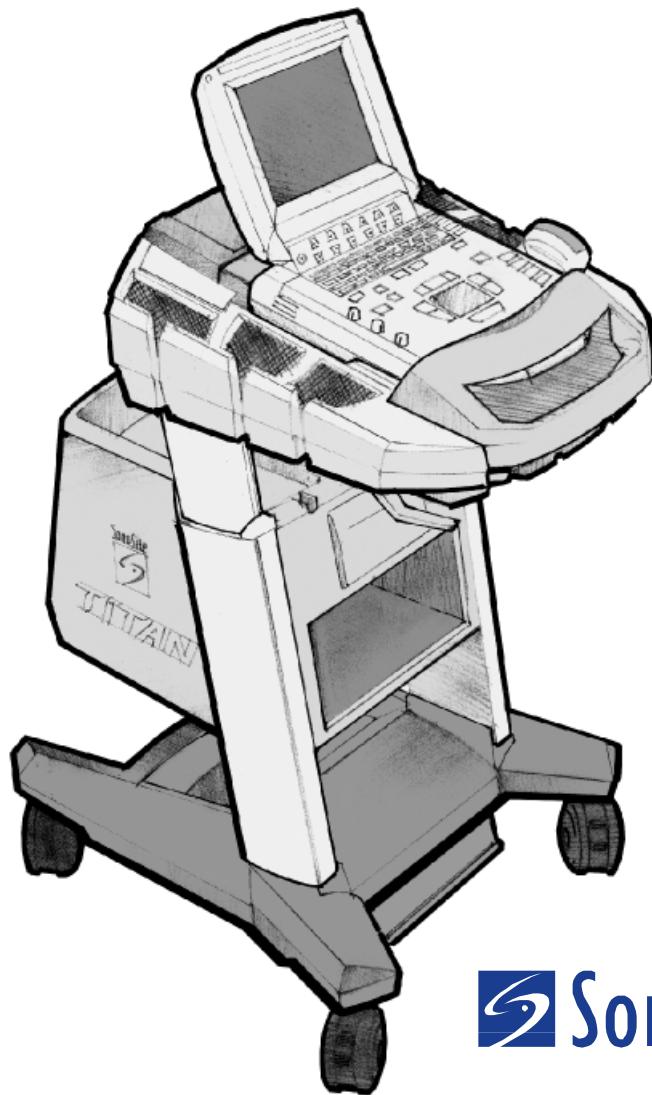


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# **TITAN™**

## ***Ultrasound System Service Manual***



 **SonoSite®**

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# Contents

## Chapter 1: Introduction

1.1 Audience .....	1
1.2 Conventions Used in This Service Manual .....	1
1.3 Product Upgrades and Updates .....	1
1.4 Customer Comments .....	1
1.5 About the System .....	2
1.6 About the System Software .....	4
1.7 Software Licensing .....	4

## Chapter 2: Safety

2.1 Electrical Safety .....	5
2.2 Equipment Safety .....	6
2.3 Battery Safety .....	7
2.4 Biological Safety .....	8
2.5 Labeling Symbols .....	8

## Chapter 3: System Overview

3.1 System Overview .....	9
3.2 Theory of Operation .....	9
3.2.1 Transducer .....	10
3.2.2 Front End Subsystem .....	10
3.2.3 Digital Signal Processing Subsystem .....	12
3.2.4 Backend Subsystem .....	12
3.2.5 Control Subsystem .....	14
3.2.6 Power Supply and Control Subsystem .....	15
3.3 System Specifications .....	16
3.3.1 System Dimensions .....	16
3.3.2 Display Dimensions .....	16
3.3.3 Transducers .....	16
3.3.4 Imaging Modes .....	16
3.3.5 Applications .....	16
3.3.6 Image Storage .....	17
3.3.7 Accessories .....	17
3.3.8 Peripherals .....	17
3.3.9 Temperature, Pressure, and Humidity Limits .....	18
3.3.10 Electrical .....	18
3.3.11 Electromechanical Safety Standards .....	18
3.3.12 EMC Standards Classification .....	19
3.3.13 Airborne Equipment Standards .....	19
3.3.14 ECG Standard .....	19
3.3.15 DICOM Standard .....	19

## Chapter 4: Setup and Operation

4.1 System Controls .....	21
4.2 System Components .....	22
4.3 Setup .....	23
4.4 Touchpad .....	24
4.5 Accessories .....	24

4.6	Preparing the System for Operation .....	25
4.6.1	Installing and Removing the Battery .....	25
4.6.2	Using AC Power/Charging Battery .....	26
4.6.3	Connecting to AC Power .....	27
4.6.4	Connecting and Removing Transducers .....	28
4.6.5	Turning the System On and Off .....	28
4.7	Upgrading the System Software .....	29
4.7.1	Obtaining a License Key .....	32
4.7.2	Installing a License Key .....	33
4.7.3	To Display the System Information Screen .....	34
4.7.4	To Display the License Update Screen .....	35

## **Chapter 5: Cleaning and Disinfecting**

5.1	Universal Precautions .....	37
5.2	Receipt of Suspected Contaminated Materials .....	37
5.3	Recommended Disinfectants .....	38

## **Chapter 6: Troubleshooting**

6.1	Basic Troubleshooting .....	39
6.2	Periodic Maintenance .....	40
6.3	System and Subsystem Diagnosis .....	41
6.4	System Repair .....	41
6.5	Test Equipment .....	41
6.6	Failure Modes .....	41
6.6.1	Display .....	41
6.6.2	Control Panel .....	41
6.6.3	System/Main PCBA .....	42
6.6.4	Battery .....	42
6.7	Troubleshooting Flow Diagrams .....	43
6.7.1	Display .....	43
6.7.2	Control Panel .....	44
6.7.3	System .....	45
6.7.4	Battery .....	46
6.7.5	Mini-Dock/Mobile Docking System .....	47

## **Chapter 7: Replacement Procedures**

7.1	Display Replacement .....	49
7.1.1	Required Parts .....	49
7.1.2	Required Tools .....	49
7.1.3	Display Removal .....	49
7.1.4	Display Replacement .....	51
7.1.5	Test the Display .....	52
7.2	Control Panel Subassembly Replacement .....	52
7.2.1	Required Parts .....	52
7.2.2	Required Tools .....	52
7.2.3	Control Panel Removal .....	52
7.2.4	Control Panel Replacement .....	52
7.3	Main System Disassembly for Repair and/or Replacement .....	53
7.3.1	Required Parts .....	53
7.3.2	Required Tools .....	53
7.3.3	Main PCBA Removal .....	53

**Chapter 8: Performance Testing**

8.1 Overview .....59

8.2 Test Equipment .....59

8.3 Setting Up Performance Tests .....59

    8.3.1 Scan Reference Orientation .....60

8.4 Testing 2D Performance .....60

    8.4.1 2D Image Quality .....60

    8.4.2 Axial Measurement Accuracy .....60

    8.4.3 Lateral Measurement Accuracy .....61

    8.4.4 Penetration .....61

8.5 Additional Performance Tests .....62

    8.5.1 CPD .....62

    8.5.2 Directional Color Power Doppler (DCPD) .....62

    8.5.3 M Mode Imaging .....63

    8.5.4 Tissue Harmonic Imaging .....63

    8.5.5 Pulsed Wave (PW) Doppler Imaging .....63

    8.5.6 Image Quality Verification Test/Livescan .....64

    8.5.7 Image Review .....64

    8.5.8 Printer .....64

    8.5.9 Battery Charging .....64

    8.5.10 Video Output .....64

8.6 Returning Products to SonoSite .....65

    8.6.1 Contacting SonoSite Technical Support .....65

    8.6.2 Shipping Instructions .....65

**Chapter 9: Accessory Service**

9.1 Mobile Docking System .....67

9.2 Mini-Dock .....69

9.3 Connectivity .....69

9.4 Block Diagrams and Schematics .....70

9.5 Theory of Operation .....78

    9.5.1 Video .....78

    9.5.2 Power Distribution .....78

9.6 Replacement Procedures .....79

    9.6.1 Required Tools .....79

    9.6.2 Cup Surround .....79

    9.6.3 Casters .....79

    9.6.4 Power Supply .....80

    9.6.5 Locking Handle .....82

    9.6.6 Deflector .....82

    9.6.7 Mini-Dock .....83

**Appendix A: Parts List**

A.1 Replacement Parts List .....85

    A.1.1 Display .....85

    A.1.2 Control Panel .....86

    A.1.3 Replacement Parts, System .....87

    A.1.4 Transducer Nest Frame Assembly .....93

    A.1.5 AC Adapter .....94

    A.1.6 Mini-Dock .....95

    A.1.7 Mobile Docking System .....96

A.2 Ordering Replacement Parts .....98

**Appendix B: Service Event Report**

**Index** .....101



## Chapter 1: Introduction

Before servicing the TITAN™ high-resolution ultrasound system, please read the information in this manual. This text applies only to the SonoSite TITAN ultrasound system product manufactured after June 19, 2003. Please find service information about products manufactured before June 17, 2003 in *C1.51 Ultrasound System Service Manual (P00715)*, *C1.75 Ultrasound System Service Manual (P01118)*, *C1.9 PLUS Ultrasound System Service Manual (P02287)*, and *C1.99 PLUS and ELITE Ultrasound System Service Manual (P02913)*.

### 1.1 Audience

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

### 1.2 Conventions Used in This Service Manual

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.
- When the steps in the operating instructions must be performed in a specific order, the steps are numbered.
- Bulleted lists present information in list format, but they do not imply a sequence.
- The system handle is on the front of the system, and the battery compartment is on the back of the system.

### 1.3 Product Upgrades and Updates

SonoSite may offer software upgrades and new features that may improve system performance. Service manual updates, explaining the effects of upgrades and new features on system performance, will accompany the upgrades.

### 1.4 Customer Comments

Questions and comments are encouraged. SonoSite is interested in your feedback regarding the service manual. Please call SonoSite at **1-877-657-8118**. If you are outside the USA, call the nearest SonoSite representative. You can also send electronic mail (e-mail) to SonoSite at the following address:

**service@sonosite.com**

## 1.5 About the System

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 are dependent on your system configuration, transducer, and exam type.

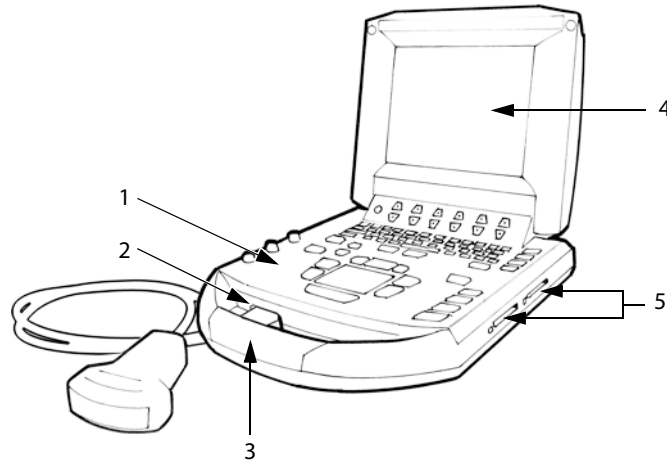


Figure 1.1 TITAN System Front View

**Table 1.1: TITAN System Front Features**

Number	Feature
1	Control panel
2	Transducer connection
3	Handle
4	Display
5	CompactFlash™ slots (front for image storage, back for system updates)

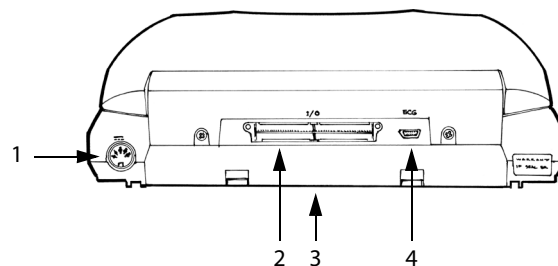


Figure 1.2 TITAN System Rear View

**Table 1.2: TITAN System Rear Connectors**

Number	Feature
1	DC input connector
2	I/O connector
3	Battery
4	ECG connector (available on future releases)

The TITAN system is a portable, software-controlled, ultrasound system using all-digital architecture. The system is used to acquire and display high-resolution, real-time ultrasound images: 2D, color power Doppler (CPD), directional color power Doppler (DCPD), Tissue Harmonic Imaging (THI), M Mode, and pulsed wave (PW) Doppler. The system has cine buffer, image zoom, labeling, biopsy, measurements, calculations, a USB connection for image transfer, image storage, image review, printing, recording, and the ability to archive Doppler with audio output to a videotape.

Currently, the system supports the following broadband transducers:

- C11/8-5 MHz 11 mm microcurved array
- C15/4-2 MHz 15 mm microcurved array
- C60/5-2 MHz 60 mm curved array
- HST/10-5 MHz 25 mm linear array
- ICT/8-5 MHz 11 mm intracavitary array
- L38/10-5 MHz 38 mm linear array

System accessories include the *TITAN* mobile docking system, the *TITAN* mini-dock, a power supply, a battery, video and printer cables, and SiteLink Image Manager 2.0 software.

System peripherals include medical grade (conforming to the requirements of EN60601-1) and non-medical (commercial) grade products. System medical grade peripherals include a printer and VCR. System non-medical grade peripherals include a CompactFlash card and a Kensington Security Cable. Use of peripherals is covered in the manufacturers' instructions, which accompany each peripheral.

## 1.6 About the System Software

The ultrasound system contains software that controls its operation. A software upgrade may be required. SonoSite will provide you with a CompactFlash card containing the software. Typically new software provides new capabilities. A single CompactFlash card can be used to update one or more systems. Software upgrades use the back CompactFlash slot on the right hand side of the system. CompactFlash cards installed in the front CompactFlash slot do not upgrade the system.

## 1.7 Software Licensing

Use of the software that you receive from SonoSite is controlled by a license key. A license key is a number sequence containing exactly 12 decimal digits.

License keys are obtained from SonoSite or from its authorized representatives. You must obtain one key for each system that will use the new software. See [“Obtaining a License Key” on page 32](#) for information on obtaining a license key.

Software that you receive from SonoSite may be installed and will operate for a short period of time without requiring a valid license key. We refer to this period of time as the “grace period.” The grace period is variable.

When you first install your software, your SonoSite system prompts you for a license key. If you have not yet obtained a valid license key, you can elect to use the software as long as the grace period time has not been fully consumed.

When a system is running in the grace period, all system functions are available. As you use the system, the grace period is slowly consumed. When the grace period has expired, the system will not be usable until a valid license key has been entered. Grace period time is not consumed while the system is powered off or when it is in “sleep” mode. Whenever a system is running in the grace period, the grace period time remaining is available on the license update screen.

**Caution:** | When the grace period expires, all system functions except for licensing are unavailable until a valid license key is entered into the system.

## Chapter 2: Safety

Read this information before using the ultrasound system. The information in this manual applies to the ultrasound system, transducer, accessories, and peripherals. This chapter contains safety information.

