M-Turbo™
Ultrasound System

Service Manual

SonoSite

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Caution: | Federal (United States) law restricts this device to sale by or on the order of a physician.

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Chapter 1: Introduction

Before servicing the M-Turbo ultrasound system, please read this manual. The information applies only to the SonoSite M-Turbo ultrasound system product manufactured after December 5, 2007.

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 *M-Turbo 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)	1-877-657-8118
Technical Support fax:	1-425-951-6700
Technical Support e-mail:	service@sonosite.com
SonoSite website:	**www.sonosite.com** (Select Resources > Support & Service)
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

Chapter 2: System Overview

About the System

The SonoSite M-Turbo high-resolution ultrasound system is a portable, full featured, general purpose, 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, M Mode, Pulsed Wave (PW) Doppler, Continuous Wave (CW) Doppler, Color Power Doppler (CPD), and color Doppler (Color) or in a combination of these modes.

The system has an electrocardiography (ECG) display feature and supports a 3-lead ECG cable assembly to collect data for M Mode and Doppler measurements. The system provides measurement capabilities for anatomical structures and fetal biometry that provide information used for clinical diagnostic purposes. The system has a PW and CW Doppler audio output feature and cine review, image zoom, labeling, biopsy, measurements and calculations, image storage and review, printing, and recording capabilities.

The system includes the ability to measure the intima-media thickness (IMT) of the carotid artery using digital ultrasound images. The IMT measurement of the carotid artery may be used adjunctively with other medical data obtained by a physician to help assess the cardiovascular health of a patient.

The system includes Digital Imaging and Communications (DICOM) capabilities as well as general computer communication capabilities to provide the acceptance, transfer, display, storage, and digital processing of ultrasound images and loops. Security support is also provided to facilitate HIPAA compliance.

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 M-Turbo 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 is a system block diagram that shows the relationship of the functional groups.

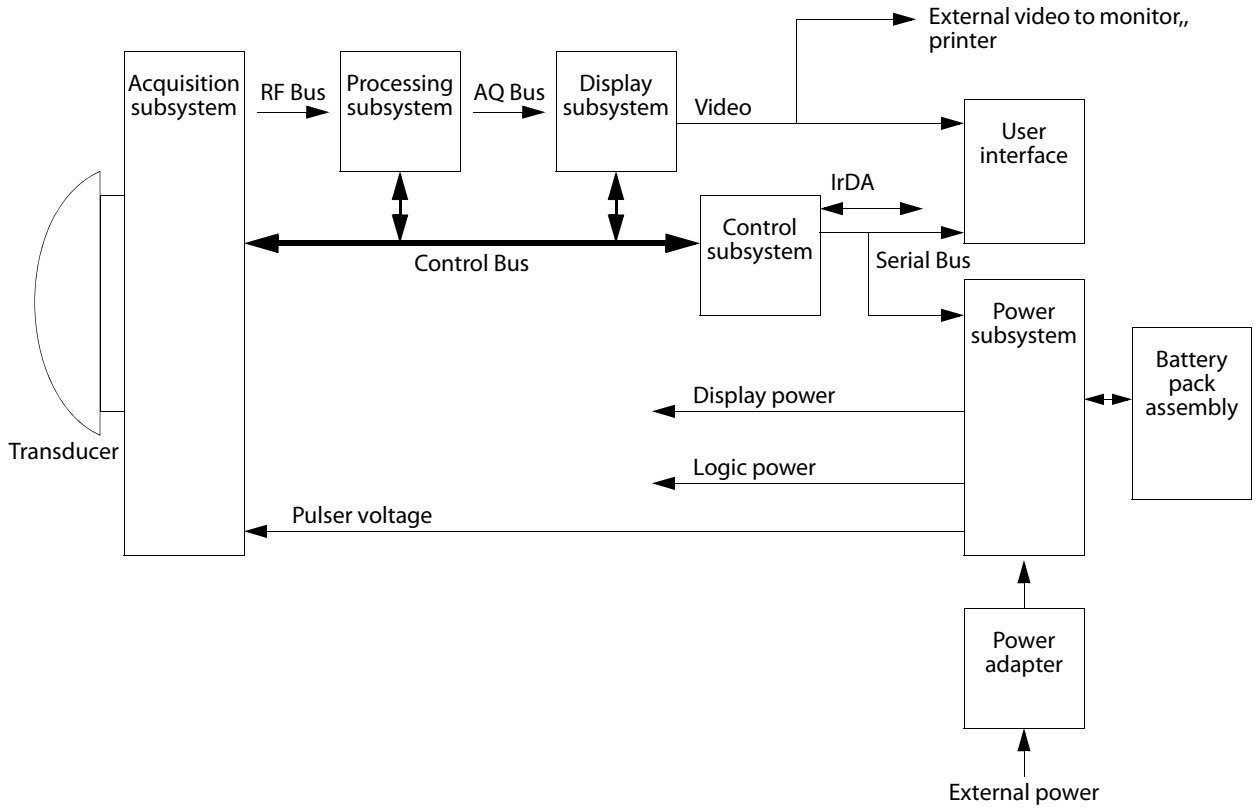

Figure 2.1 SonoSite High-Resolution Ultrasound System (M-Turbo) Block Diagram

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.

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 echos 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 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

2D mode is a two dimensional image of the amplitude of the echo signal. 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.

M Mode

M Mode is also known as “T-M mode” or “time-motion” mode. It is used primarily for cardiac measurements such as valve timing and septal wall thickness when accurate timing information is required.

Ultrasound echoes of different intensities are mapped to different gray scale values in a scrolling display. M Mode displays time motion information of the ultrasound data derived from a stationary beam. Depth is arranged along the vertical axis with time along the horizontal axis. M Mode can be used alone but is normally used in conjunction with a 2D image for spatial reference. The 2D image has a graphical line (M-line) superimposed on the 2D image indicating where the M Mode beam is located.

Color Doppler (Color)

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.

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 VCD, 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.

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.

Color Power Doppler (CPD)

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.

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.

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.

Continuous Wave (CW) Doppler

CW provides a real-time representation of blood flow and is displayed as a velocity-versus-time sweeping output. Velocity (or frequency) is presented as the vertical axis with time along the horizontal axis. The magnitude of the detected signal is represented as different gray scale values.

CW Doppler mode provides the clinician with the ability to obtain blood flow velocities focused about a user specified focal region. A continuous transmit waveform of ultrasound energy with a known frequency is transmitted and focused by the system; on the receive side, the transducer receive echoes are continuously amplified, focused about the focal region and converted to a base band quadrature signal. The signal is analyzed by a quadrature phase detector that establishes two receive channels to allow detection of flow direction. These two channels are then analyzed by a fast complex Fourier transform (FFT) circuit to establish the spectrum of frequencies present in the echoes. The data are displayed as spectrum frequencies with respect to time.

CW can be used alone but is normally used in conjunction with a 2D image for spatial reference. The 2D image has a graphical line (D-line) superimposed on the 2D image indicating where the M-mode beam is located.

Pulsed Wave (PW) Doppler

PW provides a real-time representation of blood flow and is displayed as a velocity-versus-time sweeping output. Velocity (or frequency) is presented as the vertical axis with time along the horizontal axis. The magnitude of the detected signal is represented as different gray scale values. The ultrasound data is derived from a single area, the sample volume, on a stationary beam.

PW Doppler mode provides the clinician with the ability to obtain blood flow velocities about a spatial sample volume. A burst of ultrasound with a known spectrum is transmitted by the system; on the receive side, the transducer receive echoes are amplified and range gated at the appropriate depth. The signal is analyzed by a quadrature phase detector that establishes two receive channels to allow detection of flow direction. These two channels are then analyzed by a fast complex Fourier transform (FFT) circuit to establish the spectrum of frequencies present in the echoes. The data are displayed as spectrum frequencies with respect to time.

PW can be used alone but is normally used in conjunction with a 2D image for spatial reference. The 2D image has a graphical line (D-line) superimposed on the 2D image indicating where the M-mode beam is located. The sample volume position (depth) and size are also indicated on the D-Line.

Additional System Feature Performances

Broadband Imaging

This ultrasound acquisition system uses high resolution broadband technology in the transmit pulsers, transducer, 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.

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.

Tissue Specific Imaging

In this feature, parameters for signal and image processing are optimized to maximize the image quality or to obtain the best compromise of resolution and penetration for different specific clinical applications. These parameters include: the order of received filters, the bandwidth, the dynamic range, the compression curve, the gain setting and parameters for compounding frequency band, etc. For example, different system parameter setups are used for abdominal or peritoneal scanning. This feature is for ease of use for the operator by automatically setting up system control parameters rather than manually adjusting settings for best performance.

Biopsy Guidance

The system can display a pair of biopsy guidelines that represent the anticipated path of the biopsy needle. The image of an anatomical target, biopsy guidelines, a scan plane marker, and a biopsy needle are displayed to assist in guiding the biopsy needle to the target. The system also provides needle guidance for vascular access procedures. For additional information, see the biopsy user guides.

Measurement and Calculation Capabilities

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.

