MS2024A/MS2026A

VNA Master

MAINTENANCE MANUAL

Anritsu

490 JARVIS DRIVE
MORGAN HILL, CA 95037-2809

P/N: 10580-00124
REVISION: A
PRINTED: APRIL 2006

Table of Contents

1. Introduction 1
2. Description 1
3. Recommended Test Equipment 1
4. Performance Verification 2
    - Frequency Accuracy 2
    - Port Isolation 2
    - Return Loss Verification 5
    - Power Monitor (Option 5) Verification 6
    - Bias Tee (Option 10) Verification 7
    - GPS (Option 31) Operational Check 8
5. Battery Information 9
6. Battery Pack Removal and Replacement 10
7. Removal and Replacement Procedures for Internal Assemblies 12
    - Opening the VNA Master Case 12
    - Removal and Replacement of the Option 5 Power Monitor PCB 13
    - Removal and Replacement of the VNA Module Assembly 14
    - Real Time Clock (RTC) Battery Removal and Replacement 15
    - Main PCB Assembly Replacement 16
    - LCD Assembly Replacement 18
    - LCD Backlight PCB Removal and Replacement 19
    - Keypad Membrane and PCB Replacement 20
    - Function Key Membrane and Switchpad Replacement 22
8. Accessories and Replaceable Parts List 23
9. ANRITSU Customer Service Centers 25

1. Introduction

This manual provides maintenance instructions for the VNA Master MS202xA. It describes the product and provides performance verification procedures, parts replacement procedures, and a replaceable parts list.

2. Description

The MS2024A and MS2026A VNA Masters are handheld Vector Network Analyzers designed to make accurate vector corrected 1-port magnitude, phase, and fault location measurements and 1-path, 2-port magnitude and phase measurements from 2 MHz to 6 GHz.

RF immunity rejection up to +17 dBm allows for accurate measurements in RF rich environments. More than 1000 traces and setups can be stored in internal memory and data can be transferred to a computer via Ethernet, USB, or memory card.

Frequency Ranges

MS2024A 2 MHz to 4 GHz

MS2026A 2 MHz to 6 GHz

3. Recommended Test Equipment

The following test equipment is recommended for use in testing and maintaining the VNA Master.

NOTE: Verify that the test equipment is operating properly before it is used.

Table 1. Recommended Test Equipment

Equipment	Critical Specification	Recommended Manufacturer/Model
Synthesizer	Frequency: 1 GHz with options 2A, 4 (or 5), and 15A	Anritsu Model MG3691A
Power Meter	Power Range: –70 to +20 dBm	Anritsu Dual Channel Model ML2437A
Power Sensor	Frequency: 10 MHz to 18 GHz, Range: –67 to +20 dB	Anritsu Model MA2442D
Frequency Reference	Frequency: 10 MHz	Absolute Time Corp., Model 300
Power Splitter	Frequency: DC to 18 GHz	Weinschel Model 1870A
Adapter	Frequency: 1 GHz K(m) to N(f)	Anritsu Model 34RKNF50
RF Coaxial Cable	Frequency: DC to 6.0 GHz N(m)-N(m), 50 Ohm	Anritsu Model 15NN50-1.5C
RF Detector (for Option 5)	Frequency: 10 MHz to 20 GHz	Anritsu Model 560-7N50B
High Current Test Fixture (for Option 10)	Resistance: 40 Ohm Power: 5 Watts	Anritsu Model T2904
Low Current Test Fixture (for Option 10)	Resistance: 105 Ohm Power: 1 Watt	Anritsu Model T3377
Frequency Counter	Frequency: 2 GHz	Anritsu Model MF2412B
Open/Short		Anritsu Part Number 22N50
Termination	Frequency: DC to 18 GHz Return Loss: 40 dB min	Anritsu Model 28N50-2
Termination	Frequency: DC to 18 GHz Return Loss: 40 dB min	Anritsu Model 28NF50-2
Offset Termination	Frequency: DC to 6 GHz Return Loss: 6 dB ± .35 dB	Anritsu Model SC7424
Offset Termination	Frequency: DC to 6 GHz Return Loss: 20 dB ± 1.0 dB	Anritsu Model SC7423

4. Performance Verification

The following tests can be used to verify the performance or operation of the VNA Master.