A **Warning** describes precautions necessary to prevent injury or loss of life.

A **Caution** describes precautions necessary to protect the products.

### 2.1 Electrical Safety

This system meets EN60601-1, Class I/internally-powered equipment requirements and Type BF isolated patient-applied parts safety requirements.

This system complies with the applicable medical equipment requirements published in the Canadian Standards Association (CSA), European Norm Harmonized Standards, and Underwriters Laboratories (UL) safety standards.

For maximum safety observe the following warnings and cautions:

- Warning:**
- To avoid the risk of electrical shock or injury, do not open the system enclosures. All internal adjustments and replacements, except battery replacement, must be made by a qualified technician.
  - To avoid the risk of injury, do not operate the system in the presence of flammable gasses or anesthetics. Explosion can result.
  - To avoid the risk of electrical shock, use only properly grounded equipment. Shock hazards exist if the power supply is not properly grounded. Grounding reliability can only be achieved when equipment is connected to a receptacle marked “Hospital Only” or “Hospital Grade” or the equivalent. The grounding wire must not be removed or defeated.
  - To avoid the risk of electrical shock, before using the transducer, inspect the transducer face, housing, and cable. Do not use the transducer if the transducer or cable is damaged.
  - To avoid the risk of electrical shock, always disconnect the power supply from the system before cleaning the system.
  - To avoid the risk of electrical shock, do not use any transducer that has been immersed beyond the specified cleaning or disinfection level. See [Chapter 5, “Cleaning and Disinfecting.”](#)
  - To avoid the risk of electrical shock and fire hazard, inspect the power supply, AC power cord and plug on a regular basis. Ensure they are not damaged.
  - To avoid the risk of electrical shock, use only accessories and peripherals recommended by SonoSite, including the power supply. Connection of accessories and peripherals not recommended by SonoSite could result in electrical shock. Contact SonoSite or your local representative for a list of accessories and peripherals available from or recommended by SonoSite.

**Warning:** To avoid the risk of electrical shock, use commercial grade peripherals recommended by SonoSite on battery power only. Do not connect these products to AC mains power when using the system to scan or diagnose a patient/subject. Contact SonoSite or your local representative for a list of the commercial grade peripherals available from or recommended by SonoSite.

To avoid the risk of electrical shock, inspect the interconnect cables on a regular basis for damage.

To avoid the risk of electrical shock to the patient/subject, do not touch the system battery contacts while simultaneously touching a patient/subject.

To prevent injury to the operator/bystander, the transducer must be removed from patient contact before the application of a high-voltage defibrillation pulse.

**Caution:** Although your system has been manufactured in compliance with existing EMC/EMI requirements (EN60601-1-2), use of the system in the presence of an electromagnetic field can cause degradation of the ultrasound image. If this occurs often, SonoSite suggests a review of the system environment. Identify and remove the possible sources of the emissions or move your system.

Electrostatic discharge (ESD), or static shock, is a naturally occurring phenomenon. ESD is common in conditions of low humidity, which can be caused by heating or air conditioning. Static shock is a discharge of the electrical energy from a charged body to a lesser or non-charged body. The degree of discharge can be significant enough to cause damage to a transducer or an ultrasound system. The following precautions can help reduce ESD: anti-static spray on carpets, anti-static spray on linoleum, and anti-static mats.

Do not use the system if an error message appears on the display: note the error code; call SonoSite or your local representative; turn off the system by pressing and holding the power key until the system powers down.

To avoid increasing the system and transducer connector temperature, do not block the airflow to the ventilation holes on the side of the system.

## 2.2 Equipment Safety

To protect your ultrasound system, transducer, and accessories, follow these precautions.

**Caution:** Excessive bending or twisting of cables can cause a failure or intermittent operation.

To avoid damaging the power supply, verify the power supply input is within the correct voltage range. See [“Electrical” on page 18](#) in [Chapter 3](#).

Improper cleaning or disinfecting of any part of the system can cause permanent damage. For cleaning and disinfecting instructions, see [Chapter 5, “Cleaning and Disinfecting.”](#)

Do not use solvents such as thinner or benzene, or abrasive cleaners on any part of the system.

Remove the battery from the system if the system is not likely to be used for some time.

Do not spill liquid on the system.

## 2.3 Battery Safety

To prevent the battery from bursting, igniting, or emitting fumes and causing equipment damage, observe the following precautions.

**Warning:**

The battery has a safety device. Do not disassemble or alter the battery.

Charge the batteries only when the ambient temperature is between 0° and 45°C (32° and 113°F).

Do not short-circuit the battery by directly connecting the positive and negative terminals with metal objects.

Do not heat the battery or discard it in a fire.

Do not expose the battery to storage temperatures over 60°C (140°F). Keep it away from fire and other heat sources.

Do not charge the battery near a heat source, such as a fire or heater.

Do not leave the battery in direct sunlight.

Do not pierce the battery with a sharp object, hit it, or step on it.

Do not use a damaged battery.

Do not solder a battery.

The polarity of the battery terminals is fixed and cannot be switched or reversed. Do not force the battery into the system.

Do not connect the battery to an electrical power outlet.

Do not continue recharging the battery if it does not recharge after two successive six hour charging cycles.

**Caution:**

To prevent the battery from bursting, igniting, or emitting fumes and causing equipment damage, observe the following precautions.

Do not immerse the battery in water or allow it to get wet.

Do not put the battery into a microwave oven or pressurized container.

If the battery leaks or emits an odor, remove it from all possible flammable sources.

If the battery emits an odor or heat, is deformed or discolored, or in any way appears abnormal during use, recharging or storage, immediately remove it and stop using it. If you have any questions about the battery, consult SonoSite or your local representative.

Store the battery between -20°C (-4°F) and 60°C (140°F).

Use only SonoSite batteries.

Do not use or charge the battery with non-SonoSite equipment. Only charge the battery with the TITAN system.

## 2.4 Biological Safety

Observe the following precautions related to biological safety.

**Warning:**

Non-medical (commercial) grade peripheral monitors have not been verified or validated by SonoSite as being suitable for diagnosis.

Do not use the system if it exhibits erratic or inconsistent behavior. Discontinuities in the scanning sequence are indicative of a hardware failure that must be corrected before use.

Do not use the system if it exhibits artifacts on the LCD screen, either within the clinical image or in the area outside of the clinical image. Artifacts are indicative of hardware and/or software errors that must be corrected before use.

Some transducer sheaths contain natural rubber latex and talc, which can cause allergic reactions in some individuals. Refer to 21 CFR 801.437, User labeling for devices that contain natural rubber.

Perform ultrasound procedures prudently. Use the ALARA (as low as reasonably achievable) principle.

SonoSite does not currently recommend a specific brand of acoustic standoff.

## 2.5 Labeling Symbols

Labeling symbols for SonoSite products can be found in the user guide for each product.



## Chapter 3: System Overview

### 3.1 System Overview

The system houses the system electronics, display, control panel, and the system batteries. It provides basic connections for external power, and the transducer connector and a general purpose docking connector for all other interfaces. The system operates with external transducers and optional peripheral equipment. The types of external devices that may be used are:

- Transducer(s)
- AC Power Supply/Charger
- Mobile Docking System/Mini-dock
- External Peripherals

The transducer connects to the main unit through the scanhead connector. The transducer contains data, which the system uses to drive the transducer in the scanhead, process the data received back and format and display the data for the user. The interface is backward compatible to previous systems and scanheads.

The AC power supply not only provides power from the AC mains for operating the system, it also contains the charger for charging the internal system battery. This may be used if a mobile docking system or mini-dock is not desired or available.

The mobile docking system provides power to run the system, contains the charger to charge the internal system battery and provides fixed external power, video, RS-232, and USB connections. The docking system may also provide additional control surfaces and monitors. The unit interfaces to the docking system through connections on the back of the unit. It provides a convenient place for the unit to be operated and stored under certain usage scenarios.

The mini-dock provides the breakout for all the connectors from the docking connector for remote use where a docking system may not be available and the external connections are desired. The use of a mini-dock allows the main unit to be more portable when the connections are not required.

External OEM peripherals are items such as monitor, printers, and VCRs. These can be connected to the mobile system or directly to the system with the use of the mini-dock using the video and/or printer control input/outputs.

### 3.2 Theory of Operation

The system has six major functional groups: the transducer, the frontend subsystem, the digital signal processing subsystem, the backend subsystem, the control subsystem, and the power supply and control subsystem. [Figure 3.1](#) shows how these functions interact.

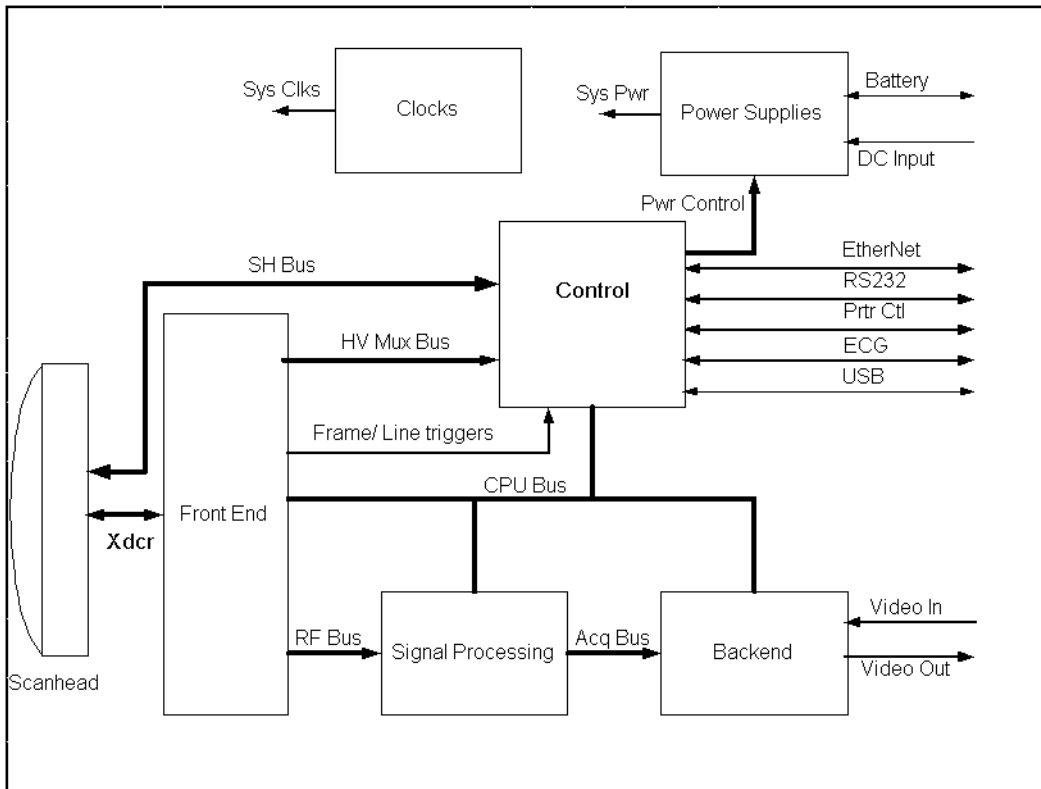


Figure 3.1 TITAN Block Diagram

### 3.2.1 Transducer

The transducer elements convert the pulser voltage to acoustic energy during the “transmit” portion of the ultrasound acquisition cycle. Also, the transducer elements convert the acoustic echo to voltage in the “receive” portion of the acquisition cycle. The system transducers have 64 to 128 elements. The front end subsystem senses the voltage developed on the transducer elements.

### 3.2.2 Front End Subsystem

The Front End is designed to support various imaging modalities such as 2D, spectral Doppler and color Doppler. From the Front End's perspective all modes can be grouped into a few basic types: single mode, simultaneous modes and triggered modes. All these modes are built from similar, basic transmit and receive sequences controlled within the Front End. A generic top level block diagram of a typical Front End is in the following figure.

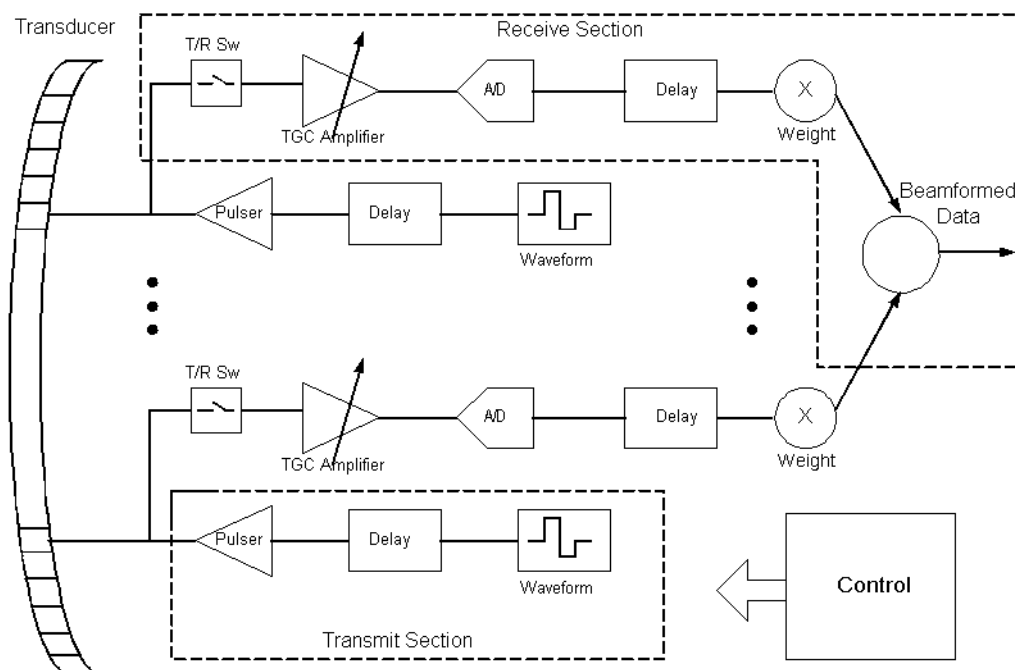


Figure 3.2 Front End Subsystem

The transmit section consists of a waveform generator, delay block, and high power high voltage driver to excite the transducer element. Multiple elements are driven with delays determined by the time of flight in the medium from the elements to the point in space where the beam is to be focused. The longer the time of flight is to the focal point the smaller the delay is for a given transmit element to allow all to arrive at the focal point at the same time. The number of elements driven is determined by element sensitivity off axis and depth of field considerations. The waveform is selected to drive the transducer at a certain center frequency, bandwidth, and power and is optimized for the given mode. The receive section consists of a transmit/receive switch to protect the receiver from the transmit voltage, a variable gain receiver to amplify and condition the return echoes, an A/D to digitize the data, a delay block to focus the return signals and a weight block to scale the return echoes for each data. All the signals are then summed together to generate the beamformed receive data. The analog gain varies with depth to compensate for signal attenuation through the medium. The delays and weights are independent for each channel. The delay and weight for the receive channel can typically be changed dynamically to keep the receive beam in continuous focus. The delay is simply set by the time of flight in the medium from the point of interest to the element, which starts at skinline and proceeds to the deepest depth of interest.