Continuous Wave Doppler Audio Output	The system provides for audio output of the CW velocity information. This can be presented as stereo information, with flow moving towards the transducer on one channel and flow away on the other, or as a mono output with the single audio output representing the summation of the flow directions.
Pulsed Wave Doppler Audio Output	The system provides for audio output of the PW velocity information. This can be presented as stereo information, with flow moving towards the transducer on one channel and flow away on the other, or as a mono output with the single audio output representing the summation of the flow directions.
Electrocardiograph (ECG) Display	ECG is provided to measure the electrical signal generated by the heart. A three lead interface: Right Arm (RA), Left Arm (LA) and Left Leg (LL), is provided on the system. The ECG signal is displayed as an amplitude-versus-time sweeping output. Amplitude is presented on the vertical axis with time along the horizontal axis.

ECG Module

The ECG module allows a representation of the heart electrical activity to be displayed in real time with ultrasound images acquired and displayed on the system video display.

The ECG module interfaces to the patient through three (3) ECG leads: Right Arm ECG lead (RA), Left Arm ECG lead (LA), and Left Leg ECG lead (LL). The ECG received signal from the ECG electrodes are isolated, amplified, and filtered by the ECG module before it is sent to the system for further processing and display.

The ECG module and cable are an integrated assembly. The module receives power from the system. Patient isolation is provided by the ECG module, allowing the connection and signals to the system to be system-ground referenced. The isolation between the patient and the system meets the requirements of IEC 601-1 for Type BF equipment.

DICOM

The system features Digital Imaging and Communications (DICOM) capability to provide the acceptance, transfer, display, storage, and digital processing of single ultrasound images as well as loops of ultrasound images.

IMT

The system includes the ability to measure the intima-media thickness (IMT) of the carotid artery using digital ultrasound images. The intima is that region of the arterial wall from and including the endothelial surface at the lumen to the luminal margin of the media. The media layer extends from the intima to the adventitia of the vessel wall. The adventitia is normally quite echogenic on ultrasound images when compared to the media. The IMT measurement of the carotid artery may be used adjunctively with other medical data obtained by a physician to help assess the cardiovascular health of a patient.

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

Length: 11.8 in. (29.97 cm)

Width: 10.8 in. (27.43 cm)

Height: 3.1 in. (7.87 cm)

Weight: 8.5 lbs. (3.9 kg) with the C60x transducer and battery installed

Display Dimensions

Length: 8.4 in. (21.34 cm)

Height: 6.3 in. (16 cm)

Diagonal: 10.4 in. (26.4 cm)

Transducers

C11x/5-2 MHz 11 mm curved array (6 ft./1.8 m)

C60x/5-2 MHz 60 mm curved array (5.5 ft./1.7 m)

HFL38x/13-6 MHz 25 mm linear array (5.6 ft./1.7 m)

ICTx/8-5 MHz 11 mm intracavitary array (5.5 ft./1.7 m)

L25x/13-6 MHz 25 mm linear array (7.5 ft./2.3 m)

L38x/10-5 MHz 38 mm linear array (5.5 ft./1.7 m)

P21x/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)

Continuous Wave (CW) Doppler

M Mode

Pulsed wave (PW) Doppler

Tissue Doppler Imaging (TDI)

Tissue Harmonic Imaging (THI)

Image and Clips Storage

The number of images and clips you can save varies with imaging mode and file format.

Accessories

Hardware, Software, and Documentation

Barcode Scanner

Battery

Biopsy Guide

Carry case

ECG Cable (6 ft/1.8m)

External display

Footswitch

Kensington Security Cable

Mini-Dock

Mobile Docking System Lite II (MDS Lite II)

Mobile Docking System M Series (MDSm)

Needle Guide

Power supply

Quick Reference Guide

SiteLink Image Manager 4.0

SonoCalc IMT

System User Guide

System AC PowerCcord (10 ft / 3.1 m)

Triple Transducer Connect

Video and printer cables

Cables

See the *M-Turbo Ultrasound System User Guide*, *MDSm User Guide*, and the *MDS Lite II 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 *M-Turbo 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

Recommended sources for printer paper: Contact CIVCO at **1-800-445-6741** or **www.civco.com** to order supplies or to find the local distributor.

Color printer

DVD recorder

15" External monitor

Non-Medical Grade

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

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

Operating Limits: Battery

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

Operating Limits: Transducer

10–40°C (50–104°F), 15–95% R.H.

Shipping/Storage Limits: System without Battery

- -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.*
- 500 to 1060hPa (0.5 to 1.05 ATM)

* For storage longer than 30 days, store at or below room temperature.

- 10–40°C (50–104°F), 15–95% R.H.

Shipping/Storage Limits: Transducer

- -35–65°C (-31–149°F), 15–95% R.H.

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]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 ElectricalEquipment.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, SiteStand, 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.

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 SonoSite Technical Support.

Table 3.1: Troubleshooting Subassemblies and Diagnostic Figures

Subassemblies	Diagnostic Figures or Table
DICOM	Table 3.2
Dipslay	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

The system displays an "assert screen" for hardware and software issues related to main PCBA failures. Main PCBA failures typically result in "assert codes" that are output to the display. If an assert screen appears, note the assert code and contact SonoSite Technical Support to clarify the failure. Figure 3.1 shows an assert screen. The assert code is the bracketed number on the line labeled "C:".

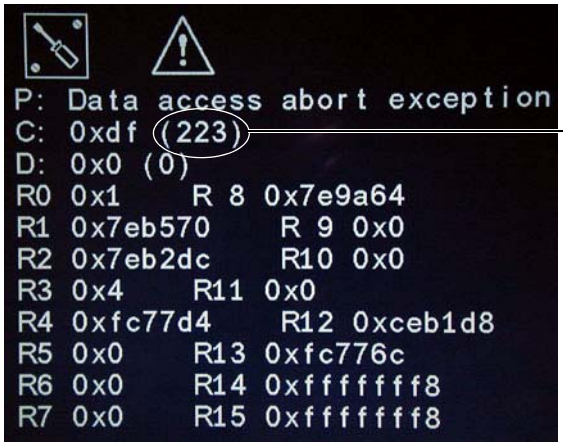

Figure 3.1 Assert Screen

Verifying a System Assert Code

System asserts are caused by hardware and/or software faults. Hardware asserts typically require main PCBA replacement. Software asserts can be reset and the system may recover. A simple method to identify the cause of the assert is identified here:

Assert Cause

1. Record the assert code.
2. Press and release the **Power** button to power the system down.
3. Press the **Power** button again to power on the system.
   - If the system powers on normally, it has recovered from the fault (software assert) and you may use the system.
   - If the assert condition remains, corrective action must be taken; usually replacement of the main PCBA 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.

Table 3.2: DICOM Troubleshooting

Error Message	Tiller Error Code	Cause	Troubleshooting
Socket communication failed	TSOCKET_CONNECT_FAILURE	Invalid network configuration. Wrong port number. Application is not running. Printer is offline.	Using Ping, verify that the Printer/Archiver is connected. • If Ping fails, check the devices IP address, M-Turbo IP address, Subnet mask, and Gateway IP address. • If Ping is OK, use Verify to check if device is available. If Verify fails: a) Check the Printer/Archiver's Port configuration on the M-Turbo. b) Ensure that the Printer is online and the Archiver's application is running.
Archiver transaction failed	TDICARCH_OPEN_FAILURE	Wrong Capture Type selected	Verify that the Archiver supports the selected Capture Type setting, e.g., US Image, SC Image or US-Ret Image.
Printer transaction failed	TDICPRNT_OPEN_FAILURE	Wrong Image settings	Verify that the printer supports the selected Image settings. E.g,. Color (RGB) or Grayscale (Monochrome)
DICOM network communication failed	TDNETWORK_OPEN_FAILURE	Device does not recognize M-Turbo, rejects association	Verify that M-Turbo AE Title or IP address is correctly configured on the Printer/Archiver. *Note: Some devices require that the Imaging modality (M-Turbo) be recognized in order to accept images. This requires configuration on the device.*
Internal failure detected	TDNETWORK_READ_FAILURE	Invalid DICOM Attribute	Check M-Turbo Printer DICOM settings for correctness (e.g., film size, format)

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.

Caution: All fasteners should be torqued to 5.5 inch pounds except where noted.

Display Replacement

Required Parts

Service Assembly, LCD Display, M-Turbo (P08659)

Required Tools

- #1 Phillips screwdriver
- Torque screwdriver, 2.0–10.0 inch pounds (0.23–1.1 newton meter)
- An anti-static mat
- A wrist grounding strap

Display Removal

Display Removal

1. Remove the battery from the system.
2. Remove the two screws from the back of the system per Figure 4.1.

Figure 4.1 System Rear

3 Lay the system on the top, and remove the two screws from the bottom of the system per Figure 4.2.

Figure 4.2 System Bottom

4 Turn the system over, fully open the display, and lift off the Control Panel per Figure 4.3.

Figure 4.3 Control Panel Removal

5 Disconnect the two connectors from the display to the Main PCBA per Figure 4.4.

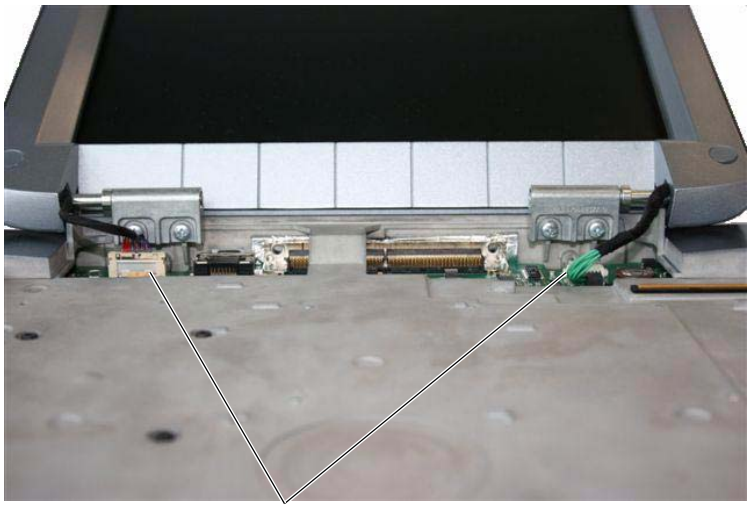

Figure 4.4 Display Connectors

6 The replacement Display Assembly does not include the Display Rear Enclosure. Remove the Display Rear Enclosure by removing the two screw caps, two screws, and then sliding the rear enclosure up and away from the display as show in Figure 4.5.

