
NanoMaxx Ultrasound System



Service Manual

SonoSite, Inc.

21919 30th Drive SE
Bothell, WA 98021-3904
USA

Telephone: 1-888-482-9449 or 1-425-951-1200
Fax: 1-425-951-1201

SonoSite Ltd

Alexander House
40A Wilbury Way
Hitchin, Herts
SG4 OAP UK

T: +44-1462-444800
F: +44-1462-444801

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Chapter 1: Introduction

Before servicing the NanoMaxx ultrasound system, please read this manual.

The ultrasound system has multiple configurations and feature sets. All are described in this service manual but not every option may apply to your system. System features depend on your system configuration, transducer, and exam type.

Refer to the *NanoMaxx Ultrasound System User Guide* for additional information regarding safety, system controls, operation, capabilities, and specifications.

Audience

The intended audience of this manual is properly trained field and in-house service personnel.

Conventions

These conventions are used in this service manual:

- A **WARNING** describes precautions necessary to prevent injury or loss of life.
- A **Caution** describes precautions necessary to protect the products.
- Numbered steps must be performed in a specific order.
- Bulleted lists present information in list format but do not imply a sequence.
- Labeling symbols are in the user guide.

Contact Information

Questions and comments are encouraged. SonoSite is interested in your feedback regarding the service manual. If you encounter difficulty with the system, use the information in this manual to help correct the problem. If the problem is not covered here, contact SonoSite Technical Support as follows:

| | |
|--|--|
| Technical Support (USA, Canada) phone: | 1-877-657-8118 |
| Technical Support fax: | 1-425-951-6700 |
| Technical Support e-mail: | service@sonosite.com |
| SonoSite Web site: | www.sonosite.com>Support |
| International Technical Support: | Contact your local representative or call (USA) +425-951-1330 |
| European Service Center: | +44-(0)1462-444-800 e-mail: uk.service@sonosite.com |
| Japan Service Center: | +81-3-5304-5337 e-mail: service-jp@sonosite.com |

Chapter 2: System Overview

About the System

The SonoSite NanoMaxx high-resolution ultrasound system is a portable, software controlled, diagnostic ultrasound system using all digital architecture. The system is used to acquire and display high-resolution, real-time ultrasound data in 2D, Color Power Doppler (CPD), and Color Doppler (Color) or in a combination of these modes.

The system provides measurement capabilities for anatomical structures and fetal biometry that provide information used for clinical diagnostic purposes. System features include cine review, image zoom, labeling, needle guidance, measurements, calculations, and image storage/review/printing/recording capabilities.

The system/transducer is capable of exceeding a TI or an MI of 1.0 in certain operating modes or mode combinations. The system displays the current output level in terms of one of two bioeffects indices (“Mechanical Index [MI]” and “Thermal Index [TI]”) in accordance with the AIUM/NEMA Standard for Real Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment.

Theory of Operation

The NanoMaxx ultrasound system has seven (7) major functional groups:

- Transducer
- Acquisition Subsystem
- Processing Subsystem
- Display Subsystem
- Control Subsystem
- User Interface Subsystem
- Power Subsystem

Figure 2.1 shows the relationship of the functional groups.

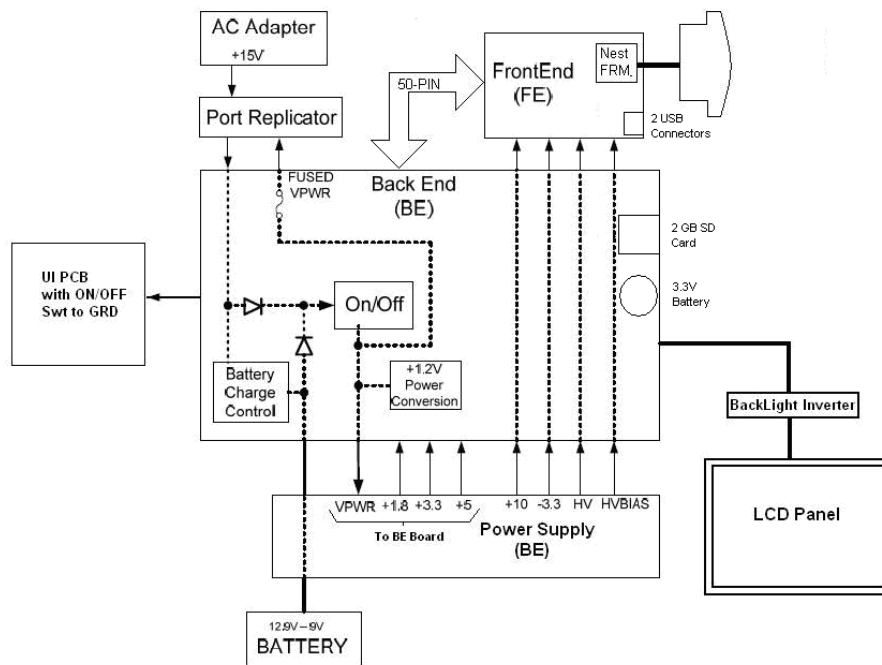


Figure 2.1 SonoSite High-Resolution Ultrasound System (NanoMaxx) Block Diagram

The **Transducer** elements convert the pulser voltage to acoustic energy during the transmit portion of the ultrasound acquisition cycle. The elements convert the acoustic echo to voltage in the receive portion of the acquisition. The voltage developed on the transducer elements is sensed by the acquisition subsystem. The system transducers have 64 to 192 elements depending on transducer selected.

The **Acquisition Subsystem** consists of the beamformer and interface to the transducer. The beamformer controls the timing of the transmit pulses to focus the acoustic beam. The beamformer amplifies the low-level received echoes and controls the receive focusing. The system beamformer transmits on up to 128 elements and receives on 64 elements.

The **Processing Subsystem** includes capabilities for interfacing with the beamformer and performing high speed processing. The processing subsystem demodulates, filters, detects, and compresses the signal supplied by the beamformer into display information.

The **Display Subsystem** converts the detected ultrasound data into picture elements (pixels). The software user interface graphics are combined with the ultrasound information and converted to a video stream. The external video port supports NTSC and PAL format.

The **Control Subsystem** consists of the central processing unit, program and video memory, permanent image storage and retrieval memory, external communication interface ports, and connection to the user interface keys. The control software includes the acoustic power and intensity software subsystem, power group monitors, and a beamformer monitor. This software guarantees a level of patient safety by ensuring the system is operating within acoustic power and intensity limits.

The **User Interface Subsystem** represents the software interface and form factor. The software interface is the interaction between the user and the screen layout components. The form factor is the type of physical buttons, location, and grouping of the buttons and the device size, shape, and weight. Dedicated controls are for high usage activities and grouped according to the user workflow.

The **Power Subsystem** provides the system power and protects the hardware from destructive and/or unsafe conditions by detecting failures in the system through hardware and software monitors. Detection of a fault results in disabling of the pulser supply, and the signaling of an error to the Control Group. The power subsystem includes the battery pack and battery charging electronics.

Description of Operating Modes

| | |
|----------------------------------|---|
| 2D Mode | <p>2D mode is a two dimensional image of the amplitude of the echo signals. It is used for location and measurement of anatomical structures and for spatial orientation during operation of other modes. In 2D, a two-dimensional cross-section of a 3-dimensional soft tissue structure such as the heart is displayed in real time. Ultrasound echoes of different intensities are mapped to different gray scale or color values in the display. The outline of the 2D cross-section may be a rectangle, parallelogram, trapezoid, sector, or a full circle, depending on the particular transducer used. 2D mode can be used in combination with any other modes.</p> |
| Color Doppler (Color) | <p>In Color Doppler, a real-time, two-dimensional cross-section of blood flow is displayed. The 2D cross-section may be presented as a rectangle, parallelogram, trapezoid, sector, or a full circle, depending on the particular transducer used.</p> <p>The 2D cross-section is presented as a full color display, with various colors being used to represent the velocity, both positive and negative, of the blood flow echoes. Often, to provide spatial orientation, the full color blood flow cross-section is overlaid on top of the gray scale cross-section of soft tissue structure (2D echo). For each pixel in the overlay, the decision of whether to display color, gray scale (echo) information or a blended combination is based on the relative strength of echoes from the soft-tissue structures and from the red blood cells.</p> <p>A high pass filter (wall filter) is used to remove the signals from stationary or slowly moving structures. Tissue motion is discriminated from blood flow by assuming that blood is moving faster than the surrounding tissue, although additional parameters may also be used to enhance the discrimination. The remaining signal after wall filtering may be averaged over time (persistence) to present a steady state image of blood flow distribution. Variance information may also be displayed to provide information when large variance is observed in the velocity information.</p> |
| Color Power Doppler (CPD) | <p>In CPD, a real-time two-dimensional cross-section of blood flow is displayed. The 2D cross-section may be presented as a rectangle, parallelogram, trapezoid, sector, or a full circle, depending on the particular transducer used.</p> <p>The 2D cross-section is presented as a full color display, with various colors being used to represent the power in blood flow echoes. Often, to provide spatial orientation, the full color blood flow cross-section is overlaid on top of the gray scale cross-section of soft tissue structure (2D echo). For each pixel in the overlay, the decision of whether to display CPD, gray scale (echo) information or a blended combination is based on the relative strength of echoes from the soft-tissue structures and from the red blood cells.</p> <p>A high pass filter (wall filter) is used to remove the signals from stationary or slowly moving structures. Tissue motion is discriminated from blood flow by assuming that blood is moving faster than the surrounding tissue, although additional parameters may also be used to enhance the discrimination. The power in the remaining signal after wall filtering may be averaged over time (persistence) to present a steady state image of blood flow distribution.</p> |

Additional System Feature Performances

| | |
|---|---|
| Broadband Imaging | <p>This ultrasound acquisition system uses high resolution broadband technology in the transmit pulsers, transducers, and receivers. The receive path can capture and process signals over a wide spectrum from below 2.0 MHz to beyond 10 MHz. For each application the transmit pulse is designed to produce an appropriate bandwidth. For example, in 2D grayscale imaging, a wide band pulse is used to support good axial resolution. For Doppler modes a narrower band pulse is used which improves the spectral resolution of the detected Doppler signal.</p> <p>In addition to transmit pulse control, programmable digital signal processing is used in the receive path to further refine the bandwidth used to produce the final image. Digital filters are applied to the digitized received signal to limit and shape the spectral bandwidth used to generate the displayed output.</p> |
| Needle Guidance | <p>The system can display a pair of needle guidelines that represent the anticipated path of the needle. The image of the anatomical target, needle guidelines, and a scan plane marker are displayed to assist in guiding the needle to the target. For additional information, see the needle user guides.</p> |
| Measurement and Calculation Capabilities | <p>The system offers a variety of measurements and calculations specific to exam type and transducer. A list of them, and author references, are in the system user guide. Measurement accuracy is also discussed.</p> |

System Specifications

This section contains system and accessory specifications and agency approvals. The specifications for recommended peripherals can be found in the manufacturers' instructions. See the applicable SonoSite accessory user guide for information on the accessories.