The control section drives the data to the various data path elements on a line by line basis, controls the timing for the transmit and receive sections, and controls the tagged information and timing of the data to the rest of the system.

Unique transmit and receive sequences, lines or PRIs, are arranged into repeated groups or frames. The simplest frame is for a single mode where the line does not change, for example M Mode or PW Doppler. Here the same line characteristics; aperture size, delay, weights, and waveform information, are continually repeated. A scanned single mode, such as 2D, keeps the same transmit aperture size but the delays and receive weights change due to the aperture translation or steering changes with each line acquired. Simultaneous modes may also change the transmit waveform and aperture size

and the delays and receive weights. Downstream processing also changes, due to the unique processing requirements for the different types of data. Triggered modes are the same as the previous modes except that the frames are started and stopped on user or external inputs.

### 3.2.3 Digital Signal Processing Subsystem

The DSP subsystem receives data from the front end chip sets, performs processing to enhance the signal-to-noise ratio of signal features of interest, and prepares data for raster scan conversion and display.

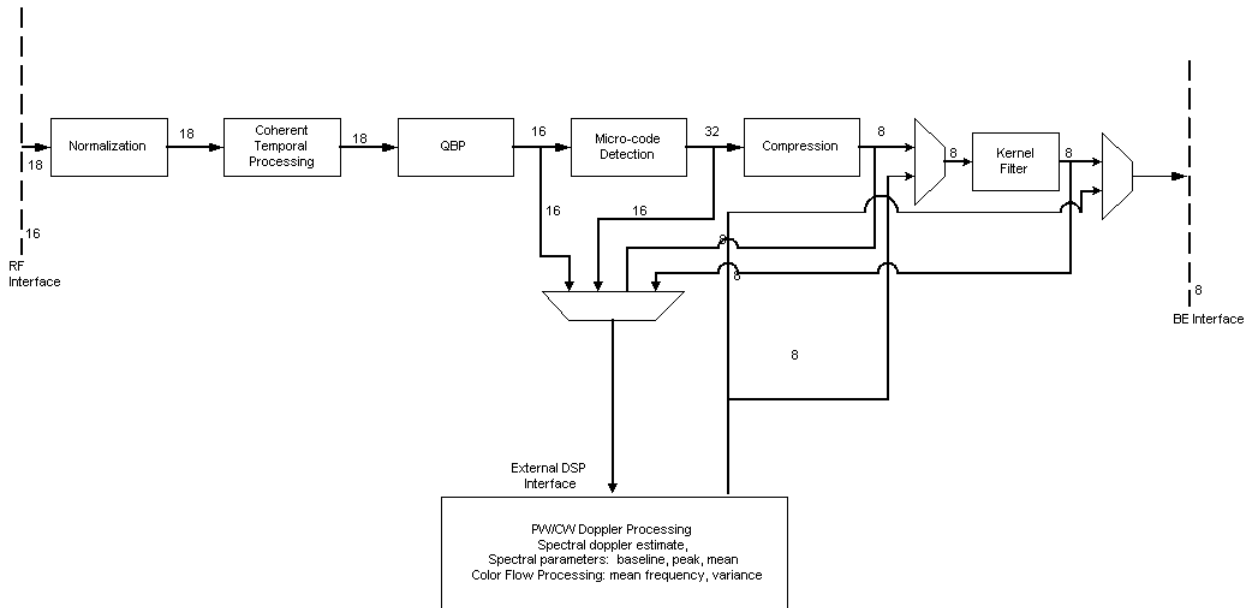


Figure 3.3 Digital Signal Processing Subsystem

### 3.2.4 Backend Subsystem

The Backend subsystem is responsible for the conversion of raw acquisition data into a raster image ready for display. This includes the acquisition data path with flash suppression and temporal filtering, and the display data path with scan conversion into raster space. The Backend subsystem also contains the video data path that supports generation of video comprising of the ultrasound image as well as graphics annotation. Video generation of both standard composite interlaced video and progressive scan video is supported. Most functionality is within the ASIC. However, the memory resources for acquisition memory, and display memory are found in external memory components. The conversion from PC type video to TV type video is also performed externally.

Control is received initially from the CPU to setup each functional block and afterward the hardware is completely data driven. This control takes the form of programming setup registers inside the blocks and setting up scan conversion tables. Each block provides temporary storage as required to buffer data and keep their respective processing pipeline full and operating. Also note that the block diagrams show only the data path, but each block is responsible for generating any necessary memory addresses for their respective input data stream.

The BackEnd subsystem is shown in the figure below.

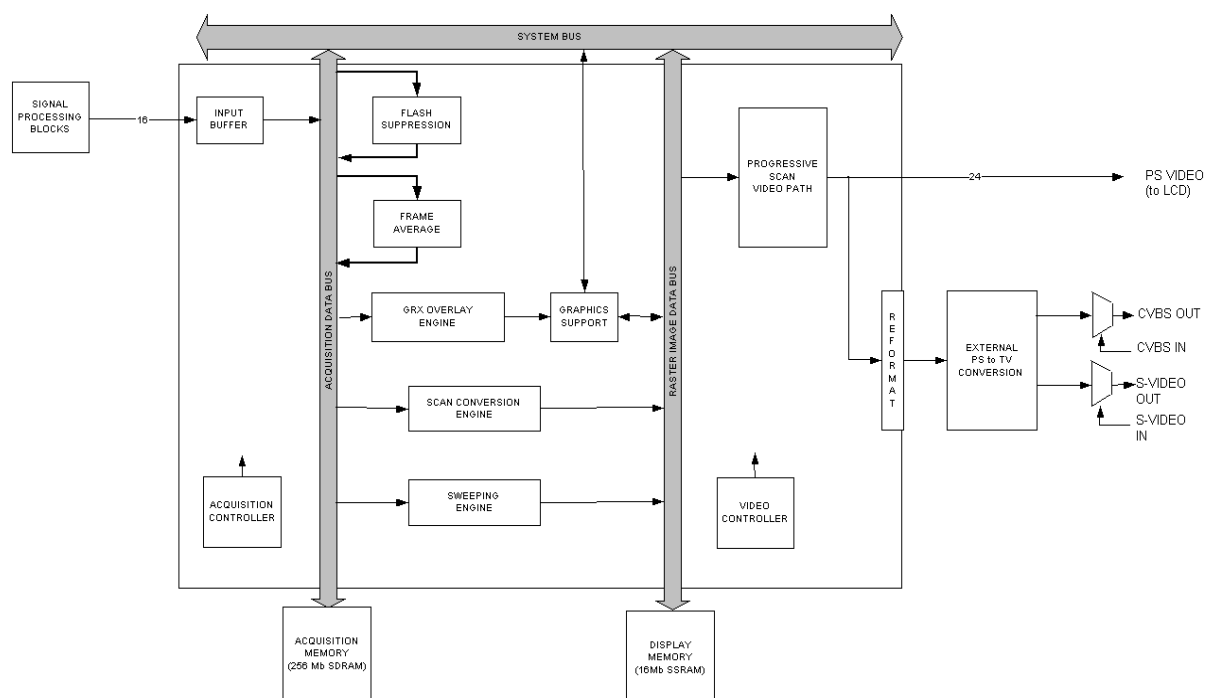


Figure 3.4 BackEnd Subsystem Block Diagram

The backend subsystem performs processing encompassing three main data domains, acquisition data, raster data, and video data.

Support for acquisition data includes the input buffer, flash suppression, frame average, and external ACQ memory. Cine buffer management is performed by the acquisition controller.

Conversion from acquisition data to raster data is performed by the graphics overlay, scan conversion engine, sweeping engine, and 3D engine. Raster data is stored in an external DISPLAY memory. Also supporting raster operations is the graphics support block that provides acceleration hardware for pixel operations from the CPU and graphics overlay engine.

Video data is processed as progressive scan (60 Hz) and supplied externally on a digital bus. In addition, interlaced (30 Hz) video is supplied in both composite and S-video formats. The progressive video path includes buffers, priority logic, and LUTs. External video in signals are input and multiplexed onto the external video out path to allow for external sources to display information on connected displays, VCRs, or printers.

### 3.2.5 Control Subsystem

The control subsystem is shown in the figure below.

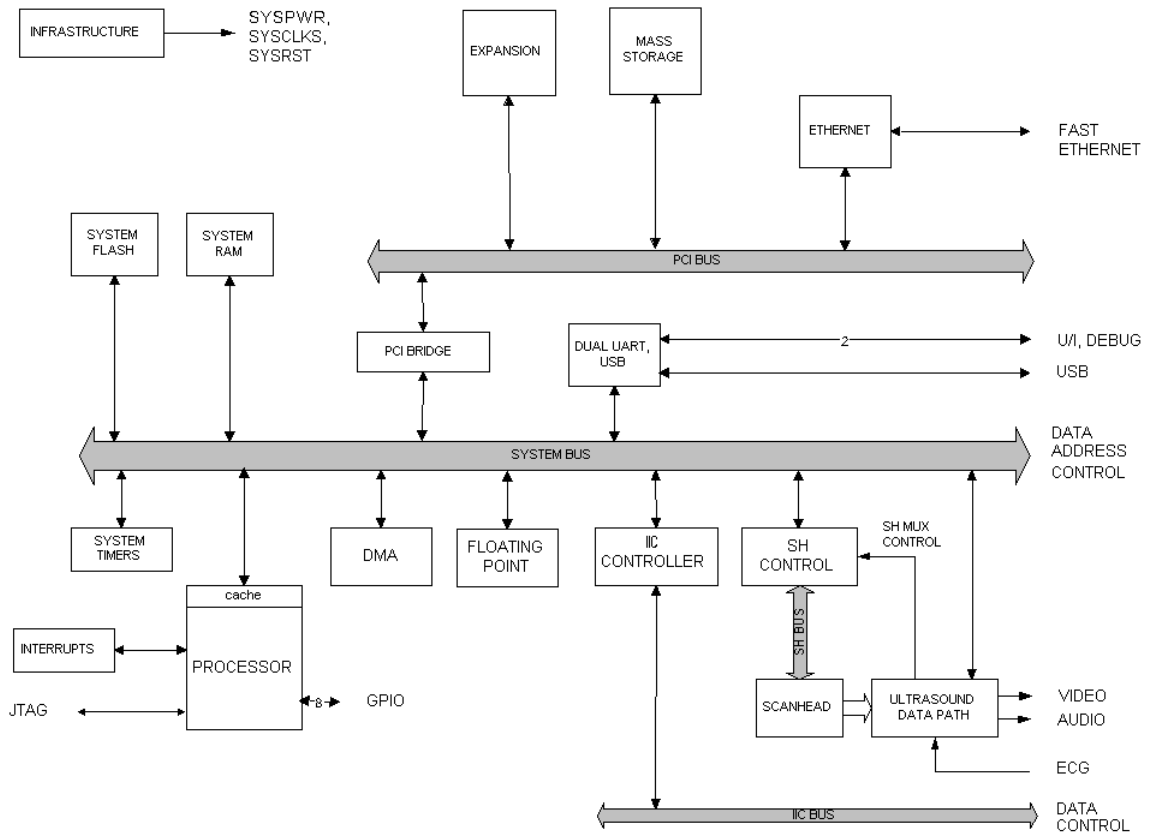


Figure 3.5 Control Subsystem

The core control subsystem contains the processor, the system bus, the system memory resources of FLASH and RAM, the interrupt logic, system timers, a DMA engine, and a floating point unit.

Support for the ultrasound subsystem consists of a scanhead interface, scanhead mux control, a portion of the system FLASH for storage of saved images, and a control path to program the ultrasound datapath.

Communication interfaces consist of an Ethernet interface, USB port, two general purpose serial bus interfaces, and the I2C bus.

### 3.2.6 Power Supply and Control Subsystem

The system Power Supply and Control System consists of an easily replaced rechargeable battery pack; an On/Off Key; a standby power regulator; digital, analog, display and transducer power supplies; a power monitor and a power control system. Operating current is drawn from the battery or an external AC/DC Adapter, which also contains circuitry for charging the battery.

The Power Supply and Control Subsystem are in the figure below.

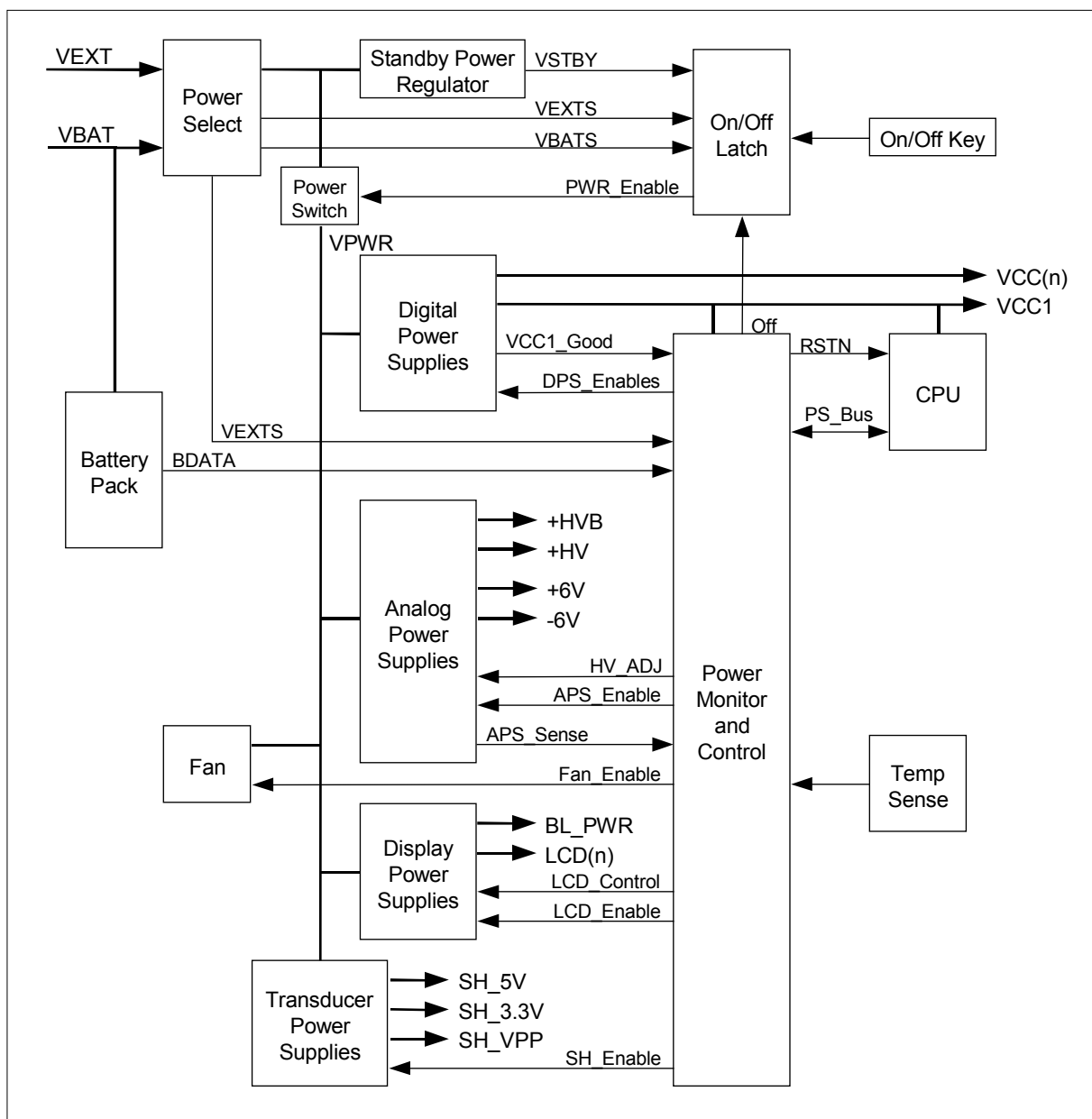


Figure 3.6 Power Supply and Control System Block Diagram

## 3.3 System Specifications

This section contains system and accessory specifications and agency approvals. The specifications for recommended peripherals can be found in the manufacturers' instructions.