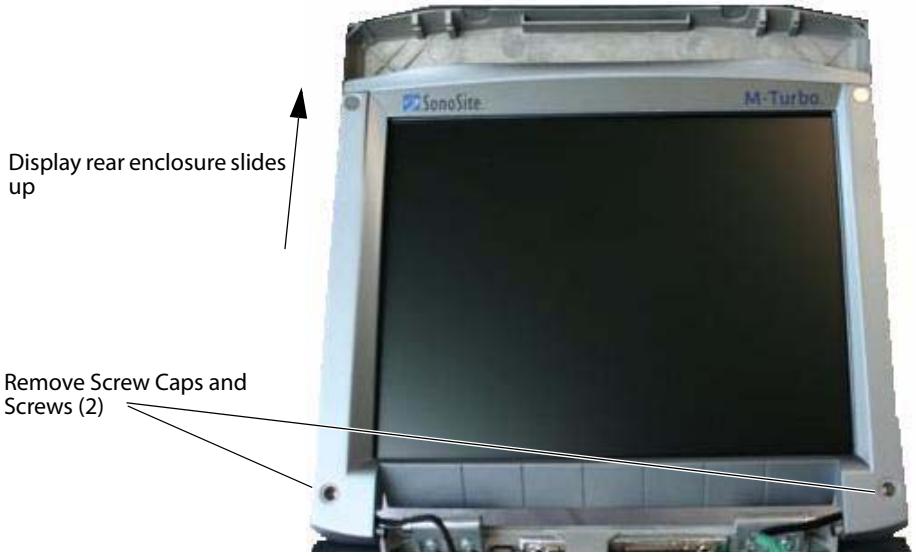

Figure 4.5 Remove Display Back Enclosure

7 Remove the four screws from the Display Hinges per Figure 4.6.

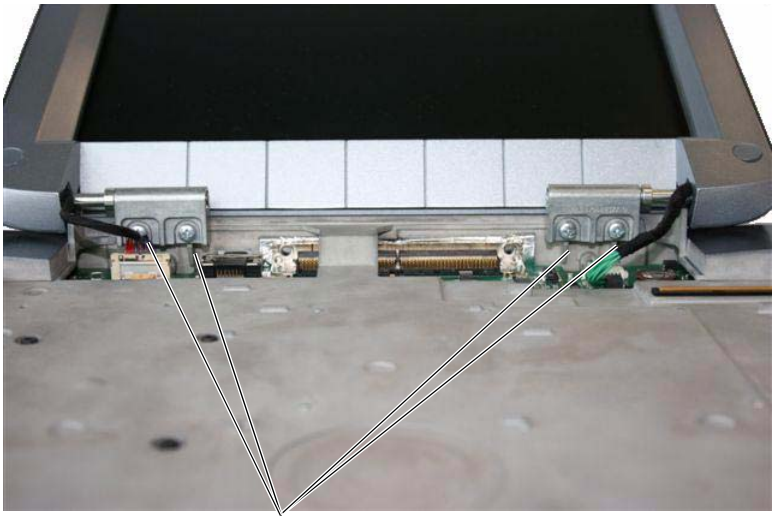

Figure 4.6 Display Screws

Display Replacement

Display Replacement

1 Set the new display in place.
2 Install the four hinge screws that hold the Display in place. Torque the screws to 5.5 inch pounds.
3 Reinstall the Display Rear Enclosure, screws (2) and screw caps.
4 Connect the two connectors that connect the Display to the Main PCBA.
5 Place the Control Panel in place.
6 Reinstall the four screws that hold the Control Panel in place. Torque the screws to 5.5 inch pounds.

Test the Display

Test Display

1 Replace the battery or attach an external power supply.
2 Press the **Power** key to apply power to the system.
3 Verify the display operates correctly.

Control Panel Subassembly Replacement

Required Parts

One of the following:

- P08856 Service Assembly, Control Panel M-Turbo, English
- P08878 Service Assembly, Control Panel M-Turbo, French
- P08879 Service Assembly, Control Panel M-Turbo, German
- P08880 Service Assembly, Control Panel M-Turbo, Italian
- P08881 Service Assembly, Control Panel M-Turbo, Spanish
- P08882 Service Assembly, Control Panel M-Turbo, Portuguese

Required Tools

- #1 Phillips screwdriver
- Torque screwdriver, 2.0–10.0 inch pounds (0.23–1.1 newton meter)
- An anti-static mat
- A wrist grounding strap

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.

Control Panel Removal

Control Panel Removal

1. Remove the two screws from the rear of the system per Figure 4.1.
2. Remove the two screws from the bottom of the system per Figure 4.2.
3. Turn the system over, fully open the display, and lift off the Control Panel per Figure 4.3.

Control Panel Replacement

Control Panel Replacement

1. Place the new control panel in place.
2. Install the four screws removed in "Control Panel Removal" on page 21. Torque the screws to 5.5 inch pounds.

Main System Disassembly for Repair and/or Replacement

Required Parts

Parts for the Main System Repair could include any of the following:

- P08939 Service Assembly Main PCBA, M-Turbo
- P08850 Service Assembly Power Supply, M-Turbo
- P05470 Service Assembly TGC, MicroMaxx (compatible with MicroMaxx and M-Turbo)
- P05473 Service Assembly Speaker, M-Turbo
- Nest Frame Assembly, M-Turbo (order these parts individually as necessary)
  - P00364 Connector, Interposer (Qty 8)
  - P00924 Screw, Shoulder, Thrust Plate (Qty 4)
  - P00353 Wear Plate
  - P00646 Spring, Thrust Plate (Qty 4)
  - P07750 Nest Frame
  - P03834 Shield, Perimeter, Long (Qty 2)
  - P03833 Shield, Perimeter, Short (Qty 2)
  - P08200 M2.5-.45x10 Socket Head Cap Screw (Qty 4)

Required Tools

- #1 Phillips screwdriver
- Torque screwdriver, 2.0–10.0 inch pounds (0.23–1.1 newton meter)
- 2 mm allen key
- Scissors
- Q-Tips
- An anti-static mat
- A wrist grounding strap

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.

System Disassembly

System Disassembly

1. Remove the battery.
2. Remove the control panel from the system following the removal procedures in "Control Panel Removal" on page 21.
3. Remove the 4 remaining screws from the bottom of the system.
4. Remove the bottom enclosure. This exposes all of the replaceable parts for the main system per Figure 4.7.

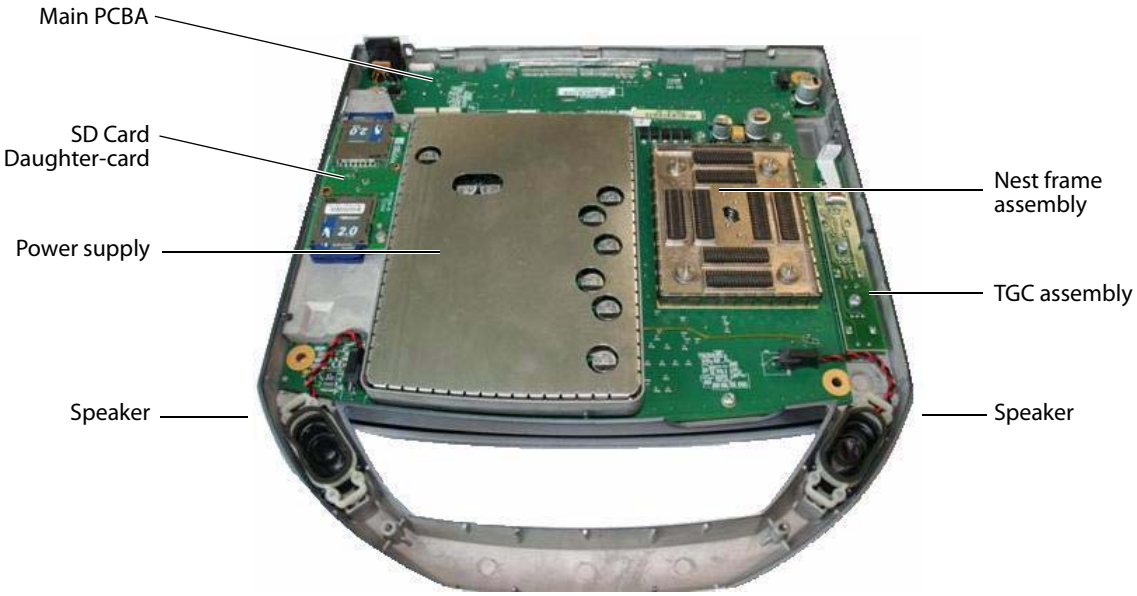

Figure 4.7 System Components

Speaker Replacement

Caution:	Use caution when removing the left speaker connector to prevent damage to the Main PCBA components around the connector.

