrusion.	

System Power-up and Test
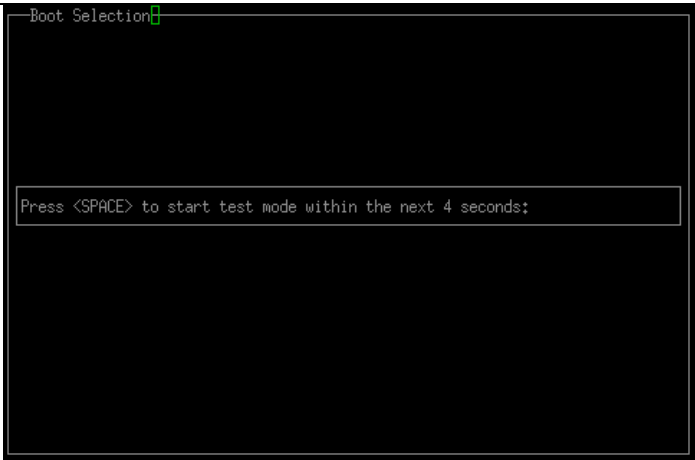
Overview of the MRI Self Test Mode
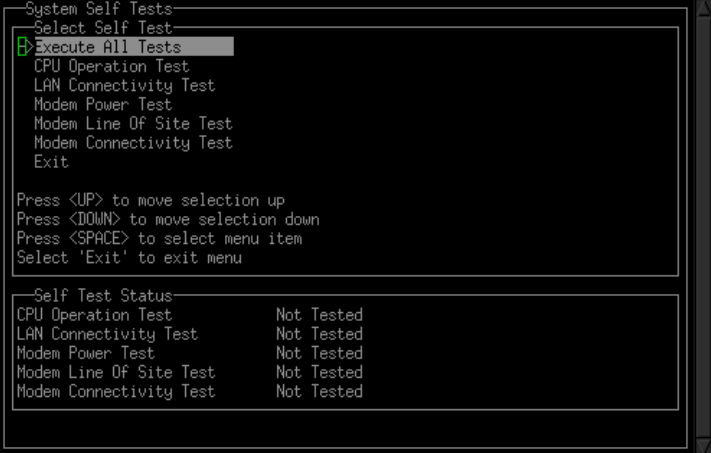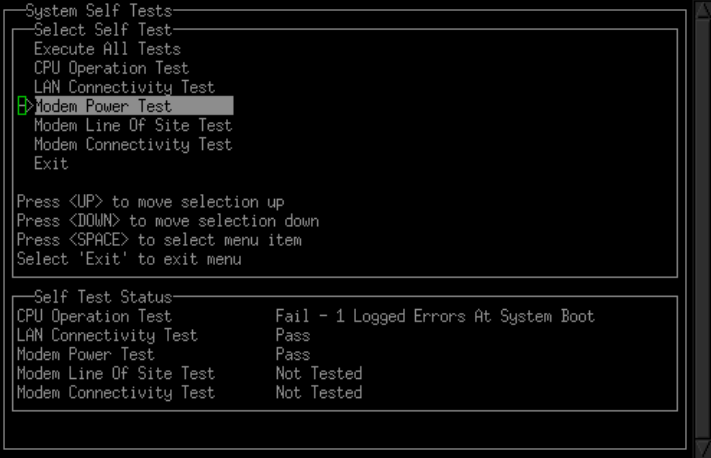
The MRI Self Test Mode has 5 tests that can be used to check out the MRI-3000 system. The tests can be run individually or as a group to verify a successful installation.

1. Execute All Tests – This test runs each of the 5 individual tests sequentially.

2. CPU Operation Test – Verifies CPU booted properly by checking last boot log for errors. Status will be either Pass or Fail.

3. LAN Connectivity Test – Verifies network connectivity to the user device. Status will be either Pass or Fail.

4. Modem Power Test – Cycles power on the modem and checks that the modem self test is okay. Status will be either Pass or Fail.

5. Modem Line Of Sight Test – Checks to see if all modems have signal strength (RSSI) greater than 0 and can establish contact with satellite. Can take up to 1 minute to complete. Status will be either Pass or Fail. NOTE: Requires a satellite to be visible in order to pass.

6. Modem Connectivity Test – Checks to see if the MRI-3000 can connect to the ground based MRI Server via the satellite. Status will be either Pass or Fail.
    NOTE: Requires a satellite to be visible in order to pass.
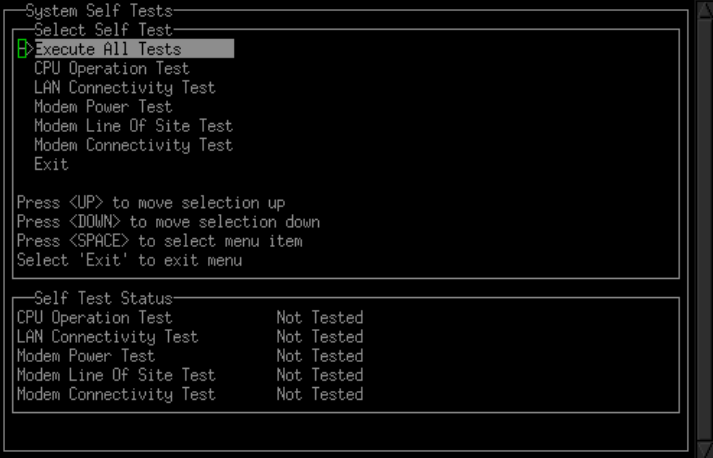
System Verification