4.1 Frequency Accuracy

The following test can be used to verify the CW frequency accuracy of the VNA Master. Measurement calibration of the VNA is not required for this test.

Equipment Required:

- VNA Master External Power Supply, Anritsu Part Number 40-168
- Frequency Counter, Anritsu Model MF2412B
- RF Coaxial Cable, Anritsu Model 15NN50-1.5C

Procedure:

1. Connect the external power supply (Anritsu part number 40-168) to the VNA Master.
2. Press the **On/Off** key to turn on the VNA Master.
3. Press the **Shift** key, the **Preset** key (1), and then the Preset soft key to reset the instrument to the default starting conditions.

NOTE: Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

4. Press the **Measurement** key, then press the S21 Transmission soft key. Verify that the Log Magnitude soft key is selected (there will be a red dot on the key label). If not, select the Log Magnitude soft key.
5. Press the **Shift** key, then press the **Sweep** (3) key.
6. Verify that the RF Immunity is set to Normal (the word Normal will be underlined on the soft key label). If not, press the RF Immunity soft key to set the instrument to Normal.
7. Press the **Freq/Dist** key, then press the Start Freq soft key.
8. Verify that the Start Frequency is set to 2 GHz. If not, enter 2 then press the GHz soft key to set the Start Frequency to 2 GHz.
9. Press the Stop Freq soft key.
10. Using the keypad, enter 2 and press the GHz soft key to set the Stop Frequency to 2 GHz.
11. Connect the RF cable from the VNA Master RF Out test port to the RF Input1 connector on the Frequency Counter.
12. Turn on the Frequency Counter and press the **Preset** key.
13. Verify that Frequency Counter reading is 2 GHz, ±50 KHz.

4.2 Port Isolation

The following test can be used to verify the transmission test port isolation. Measurement calibration of the VNA Master is required for this test.

Equipment Required:

- 50 Ohm Termination, Anritsu Model 28N50-2
- 50 Ohm Termination, Anritsu Model 28NF50-2
- Open/Short, Anritsu Part Number 22N50
- VNA Master External Power Supply, Anritsu Part Number 40-168
- RF Coaxial Cable, Anritsu Model 15NN50-1.5C

Procedure:

1. Connect the external power supply (Anritsu part number 40-168) to the VNA Master.
2. Press the **On/Off** key to turn on the VNA Master.

3. Press the **Shift** key, the **Preset** key (1), and then the Preset soft key to reset the instrument to the default starting conditions.

NOTE: Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

4. Press the **Measurement** key, then press the S21 Transmission soft key. Verify that the Log Magnitude soft key is selected (there will be a red dot on the key label). If not, select the Log Magnitude soft key.
5. Press the **Shift** key, then press the **Sweep** (3) key.
6. Verify that the RF Immunity is set to High (the word High will be underlined on the soft key label). If not, press the RF Immunity soft key to set the instrument to High.
7. Press the **Scale** key, then press Reference Value soft key.
8. Use the keypad to enter -80, then press the dB soft key.
9. Press the Resolution Per Div soft key and use the keypad to enter 5, then press the dB soft key.
10. Press the **Shift** key, then press the **Calibrate** (2) key.
11. Verify that the Cal Type is set to 2-Port and the Cal Power is set to High. If not, select the soft key to change the setting.
12. Press the Start Cal soft key and follow the on screen instructions to perform an OSL-THRU-ISOL calibration using the 22N50 Open/Short, 28NF50-2 and 28NF50-2 Terminations, and the 15NN50-1.5C Test Port Extension Cable (refer to Figure 1).