Speaker Replacement

1. Press on the connector release and pull the connector out of the receptacle.
2. Gently pry off the retaining clip with a flat bladed pry tool. See Figure 4.8.
3. Replace the speakers by reversing steps 1-2.

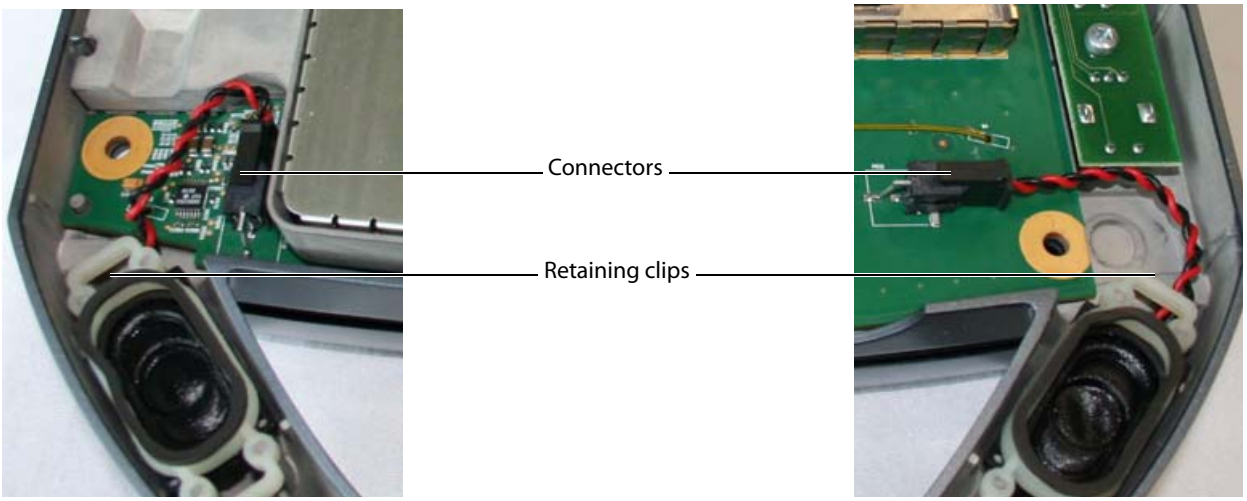

Figure 4.8 Speaker Replacement

Power Supply Removal

1 Gently pry the shield from the power supply and set it aside. This part will be used in reassembly. Note that the shield fits only one way. See Figure 4.9.

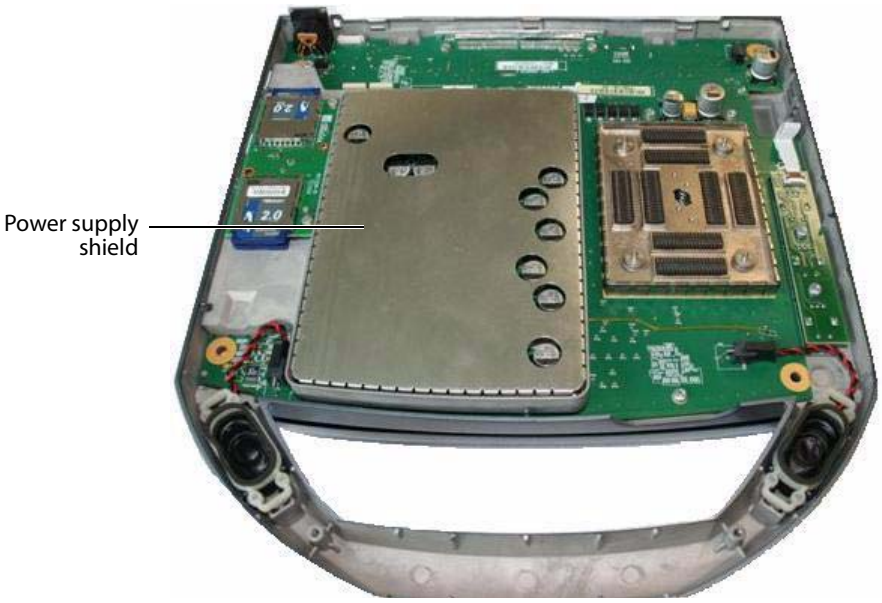

Figure 4.9 Power Supply Shield

2 Remove the 7 screws that hold down the power supply PCB per Figure 4.10.

3 Gently lift the power supply away from the Main PCBA.

4 Install the new Power Suppply PCBA by reversing steps 1-3.

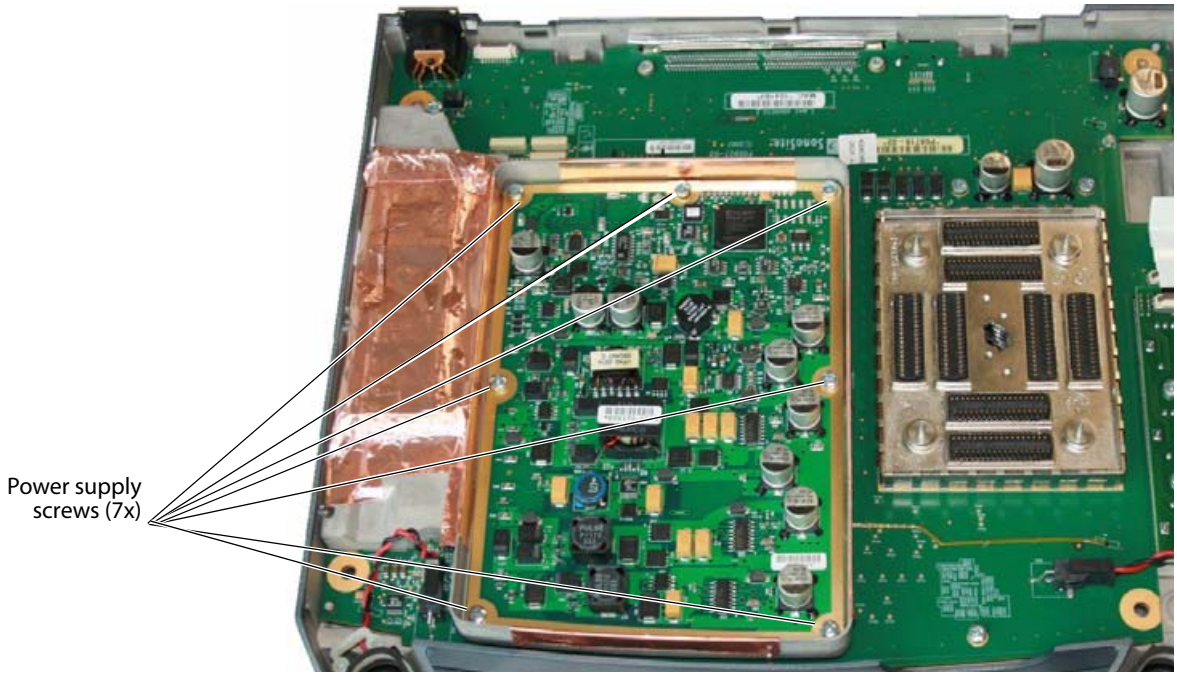

Figure 4.10 Power Supply Screws

SD Card Daughter-card Removal

1 Carefully remove the copper tape from the SD Card Daughter-card. See Figure 4.11.

Figure 4.11 SD Card Daughter-card copper tape

2 Remove the 4 screws that hold down the SD Card Daughter-card per Figure 4.12. Note the location of the one longer screw for reassembly.