System Dimensions

Height: 8.2in. (20.8 cm)

Width: 14.1 in. (35.8 cm)

Depth: 2.3in. (5.8 cm)

Weight: 6 lbs. (2.72 kg)

Display Dimensions

Length: 8.4 in. (21.34 cm)

Height: 6.3 in. (16 cm)

Diagonal: 10.4 in. (26.4 cm)

Transducers

Note: Each of the NanoMaxx system types (S-ICU, S-Nerve, etc.) supports a unique combination of transducers.

C11n/8-5 MHz 11 mm curved array (6 ft./1.8 m)

C60n/5-2 MHz 60 mm curved array (5.5 ft./1.7 m)

L25n/13-6 MHz 25 mm linear array (7.5 ft./2.3 m)

L38n/10-5 MHz 38 mm linear array (5.5 ft./1.7 m)

P21n/5-1 MHz 21 mm phased array (6 ft./1.8 m)

Imaging Modes

- 2D (256 gray shades)
- Color power Doppler (CPD) (256 colors)
- Color Doppler (Color) (256 colors)

Image and Clip Storage

The number of images and clips you can save varies with imaging mode and file format. The internal storage can save approximately 40 patients with 50 images each.

Accessories

Hardware, Software, and Documentation

- Battery
- Carry Case
- Kensington Security Cable
- Needle Guides (L25n only)
- Power supply
- SonoCalc IMT Software 4.1
- V-Universal Stand
- System User Guide (CD Standard/Hardcopy optional)
- System AC PowerCcord (10 ft / 3.1 m)
- VESA Compliant Mounting
- Video and printer cables

Cables

See the *NanoMaxx Ultrasound System User Guide* or the *V-Universal Stand User Guide* for information on cables.

Peripherals

Peripherals include the following medical grade (conforming to the requirements of EN60601-1) and non-medical grade (commercial) products. Manufacturer's instructions accompany each peripheral. System setup instructions are in the *NanoMaxx Ultrasound System User Guide*. Instructions for using peripherals with the system are in the applicable SonoSite accessory user guide.

Medical Grade

- Black-and-white printer

Non-Medical Grade

- 2GB USB Memory Stick

Temperature, Pressure, and Humidity Limits

Note: The temperature, pressure, and humidity limits apply only to the ultrasound system and transducers.

Operating Limits: System, battery, and transducer

- 10–40°C (50–104°F), 15–95% R.H.
- 700 to 1060hPa (0.7 to 1.05 ATM)

Shipping/Storage Limits: System and transducer

- -35–65°C (-31–149°F), 15–95% R.H.
- 500 to 1060hPa (0.5 to 1.05 ATM)

Shipping/Storage Limits: Battery

- -20–60°C (-4–140°F), 0–95% R.H. (For storage longer than 30 days, store at or below room temperature.)
- 500 to 1060hPa (0.5 to 1.05 ATM)

Electrical

Power Supply Input: 100-240 VAC, 50/60 Hz, 2.0 A Max @ 100 VAC.
Power Supply Output 1: 15 VDC, 5.0A Max (system)
Power Supply Output 2: 12 VDC, 2.3A Max (battery)
Combined output not exceeding 75W.

Battery

6-cell, 11.2 VDC, 5.2 amp-hours, rechargeable lithium ion battery pack.

Run time is up to 2 hours, depending on imaging mode and display brightness.

Electromechanical Safety Standards

EN 60601-1:1997, European Norm, Medical Electrical Equipment–Part 1. General Requirements for Safety.

EN 60601-1-1:2001, European Norm, Medical Electrical Equipment–Part 1. General Requirements for Safety–Section 1-1. Collateral Standard. Safety Requirements for Medical Electrical Systems.

EN 60601-1-2:2001, European Norm, Medical Electrical Equipment – Part 1-2: General Requirements for Safety - Collateral Standard: Electromagnetic compatibility - Requirements and tests

EN 60601-2-37:2001 + Amendment A1:2005, European Norm, Particular requirements for the safety of ultrasonic medical diagnostic and monitoring equipment.

CAN/CSA C22.2, No. 601.1-M90, Canadian Standards Association, Medical Electrical Equipment. Part 1. General Requirements for Safety (including CSA 601.1 Supplement 1:1994 and CSA 601.1 Amendment 2:1998)

CEI/IEC 61157:1992, International Electrotechnical Commission, Requirements for the Declaration of the Acoustic Output of Medical Diagnostic Ultrasonic Equipment.

UL 60601-1 (1st Edition), Underwriters Laboratories, Medical Electrical Equipment - Part 1: General Requirements for Safety.

EMC Standards Classification

EN 60601-1-2:2001, European Norm, Medical Electrical Equipment. General Requirements for Safety-Collateral Standard. Electromagnetic Compatibility. Requirements and Tests.

CISPR11:2004, International Electrotechnical Commission, International Special Committee on Radio Interference. Industrial, Scientific, and Medical (ISM) Radio-Frequency Equipment Electromagnetic Disturbance Characteristics-Limits and Methods of Measurement.

The Classification for the SonoSite system, V Universal Stand, accessories, and peripherals when configured together is: Group 1, Class A.

Airborne Equipment Standards

RTCA/DO-160E:2004, Radio Technical Commission for Aeronautics, Environmental Conditions and Test Procedures for Airborne Equipment, Section 21.0 Emission of Radio Frequency Energy, Category B.

DICOM Standard

NEMA PS 3.15: 2000, Digital Imaging and Communications in Medicine (DICOM)-Part 15: Security Profiles.

HIPAA Standard

The Health Insurance and Portability and Accountability Act, Pub.L. No. 104-191 (1996).

45 CFR 160, General Administrative Requirements.

45 CFR 164, Security and Privacy.

Chapter 3: Troubleshooting

This chapter contains information to help you correct problems with system operation and provides instructions on the proper care of the system, transducer, and accessories.

Periodic Maintenance

There is no recommended periodic or preventive maintenance required for the system, transducers, or accessories. There are no internal adjustments or alignments required. There are no functions that require periodic testing or calibration. Performance tests are described in [Chapter 5, “Performance Testing,”](#) of this manual. Performing maintenance activities not described in this manual may void the product warranty.

Local regulations may require electrical safety testing.

Contact SonoSite Technical Support for any maintenance questions.

Technical Bulletins

Product Technical Bulletins describing known system issues are periodically placed on SonoSite.com. Select **Support** and then follow the links to **NanoMaxx Support Documents**.

System and Subsystem Diagnosis

This section covers basic diagnostic and troubleshooting procedures you may follow if the system does not operate properly. To diagnose system failures, consult the referenced diagnostic figures that follow or call SonoSite Technical Support.

Table 3.1: Troubleshooting Subassemblies and Diagnostic Figures

| Subassemblies | Diagnostic Figures or Table |
|---------------|-----------------------------|
| Display | TBA |
| Battery | TBA |
| Control Panel | TBA |

System Repair

The system is repairable through subassembly replacement or through replacement of parts as recommended by SonoSite in [Chapter 4, “Replacement Procedures.”](#) Component level repair of Printed Circuit Board Assemblies is performed only at the SonoSite repair facility. Replacement of board level components by unauthorized service facilities voids the SonoSite warranty.

Test Equipment

Test equipment is not required for this troubleshooting section. Troubleshooting test aids include an external monitor and a spare battery.

Failure (Assert) Codes

"Assert" or "Assert Code" are software error codes that are generated by all SonoSite products when certain hardware or software fault conditions exist. Providing the Assert Code to the Technical Support Group may assist in quicker and more accurate fault diagnosis.

Hardware Assert Codes typically cannot be reset and will usually require Main PCB replacement. Many software Assert Codes can be reset and the system may recover and operate normally, usually requiring a reboot.

Handling Assert Codes

- 1 Record the Assert Code. The Assert Code is a four or five digit number shown on the C: line of the Maintenance Screen. A typical Maintenance Screen with an Assert Code is shown in [Figure 3.1](#).