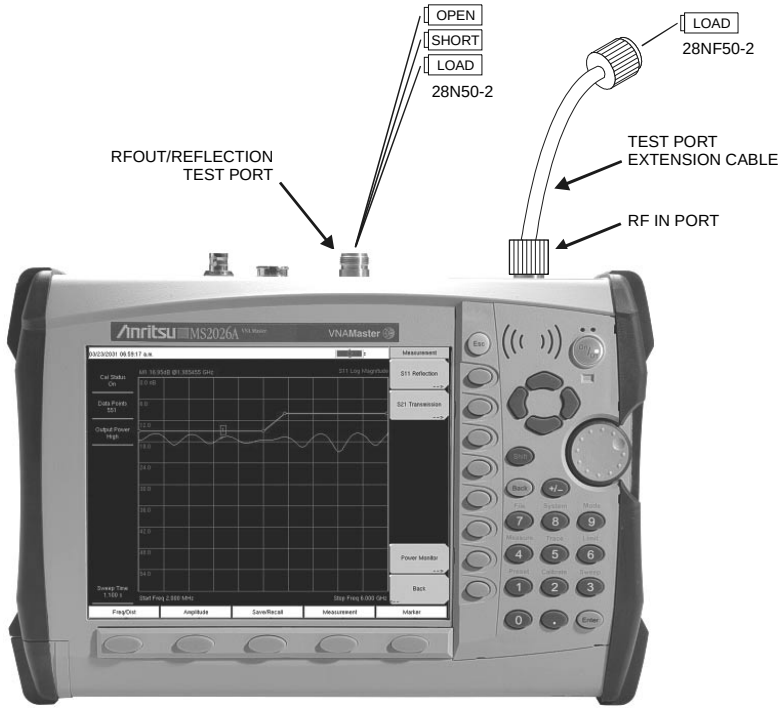

Figure 1. OSL-Thru-ISOL Calibration Setup

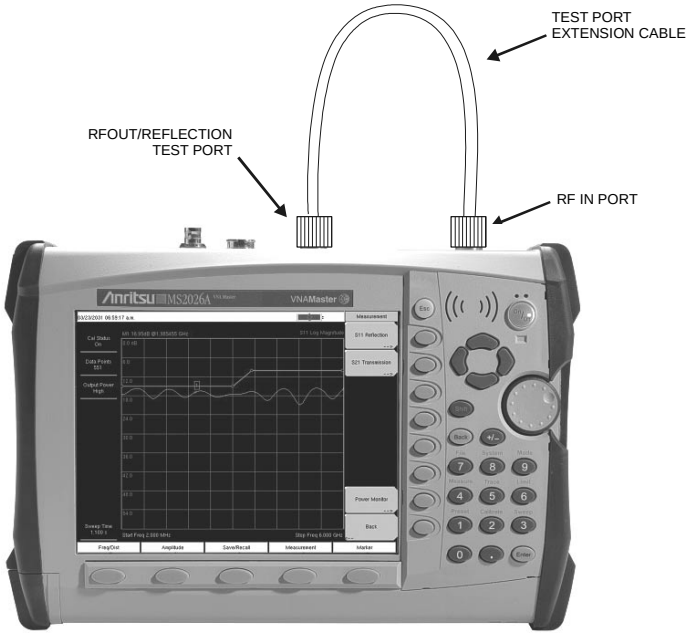

Figure 2. Test Setup

13. Disconnect the cable from the RF Out/Reflection Port, connect a 28NF50-2 Load to the cable, and connect a 28N50-2 Load to the RF Out/Reflection Port.
14. Press the **Shift** key, then press the **Limit** (6) key.
15. Press the On/Off soft key to set the limit line to On.
16. Press the Limit Edit soft key and verify that the frequency is set to 2 MHz.
17. Press the Amplitude soft key, use the keypad to enter -80, then press the dB soft key.
18. Press the Add Point soft key, then use the keypad to enter 3 and press the GHz soft key.
19. Press the Amplitude soft key, use the keypad to enter -80, then press the dB soft key.
20. Press the Add Point soft key, then press the Frequency soft key.
21. Use the keypad to enter 3 and press the GHz soft key.
22. Press the Amplitude soft key, use the keypad to enter -70, then press the dB soft key.
23. Press the Add Point soft key, then press the Frequency soft key.
24. Use the keypad to enter 5.5 and press the GHz soft key.
25. Press the Amplitude soft key, use the keypad to enter -70, then press the dB soft key.
26. Press the Add Point soft key, then press the Frequency soft key.
27. Use the keypad to enter 5.5 and press the GHz soft key.
28. Press the Amplitude soft key, use the keypad to enter -65, then press the dB soft key.
29. Press the Next Point Right soft key.
30. Verify that the Frequency is set to 6 GHz.
31. Press the Amplitude soft key, use the keypad to enter -65, then press the dB soft key.

32. Verify that the noise floor is below the limit line.

Table 2 2-Port Isolation Specification

Frequency Range	Dynamic Range (dB)
2 MHz to 3 GHz	80
3 GHz to 5.5 GHz	70
5.5 GHz to 6 GHz	65

4.3 Return Loss Verification

The following test can be used to verify the accuracy of return loss measurements. Measurement calibration of the VNA Master is required for this test.

Equipment Required:

- 20 dB offset, Anritsu SC7423
- 6 dB offset, Anritsu SC7424
- Open/Short, Anritsu 22N50
- 50 Ohm Termination, Anritsu 28N50-2
- VNA Master External Power Supply, Anritsu Part Number 40-168

Procedure:

1. Connect the external power supply (Anritsu part number 40-168) to the VNA Master.
2. Press the **On/Off** key to turn on the VNA Master.
3. Press the **Shift** key, the **Preset** key (1), and then the Preset soft key to reset the instrument to the default starting conditions.