### 3.3.1 System Dimensions

Length: 11.8 in. (29.97 cm)

Width: 10.9 in. (27.69 cm)

Depth: 3.0 in. (7.62 cm)

Weight: 8.3 lbs. (3.76 kg) with the C60 transducer and battery installed

### 3.3.2 Display Dimensions

Length: 5.1875 in. (13.18 cm)

Width: 6.75 in. (17.15 cm)

Diagonal: 8.5 in. (21.59 cm)

### 3.3.3 Transducers

- C11/8-5 MHz 11 mm microcurved array (5 ft./1.5 m)
- C15/4-2 MHz 15 mm microcurved array (5.5 ft./1.7 m)
- C60/5-2 MHz 60 mm curved array (5 ft./1.5 m)
- HST/10-5 MHz 25 mm linear array (8 ft./2.1 m)
- ICT/8-5 MHz 11 mm intracavitary array (5 ft./1.5 m)
- L38/10-5 MHz 38 mm linear array (5.5 ft./1.7 m)

### 3.3.4 Imaging Modes

2D (256 gray shades)

Color power Doppler (CPD) (256 colors)

Directional color power Doppler (DCPD) (256 colors)

M Mode

Pulsed wave (PW) Doppler

Tissue Harmonic Imaging

### 3.3.5 Applications

Abdominal Imaging

Cardiac Imaging

Cephalic Imaging

Gynecology Imaging

Interventional and Intraoperative Imaging Applications

Obstetrical Imaging

Pediatric and Neonatal Imaging

Superficial Imaging

Vascular Imaging



### 3.3.6 Image Storage

The number images saved to the CompactFlash card vary depending on the card storage capacity.  
Cine buffer

### 3.3.7 Accessories

#### 3.3.7.1 Hardware, Software, and Documentation

AIUM Ultrasound Medical Safety Guidance Document  
Battery  
Biopsy Guide  
Mobile Docking System  
Mini-Dock  
Power supply  
Quick Reference Guide  
SiteLink Image Manager 2.0  
SiteLink DICOM 2.0  
SonoKnowledge education package  
System User Guide  
Ultrasound gel

#### 3.3.7.2 Cables

Print control cable (10 ft./3.1 m)  
Printer AC power cord (1 ft./30.5 cm)  
VCR AC power cord (1.5 ft./45.7 cm)  
VCR (control/audio) cable (6 ft./1.8 m)  
Video cable (RCA/RCA) (10 ft./3.1 m)  
Video cable (RCA/BNC) (10 ft./3.1 m)  
S-video (6 ft./1.8 m)  
System AC power cord (10 ft./3.1 m)  
USB cable for SiteLink (10 ft./3.1 m)

### 3.3.8 Peripherals

See the manufacturer's specifications for the following peripherals.

#### 3.3.8.1 Medical Grade

Black-and-white printer

**Recommended sources for printer paper:** Contact Sony at **1-800-686-7669** or [www.sony.com/professional](http://www.sony.com/professional) to order supplies or to obtain the name and number of the local distributor.

Color printer

Video cassette recorder

#### 3.3.8.2 Non-Medical Grade

Kensington Security Cable

### 3.3.9 Temperature, Pressure, and Humidity Limits

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)

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)

Operating Limits: Battery

- 10–40°C (50–104°F), 15–95% R.H.

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.

Operating Limits: Transducer

- 10–40°C (50–104°F), 15–95% R.H.

Shipping/Storage Limits: Transducer

- -35–65°C (-31–149°F), 15–95% R.H.

### 3.3.10 Electrical

Power Supply Input: 100-240 VAC, 50/60 Hz, 1.2 A Max @ 100 VAC.

Power Supply Output (system on): (1) 15 VDC, 2.7A Max (system)  
(2) 12.6 VDC, 0.8A Max (battery charging)

Power Supply Output (system off): (1) 15 VDC, 2.0A Max (system)  
(2) 12.6 VDC, 1.8A Max (battery charging)  
Combined output not exceeding 52W.

Battery

- 6-cell, 11.25 VDC, 4.4 amp-hours, rechargeable lithium ion battery pack.
- Run time is 2 hours or more, depending on imaging mode and display brightness.

### 3.3.11 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.

C22.2, No. 601.1:1990, Canadian Standards Association, Medical Electrical Equipment–Part 1. General Requirements for Safety.

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

UL 2601-1:1997, Second Edition, Underwriters Laboratories, Medical Electrical Equipment–Part 1: General Requirements for Safety.

### **3.3.12 EMC Standards Classification**

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

CISPR11:97, 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.

### **3.3.13 Airborne Equipment Standards**

RTCA/DO160D:1997, Radio Technical Commission for Aeronautics, Environmental Conditions and Test Procedures for Airborne Equipment, Section 21.0 Emission of Radio Frequency Energy, Category B.

### **3.3.14 ECG Standard**

ANSI/AAMI EC53-1995, Association for the Advancement of Medical Instrumentation, ECG Cables, and Lead Wires.

The SonoSite ultrasound system meets the requirements of this standard except Section 4.4.1 (Exposure to ethylene oxide (EO) sterilization) and Section 4.5.9 (Connector retention force). The requirement in Section 4.5.9 does not apply, because the product weighs less than 8.4 pounds.

### **3.3.15 DICOM Standard**

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



## Chapter 4: Setup and Operation

### 4.1 System Controls

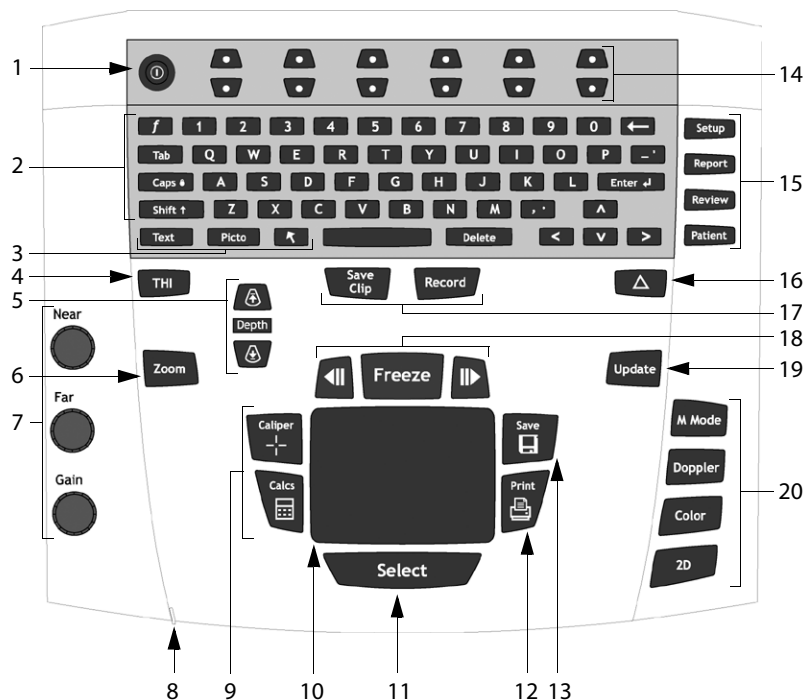



Figure 4.1 System Controls

Table 4.1: System Controls

Number	System Control	Description	
1	Power	Turns system on and off.	
2	Alphanumeric	Use to enter text and numbers.	
3	Annotation	Text Picto Arrow	Turns the keyboard on and off for text entry. Turns the pictographs/pictograph marker on and off. Displays an arrow that can be moved and rotated within the image area.
4	THI	Turns Tissue Harmonic Imaging on and off.	
5	Depth	Depth Depth Up Depth Down	Adjusts the imaging depth for 2D. Decreases imaging depth. Increases imaging depth.
6	Zoom	Magnifies image 2x.	
7	Gain	Near Far Gain	Adjusts the gain applied to the near field of the image. Adjusts the gain applied to the far field of the image. Adjusts the overall gain applied to the entire image.

**Table 4.1: System Controls (Continued)**

Number	System Control	Description	
8	AC power indicator	A steady green light indicates AC power is connected. A flashing green light indicates the system is in sleep mode.	
9	Measurements/ Calculations	Caliper activates a measurement caliper on the screen. Calcs turns the calculation menu on and off.	
10	Touchpad	Use to select, adjust, and move objects on the screen.	
11	Select	Use to switch among touchpad control for line position (2D), text position (text), calipers for measurement (calipers), pictograph marker position/angle (picto), arrow position/orientation (arrow).	
12	Print	Prints the active image to the printer.	
13	Save	Saves an image to the CompactFlash card.	
14	Remappable controls	Controls features on the context menu which are adjusted based on the system state.	
15	Forms	Setup	Access to the system settings.
		Report	Access to the patient report.
		Review	Access to the patient list and saved patient images.
		Patient	Access to patient information.
16	 (Delta key)	Use as a shortcut to existing functionality in the system.	
17	Video recording	Record	Turns VCR record on and off. (Available on future releases.)
		Save Clip	
18	Freeze	Freeze	Stops the live imaging and displays a frozen image. Review images stored in the cine buffer; (back/forward) through last-in, first-out sequence. All mode images can be stored and reviewed in the cine buffer.
		Cine	
		back/forward	
19	Update	Toggles between image modes in M Mode and Doppler, e.g., between Doppler sample line and Doppler spectral trace.	
20	Modes	M Mode	Turns M Mode on and off.
		Doppler	Turns Doppler on and off.
		Color	Turns CPD/DCPD on and off.
		2D	Turns 2D on and off.

## 4.2 System Components

The SonoSite system components are identified in [“About the System” on page 2](#).

## 4.3 Setup

<b>Key click</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Audio, Battery from the on-screen menu.</li> <li>3 In the Key click list, select On or Off.</li> </ol>
<b>Beep alert</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Audio, Battery from the on-screen menu.</li> <li>3 In the Beep alert list, select On or Off.</li> </ol>
<b>Sleep delay</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Audio, Battery from the on-screen menu.</li> <li>3 In the Sleep delay list, select Off, 5, or 10 minutes.</li> </ol>
<b>Power delay</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Audio, Battery, from the on-screen menu.</li> <li>3 In the Power delay list, select Off, 15, or 30 minutes.</li> </ol>
<b>OB Authors</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Calculations from the on-screen menu.</li> <li>3 In OB Authors list, select the desired OB authors.</li> </ol>
<b>Date</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Date and Time, Presets from the on-screen menu.</li> <li>3 In the Date field, enter the current date (year, month, and day).</li> </ol>
<b>Time</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Date and Time, Presets from the on-screen menu.</li> <li>3 In the Time field, enter the current time in 24 hour format (hours and minutes).</li> </ol>
<b>Thermal Index</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Date and Time, Presets from the on-screen menu.</li> <li>3 In the Thermal Index list, select TIS, TIB, or TIC.</li> </ol>
<b>Doppler Scale</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Date and Time, Presets from the on-screen menu.</li> <li>3 In the Doppler Scale list, select cm/s or kHz.</li> </ol>
<b>Printer</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Date and Time, Presets from the on-screen menu.</li> <li>3 In the Printer list, select the desired printer from the list of recommended printers.</li> </ol>
<b>Video mode</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Date and Time, Presets from the on-screen menu.</li> <li>3 In the Video mode list, select NTSC or PAL.</li> </ol>
<b>Delta Key</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Delta Key, F Keys from the on-screen menu.</li> <li>3 Select desired functionality for the Delta key. The Delta key will now control this function.</li> </ol>

<b>F Keys</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Delta Key, F Keys from the on-screen menu.</li> <li>3 Type in desired text. Use the <b>Backspace</b> key or <b>Delete</b> key to correct mistakes.</li> </ol>
<b>Patient Header</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Display Information from the on-screen menu.</li> <li>3 Select the desired check boxes to display desired information in the patient header.</li> </ol>
<b>Mode Data</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Display Information from the on-screen menu.</li> <li>3 Select the desired check boxes to display imaging information on the screen.</li> </ol>
<b>System Status</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select Display Information from the on-screen menu.</li> <li>3 Select the desired check boxes to display the system status on the screen.</li> </ol>
<b>System Information</b>	<ol style="list-style-type: none"> <li>1 Press the <b>Setup</b> key.</li> <li>2 Select System Information from the on-screen menu.</li> </ol> <p><i>Note: To install a license key see “Installing a License Key” on page 33.</i></p>
<b>Reset</b>	To return settings for this setup page to factory default, select Reset from the on-screen menu.

Press the **Setup** key to exit.

## 4.4 Touchpad

The touchpad is used to select, adjust, and move objects on the screen. For example, it controls the caliper position, CPD/DCPD box position, floating cursor, and more.

*Note: The arrow keys control much of the same functionality as the touchpad.*

## 4.5 Accessories

For information about accessories and other SonoSite products, refer to the user guide for each product.



## 4.6 Preparing the System for Operation

### 4.6.1 Installing and Removing the Battery

**Caution:** Use only the specified SonoSite battery pack. For battery safety notes, see “Battery Safety” on page 7.

The system can be powered from either a battery pack or external power. The battery pack is a 6-cell, 11.25V (nominal), 4.4 amp-hour, Lithium-Ion, rechargeable battery pack. The battery comprises six lithium-ion cells plus electronics, a temperature sensor, and battery contacts. If the battery is being installed for the first time, it will need to be charged.

**Warning:** To avoid injury to the operator and to prevent damage to the ultrasound system, inspect the battery for leaks prior to installing.