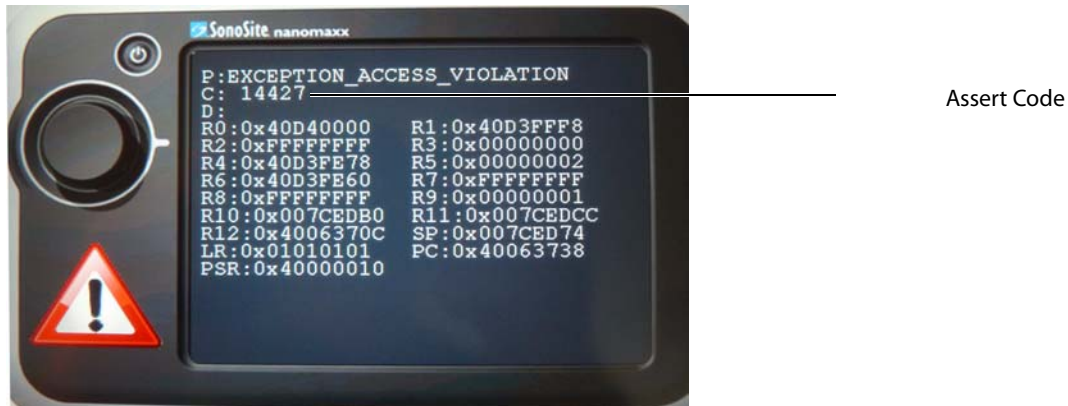


Figure 3.1 Maintenance Screen with Assert Code

- 2 Press and release the Power button to power the system down. It may be necessary to hold down the Power button as long as 10 seconds in some cases.
- 3 Press the Power button again to power the system up.
 - If the system powers up normally, it has recovered from the fault (software assert) and you may use the system.
 - If the Assert Code remains, corrective action must be taken; usually replacement of the the Back End PCB is required. Contact SonoSite Technical Support for assistance and to obtain repair parts.

If the Power button is not functional, all sources of power must be removed to allow the system to power down. i.e., disconnect AC power and remove the battery.

Chapter 4: Replacement Procedures

Caution: Always use correct ESD procedures. ESD damage is cumulative and may not be noticeable at first. Initial ESD symptoms may be slightly degraded performance or image quality.

Required Tools

- #1 and #2 Phillips screwdrivers
- #1 and #2 Flat Blade screwdrivers
- 3 mm Allen Key
- 3/16" Nut Driver or equivalent wrench/socket
- Kapton tape
- Torque screwdriver, 2.0–10.0 inch pounds (23–110 newton-centimeters)
- Cotton swabs (Q Tips)
- Anti-static mat & wrist grounding strap

Rear Cover Removal

Removal of the Rear Cover is required to access all other system components.

- 1 Remove the battery from the system.
- 2 Remove the six screws from the Rear Cover as shown in [Figure 4.1](#)

Caution: There are several cables connecting the top and bottom halves of the system. Use caution when removing the rear cover to prevent cable or PCB damage.

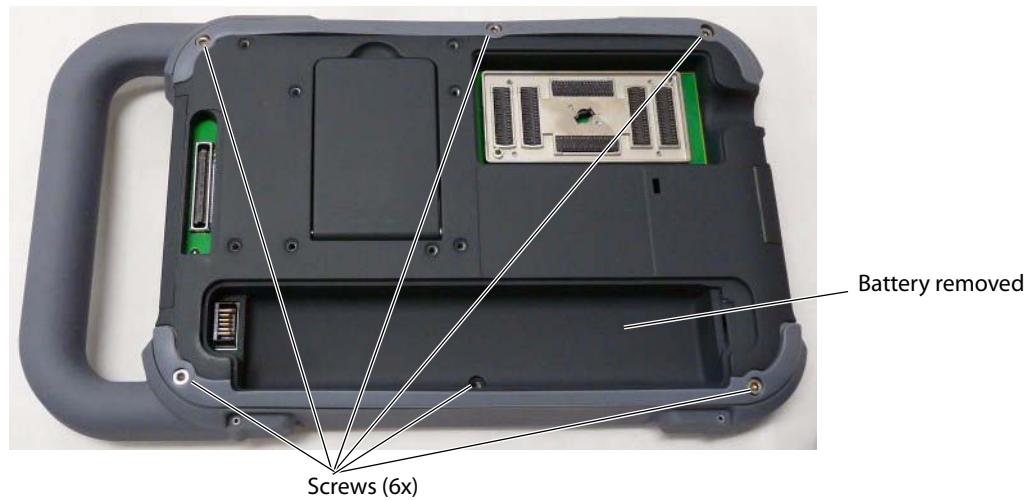


Figure 4.1 Rear Cover Removal

- 3 Disconnect the three cables connecting the upper and lower halves of the system as show in [Figure 4.2](#)

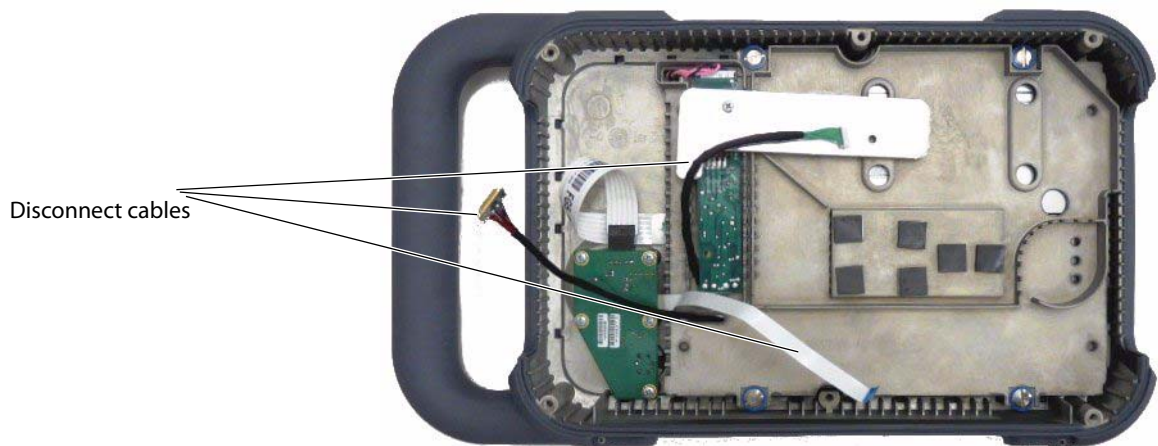


Figure 4.2 Disconnecting Cables

Rear Cover Installation

- 1 Reconnect the three cables.
- 2 Insert the top of the Rear Cover under the top cap, and press down to mate with the Front Enclosure.
- 3 Install the six screws removed from the Rear Cover and torque to 5.5 inch/pounds (62 newton-centimeters).
- 4 Install the battery.