NOTE: Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

4. Press the **Measurement** key, then press the S11 Reflection soft key. Verify that the Log Magnitude soft key is selected (there will be a red dot on the key label). If not, select the Log Magnitude soft key.
5. Press the **Shift** key, then press the **Calibrate** (2) key. Verify that the Type is set to 1-Port and Cal Power is High.
6. Press the Start Cal soft key. Follow the instructions on the screen to perform a calibration using a 22N50 Open/Short and 28N50-2 Termination.
7. Press the **Scale** key, then press Reference Value soft key. Use the keypad to enter 20, then press the dB soft key.
8. Press the Resolution Per Div soft key. Use the keypad to enter .4, then press the dB soft key.
9. Connect the 20 dB offset to the RF Out test port.
10. Press the **Marker** key and select the Peak Search soft key and record the Marker value.
11. Press the Valley Search soft key and record the Marker value.
12. Verify that both the Peak and Valley readings are within 20 ±1.61 dB.
13. Disconnect the 20 dB offset.
14. Press the **Scale** key, then press the Reference Value soft key. Use the keypad to enter 6, then press the dB soft key.
15. Press the Resolution Per Div soft key. Use the keypad to enter 0.2, then press the dB soft key.
16. Connect the 6 dB offset to the RF Out test port.
17. Press the **Marker** key and select the Peak Search soft key and record the Marker value.
18. Press the Valley Search soft key and record the Marker value.
19. Verify that both the Peak and Valley readings are within 6 ±0.95 dB.

4.4 Power Monitor (Option 5) Verification

If the Power Monitor (Option 5) is installed in the VNA Master, the following test can be used to verify the accuracy of the power measurements.

Equipment Required:

- Anritsu MG3691A Synthesized Signal Source with options 2A, 4 (or 5), and 15A
- Power Meter, Anritsu Model ML2437A
- Power Sensor, Anritsu Model MA2442D
- RF Detector, Anritsu 560-7N50B
- Power Splitter, Weinschel Model 1870A
- RF Coaxial Cable, Anritsu Model 15NN50-1.5C
- Adapter, Anritsu Model 34RKNF50
- VNA Master External Power Supply, Anritsu Part Number 40-168

Procedure

1. Connect the external power supply (Anritsu part number 40-168) to the VNA Master.
2. Press the **On/Off** key to turn on the VNA Master.
3. Press the **Shift** key, the **Preset** key (1), and then the Preset soft key to reset the instrument to the default starting conditions.