3 Gently lift the SD Card Daughter-card straight up away from the Main PCBA.

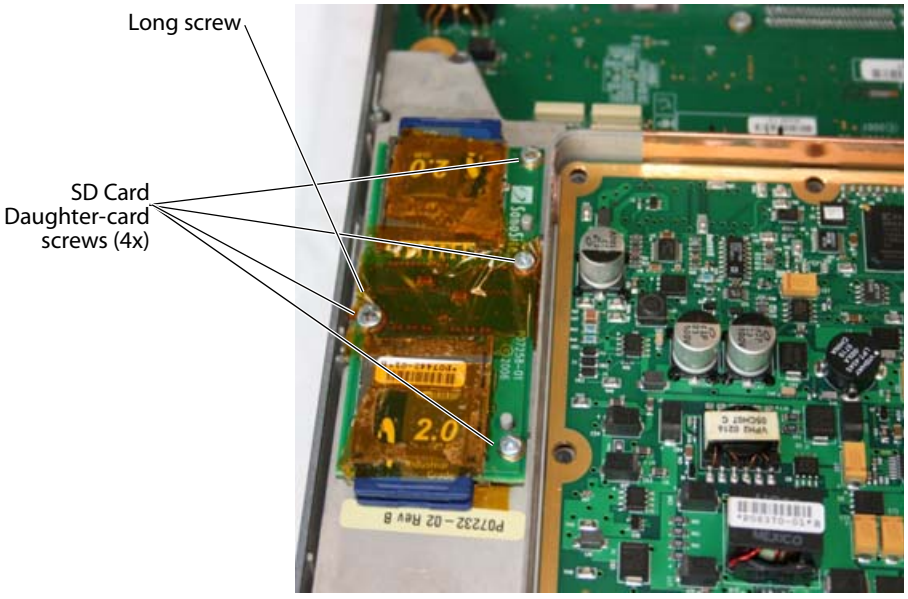

Figure 4.12 SD Card Daughter-card screws

SD Card Daughter-card Replacement

1 Remove Power Supply frame assembly from the Main PCBA.

2 Apply one strip of 1″ x 5″ self adhesive copper tape to the edge of the Power Supply frame as shown in Figure 4.13.

3 The copper tape must be cut away from the ventilation holes in the frame or failure of the Main PCBA will occur.

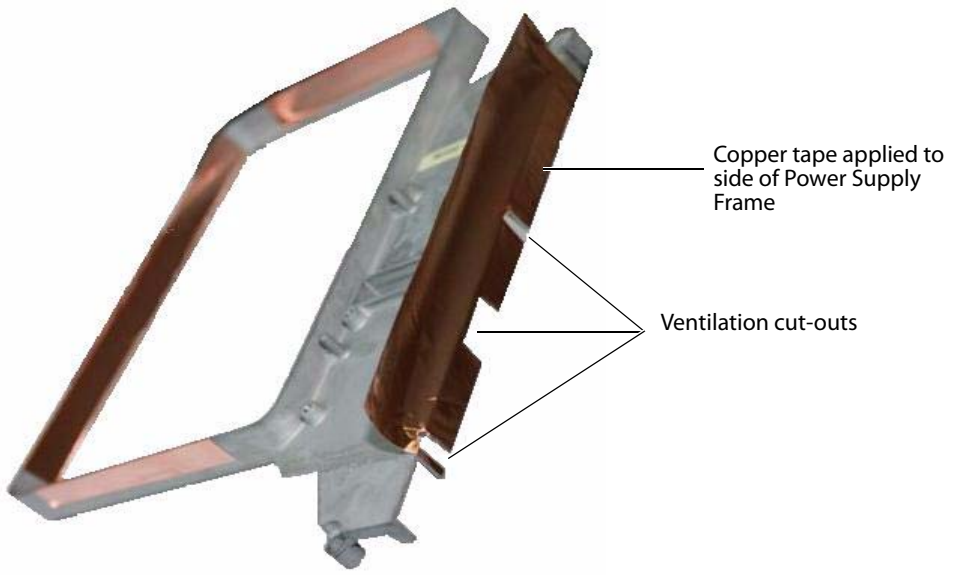

Figure 4.13 SD Card Daughter-card copper tape

4 Place the Power Supply frame back onto the Main PCBA.

5 Place the Power Supply PCBA in the frame and secure with the 7 screws

6 Install the SD Card Daughter-card onto the Main PCBA frame using the alignment holes/pins on the card and frame.SeeFigure 4.14.

Caution: Improper installation of the SD Card Daughter-card will cause all or part of the internal image storage memory to not be recognized by the system.

7 Install the screws ensuring proper location of longer screw.

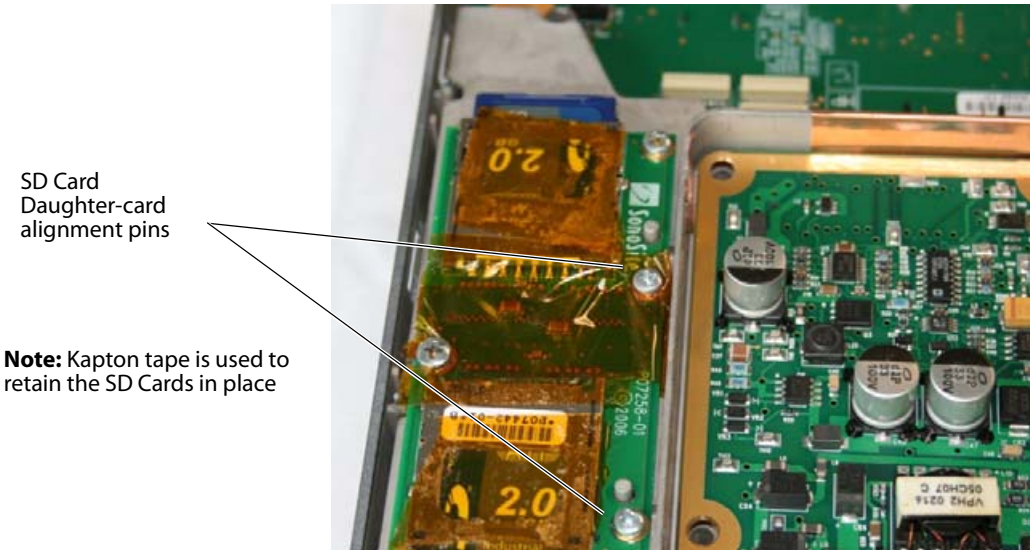

Figure 4.14 SD Card Daughter-card alignment

8 Fold the copper strip installed in Step 1 over the top of the SD Card Daughter-card.

9 Install a second strip of 1″ x 5″ self-adhesive copper tape over the SD Card Daughter-card on the edge closest to the Power Supply frame as show in Figure 4.15.

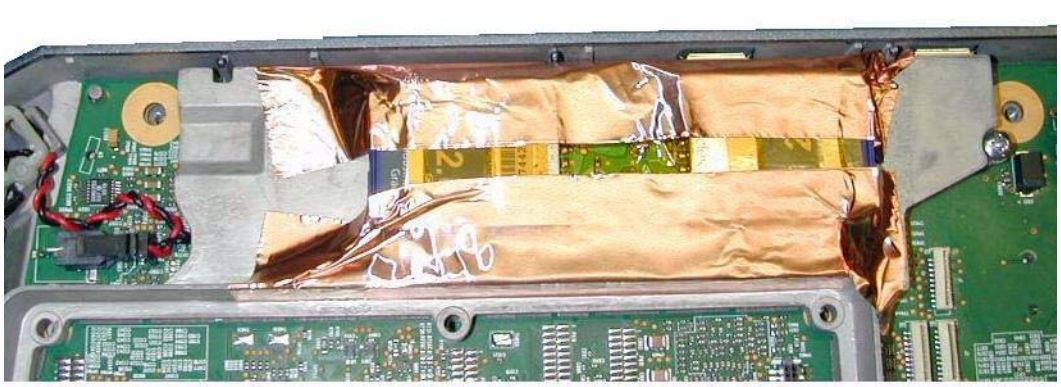

Figure 4.15 Copper Tape Installation

10 Install a third strip of 1″ x 5″ self-adhesive copper tape over the SD Card Daughter-card as shown in Figure 4.16.

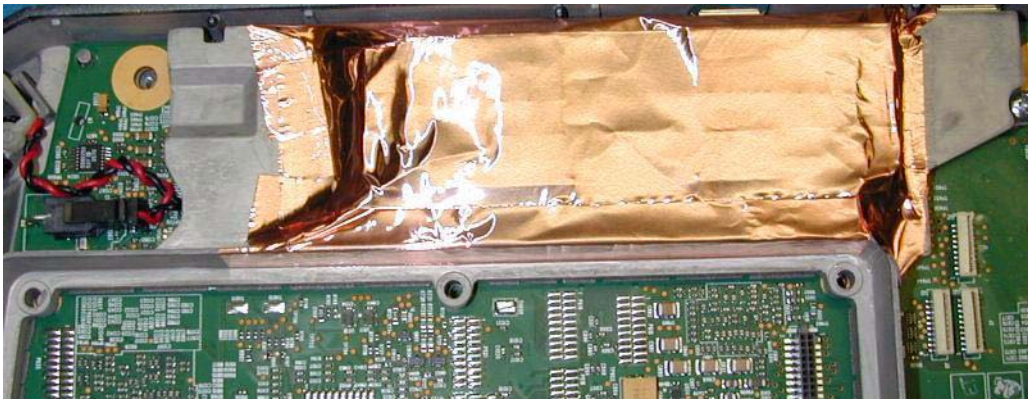

Figure 4.16 Copper Tape Installation

11 The adhesive on the copper strips must be activated by rubbing the entire surface of the copper tape using a Q-tip as shown in Figure 4.17.

Note: Rub the entire surface of the copper tape to ensure proper adhesion.

Figure 4.17 Activating Copper Tape Adhesion

TGC PCBA Replacement

TGC PCBA Removal

1. Remove the Control Panel if not already removed.
2. Remove the TGC knobs identified in Figure 4.18.

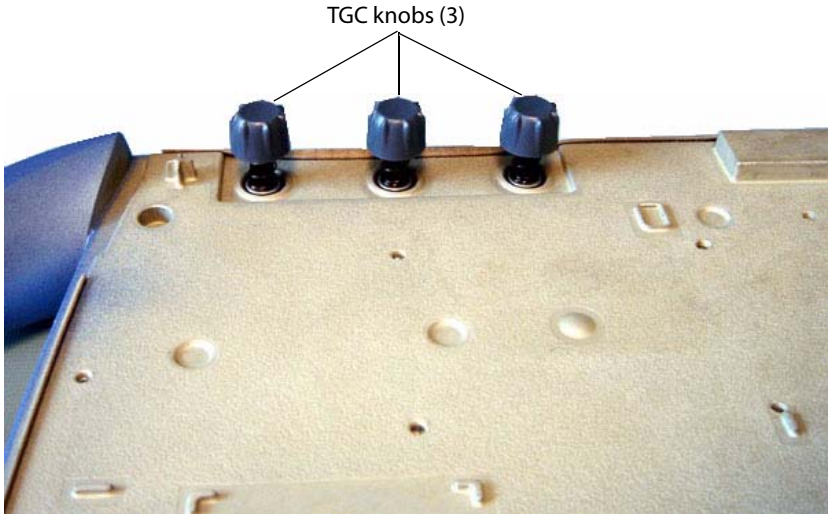

Figure 4.18 TGC Knobs

3 Remove the flex cable from the TGC PCB by lifting on the flex release tab. See Figure 4.19.
4 Remove the flex cable from the Main PCBA by lifting gently on the flex release tab.
5 Remove the two screws holding the TGC PCBA in place.
6 Reverse steps 1-5 to reinstall the TGC PCB.