Major System Components

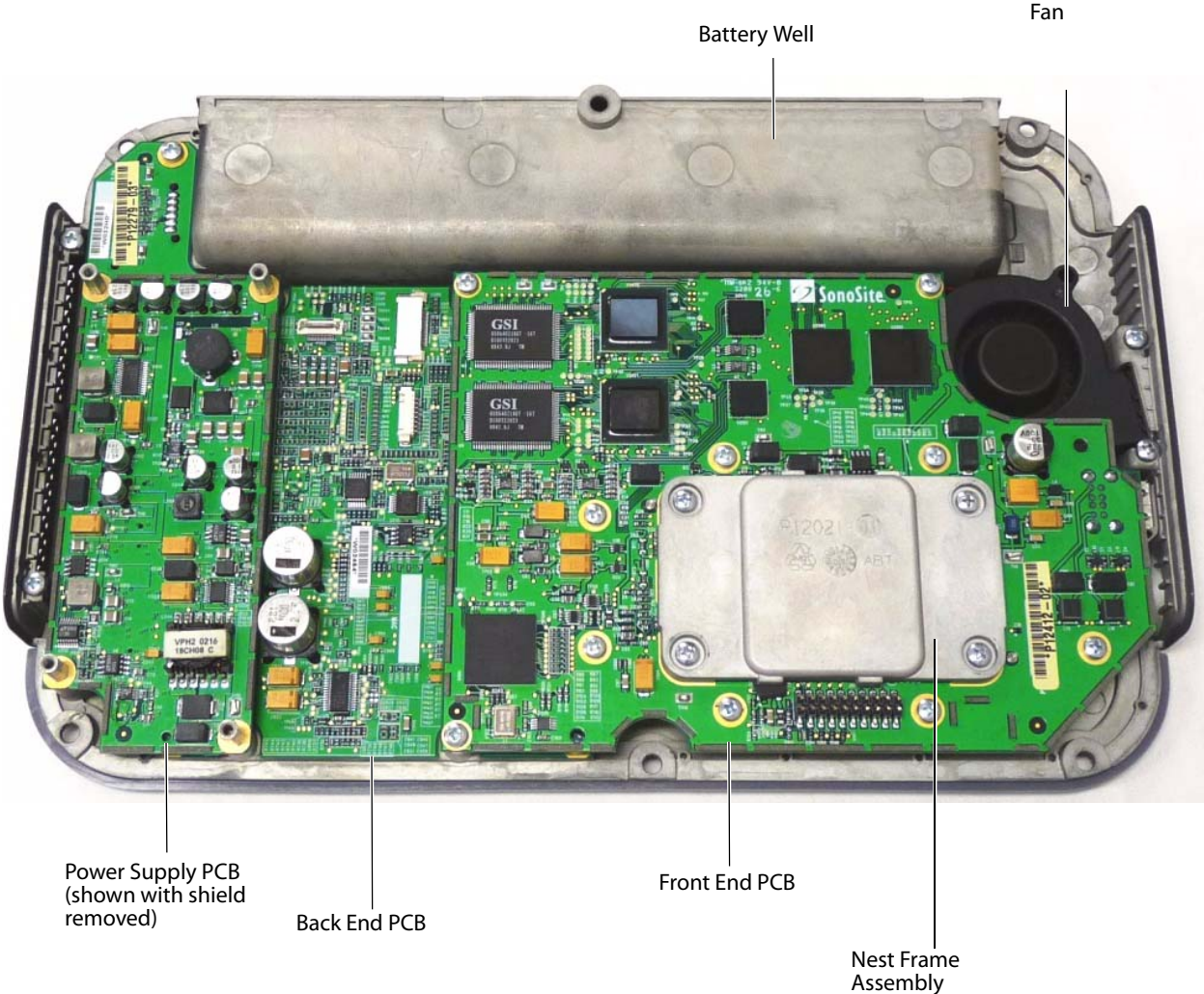


Figure 4.3 Major System Components

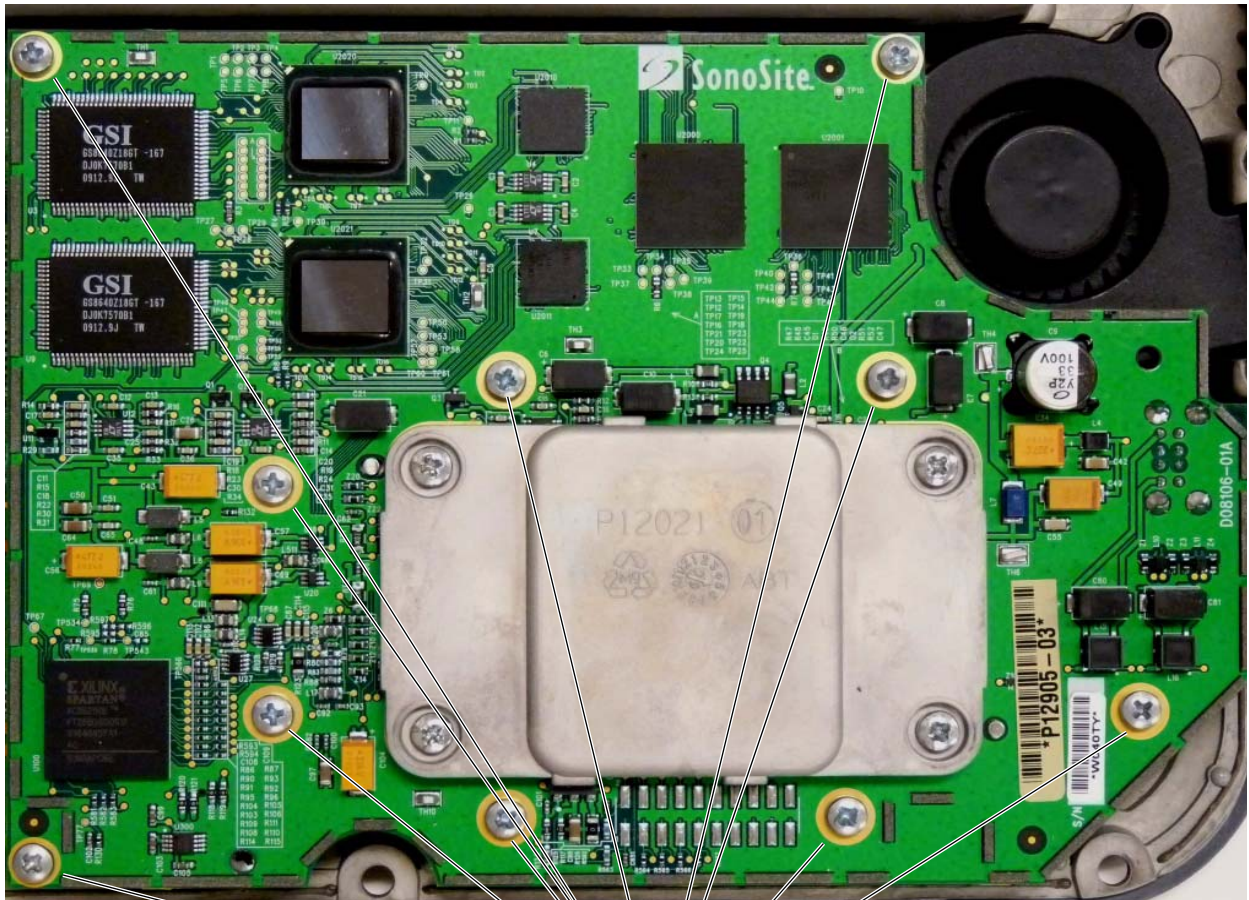
Front End PCB Replacement

Required Parts

- P12717 Service Assembly, Front End PCB, NanoMaxx

Front End PCB Removal

- 1 Remove the Rear Cover as described in “Rear Cover Removal” on page 14.
- 2 Remove the ten screws shown in Figure 4.4.



Remove P09037 M3.5x6mm screws (10x).

Figure 4.4 Front End PCB Replacement

Front End PCB Installation

- 1 Reinstall the ten screws shown in Figure 4.4, and torque to 5.5 inch/pounds (62 newton-centimeters).
- 2 Reinstall the Rear Cover as described in “Rear Cover Installation” on page 14.

Power Supply PCB Replacement

Required Parts

- P12745 Service Assembly, Power Supply, M-Turbo / NanoMaxx

Power Supply PCB Removal

- 1 Remove the Rear Cover as described in “Rear Cover Removal” on page 14.
- 2 Remove the upper Power Supply Shield (not shown) by removing the 4 screws.
- 3 Remove the hex standoffs (x4) as shown in [Figure 4.5](#).
- 4 Remove the screw as shown in [Figure 4.5](#).
- 5 Remove the Power Supply PCB.

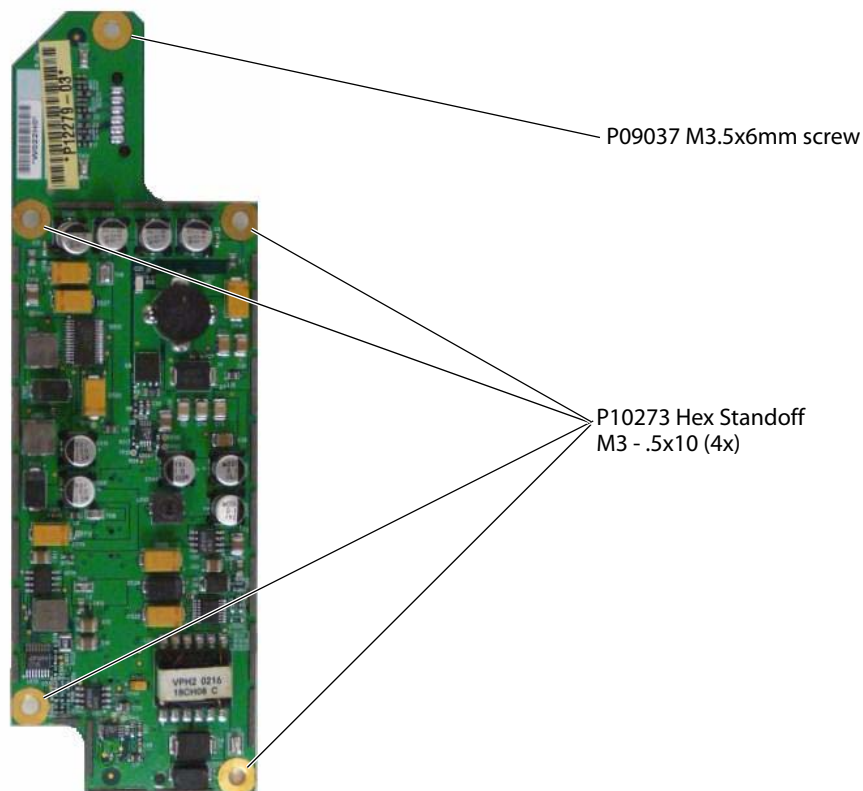


Figure 4.5 Power Supply PCB Replacement

Power Supply PCB Installation

- 1 Ensure the Lower Power Supply Shield is properly installed under the Power Supply mounting location.
- 2 Place the replacement Power Supply PCB onto the Front End PCB.
- 3 Reinstall the one screw and the four hex standoffs in the locations shown in [Figure 4.5](#) and torque all fasteners to 5.5 inch/pounds (62 newton-centimeters).
- 4 Reinstall the Upper Power Supply shield and torque the shield fasteners to 5.5 inch/pounds (62 newton-centimeters).

Back End PCB Replacement

Required Parts

- P12718 Service Assembly, Back End, M-Turbo / NanoMaxx

Back End PCB Removal

- 1 Remove the Rear Cover as described in “Rear Cover Removal” on page 14.
- 2 Remove the Front End PCB as described in “Front End PCB Removal” on page 16.
- 3 Remove the Power Supply PCB as described in “Power Supply PCB Removal” on page 17.
- 4 Disconnect the Fan cable from the Back End PCB as shown in Figure 4.6.
- 5 Remove the eight screws as shown in Figure 4.6.
- 6 Remove the SD Card from the holder for use with the replacement PCB.