NOTE: Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

4. Set the MG3691A output to 1.0 GHz.
5. Connect the power sensor to the power meter and calibrate the sensor.
6. Connect MG3691A, power meter, RF detector, and sensor as shown in Figure 3.

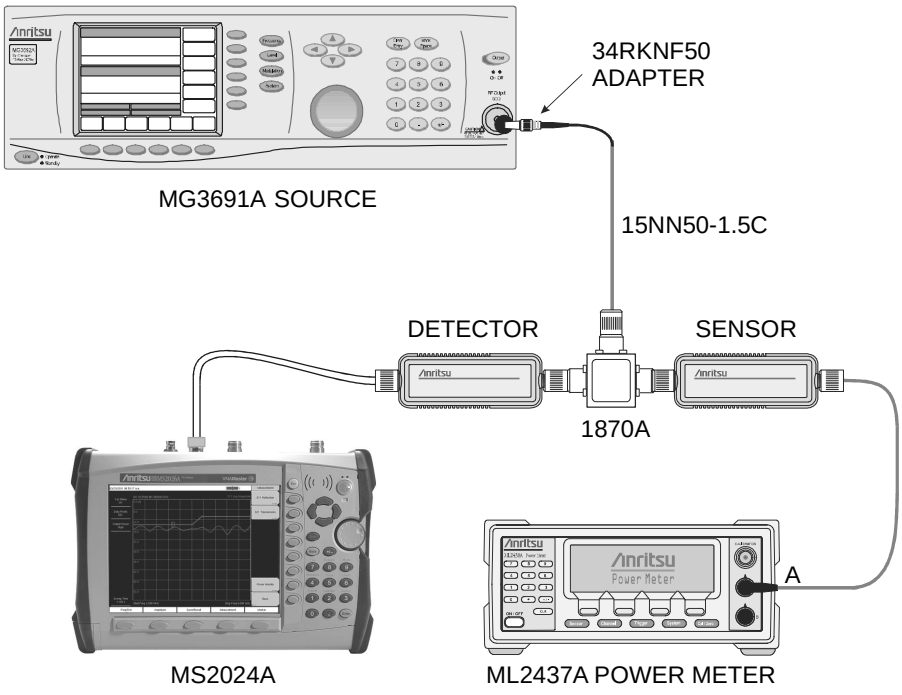

Figure 3. Power Monitor Verification Test Setup

7. Press the *Freq/Dist* key, and select the Start Freq soft key. Using the keypad, enter 1, then press the GHz soft key.
8. Press the Stop Freq soft key. Using the keypad, enter 1, then press the GHz soft key.
9. Press the **Measurement** key and select the Power Monitor soft key.
10. On the MG3691A press the Level key, then use the knob to adjust the power level so that the power meter reads -40 dBm.
11. Verify that the VNA Master reading is 40 ± 1.0 dBm.
12. Repeat steps 10 and 11 for the other power level settings shown in Table 3.

Table 3 Power Monitor Verification

Power Level (dB)	Spec (dB)
-40	± 1.0
-21	
-4	
0	
+13	

4.5 Bias Tee (Option 10) Verification

If the Bias Tee (Option 10) is installed in the VNA Master, the following test can be used to verify the performance of the bias termination.

Equipment Required:

- 105 Ohm, 1 Watt, Low Current Load, Anritsu T3377
- 40 Ohm, 5 Watt, High Current Load, Anritsu T2904
- VNA Master External Power Supply, Anritsu Part Number 40-168

Procedure:

1. Connect the external power supply (Anritsu part number 40-168) to the VNA Master.
2. Press the **On/Off** key to turn on the VNA Master.
3. Press the **Shift** key, the **Preset** key (1), and then the Preset soft key to reset the instrument to the default starting conditions.