Table 10: System Verification

Procedure	Comments
1. Using the USB Null Modem cable specified in Table 1, connect a Laptop to MRI-3000 Controller Unit diagnostic Test port. CAUTION: Use of any standard USB to USB cable may result in equipment damage.	
2. On the laptop, start the Terminal Program and configure the serial port.	Serial Settings: Baud (speed): 115,200 Data Bits: 8 Stop Bits: 1 Parity: No Parity Flow Control: XON/XOFF
3. Plug in the MRI-3000 Controller Unit.	
4. In terminal window, initiate the self test by pressing the \<SPACE\> bar within 5 seconds after the Boot Selection is displayed.	

5. Review the Globalstar OSAT Call Times and find the next available satellite pass. The test should be run with at least 2 minutes of satellite visibility remaining.	

6. Select the Execute All Tests using the <Up> or <Down> arrows to highlight and then pressing the <SPACE> bar.	```
	─System Self Tests──────────────────────
	  ─Select Self Test──
	 ▷Execute All Tests
	   CPU Operation Test
	   LAN Connectivity Test
	   Modem Power Test
	   Modem Line Of Site Test
	   Modem Connectivity Test
	   Exit
	
	  Press <UP> to move selection up
	  Press <DOWN> to move selection down
	  Press <SPACE> to select menu item
	  Select 'Exit' to exit menu
	
	  ─Self Test Status──
	  CPU Operation Test Not Tested
	  LAN Connectivity Test Not Tested
	  Modem Power Test Not Tested
	  Modem Line Of Site Test Not Tested
	  Modem Connectivity Test Not Tested
	``

7. Monitor the Self Test Status window and verify that each Test Status shows a status of Pass. If any test indicates Fail, refer to the Troubleshooting section to repair the failure and then return to step 3 of System Verification. If all tests Pass, continue to the next step. NOTE: A satellite must be in view for the Modem Line of Site Test and the Modem Connectivity Test to Pass.	```
	─System Self Tests──────────────────────
	  ─Select Self Test──
	   Execute All Tests
	   CPU Operation Test
	   LAN Connectivity Test
	 ▷Modem Power Test
	   Modem Line Of Site Test
	   Modem Connectivity Test
	   Exit
	
	  Press <UP> to move selection up
	  Press <DOWN> to move selection down
	  Press <SPACE> to select menu item
	  Select 'Exit' to exit menu
	
	  ─Self Test Status──
	  CPU Operation Test Fail - 1 Logged Errors At System Boot
	  LAN Connectivity Test Pass
	  Modem Power Test Pass
	  Modem Line Of Site Test Not Tested
	  Modem Connectivity Test Not Tested
	``

|		
8.	Select Exit by using the <Down> arrow to highlight and then press the <SPACE> bar. This will reboot the MRI-3000 Controller Unit.	``` ┌System Self Tests─────────────────────────────┐ ┌─Select Self Test─────┐ ▷Execute All Tests CPU Operation Test LAN Connectivity Test Modem Power Test Modem Line Of Site Test Modem Connectivity Test Exit Press <UP> to move selection up Press <DOWN> to move selection down Press <SPACE> to select menu item Select 'Exit' to exit menu ┌─Self Test Status─────┐ CPU Operation Test Not Tested LAN Connectivity Test Not Tested Modem Power Test Not Tested Modem Line Of Site Test Not Tested Modem Connectivity Test Not Tested ```
9.	Disconnect the USB transfer cable from the MRI-3000 Controller Unit and turn off the laptop.	The MRI-3000 installation was successful and is now configured for unattended operation.

<u>Operation</u>

The MRI-3000 System is now configured and ready for operation. It requires no further action by an installer or operator to function. If power is lost, the MRI-3000 will startup automatically when power is restored.

Overview of the MRI Startup Process

Five basic things are verified every time the MRI-3000 starts up:

1. The internal processor

2. The satellite modem

3. Ethernet connectivity to the User Device

4. That the MRI-3000 can see / contact the satellite

5. That the MRI-3000 can contact the MRI router at the other end of the Satellite path

Figure 2: Overview of the MRI Startup Test
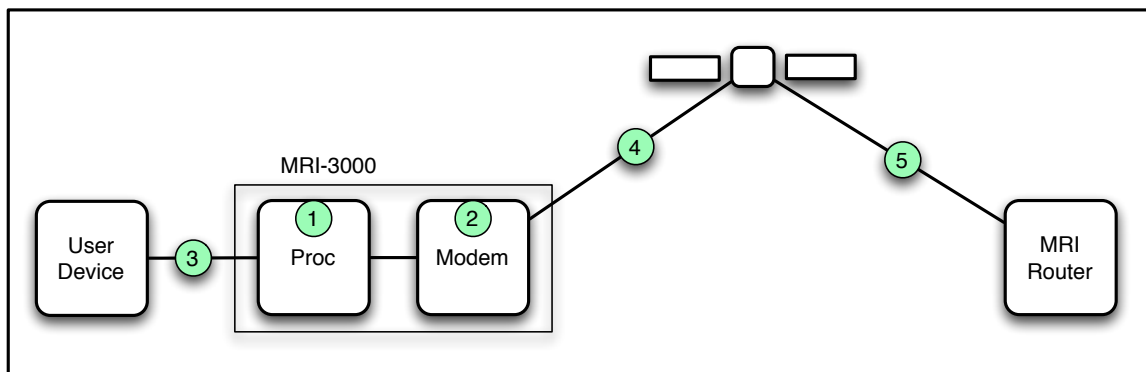
Customer Care / Warranty

Call Customer Care (1-877-452-5782) for all Subscription Related and Warranty Issues. The ESN and MDN numbers of the unit will be required, along with the Subscriber Account Name

The MRI-3000 comes with the following Product Warranty.

LIMITED WARRANTY. CornerTurn provides a one (1) year Limited Product Warranty that the Meter Reading Interface (MRI) Terminal (the "Terminal") shall be free from defects in workmanship and materials under normal use and service. CornerTurn's obligation under this warranty is limited to repairing and replacing, at CornerTurn's election, any Terminal, that within twelve (12) months of initial date of shipment is determined to be defective in material or workmanship upon examination by CornerTurn, without charge for parts or labor. CornerTurn reserves the right to use new or refurbished parts and/or the current technology for any repairs/replacements, provided that they maintain form, fit, function compatibility. Customer is to provide CornerTurn with notice of the defect, including all reasonable available details regarding the nature of the nonconformity or defect, and request a Returned Merchandise Authorization. Any Terminal must be returned to CornerTurn; no field repairs will be performed. This warranty shall not apply to repair or replacement necessitated by accident, disaster, customer supplied interfacing, unauthorized modification or repairs, misuse or abuse. Except where prohibited by law, any Terminal or part replaced under warranty by CornerTurn shall become the property of CornerTurn. The performance of this limited warranty does not extend the warranty period for any Terminal beyond the original limited warranty period. ALL OTHER STATUTORY AND IMPLIED WARRANTIES (INCLUDING IMPLIED WARRANTY OF MERCHANTIBILITY AND FITNESS FOR A PARTICULAR PURPOSE) ARE EXCLUDED except warranty of title.

For Warranty Issues contact Customer Care

MRI-3000 Installation Checklist

Antenna located with a clear view of sky down to 10 degrees elevation

Antenna mounted

MRI-3000 Controller Unit mounted

RF cables connected to Antenna

RF cables connected to MRI-3000 Controller Unit

Power Cable connected to MRI-3000 Controller Unit

Ethernet cable connected to MRI-3000 Controller Unit

Ethernet cable connected to user equipment

System Verification testing passed with all tests having status of Pass

All building/enclosure penetrations caulked and/or sealed.

All cables securely mounted

Site cleanup completed

Troubleshooting

Find the Failure Condition that you are troubleshooting. Start with the first step and continue in order until you find the cause of the failure. Once you've corrected the failure, return to the System Verification testing.

CPU Operation Test – Fail
1. Cycle power on MRI-3000 Controller Unit.
2. Call Customer Support Center.

LAN Connectivity Test – Fail
1. Verify Ethernet Cable is connected to end user equipment.
2. Verify Ethernet Cable is connected to MRI-3000 Controller Unit.
3. Verify Ethernet Cable is wired straight through.
4. Cycle power on MRI-3000 Controller Unit.
5. Replace Ethernet Cable
6. Call Customer Support Center.

Modem Power Test – Fail
1. Cycle power on MRI-3000 Controller Unit.
2. Call Customer Support Center.

Modem Line of Sight Test – Fail
1. Check OSAT Globalstar Call Times and make sure test is run during an available call time.
2. Cycle power on MRI-3000 Controller Unit.
3. Call Customer Support Center.

Modem Connectivity Test – Fail
1. Check OSAT Globalstar Call Times and make sure test is run during an available call time and the test has time to complete.
2. Record the status information from the failed test and call Customer Support Center.

MRI-3000 Installation Record

1. Date	
2. Globalstar Phone Number	
3. MRI-3000 Serial Number	
4. Built-In Test Completion	1 – CPU Operation _____ 2 – LAN Connect _____ 3 – Modem Power _____ 4 – Modem LOS _____ 5 – Modem Conn._____ Time of Completion _____
5. Name of Installer	
6. Pictures taken of the installation	Antenna _____ MRI-3000 _____ User Equipment _____
7. Pictures of the location taken from the Antenna looking in all directions	
8. Describe any other antennas or equipment nearby	