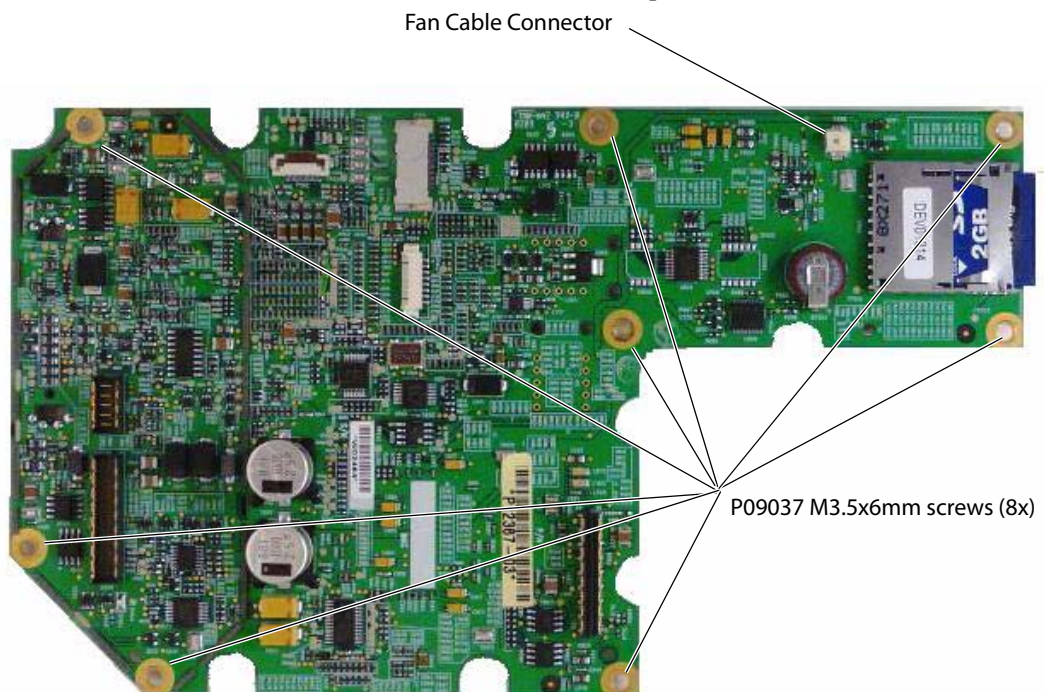


Figure 4.6 Back End PCB Replacement

Back End PCB Installation

- 1 Install the SD card (removed from old PCB) into the replacement Back End PCB.
- 2 Install the replacement Back End PCB into the frame.
- 3 Install the eight screws and torque the screws to 5.5 inch/pounds (62 newton-centimeters).

Caution: Inspect the Power Supply Shield to ensure that none of the contacts are bent. Improper contact between the shield and the Power Supply Frame can cause image noise problems.

- 4 Reconnect the fan cable to the Back End PCB as shown in Figure 4.6.
- 5 Reinstall the Front End PCB as described in “Front End PCB Installation” on page 16.
- 6 Reinstall the Power Supply PCB as described in “Power Supply PCB Installation” on page 17.
- 7 Reinstall the Rear Cover as described in “Rear Cover Installation” on page 14.

Other Major System Components

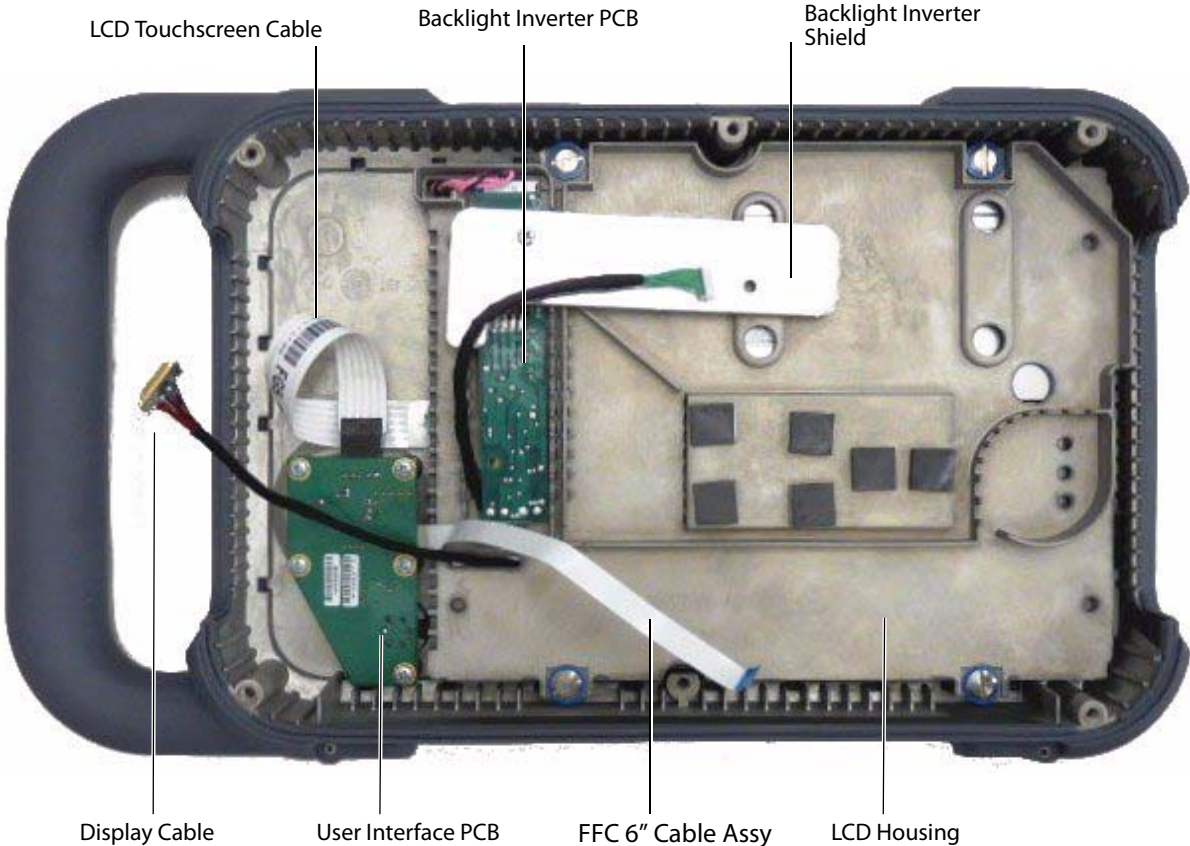


Figure 4.7 Other Major System Components

User Interface PCB Replacement

Required Parts

- P12329 User Interface PCB, NanoMaxx

User Interface PCB Removal

- 1 Remove the Rear Cover as described in “Rear Cover Removal” on page 14.
- 2 Remove the knob from the front of the system.
- 3 Disconnect the LCD touchscreen ribbon cable from the User Interface PCB as shown in Figure 4.8.
- 4 Remove the five screws shown in Figure 4.8.

Caution: The FFC ribbon cable connector is fragile and will require replacement of the User Interface PCB if damaged.

- 5 Disconnect the FFC ribbon cable by gently lifting up on the connector latch as shown in Figure 4.8.

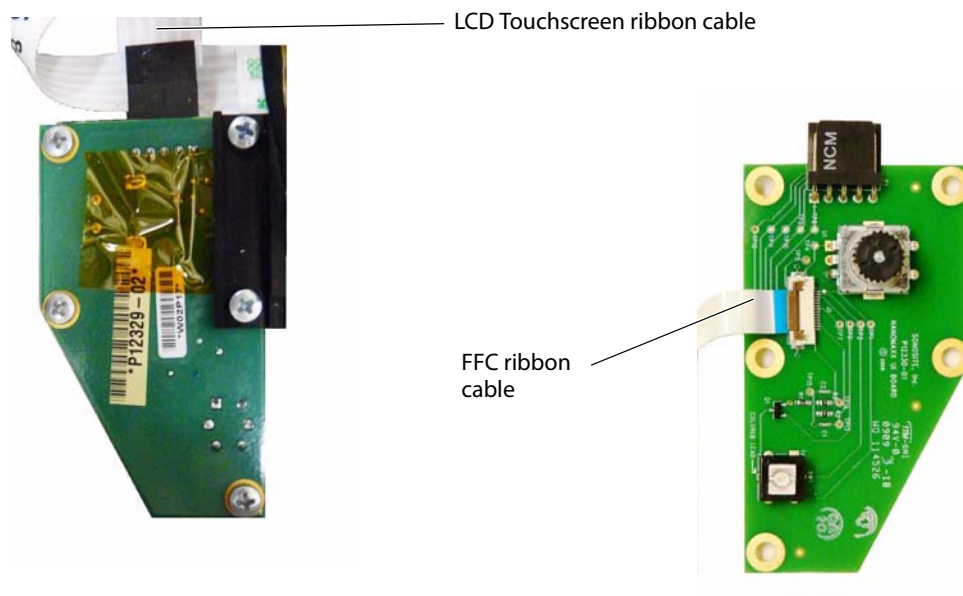


Figure 4.8 User Interface PCB Replacement

User Interface PCB Installation

- 1 Reinstall the FFC ribbon cable onto the replacement User Interface PCB as shown in Figure 4.8. Ensure the cable is fully seated into the connector and reengage the connector latch.
- 2 Install the replacement User Interface PCB onto the front enclosure as shown Figure 4.8.
- 3 Reinstall the five screws and torque the screws to 5.5 inch/pounds (62 newton-centimeters).
- 4 Reconnect the LCD Touchscreen ribbon cable ensuring the cable is looped as shown in Figure 4.7.
- 5 Reinstall the knob on the front enclosure.
- 6 Reinstall the Rear Cover as described in “Rear Cover Installation” on page 14.

Display Backlight Inverter (BLI) PCB Replacement

Required Parts

- P09195 Display Backlight Inverter PCB
- P09199 Backlight Inverter Wire Harness (optional)

Display Backlight Inverter PCB Removal

- 1 Remove the Rear Cover as described in [“Rear Cover Removal”](#) on page 14.
- 2 Remove the two screws from the Backlight Shield Cover and set the shield aside.
- 3 Disconnect the LCD wire harness connecting the Backlight Inverter PCB and the LCD as shown in [Figure 4.9](#)
- 4 Carefully remove the Backlight Inverter PCB from the enclosure.
- 5 Disconnect the BLI Power Harness from the Backlight Inverter PCB and set aside.