NOTE: Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

4. Press the **Shift** key, and then the **Sweep** (3) key.

Low Current Test

1. Press the Bias Tee soft key and verify that the 12V soft key is selected and the Current soft key is set to Low.
2. Press the Bias Tee On/Off soft key to turn the Bias Tee On.
3. Connect the 105 Ohm load to the RF In test port.
4. Verify the voltage and current readings displayed on the left side of the screen are within the specifications shown in Table 4.
5. Select each of the voltage setting soft keys and verify the voltage and current readings displayed on the left side of the screen are within the specifications shown in Table 4.

Table 4 Bias Tee Verification, 105 Ohm Load, Low Current

Voltage Setting (V)	12	15	18	21	25
Voltage Specification (V)	± 0.5	± 0.6	± 0.7	± 0.8	± 1.0
Current Specification (mA)	85-145	113-173	142-202	172-230	199-259

High Current Test

1. Press the Current soft key and set the Bias Tee current to High.
2. Verify the voltage and current readings displayed on the left side of the screen are within the specifications shown in Table 5.
3. Select the 15V soft key and verify the voltage and current readings displayed on the left side of the screen are within the specifications shown in Table 5.

Table 5 Bias Tee Verification, 105 Ohm Load, High Current

Voltage Setting (V)	12	15
Voltage Specification (V)	± 0.5	± 0.6
Current Specification (mA)	85-145	113-173

4. Disconnect the 105 Ohm load and connect the 40 Ohm load to the RF In port.
5. Select the 12V soft key and verify the voltage and current readings displayed on the left side of the screen are within the specifications shown in Table 6.
6. Select the 15V soft key and verify the voltage and current readings displayed on the left side of the screen are within the specifications shown in Table 6.

Table 6 Bias Tee Verification, 40 Ohm Load, High Current

Voltage Setting (V)	12	15
Voltage Specification (V)	± 0.5	± 0.6
Current Specification (mA)	25-350	325-425

Fault Test

1. Press the Current soft key and set the Bias Tee current to Low.
2. Select the 15V soft key.
3. Connect the 40 Ohm load to the RF In port.
4. Verify that the instrument makes a clicking sound and the Bias Tee current reading displayed on the left side of the screen is 0 mA.

4.6 GPS (Option 31) Operational Check

The following test can be used to verify the operation of the GPS option.

Equipment Required:

- VNA Master External Power Supply, Anritsu Part Number 40-168
- Anritsu 2000-1410 Magnet Mount GPS Antenna or equivalent

Procedure:

1. Connect the external power supply (Anritsu part number 40-168) to the VNA Master.
2. Press the **On/Off** key to turn on the VNA Master.
3. Press the **Shift** key, the **Preset** key (1), and then the Preset soft key to reset the instrument to the default starting conditions.

NOTE: Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

4. Connect the GPS antenna to the GPS Antenna connector on the VNA Master.
5. Press the **Shift** key, and then press the **System** (8) key.
6. Press the GPS soft key, then press the GPS On/Off soft key to turn the GPS On.
7. When the GPS fix is acquired, the GPS indicator at the top of the screen will turn green.
8. Press the GPS Info soft key to view the latitude, longitude, altitude, and other GPS information.

5. Battery Information

The following information relates to the care and handling of the VNA Master battery, and Lithium-Ion batteries in general.