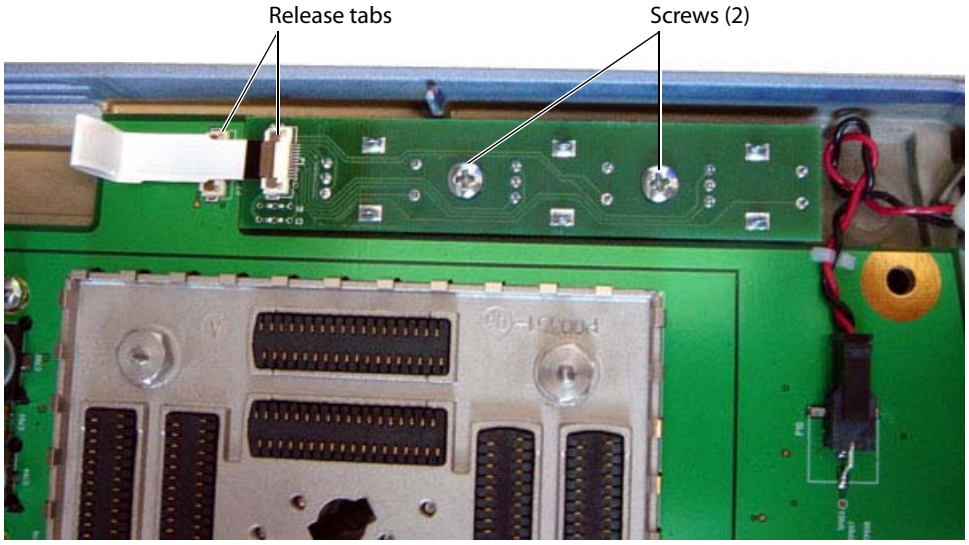

Figure 4.19 TGC PCBA Removal

Main PCBA Replacement

Main PCBA Removal

1 Remove the Power Supply PCBA, SD Card Daughter-card, and TGC PCBA as described in the previous steps.
2 Remove the 3 screws holding the Main PCBA in place per Figure 4.20. Dissconnect the speaker wires from the Main PCBA.

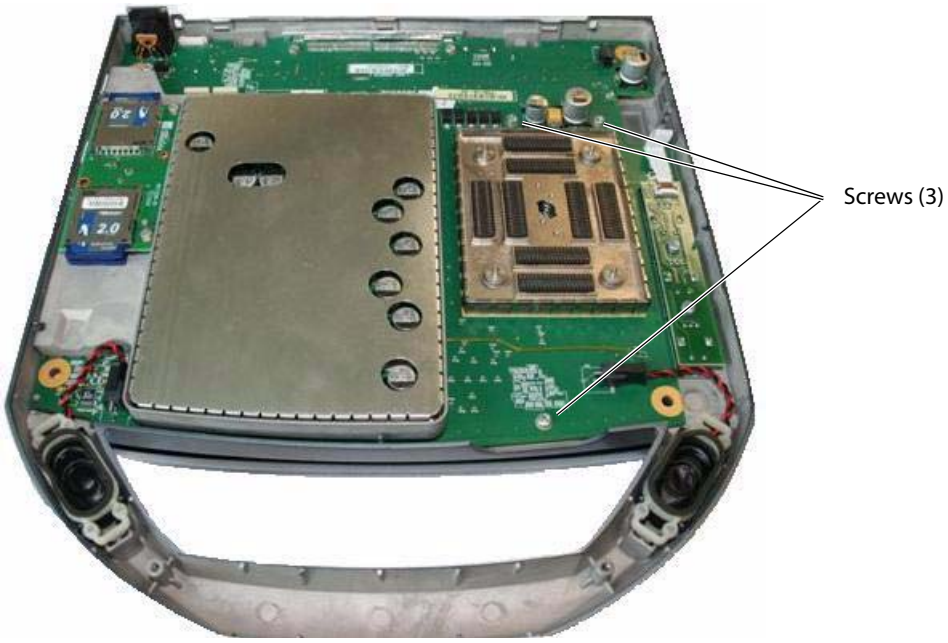

Figure 4.20 Main PCBA Screws

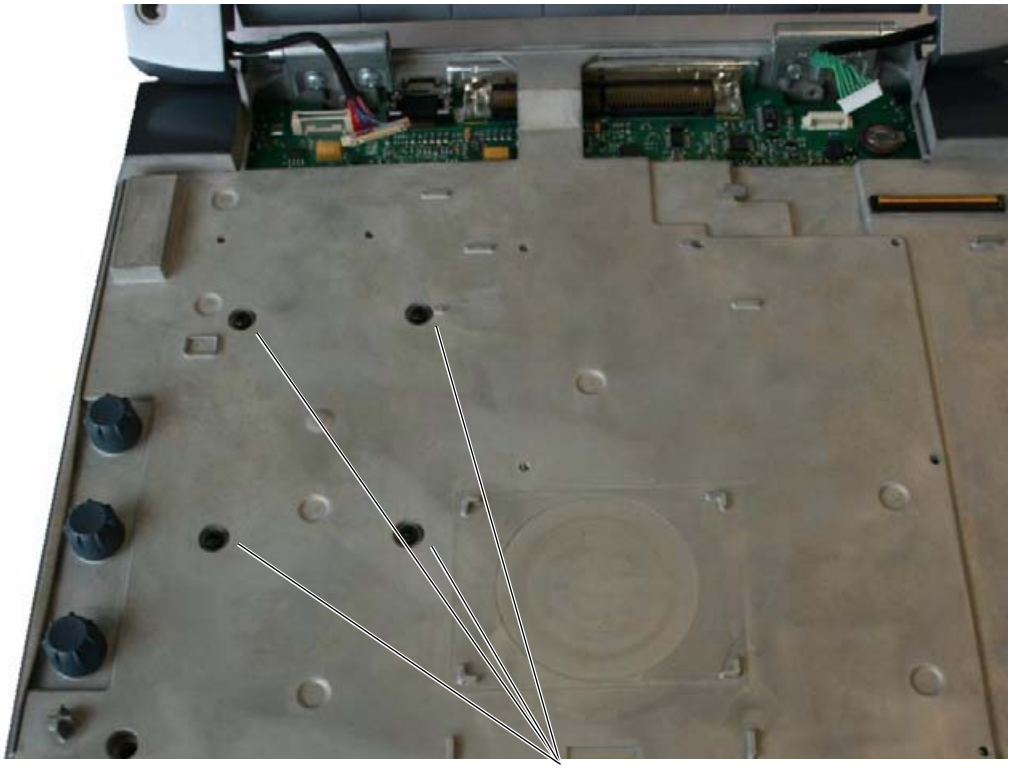

Figure 4.21 Nest Frame Top Screws

3 Turn the system over.

4 Remove the 4 Socket Head Cap Screw as shown in Figure 4.21. This releases the Nest Frame and will allow the Main PCBA to be removed.

5 As you remove the nest frame assembly from the PCBA, tilt the PCBA and enclosure to almost vertical to avoid spilling the Interposer Connectors from the assembly.

6 Lift on the edge of the Main PCBA closest to the system handle.

Main PCBA Replacement

Replace the Main PCBA by following the reverse of the removal procedure. Do not tighten all the screws until everything is in place.

1 Replace the Main PCBA.
2 Reinstall the Nest Frame Assembly. The Nest Frame Socket Head Cap Screws should be torqued to 4.5 inch pounds
3 Reconnect the speaker wires.
4 Reinstall the Power Supply PCBA.
5 Reinstall the SD Card Daughter-card and copper tape.
6 Reinstall the TGC assembly.
7 Reinstall the shield to the Power Supply.
8 Tighten all screws to their specified torque of 5.5 inch pounds.
9 Reinstall the Control Panel.
10 Reinstall the bottom enclosure.

Chapter 5: Performance Testing

Overview

WARNING: **Critical Test Function** — A failure of the system functions tested in this section could affect safety or effectiveness of the system adversely. 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 uavailable to test.

Test Equipment

- SonoSite ultrasound system under test
- C60x/5-2 MHz transducer
- P21x/5-1 MHz transducer
- 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
- External Monitor
- Acoustic gel

Setting Up Performance Tests

Set up Performance Tests	1	Attach the C60x/5-2 MHz transducer to the system.
	2	Select Gen for optimization and OB for exam 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 of the keyboard keys are functional. Verify that all controls operate 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.
	7	Capture a Cineloop buffer. Exercise the Cineloop controls and verify proper operation.
	8	Close the lid and verify the unit goes into sleep mode. Open the lid and verify the unit returns to normal operation.
	9	Verify the airflow from the vent on the left side of the system is blowing out.