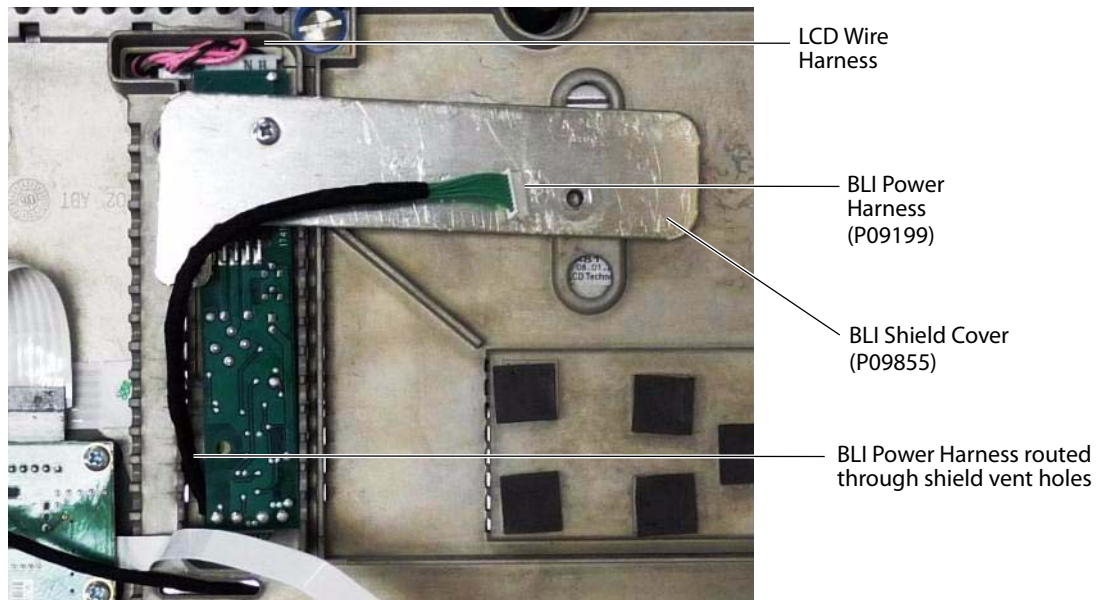


Figure 4.9 Backlight Inverter Replacement

Display Backlight Inverter PCB Installation

- 1 Reconnect the BLI Power Harness to the replacement Backlight Inverter PCB.
- 2 Reconnect the LCD wire harness to the replacement Backlight Inverter PCB.
- 3 Insert the replacement Backlight Inverter PCB into the on the LCD Housing as shown in [Figure 4.9](#).
- 4 Route the BLI Power Harness through the enclosure vent holes as shown in [Figure 4.9](#).
- 5 Reinstall the Backlight Inverter Shield Cover and two mounting screws. Torque the screws to 5.5 inch/pounds (62 newton-centimeters).
- 6 Reinstall the Rear Cover as described in [“Rear Cover Installation”](#) on page 14.

LCD Replacement

Required Parts

- P09732 LCD, 8.4". This part number is for the LCD monitor only. Cables and mounting hardware are not included.
- P09200 Display Wire Harness (optional)

LCD Removal

- 1 Remove the Rear Cover as described in ["Rear Cover Removal"](#) on page 14.
- 2 Disconnect the LCD Power Wire Harness from the Display Backlight Inverter PCB as shown in [Figure 4.10](#).
- 3 Disconnect the Touchscreen cable from the User Interface PCB as shown in [Figure 4.10](#).
- 4 Remove the four LCD frame mounting screws shown in [Figure 4.10](#).
- 5 Remove the LCD mounting frame from the front enclosure.
- 6 Remove the Display Cable connected to the LCD.

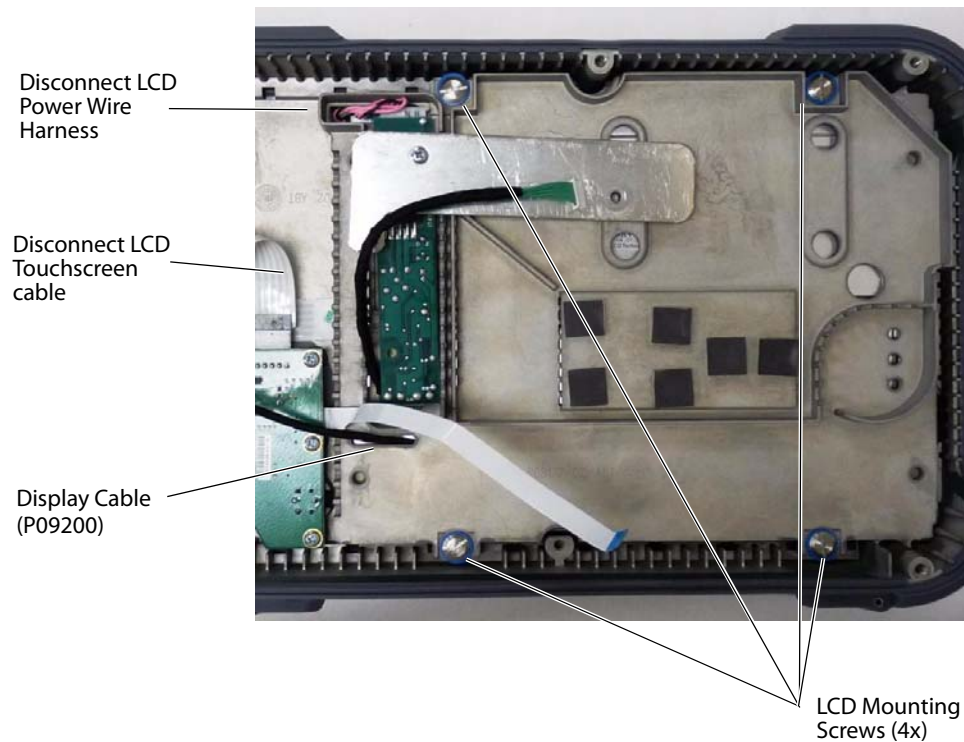


Figure 4.10 LCD Removal

LCD Installation

Caution: Use extreme caution when installing the Display Cable to prevent irreparable damage to the LCD.

- 1 Connect the Display Cable to the LCD as shown in [Figure 4.11A](#). Apply a piece of Kapton tape to the connector and LCD housing to aid in cable retention.
- 2 Insert the replacement LCD into the Display Housing loosely routing the cables as shown in [Figure 4.11B](#).
- 3 Route the Display Cable under the display housing as shown in [Figure 4.11C](#). Be careful not to disengage the cable from the LCD connector as shown in [Figure 4.11A](#).
- 4 Insert the Display Housing with LCD into the front enclosure and loosely install the four mounting screws as shown in [Figure 4.10](#) on page 22.
- 5 Check proper routing of cables to prevent damage.
- 6 Observe the position of the LCD from the front of the enclosure and adjust the position as necessary to center the LCD in the opening.
- 7 Tighten the four mounting screws to 5.5 inch/pounds (62 newton-centimeters).

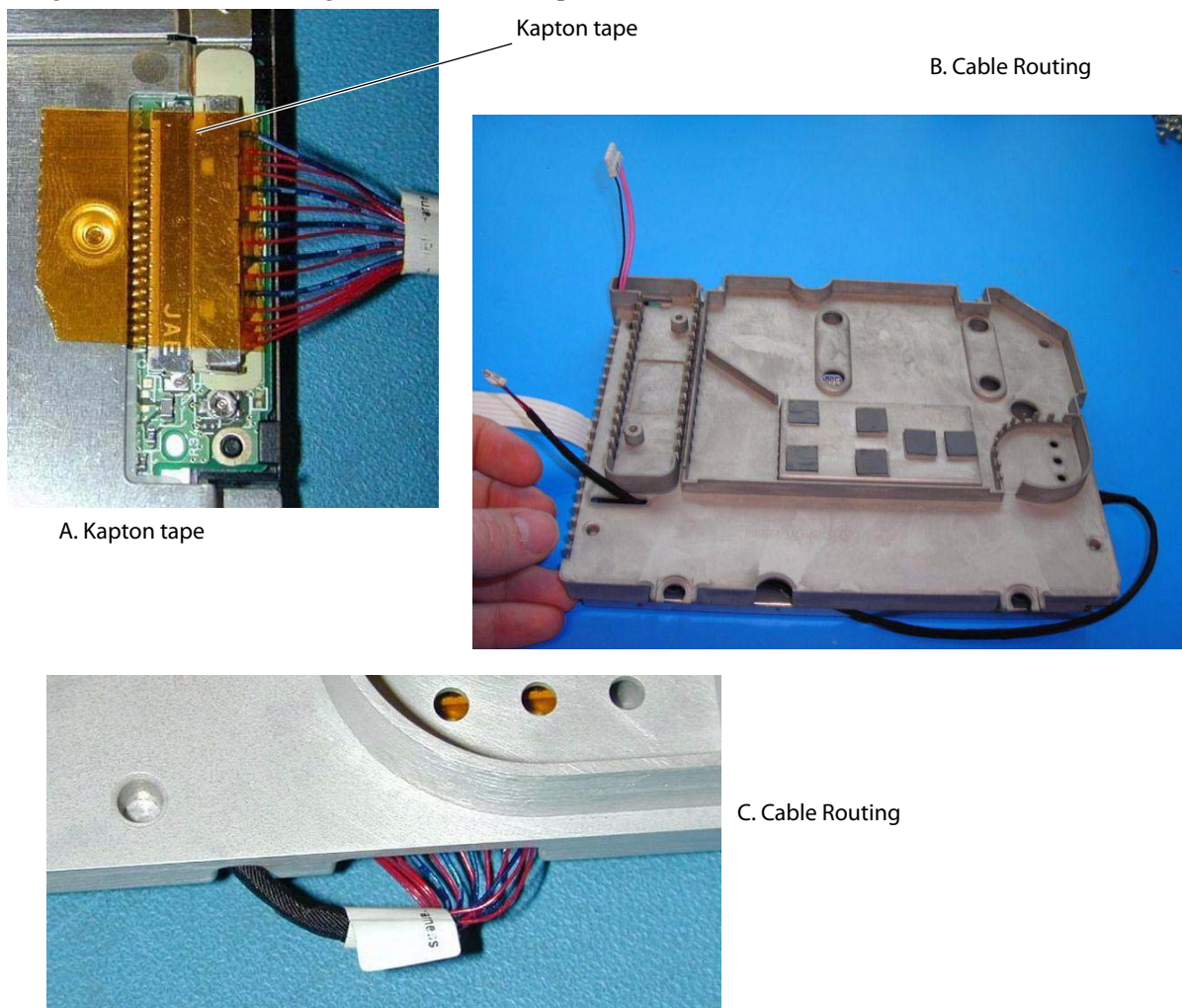


Figure 4.11 LCD Installation

- 8 Reconnect the LCD Power Wire Harness and dress the cable as shown in [Figure 4.10](#) on page 22.
- 9 Reinstall the Rear Cover as described in [“Rear Cover Installation”](#) on page 14.