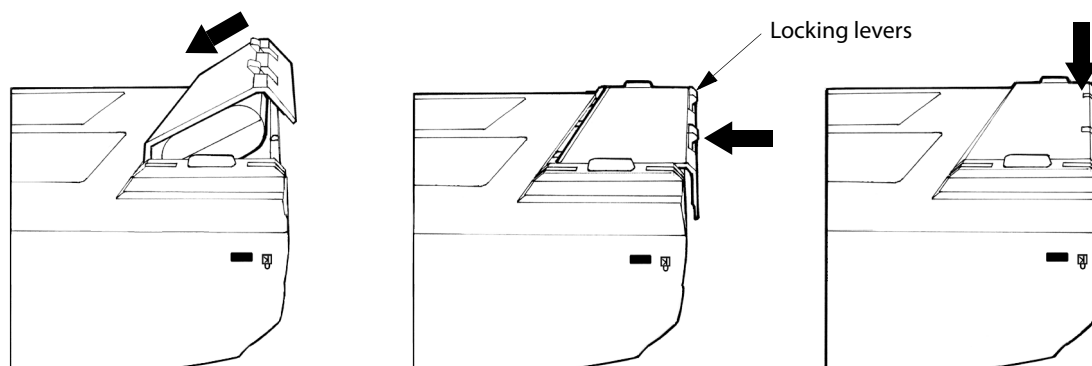


Figure 4.2 Insert Battery into System

#### To install the battery:

- 1 Turn the system upside down.
- 2 Place the battery into the battery compartment, at a slight angle. See [Figure 4.2](#).
- 3 Slide the battery forward until it locks into place.
- 4 Push down on the two locking levers to secure battery.

#### To remove battery:

- 1 Push up on the two locking levers.
- 2 Slide the battery back.
- 3 Lift the battery from the compartment.

## 4.6.2 Using AC Power/Charging Battery

The battery charges when the system is connected to the AC power supply. If the system is off and connected to AC power, a completely discharged battery will fully charge in 2.5 to 3.5 hours. If the system is on and connected to AC power, a completely discharged battery will fully charge in 5 to 6 hours.

The system can run on AC power or charged battery in three ways.

- Connected directly to the system
- Connected to the mini-dock (see “To operate the system using AC power (directly to system):” on page 26)
- Connected to the mobile docking system (see “To connect AC power using the mini-dock:” on page 27)

### To operate the system using AC power (directly to system):

**Caution:** Verify the hospital supply voltage corresponds to the power supply voltage range. See “Electrical” on page 18.

- 1 Connect the DC power cable from the power supply to the connector on the system. See [Figure 1.2 on page 3](#).
- 2 Connect one end of the system AC power cord into the power supply. Then plug the other end into a hospital-grade electrical outlet.

#### 4.6.2.1 Battery Charge Indicators

The Battery Charge Indicator, a battery icon located on the upper right hand section of the display, indicates the current battery level.

- All Battery Indicator segments lit mean the system battery is fully charged.
- Some Battery Indicator segments lit mean the system battery is partially charged.
- When the battery is charging the Battery Indicator segments light sequentially.

[Table 4.2](#) contains the charging specifications for the system.

**Table 4.2: System Charging Specification**

System Charging Parameter	Specification
Charge time to 80% capacity, with System power off	3 hours @ 25° C
Charge time to 80% capacity, with System power on	6 hours @ 25° C

### 4.6.3 Connecting to AC Power

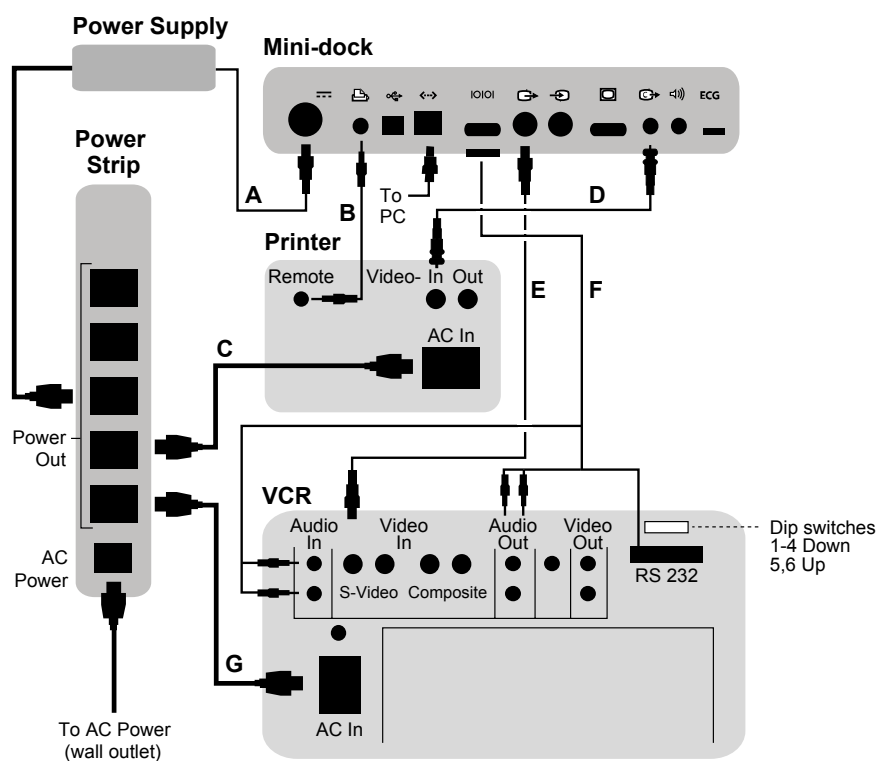


Figure 4.3 Connectivity Diagram

#### To connect AC power to the docking system:

*Note: The AC power cord to the power supply and the DC power cord from the power supply are preinstalled.*

- 1 Remove back panel.
- 2 Connect the system AC power cord to the power strip on the top shelf of the mobile docking system.  
A country specific AC power cord is provided.
- 3 When ready to use, route the AC power cord out the back, and replace the back panel.
- 4 Connect the system AC power cord to a hospital-grade electrical outlet.

#### To connect AC power using the mini-dock:

- 1 Insert the ultrasound system into the mini-dock.
- 2 Connect the DC power cable from the power supply to the connector on the mini-dock.
- 3 Connect one end of the system AC power cord into the power supply. Then plug the other end into a hospital-grade electrical outlet.

#### 4.6.4 Connecting and Removing Transducers

**Warning:** The transducer connector can become hot during operation. This is normal. Operate the system in the docking system or on a flat, hard surface to allow air flow past the connector.

**Caution:** The electrical contacts inside the system transducer connector may be damaged by foreign material. Keep foreign material out of the connector.

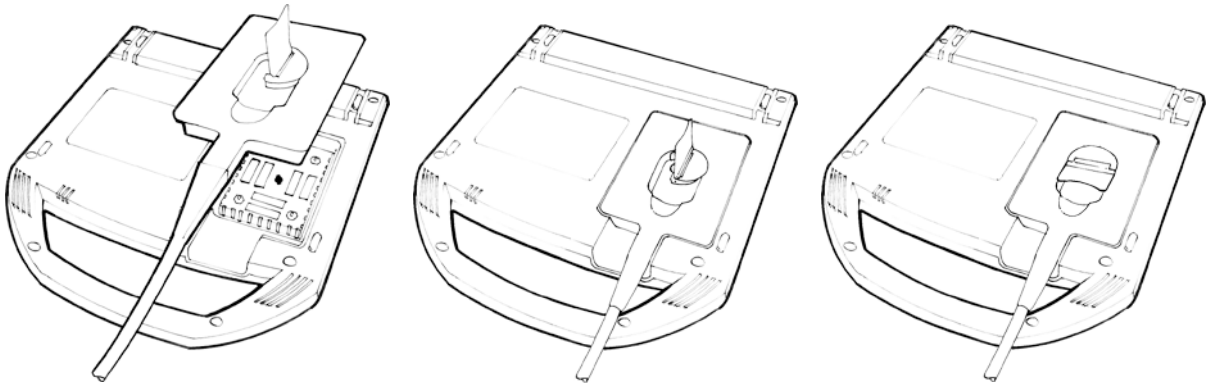


Figure 4.4 Connect the Transducer

##### To connect the transducer:

- 1 Turn the system upside down (if not in docking system).
- 2 Pull the transducer latch up and rotate it clockwise.
- 3 Align the transducer connector with the connector on the bottom of the system.
- 4 Insert the transducer connector into the system connector.
- 5 Turn the latch counterclockwise.
- 6 Press the latch down, securing the transducer connector to the system.

##### To remove the transducer:

- 1 Pull the latch up and rotate it clockwise.
- 2 Pull the transducer connector away from the system.

#### 4.6.5 Turning the System On and Off

##### To turn the system on/off:

**Caution:** Do not use the system if an error message appears on the display. Note the error code and turn off the system. Call SonoSite or your local representative.

- 1 Locate the **Power** key on the top left side of the system. See [Figure 4.1 on page 21](#).
- 2 Press the **Power** key once to turn on and once to turn off.

**To wake up the system:**

To conserve battery life, the system is configured to go into sleep mode. The system goes into sleep mode when the lid is closed or if the system has not been touched for a preset amount of time. Press any key, touch the touchpad, open the lid to wake up the system. To adjust the time for sleep delay, see “Sleep delay” on page 23.

## 4.7 Upgrading the System Software

As described in “About the System Software” on page 4, software upgrades are provided on CompactFlash cards, which are installed in the rear CompactFlash slot on the right hand side of the system. Upgrades provided may be required or optional.

Whenever you install a CompactFlash card containing a newer version of software into the system, the system will determine the level of software, prepare the system for the upgrade, and then install the new software onto the system.

**To upgrade the system software:**

- 1 Insert CompactFlash card into the back slot.

The system displays the following message:

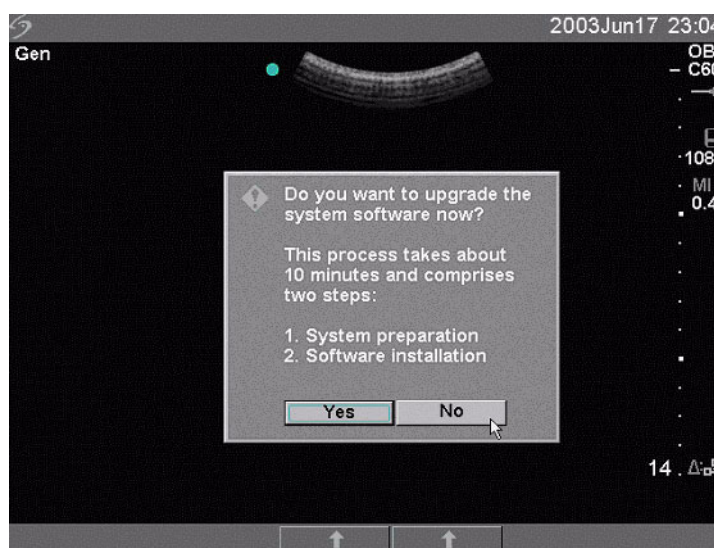


Figure 4.5 Upgrade System Software

- 2 Press **Yes** to accept and **No** to reject the upgrade.

*Note: If you do not perform the upgrade:*

- the new transducer is not available
- the new features are not enabled
- the new software benefits are not available

When you have accepted the upgrade, the system loads the new software and displays the following message:

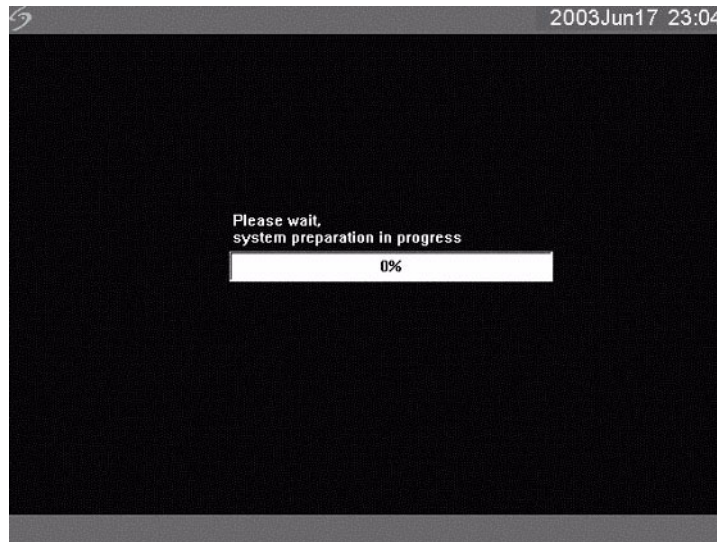


Figure 4.6 System Software Loading

*Note: The system upgrade can take up to 10 minutes; however, many software upgrades will be completed in less time.*

When the software upgrade has prepared the system for upgrade, the system displays the following message:

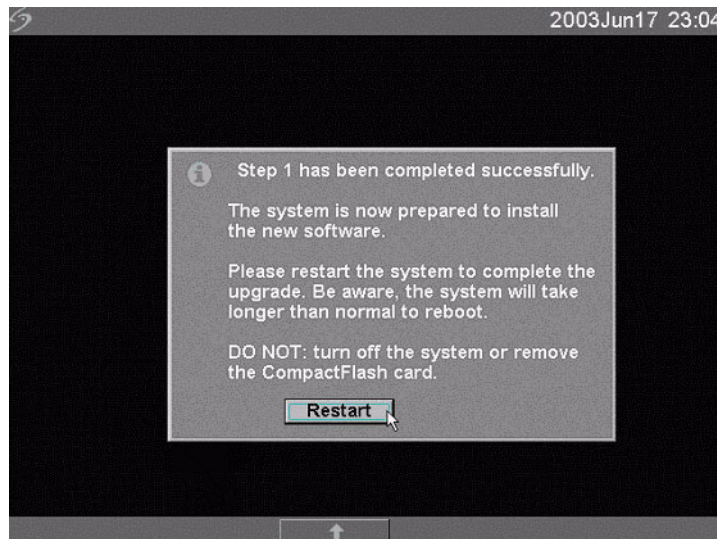


Figure 4.7 System Software Step 1 Restart

3 Press **Restart**.

If the software upgrade is unsuccessful, the system displays an error code and you must contact SonoSite technical support at 1-877-657-8118.