- The battery supplied with the VNA Master may need charging before use. Before using the VNA Master, the internal battery may be charged either in the VNA Master, using either the AC-DC Adapter (40-168) or the 12-Volt DC adapter (806-62), or separately in the optional Dual Battery Charger (2000-1374).
- Use only Anritsu approved battery packs.
- Recharge the battery only in the VNA Master or in an Anritsu approved charger.
- When the VNA Master or the charger is not in use, disconnect it from the power source.
- Do not charge batteries for longer than 24 hours; overcharging may shorten battery life.
- If left unused a fully charged battery will discharge itself over time.
- Temperature extremes affect the ability of the battery to charge: allow the battery to cool down or warm up as necessary before use or charging.
- Discharge the battery from time to time to improve battery performance and battery life.
- The battery can be charged and discharged hundreds of times, but it will eventually wear out.
- The battery may need to be replaced when the operating time between charging becomes noticeably shorter than normal.
- Never use a damaged or worn out charger or battery.
- Storing the battery in extreme hot or cold places will reduce the capacity and lifetime of the battery.
- Never short-circuit the battery terminals.
- Do not drop, mutilate or attempt to disassemble the battery.
- Do not dispose of batteries in a fire!
- Batteries must be recycled or disposed of properly. Do not place batteries in household garbage.
- Always use the battery for its intended purpose only.

6. Battery Pack Removal and Replacement

This section provides instructions for the removal and replacing the VNA Master battery pack.

NOTE: Many of the procedures in this section are generic, and apply to many similar instruments. Photos and illustrations used are representative and may show instruments other than the VNA Master.

1. With the VNA Master laying flat, face up, on a stable surface, locate the battery access door, as illustrated in Figure 4.

Figure 4. Battery Access Door Location

2. Place a finger in the battery access door notch and push the door down towards the bottom of the instrument, as illustrated in Figure 5.

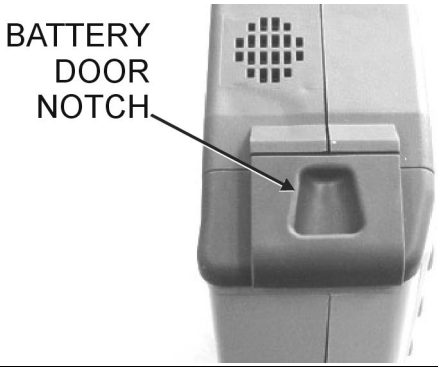

Figure 5. Battery Access Door Notch

3. Remove the battery access door, as illustrated in Figure 6.

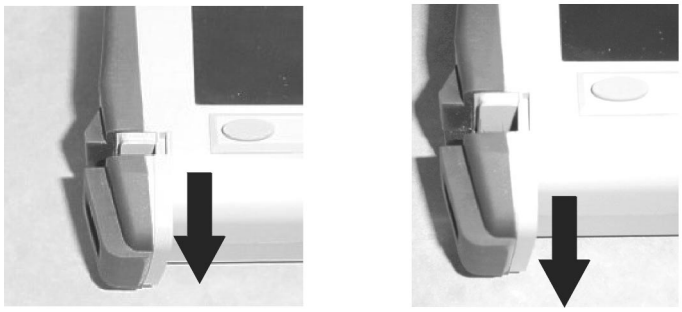

Figure 6. Removing the Battery Access Door

4. With the battery access door completely removed, grasp the battery lanyard and pull the battery straight out of the unit, as illustrated in Figure 7.

Figure 7. Removing the Battery

5. Replacement is the opposite of removal. Note the orientation of the battery contacts, and be sure to insert the new battery with the contacts facing the bottom of the unit, as illustrated in Figure 8.

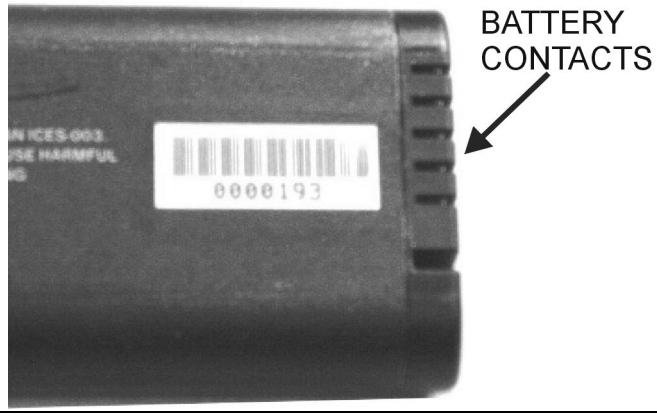

Figure 8. Battery Contacts