Chapter 5: Performance Testing

Overview

WARNING: **Critical Test Function** — A failure of the system functions tested in this section could adversely affect the safety or effectiveness of the system. While performing the steps in this section, verify that the images on the system display and on the external monitor are acceptable.

To obtain 2D images, SonoSite recommends using the RMI 413A Soft Tissue Phantom or the RMI 403 GS Multipurpose Phantom. A .7db/cm phantom is required for performing penetration measurements. Any equivalent .7db/cm Phantom is acceptable.

When making penetration measurements on a phantom, apply the phantom reference value and tolerance to the measurement.

Some features and capabilities are optional and therefore may be unavailable to test.

Test Equipment

- SonoSite ultrasound system under test
- Transducer compatible with the system under test
- RMI 413A Soft Tissue Phantom, RMI 403 GS Multipurpose Phantom, or equivalent. A referenced .7db/cm phantom is required for performing penetration measurements.
- Video printer recommended
- Acoustic gel

Set Up Performance Tests

Set Up Performance Tests

- 1 Attach a compatible transducer to the system under test.
- 2 Select **Gen** for optimization type.
- 3 Couple the transducer to the phantom, adjusting gain settings and transducer for a proper phantom image (e.g., pins are high-level echoes positioned in straight lines; cysts are sonolucent, edges are sharp, and graphite particles of the phantom are mid-grays).

Basic Operational Tests

Basic System Operation Tests

- 1 Verify that the correct transducer name appears in the upper right corner of the system display.
- 2 Verify proper date and time.
- 3 Verify that the scan plane orientation mark in the image located near the skinline corresponds to element #1 on the transducer. To test, put your finger on the probe and run it across the transducer face. Your finger touching the transducer face should appear at the orientation mark on the display image format.
- 4 Verify that all controls and buttons smoothly over their full range and that the system responds properly.
- 5 Verify that all of the softkeys are functional.
- 6 Verify that as the Gain controls are increased and decreased, there is a corresponding increase and decrease in echo intensity.

2D Performance Tests

2D Performance / Image Quality

Test 2D Performance and Image Quality

- 1 Adjust the position of the transducer on the phantom to acquire a good phantom image as described in the “Set Up Performance Tests” section.
- 2 With the array pointing down and the orientation mark to the operator’s left, element #1 corresponds with the left side of the array.
- 3 Use the 2D system controls to obtain a clear image that shows both the horizontal and vertical rows of pins.
- 4 Verify that the ultrasound image appears uniform in both the axial and lateral direction, with no dropouts or intensity variations.
- 5 Verify that the cystic structure at the focal zone is clearly differentiated from the surrounding tissue and is echo-free, while solid tissue with numerous echo sources appears solid.
- 6 Press the **Freeze** key and then save the image. Press the **Freeze** key again to return to live imaging.

Axial Measurement Accuracy

Note: Measurements must be performed while the image is frozen.

Set Up Axial Measurement Accuracy

- 1 Acquire a phantom image of the target pins as described above.
- 2 Press the **Freeze** key.
- 3 Press the **Calipers** key. The caliper appears. (See the *NanoMaxx Ultrasound System User Guide*, if necessary, for caliper operation.)
- 4 Use the Knob and Up/Down - Left/Right buttons to position the first end of the caliper.
- 5 Press the **Select** button to enable the other end of the caliper.
- 6 Use the Knob and Up/Down - Left/Right buttons to position the second end of the caliper.

The results update as you move the caliper, and the measurement is complete when you finish moving the calipers.

Test Axial Measurement Accuracy

- 1 Measure the distance, center to center, of any two pins that are 5-12 cm apart vertically.
- 2 Verify that the distance measured is within the tolerance listed in [Table 1](#) on page 27.

Lateral Measurement Accuracy

Set Up Lateral Measurement Accuracy

Perform “Set Up Axial Measurement Accuracy” on page 26.

Test Lateral Measurement Accuracy

- 1 Measure the distance, center to center, of any two pins that are 4-10 cm apart horizontally.
- 2 Verify that the distance measured is within the tolerance listed in [Table 1](#).
- 3 Press the **Freeze** key to return the system to live 2D mode.

Table 1: System Measurement Accuracy

| Measurements | Tolerance |
|------------------|-----------|
| Axial Distance | +/- 2% |
| Lateral Distance | +/- 2% |

Penetration

TBD

Additional Performance Tests

Color Doppler (Color)

Test Color

- 1 Connect any transducer.
- 2 Press the **Color** key.
- 3 A Region of Interest (ROI) box is displayed on top of the grayscale image. Use the touchscreen to move the CPD ROI. Verify that the ROI moves to the new position on the display.
- 4 Adjust the **Depth** control for minimum depth in the image.
- 5 Adjust the **Gain** control so that color speckles just appear inside the ROI box.
- 6 Gently tap the face of the transducer and observe that the ROI box fills with color information.
- 7 Press the **Freeze** key and then save the image.
- 8 Press the **Freeze** key again to return to live imaging.

Color Power Doppler (CPD)

Test CPD

- 1 Connect any transducer.
- 2 Press the **Color** key. A ROI box appears on top of the grayscale image.
- 3 Press the **Color** key on the left side of the display to switch to CPD. “CPD” should be annotated on the Color/CPD key.
- 4 Adjust the **Depth** control for minimum depth in the image.
- 5 Adjust the **Gain** control so that color speckles appear just inside the ROI box.
- 6 Gently tap the face of the transducer, and observe that the ROI box fills with color information.

Image Quality Verification Test/Livescan

- Products with replaced subassemblies, or products that have been otherwise disassembled, should undergo an Image Quality Verification Test/Livescan.
- The Image Quality Verification Test/Livescan should be performed after successfully completing all applicable performance tests listed above.
- The test is completed before returning the system to operation.
- It is recommended that a certified sonographer perform the image quality verification.
- The Livescan test performed is at the discretion of the sonographer and will represent their acceptance of a successful service event.
- Review all saved images and verify that the images are displayed properly.

Printer

Test Printer Operation (Optional)

- 1 Verify proper printer type is configured.
- 2 Press the print button and verify that the printer begins to print an image. After the image begins to emerge from the printer, press the print button again. The printer should ignore the second print command.
- 3 Verify the proper content of the printed image.

Battery Charging

Test Battery Charging Operation

- 1 Insert a battery into the system and remove the power cord from the NanoMaxx dock.
- 2 Press the power key to turn the system on.
- 3 Allow the battery to discharge. The battery indicator icon on the display, below the Transducer Type indicator, extinguishes from right to left as the battery discharges.
Note: The Power and Sleep delay settings in the Audio, Battery setup page should be selected to Off to properly perform this test. The battery may take 1–2 hours to discharge.
- 4 Attach the AC power cord to the power connector. Press the power key to turn the system on.
- 5 Note that the battery indicator indicates that the battery is charging. The sections of the battery indicator will light sequentially from left to right as the battery charges.

Video Output

Caution: Use only the recommended video monitor or printer when verifying the video output at the video receptacle.

Test Video Output (Optional)

- 1 Attach an external video monitor to the video connector using the video cable.
- 2 Turn on the system power and verify that the video on the external monitor matches the video on the system display.

If the video does not appear similar, or there is no display on the external monitor, see [Chapter 3, “Troubleshooting”](#) for troubleshooting procedures.

Appendix A: Replacement Parts List

The following tables contain all the field-replaceable parts for the NanoMaxx ultrasound system. Quantities are one unless otherwise noted.