After restart, the system goes into the upgrade process. The system displays the following message:

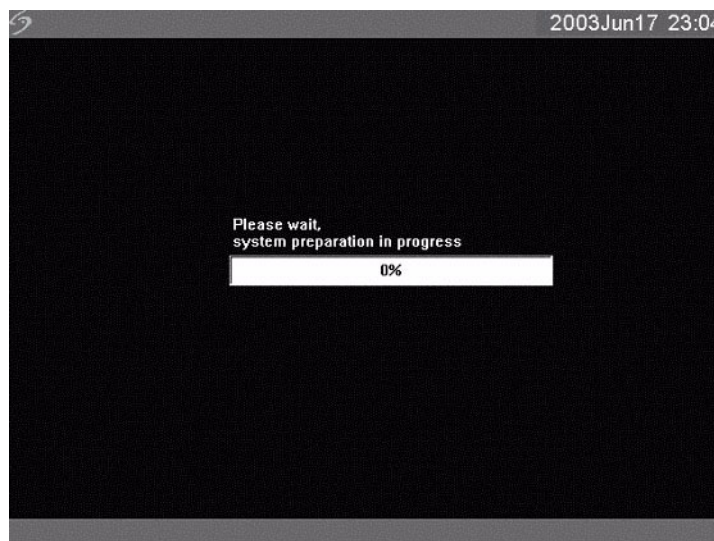


Figure 4.8 System Software Installation

When the system preparation is completed, the system displays the following message:

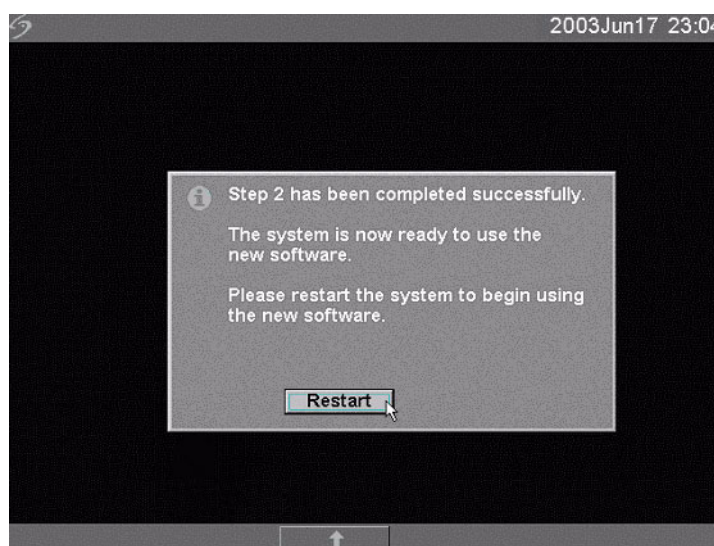


Figure 4.9 System Software Step 2 Restart

4 Press **Restart**.

During the restart, the initial system screen shows a progress indicator. The progress indicator is present while the system is replacing its operating software and disappears when the process is completed.

When the operating software has been replaced, the system presents you with the license update screen so that you may license the software.

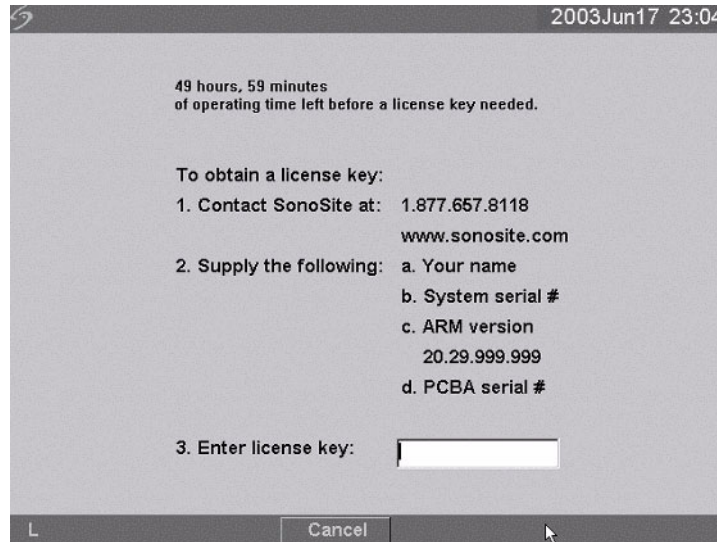


Figure 4.10 System Software License Key

At this point, the software upgrade process is complete, but the system software is not yet licensed. The following section explains how to license your software.

### 4.7.1 Obtaining a License Key

A license key is required to update your system. It may be obtained by contacting SonoSite, Inc. Technical Support Department.

USA/Canada Customers

- Technical support: 1-877-657-8118
- Technical support fax: 1-425-951-6700
- Technical support e-mail: [service@sonosite.com](mailto:service@sonosite.com)
- SonoSite website: [www.sonosite.com](http://www.sonosite.com) and select Products & Solutions and then Technical Support

International Customers

- Contact your local representative or call 425-951-1330
- Technical support fax: 425-951-6700
- Technical support e-mail: [service@sonosite.com](mailto:service@sonosite.com)
- SonoSite website: [www.sonosite.com](http://www.sonosite.com) and select Products & Solutions and then Technical Support

To receive your license key, you will need to provide the following information, which is displayed on the system information screen of your system:

- Name of the person installing the upgrade
- System serial number (located on the bottom of your system)
- ARM version
- PCBA serial number



## 4.7.2 Installing a License Key

When you have obtained a license key for your software, you must enter it into the system. Once a valid license key has been entered, the system remains licensed until the next time the system software is upgraded.

- 1 Turn on the system.

If the software is not yet licensed, the license update screen displays.

The license update screen displays the following information: how to contact SonoSite, and the required information to obtain the License Update number, and the grace period (time remaining) on your system.

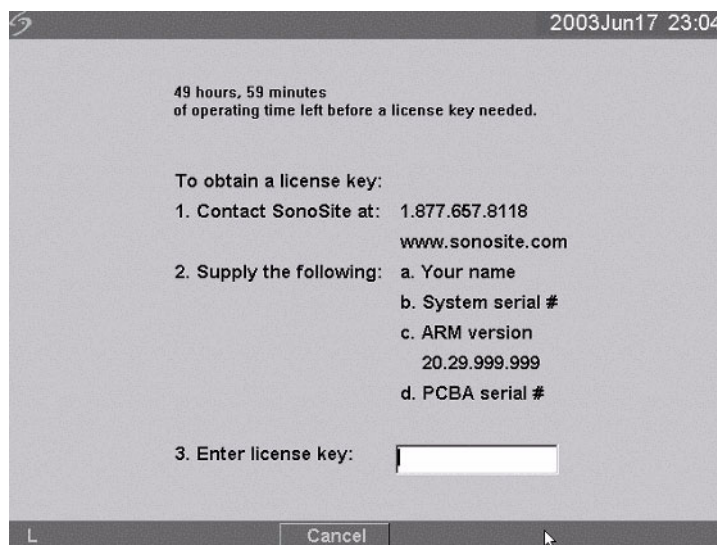


Figure 4.11 License Screen

*Note: The software versions on your system may vary based on your upgrade and configuration.*

- 2 Enter your license key in the license number field.  
If the license key that you entered is recognized by the system as being valid for your system and the software you installed, Done appears on-screen.
- 3 Select Done from the on-screen menu to install the license key and license your software.  
If the license key that you entered is not recognized by the system, the Cancel button remains on the screen as long as the defined grace period has not expired.  
If the grace period has expired, the menu item will indicate this by showing zero hours remaining in the grace period. At this point, you must then enter a valid license key before you can use the system.

*Note: If you have entered a valid license key and you cannot complete the licensing procedure, verify that the license key has been entered correctly. The license key should be exactly 12 digits (for example, 123348990552) with no other characters or punctuation.*

*Note: If after confirming correct entry of the license key, you are still unable to license your system, call SonoSite technical support. USA/Canada customers call 1-877-657-8118. International customers call your local representative or 1-425-951-1330.*

If the system is on and the grace period expires, the license update screen must be displayed from the system information screen. See [“System Information”](#) on page 24.

### 4.7.3 To Display the System Information Screen

- 1 Press the **Setup** key.
- 2 Select System Information from the on-screen menu.

The system information screen displays the following information: Product, Modes, Previous License Update, Boot Version, ARM Version, DSP Version, PCBA Serial Number, PLD, CPLD Version, SH Database Version, and SH Serial Number.

*Note: The software versions on your system may vary based on your upgrade and configuration.*

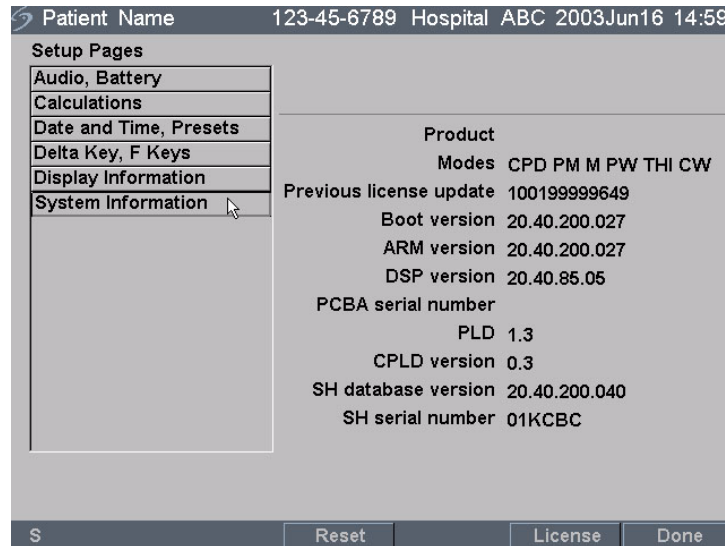


Figure 4.12 System Information Screen

#### 4.7.4 To Display the License Update Screen

- 1 Press the **Setup** key.
- 2 Select System Information from the on-screen menu.
- 3 On the lower section of system information screen, select the button under License. The license update screen displays.
- 4 Perform the steps in “Installing a License Key” on page 33.

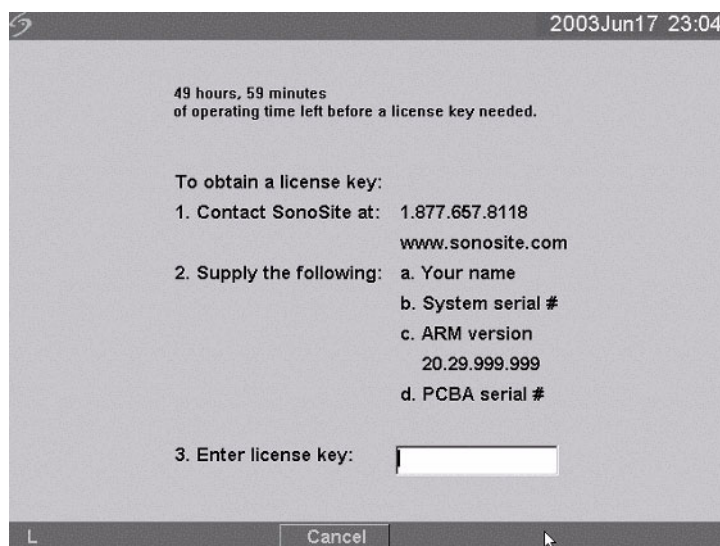


Figure 4.13 Setup Screen: License Key



## Chapter 5: Cleaning and Disinfecting

### 5.1 Universal Precautions

SonoSite recommends that personnel who have regular exposure to medical devices returned for service practice “universal precautions.” Universal precautions are an approach to infection control. Those servicing this product should follow the prescribed standards for their area.

### 5.2 Receipt of Suspected Contaminated Materials

SonoSite recommends that personnel who have regular exposure to medical devices returned for service practice “universal precautions.” Universal precautions are an approach to infection control. Those servicing this product should follow the prescribed standards for their area.

If visual inspection suggests possible contamination when opening a product returned for service, take proper steps to contain the contamination. Wear necessary Personal Protective Equipment (PPE) (gloves, masks, and gowns) when opening or examining a suspect package.

Before transfer to a service area, label the suspect package “contaminated” and seal it to prevent exposure.

Discard any packing materials removed from a package suspected of contamination in a biohazard container.

Discard any contaminated materials received with the product in an appropriate biohazard container. Contaminated materials may include biohazardous waste and sharps.

Maintain a disinfecting agent in case any work surface is contaminated. The recommended agent is 0.5% sodium hypochlorite (bleach) solution. To prepare the agent, mix one part household bleach (5.25% - 6% sodium hypochlorite) to nine parts water. Spray or wipe the solution onto the work surface and allow to air dry.

Please use these recommendations when cleaning or disinfecting your ultrasound system, transducers, and accessories. This chapter assists in effective cleaning and disinfection, but it is also intended to protect the system and transducers against damage during cleaning or disinfection.

For more information about cleaning or disinfecting solutions or ultrasound gels for the transducer, call SonoSite technical support or your local representative. For information about a specific product, call the product manufacturer.

### 5.3 Recommended Disinfectants

For a list of disinfectants recommended for use on the system and transducers, see the *TITAN Ultrasound System User Guide*.



## Chapter 6: Troubleshooting

### 6.1 Basic 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.

If you encounter difficulty with the system, use the information in this chapter to help correct the problem. If the problem is not covered here, contact SonoSite technical support at the following numbers or addresses:

#### USA/Canada Customers

- Technical support: 1-877-657-8118
- Technical support fax: 1-425-951-6700
- Technical support e-mail: [service@sonosite.com](mailto:service@sonosite.com)
- SonoSite website: [www.sonosite.com](http://www.sonosite.com) and select Products & Solutions and then Technical Support


#### International Customers

- Contact your local representative or call 425-951-1330
- Technical support fax: 425-951-6700
- Technical support e-mail: [service@sonosite.com](mailto:service@sonosite.com)
- SonoSite website: [www.sonosite.com](http://www.sonosite.com) and select Products & Solutions and then Technical Support

**Table 6.1: Troubleshooting**

Symptom	Solution
System will not power on.	Check all power connections. Perform the following sequence: remove DC input connector and battery; wait 10 seconds; connect DC input or install battery; press the power key. Ensure the battery is charged.
System image quality is poor.	Adjust the LCD screen to improve viewing angle. Adjust the brightness, as necessary, to improve image quality. Adjust the gain.
Zoom does not work.	Press <b>Freeze</b> key. Zoom does not work when the image is frozen.
No CPD image.	Adjust the gain.
No DCPD image.	Adjust the gain.
No OB measurement selections.	Select the OB or Gyn exam type.
Print does not work.	Set the correct printer in system setup. Check the printer connections. Check the printer to ensure that it is turned on and set up properly. See the printer manufacturer's instructions, if necessary.

**Table 6.1: Troubleshooting (Continued)**

Symptom	Solution
VCR does not record.	Check the VCR connections. Check the VCR to ensure that it is turned on and set up properly. See the VCR manufacturers' instructions, if necessary.
External monitor does not work.	Check the monitor connections. Check the monitor to ensure that it is turned on and set up properly. See the monitor manufacturers' instructions, if necessary.
Unexpected labels using the function keys.	Ensure labels have been assigned to the function keys.
Inaccurate fetal age calculation.	Ensure that the patient information, date, and time are set accurately.
System does not recognize the transducer.	Disconnect and reconnect the transducer.
Text cursor does not move when touchpad or arrows are selected.	Text cursor is constrained to one line.
A maintenance icon  displays on the system screen.	This icon indicates that system maintenance may be required. Record the number in parentheses on the C: line and contact SonoSite or your SonoSite representative.