2D Performance Tests

2D Performance / Image Quality

Test 2D Performance and Image Quality	1	Use a C60x/5-2 MHz transducer in 2D mode.
	2	Adjust the position of the C60x/5-2 MHz transducer on the phantom.
	3	With the array pointing down and the orientation mark to the operator's left, element #1 corresponds with the left side of the array.
	4	Use the 2D system controls to obtain a clear image that shows both the horizontal and vertical rows of pins.
	5	Verify that the ultrasound image appears uniform in both the axial and lateral direction, with no dropouts or intensity variations.
	6	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.
	7	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 the image.
	2	Press the **Freeze** key.
	3	Press the **Caliper** key. The caliper appears on the image display. (See the *M-Turbo Ultrasound System User Guide*, if necessary, for caliper operation.)
	4	Use the touchpad to position one of the calipers.
	5	Press the **Select** key to fix the caliper and enable the other caliper.
	6	Use the touchpad to move the other caliper. The results update as you move the caliper, and the measurement is complete when you finish moving the calipers. (Press the **Select** key to alternate the active caliper, and adjust the measurement with the touchpad.)
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 5.1.

Lateral Measurement Accuracy

Set Up Lateral Measurement Accuracy	Perform "Set Up Axial Measurement Accuracy" on page 35.	
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 5.1.
	3	Press the **Freeze** key to return the system to live 2D mode.

Table 5.1: System Measurement Accuracy

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

Penetration

Caution: A referenced .7db/cm phantom is required for performing penetration measurements

Test Penetration	1	Adjust the system controls to obtain a clear image that shows the limits of echo penetration as shown in Table 5.2.
	2	Set the system exam type and optimization mode settings to the values shown in Table 5.2.
	3	Measure from the center of the skinline to the deepest vertical position—where the scatter echoes start to break up and tissue definition is lost.
	4	When making penetration measurements on a phantom, apply the phantom reference value and tolerance to the measurement.
	5	Press the **Freeze** key and then save the image. Press the **Freeze** key again to return to live imaging.

Table 5.2: Imaging Performance

Imaging Performance	C11x	C60x	ICTx	HFL38	L25x	L38x	P21x
Exam type	Nerve	OB	OB	Small Parts	Sup	Breast	ABD
Optimization	Gen	Gen	Gen	Res	Res	Res	Pen
2D Penetration	**6.8cm**	**14.0 cm**	**6.5 cm**	**4.5 cm**	**4.3 cm**	**5.7 cm**	**21.0 cm**

Additional Performance Tests

Color Doppler (Color)

Test Color

1. Connect any transducer.
2. Press the **Color** key. "Color" should be annotated in the top left corner of the display.
3. A Region of Interest (ROI) box is displayed on top of the grayscale image. Use the touchpad 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. 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 Region of Interest (ROI) box is displayed on top of the grayscale image.
3. Press the **Color** softkey to switch to CPD. "CPD" should be annotated in the top left corner of 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.

M Mode Imaging

Test M Mode Imaging	1 Attach a C60x transducer and acquire an image. 2 Press the **M Mode** key for the M Mode sample line. 3 Position the M Mode sample line over the image using the touchpad. 4 Press the **M Mode** key again to turn on M Mode. 5 Select the desired sweep speed from the on-screen menu (slow, med, or fast). The on-screen menu will show the selected sweep speed. 6 Press the **Freeze** key to freeze the image. Save the image. Press the **Freeze** key again to return to live imaging. 7 Press the **2D** key to return to 2D imaging.

Tissue Harmonic Imaging

Test THI Imaging	1 Attach the C60x transducer and acquire an image. 2 Set the depth to maximum and note the depth at which echo information is lost. 3 Press the **THI** key on the control panel so it displays THI on the display. Tissue Harmonic Imaging in now active. 4 Observe a decrease in dot size and a significant loss in penetration due to the higher frequency. Image resolution increases. 5 Press the **Freeze** key and then save the image. Press the **Freeze** key again to return to live imaging. 6 Press the **THI** key again to turn off Tissue Harmonic Imaging.

Pulsed Wave (PW) Doppler Imaging

Test PW Doppler Imaging	1 Attach the P21x transducer. 2 Press the **Doppler** key for the Doppler sample gate. 3 Press the **Doppler** key again for the Doppler spectral trace. 4 Place a large drop of ultrasound gel on the transducer lens. 5 Adjust the **Gain** control as necessary and then gently tap the top of the gel and observe a reflection on the spectral trace and the sound from the speakers. 6 Press the **Freeze** key and then save the image. Press the **Freeze** key again to return to live imaging. 7 Press the **2D** key to return to 2D imaging.

Continuous Wave (CW) Doppler Imaging

Test CW Doppler Imaging	1 Attach the P21x transducer. 2 Press the **Patient** key. 3 Select the **Cardiac** exam type. 4 Press the **Done** softkey. 5 Press the **Doppler** key for the Doppler sample gate. 6 Press the PW softkey to switch to CW Mode. 7 Press the **Doppler** key again for the Doppler spectral trace. 8 Place a large drop of ultrasound gel on the transducer lens. 9 Adjust the **Gain** control as necessary and then gently tap the top of the gel and observe a reflection on the spectral trace and the sound from the speakers. 10 Press the **Freeze** key and then save the image. Press the **Freeze** key again to return to live imaging. 11 Press the **2D** key to return to 2D imaging.

Image Quality Verification Test/Livescan

- Products with replaced subassemblies, or products that have been otherwise disassembled, must undergo an Image Quality Verification Test/Livescan.
- The Image Quality Verification Test/Livescan should be performed after successfully completing all applicable performance tests listed prior in this chapter.
- The test is completed before returning the system to service.
- A certified sonographer must perform the test.
- 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	1 Verify proper printer type is configured in the system Setups page. 1 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. 2 Verify the proper content of the printed image.

Battery Charging

Test Battery Charging Operation

1. Remove the system from the docking system and insert a battery into the system.
2. Press the **Power** key to turn the system on. Allow the battery to discharge. The battery indicator icon on the display, below the Transducer Type indicator, will extinguish from left to right as the battery discharges.

   Note: The Power and Sleep delays in the Setup page should be selected to "Off" to properly perform this test. The battery may take 1–2 hours to discharge.
3. Reattach the system to the Docking System and attach the AC power cord to the power connector.
4. 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

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 M-Turbo ultrasound system. Quantities are one unless otherwise noted.

Display

Table A.1: Display

Find Number	Part Number	Description
1	P08659	Service Assembly Display M-Turbo *Note: The Display Assembly does not include the rear Display Enclosure (item 3). This should be retained from the unit being replaced.*
2	P08060	Hinge
3	P08855	Service Assy, Display Enclosure, Gray (Olympic Mist), M-Turbo
	P08874	Service Assy, Display Enclosure, Blue (Glacier Sky), M-Turbo
	P08875	Service Assy, Display Enclosure, Green (Pacific Pine), M-Turbo
	P08876	Service Assy, Display Enclosure, Brown (Copper River), M-Turbo
	P08877	Service Assy, Display Enclosure, Pink (Alpine Berry), M-Turbo

Control Panel

Table A.2: Control Panel

Part Number	Description
P08856	Service Assembly Control Panel, M-Turbo, English
P08878	Service Assembly Control Panel, M-Turbo, French
P08879	Service Assembly Control Panel, M-Turbo, German
P08880	Service Assembly Control Panel, M-Turbo, Italian
P08881	Service Assembly Control Panel, M-Turbo, Spanish
P08882	Service Assembly Control Panel, M-Turbo, Portuguese

System

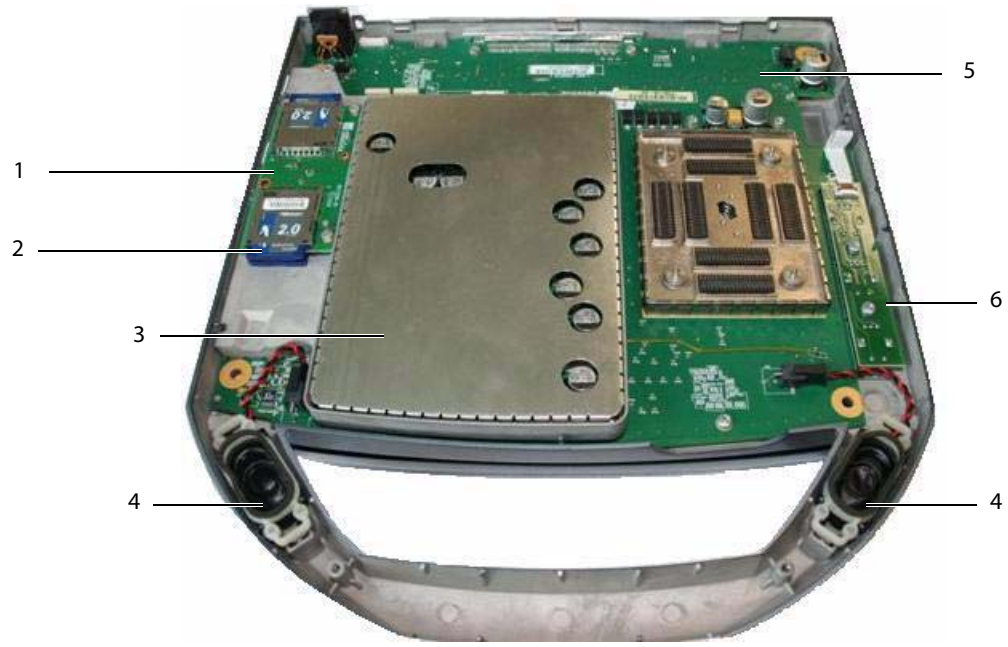

Table A.3: System

Find Number	Part Number	Description
1	P07442	SD Card Daughter-card
2	P09202	2GB SD Card
not shown	P09216-01	Copper Tape for SD Card Daughter-card (Note: Part number referenced is per inch of copper tape. Approximately 15 inches of 1" wide tape is required per system.)
3	P08850	Service Assembly, Power Supply, M-Turbo
4	P03872	Service Assembly, Speaker
5	P08939	Service Assembly Main PCBA, M-Turbo *Note: This part does not include the transducer nest frame assembly. Those parts must be ordered separately if needed to complete the replacement of the Main PCBA.*
6	P05470	Service Assembly, TGC PCB
Not shown	P00361	Foot