Major System Components



Table 1: Major System Components

| Item Number | Part Number | Description |
|-------------|-------------|---|
| 1 | P12745 | Power Supply PCB Service Assembly (Shown without shields) |
| Not shown | P09866 | Shield, Digital Bottom (Bottom Power Supply Shield) |
| Not shown | P09867 | Shield, Digital Top (Top Power Supply Shield) |
| 2 | P12718 | Back End PCB Service Assembly |
| 3 | P12717 | Front End PCB Service Assembly |
| 4 | P09196 | Fan/Cable |
| 5 | P13068 | Service Assembly, NanoMaxx Rear Enclosure (Enclosure only - does not contain any of the parts listed above) |

Other System Components

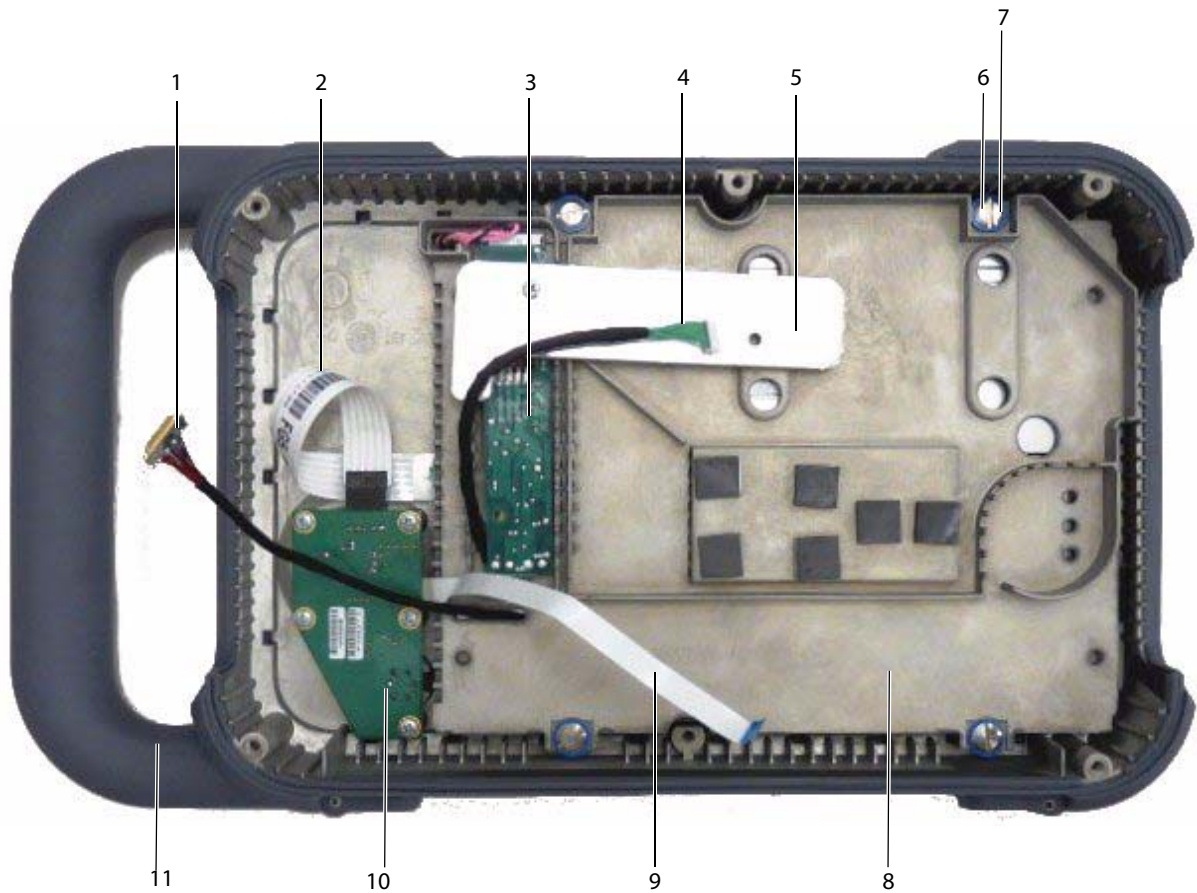


Table 2: Other System Components

| Item Number | Part Number | Description |
|-------------|-------------|---|
| 1 | P09200 | Display Cable Assy |
| 2 | - | Part of LCD Assembly |
| 3 | P09195 | Backlight Inverter PCB |
| 4 | P09199 | BLI Power Harness (Inverter Cable Assy) |
| 5 | P09895 | Backlight Inverter Cover (Shown partially removed) |
| 6 | P08398 | Display Isolation Damper Shoulder Screw (4x) |
| 7 | P07477 | Display Isolation Damper (4x) |
| 8 | P09177 | Display Housing |
| 9 | P09977 | FFC 6" Cable Assy |
| 10 | P12329 | User Interface PCB |
| 11 | P12755 | Service Assembly, Front Enclosure (Enclosure only - does not contain any of the parts listed above) |
| Not shown | P09732 | 8.4" LCD Assembly (Installed under item 7 Display Housing) |

Miscellaneous System Components



Table 3: Miscellaneous System Components

| Item Number | Part Number | Description |
|-------------|-------------|--------------|
| 1 | P09187 | Encoder Knob |
| Not shown | P12889 | Battery |

Ordering Replacement Parts

To order parts, contact SonoSite Technical Support. See [“Contact Information”](#) on page 1.

Appendix B: Service Event Reporting

The Service Event Report provides information about product failures to the manufacturer and to authorized service facilities, which provide approved warranty services for SonoSite products. For all repairs completed, complete the form and email a copy of it to service@sonosite.com or mail to the following address:

SonoSite, Inc.
Technical Support
21919 30th Drive SE
Bothell, Washington 98021
USA

To contact SonoSite Technical Support, see [“Contact Information”](#) on page 1.

Service Event Report Form



Service Event Report

Instructions on reverse

| Service Type (check one) |
|--|
| <input type="checkbox"/> Out of Box Failure |
| <input type="checkbox"/> Warranty Service |
| <input type="checkbox"/> Out of Warranty Service |

| Parts Status (check one) |
|---|
| <input type="checkbox"/> No parts necessary for this repair. Service Event Report for your information. |
| <input type="checkbox"/> I need parts for this repair (list the parts below and attach Purchase Order) |
| <input type="checkbox"/> I need parts to replenish my stock (list the parts used below and attach Purchase Order) |
| <input type="checkbox"/> Will not replenish stock. Please give me a RMA for the return of the faulty parts. |
| <input type="checkbox"/> No parts necessary. Please issue a RMA for repair at SonoSite. |

| For SonoSite Use Only | |
|-----------------------|--|
| Service Request | |
| Order Number | |
| RMA Number | |
| Work Order | |

Service Provider

| | | | |
|-----------------|--|---------------------|--|
| Name: | | Provider Reference: | |
| Company: | | Date Reported: | |
| Address: | | | |
| Phone Number: | | Fax Number: | |
| E-mail address: | | | |

Device Description

| | | | |
|-------------------|--|----------------|--|
| Ref Number: | | Serial Number: | |
| Name: | | Lot Number: | |
| ARM/SHDB Version: | | Configuration: | |

Problem Found

| |
|--|
| |
|--|

Service Performed

| | | | |
|---------------|--|-------|--|
| | | | |
| Performed By: | | Date: | |

Parts Removed

| Part Name | Part Number | Serial Number | Lot Number | Rev | Replaced By |
|-----------|-------------|---------------|------------|-----|-------------|
| | | | | | |
| | | | | | |

Parts Installed

| Part Name | Part Number | Serial Number | Lot Number | Rev | Replaced By |
|-----------|-------------|---------------|------------|-----|-------------|
| | | | | | |
| | | | | | |

Tests Performed (attach test data)

| | | | |
|---|--|---|--|
| Test: | | Test: | |
| Performed By: | | Performed By: | |
| Result: Pass <input type="checkbox"/> Fail <input type="checkbox"/> | | Result: Pass <input type="checkbox"/> Fail <input type="checkbox"/> | |

Page ____ of ____

Attach additional sheets as required

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Service Event Report Instructions

Instructions for completing the Service Event Report

Sections highlighted in yellow must be completed for SonoSite to accept the Service Event Report. If additional information is required for certain circumstances you will be advised.

Forward the completed form to:

Email: service@sonosite.com

Fax: +1-425-951-6700

Service Type

- **Out of Box Failure:** the item has arrived from SonoSite with failures.
- **Warranty Service:** the item has failed after arrival and is covered by either the included warranty or a valid extended warranty.
- **Out of Warranty Service:** the item has failed and it is no longer covered by a warranty.

Parts Status

- Check One.

Service Provider

- **Name:** the name of the technician performing the work.
- **Provider Reference:** a unique number used by the Provider to track Service Event Reports. Any format is acceptable.
- **Company:** the name of the Distributor or authorized repair facility.
- **Address:** the address replacement parts will be shipped to.
- **Date Reported:** the date the failure was reported to SonoSite.
- **Phone Number:** the phone number to contact the service technician.
- **Fax Number:** the fax number to contact the service technician.
- **Email Address:** the email address to contact the service technician.

Device Description:

- **Name:** the description of the failed product.
- **Ref Number:** the reference number from the part number label of the failed product.
- **Serial Number:** the serial number from the part number label of the failed product.
- **Lot Number:** if applicable, the Lot Number from the device identification label.
- **ARM/SHDB Version:** the software level of the failed device. Typically found on the system information screen.
- **Configuration:** for configurable devices, the optional features enabled.

Event Description

- A description of the problem in the words of the user. Typically what the user reports to the repair facility.

Diagnosis

- A description of what the repair technician found. Include a list of the suspect parts.

Service Performed

- A description of the work performed to repair the system. Typically only completed if it is repaired from stock repair parts.

Parts Removed

- **Part Name:** the name of the failed/suspect part to be replaced.
- **Part Number:** the part number of the failed/suspect part.
- **Serial Number:** the serial number from the failed/suspect part.
- **Lot Number:** the lot number if applicable.
- **Rev:** the revision of the failed/suspect part if available.
- **Replaced By:** the person replacing the part.

Parts Installed

- The same information as the Parts Removed except from the parts installed if work has already been performed. If you are waiting for parts to be ordered, leave this section blank.

Tests Performed

- The results of any testing performed, if testing has already been performed.

Returning Products to SonoSite

You will be asked to provide the following information:

- Contact name and phone number
- Product name
- Serial number
- Description of the problem

Shipping Instructions

Please contact SonoSite to get a return material authorization number (RMA). Contact SonoSite before returning any product.

The shipping address for all returned products is:

SonoSite, Inc.
Attn: Technical Support RMA _____
21919 30th Drive SE
Bothell, Washington 98021
USA

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