## 6.2 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. All maintenance and/or performance tests are described in [Chapter 8, "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.



## 6.3 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 the SonoSite Technical Support department.

**Table 6.2: Troubleshooting Subassemblies and Diagnostic Figures**

Subassemblies	Diagnostic Figures
Display	Figure 6.2
Control Panel	Figure 6.3
System	Figure 6.4
Battery	Figure 6.5
Mini-Dock/Mobile Docking System	Figure 6.6

## 6.4 System Repair

The system is repairable through subassembly replacement or through replacement of parts as recommended by SonoSite in [Chapter 7, “Replacement Procedures”](#) of this manual. 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.

## 6.5 Test Equipment

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

## 6.6 Failure Modes

### 6.6.1 Display

Attach an external monitor to the external video connector to verify display failures. For example, if the system display is blank and the external monitor works properly, the system display requires servicing.

Follow the Display Flow Diagram ([Figure 6.2](#)) to evaluate the cause of failure.

### 6.6.2 Control Panel

Go to the patient information screen and press each individual key on the keyboard to identify and verify control panel failures. Press function keys and note their response.

Follow the Control Panel Flow Diagram ([Figure 6.3](#)) to evaluate the cause of failure.

### 6.6.3 System/Main PCBA

The main PCBA may present symptoms that are difficult to assess. Main PCBA failures typically result in “assert codes” that are output to the display. If an assert code should display, note the assert code and contact SonoSite technical support to clarify the failure. [Figure 6.1](#) shows an assert code and a maintenance icon displayed on the system screen.

Follow the System Flow Diagram ([Figure 6.4](#)) to evaluate the cause of failure.

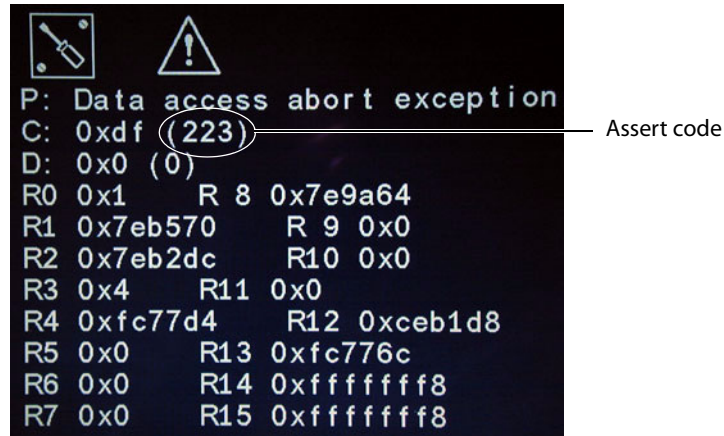


Figure 6.1 Assert Screen

#### 6.6.3.1 Clearing a System Assert Code

After the assert code has been recorded, power down the system.

- 1 Press the **Power** key on the system and release it.
- 2 Turn the power back on to check if the fault cleared or if the condition remains.  
If the condition cleared, you may use the system. If the condition remains, corrective action must be taken before the system can be used. Contact SonoSite Technical Support for assistance or repair parts.
- 3 If the **Power** key is not functional, all sources of power must be removed to allow the system to power down.

### 6.6.4 Battery

If the system does not operate or does not run for the expected duration for a given charge, battery failure may have occurred.

Follow the Battery Flow Diagram ([Figure 6.5](#)) to evaluate the cause of failure.