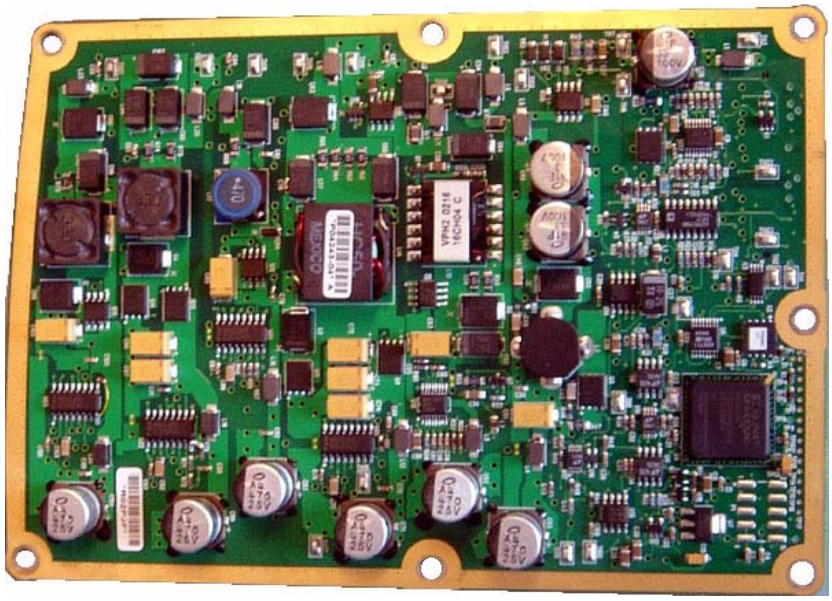

Figure A.1 Power Supply, P08850

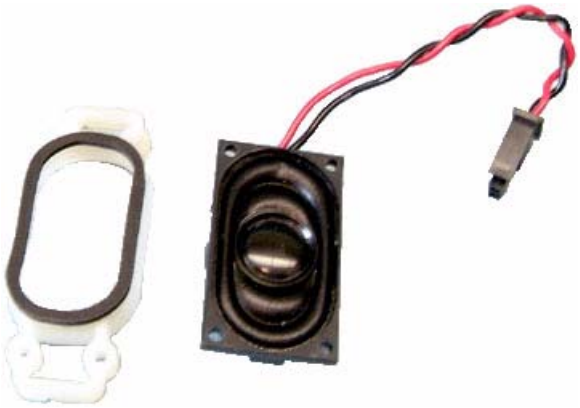

Figure A.2 Speaker Assembly, P03872

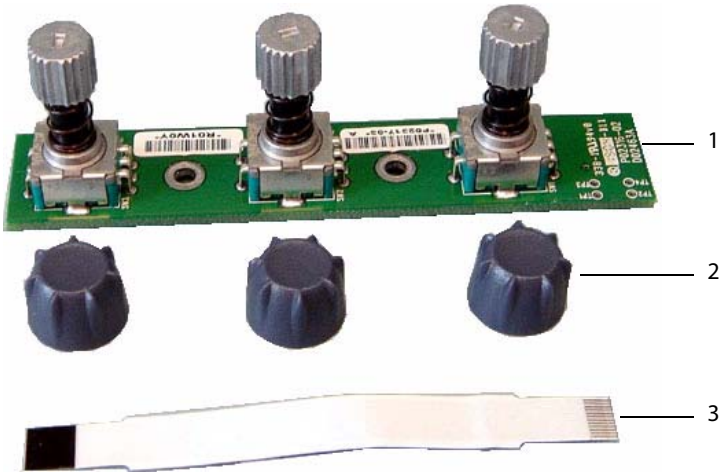

Figure A.3 TGC Assembly, P05470

Table A.4: TGC Assembly

Find Number	Part Number	Description
1	P02317	Assembly, PCB, TGC
2	P06287	Knob, TGC
3	P02308	FFC, 12 Position Jumper

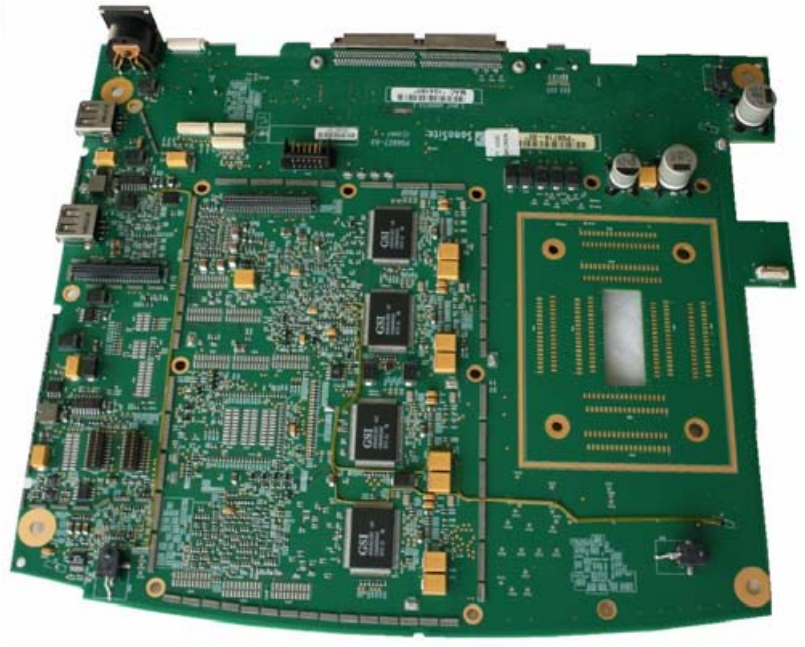

Figure A.4 Main PCB Assembly, P08939

Transducer Nest Frame Assembly

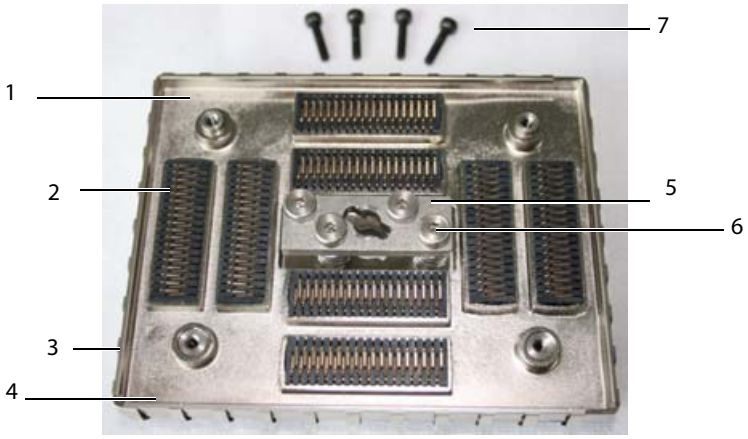

Figure A.5 Nest Frame Parts

Table A.5: Nest Frame Assembly

Find Number	Part Number	Description
1	P07750	Nest Frame Assembly
2	P00364	Connector, Interposer (8x)
3	P03833	Shield, Perimeter, Short (2x)
4	P03834	Shield, Perimeter, Long (2x)
5	P00924	Screw, Shoulder, Thrust Plate (4x)
6	P00353	Wear Plate
not shown	P00646	Spring, Thrust Plate, .047 wire (4x)
7	P08200	Socket Head Cap Screw, M2.5-.45x10mm (4x)

Ordering Replacement Parts

To order parts, contact SonoSite Technical Support as indicated in "Contact Information" on page 1.

Appendix B: Service Event Report

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 return a copy of it 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

SonoSite
Carrying Ultrasound into the Future

Service Event Report

Instructions on reverse

Service Type (check one)
☐ Out of Box Failure
☐ Warranty Service
☐ Out of Warranty Service

Parts Status (check one)	
☐	No parts necessary for this repair. Service Event Report for your information.
☐	I need parts for this repair (list the parts below and attach Purchase Order)
☐	I need parts to replenish my stock (list the parts used below and attach Purchase Order)
☐	Will not replenish stock. Please give me a RMA for the return of the faulty parts.
☐	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 ☐ Fail ☐	Result: Pass ☐ Fail ☐

Attach additional sheets as required

Page ____ of ____

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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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