## 6.7 Troubleshooting Flow Diagrams

### 6.7.1 Display

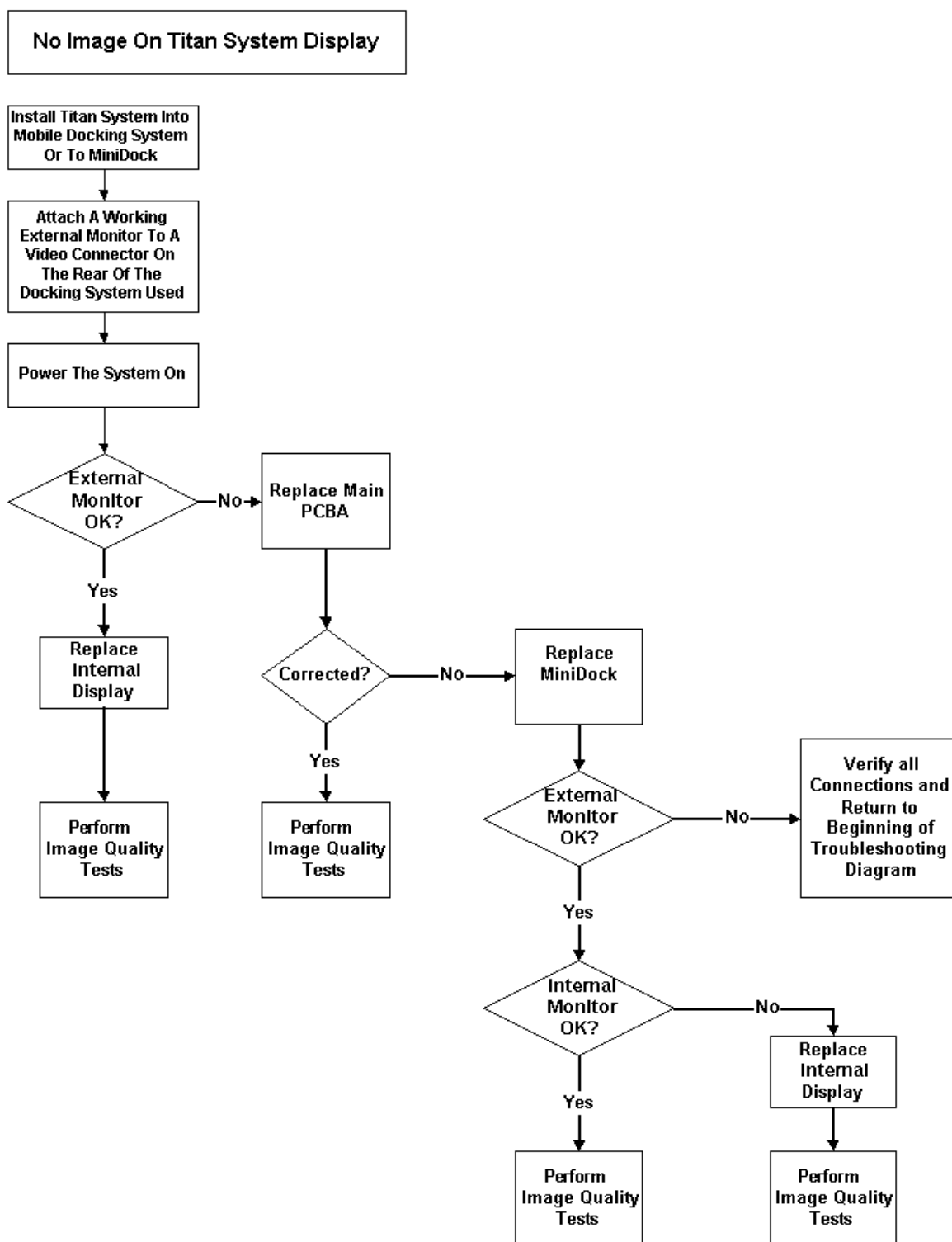


Figure 6.2 Display Flow Diagram

## 6.7.2 Control Panel

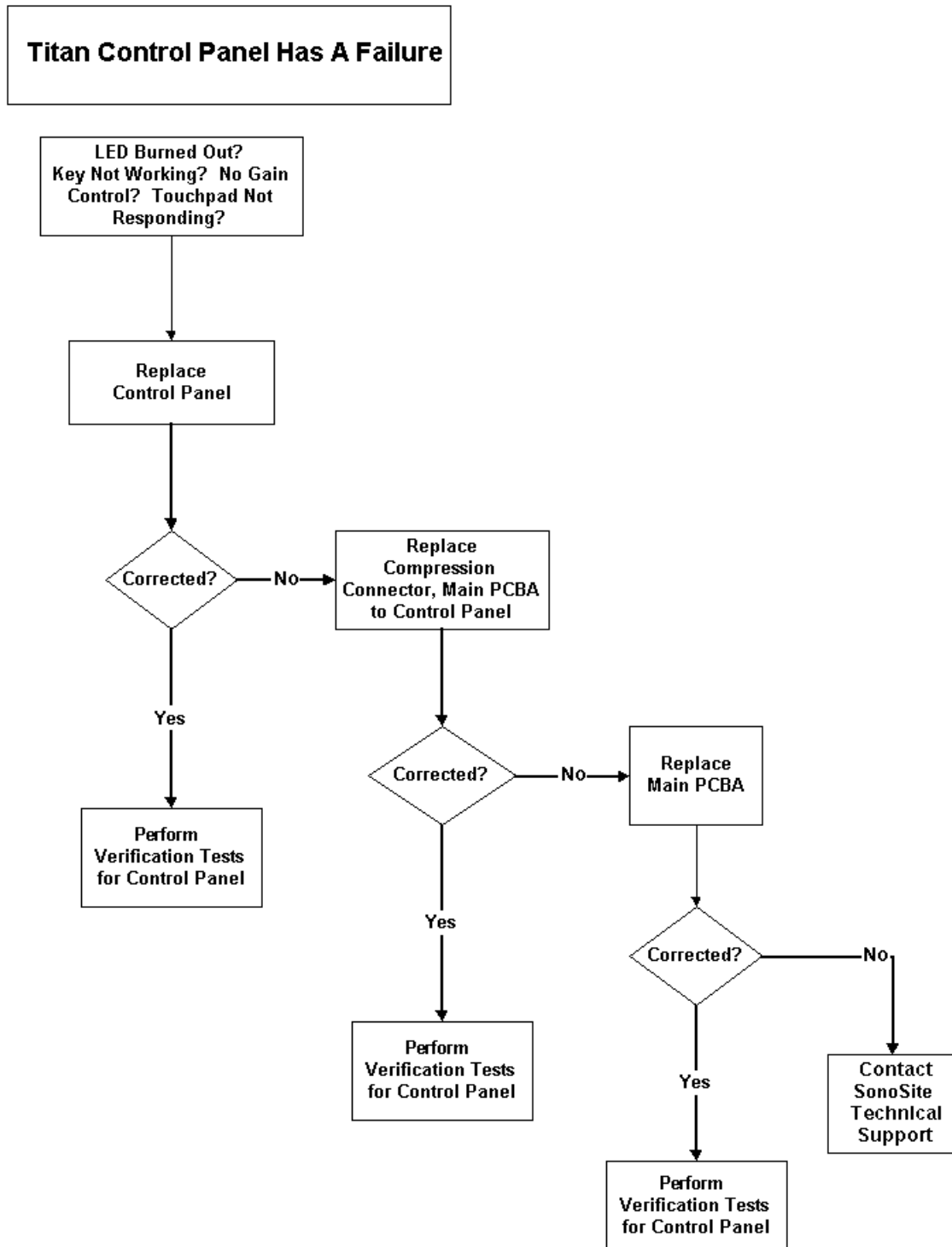


Figure 6.3 Control Panel Flow Diagram

### 6.7.3 System

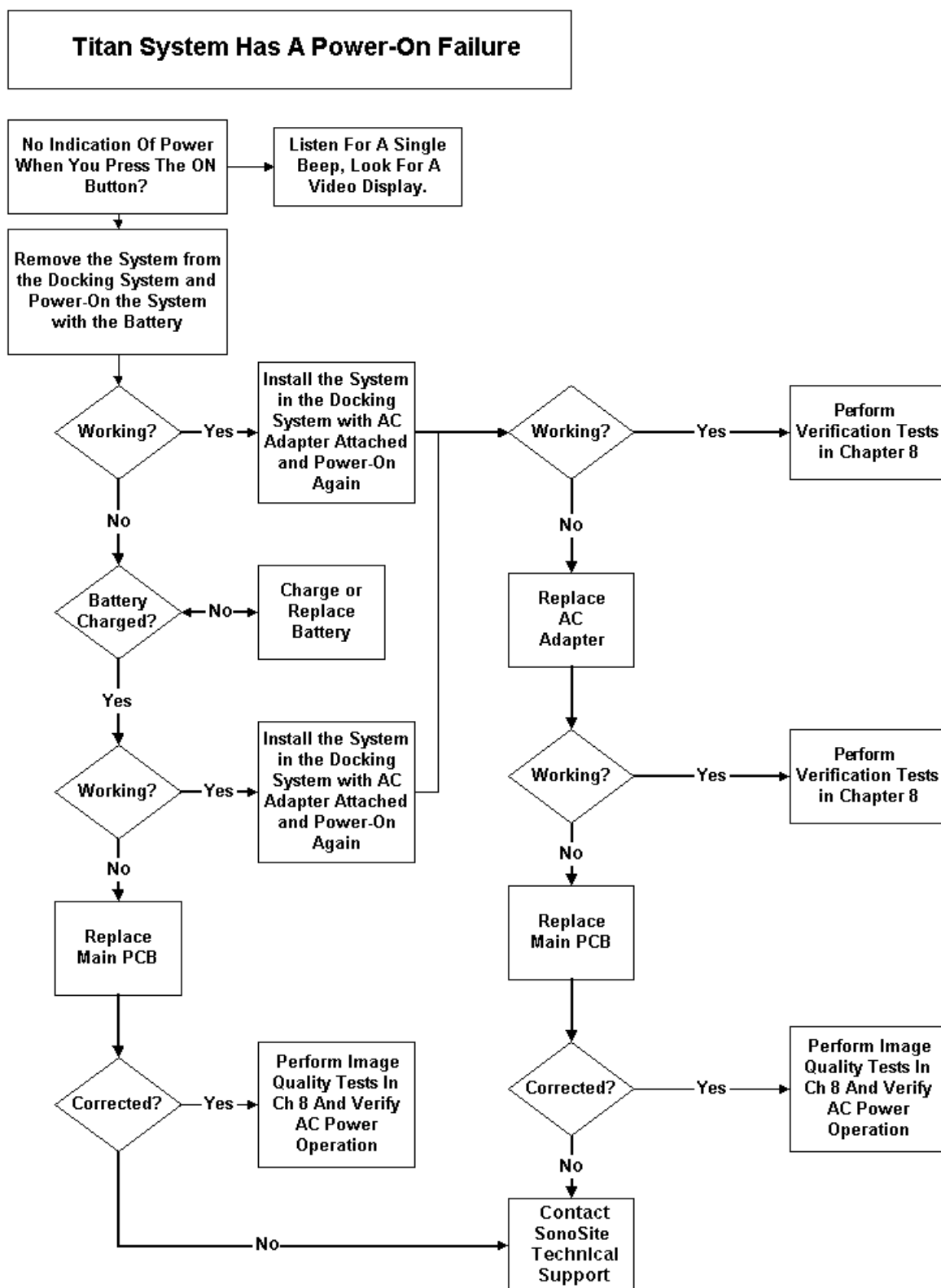


Figure 6.4 System Flow Diagram

### 6.7.4 Battery

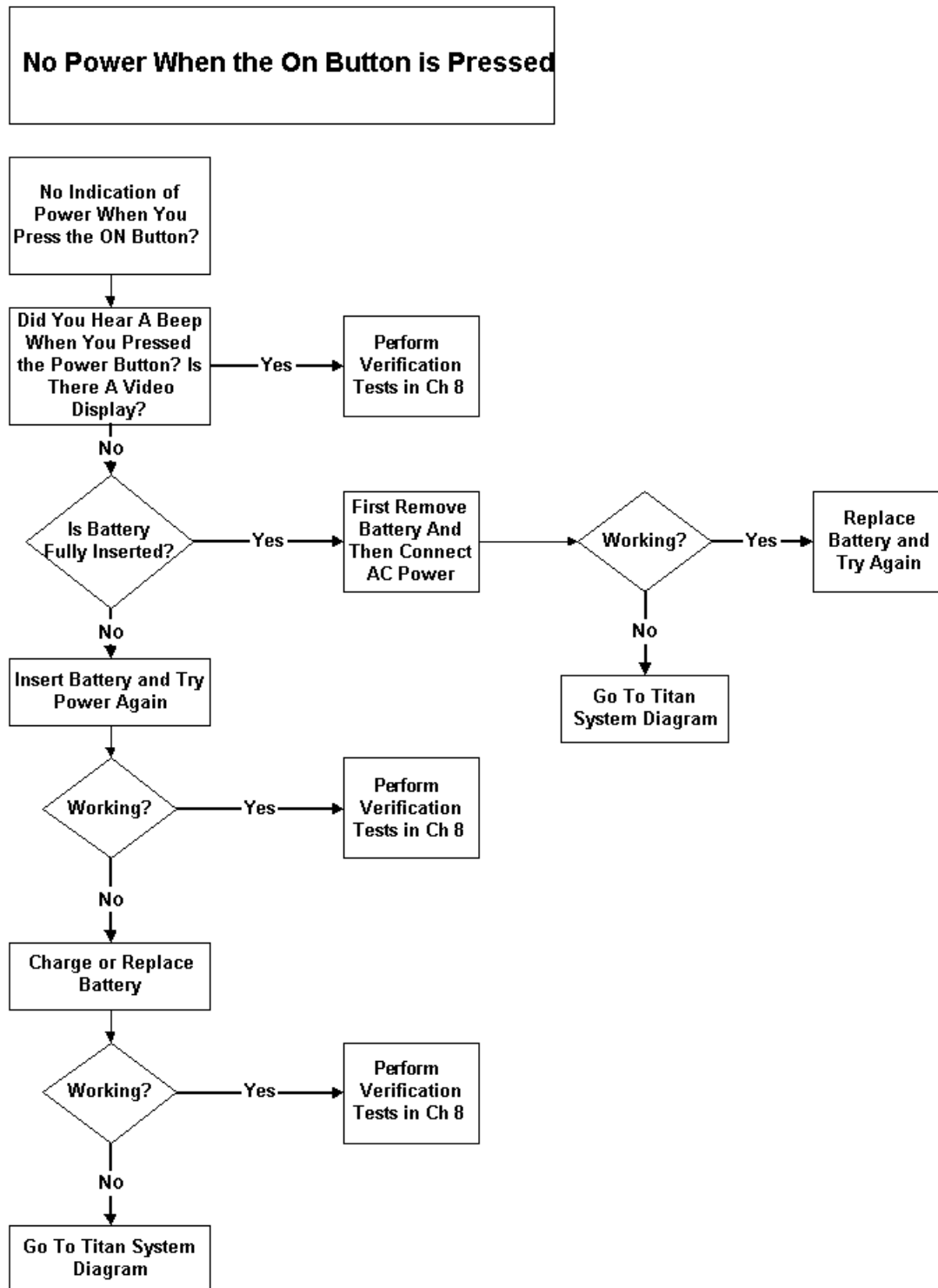


Figure 6.5 Battery Flow Diagram

### 6.7.5 Mini-Dock/Mobile Docking System

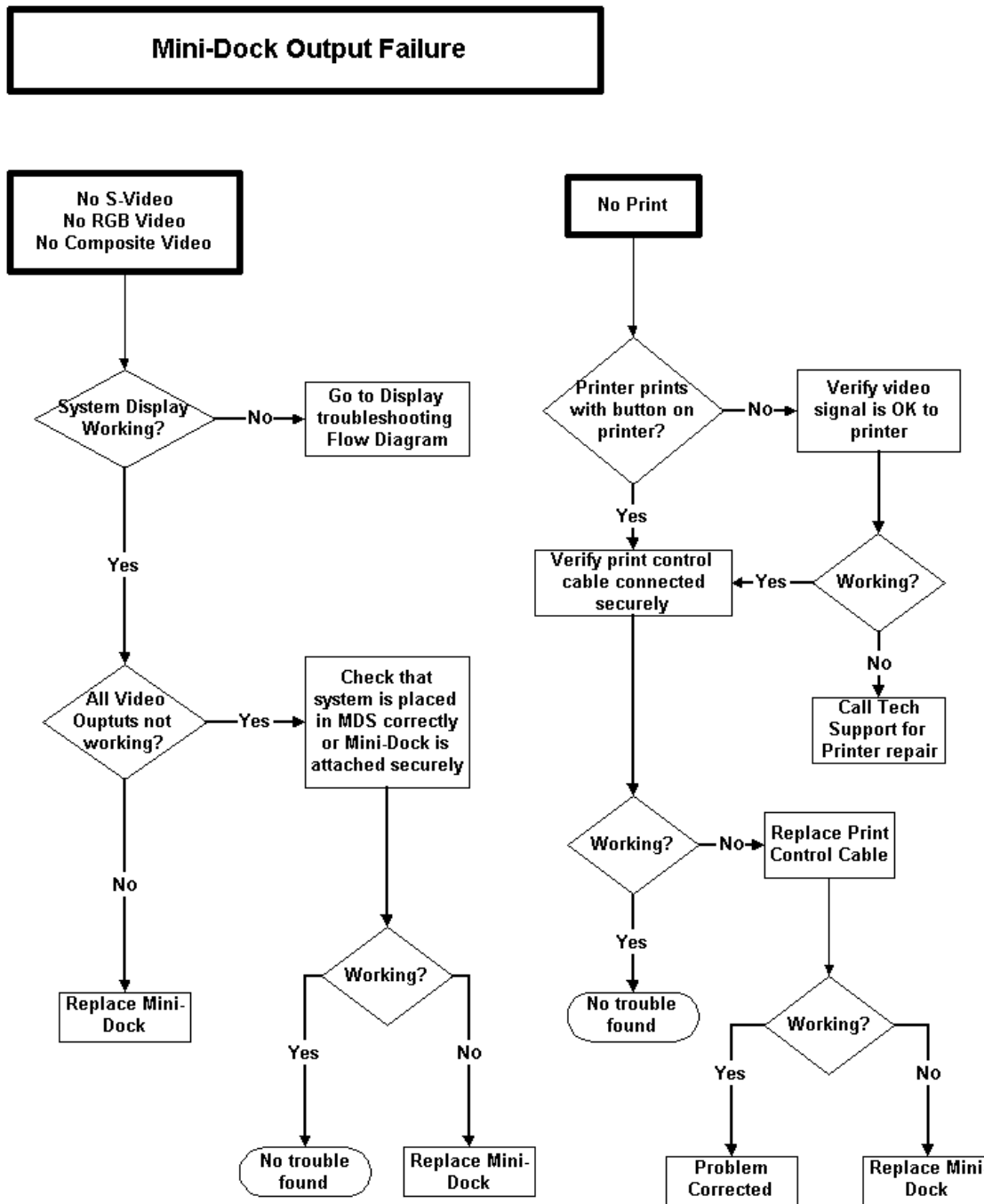


Figure 6.6 Mini-Dock and Mobile Docking System Flow Diagram, Part 1

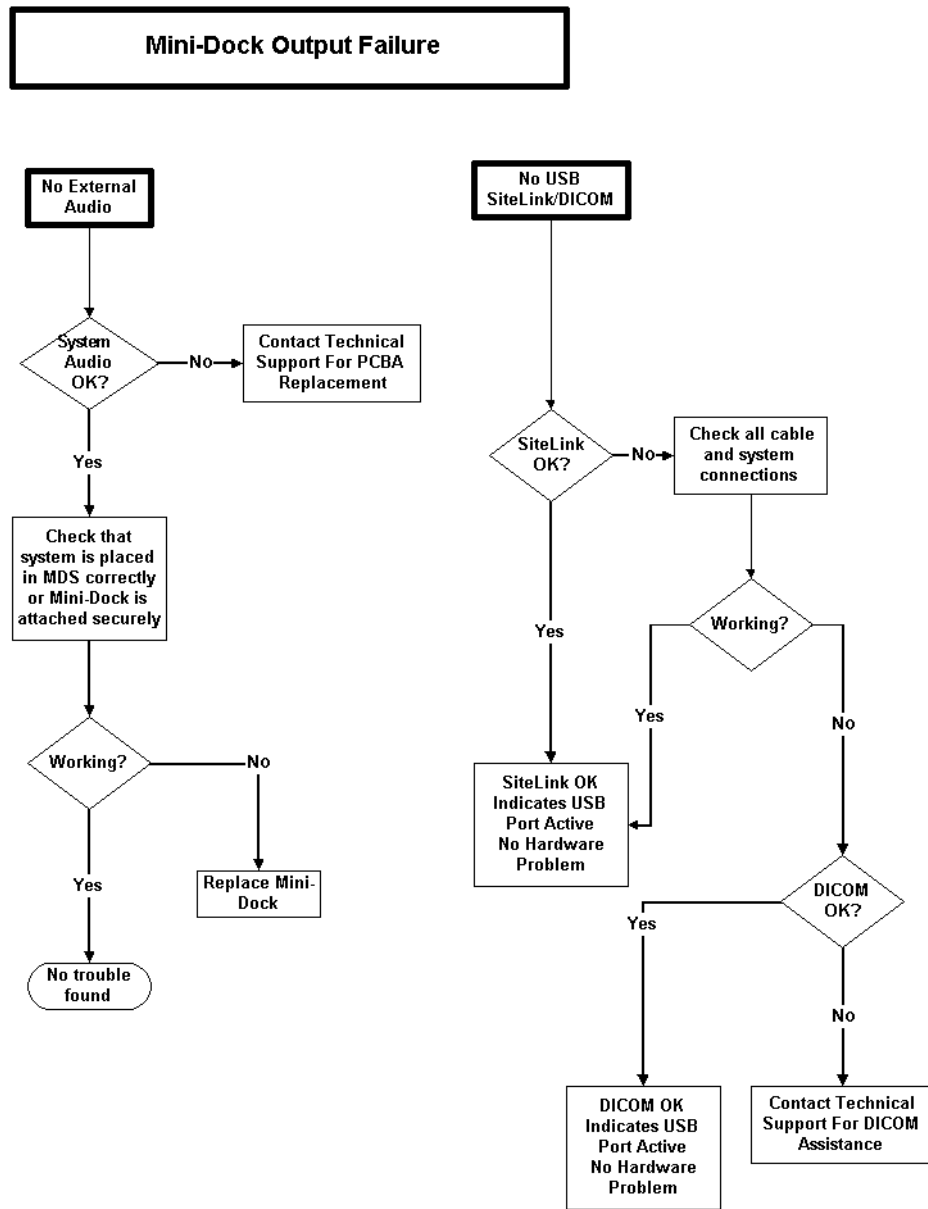


Figure 6.7 Mini-Dock and Mobile Docking System Flow Diagram, Part 2



## Chapter 7: Replacement Procedures

### 7.1 Display Replacement

Note: Consult *Chapter 6, "Troubleshooting"* before making any repairs.

#### 7.1.1 Required Parts

Service Assembly, Display, TITAN (P03861)

#### 7.1.2 Required Tools

- #1 Phillips screwdriver
- Torque screwdriver, 2.0–10.0 in./lb. (0.23–1.1 newton meter)
- 8 mm nut driver
- 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.

#### 7.1.3 Display Removal

- 1 Remove the battery from the system. See [Section 4.6.1, "Installing and Removing the Battery,"](#) on [page 25](#) for battery removal.
- 2 Remove the two screws from the back of the system per [Figure 7.1](#).

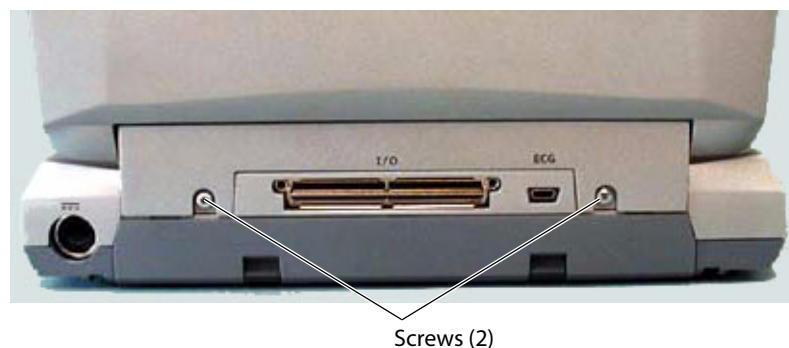


Figure 7.1 System Rear

- 3 Lay the system on the top and remove the two screws from the bottom of the system per [Figure 7.2](#).



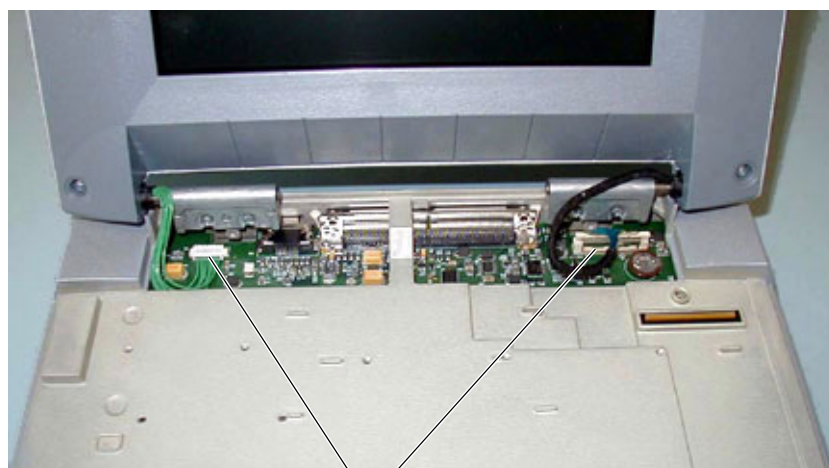
Figure 7.2 System Bottom

- 4 Turn the system over, fully open the display, and lift off the Control Panel per [Figure 7.3](#).



Figure 7.3 Control Panel Removal

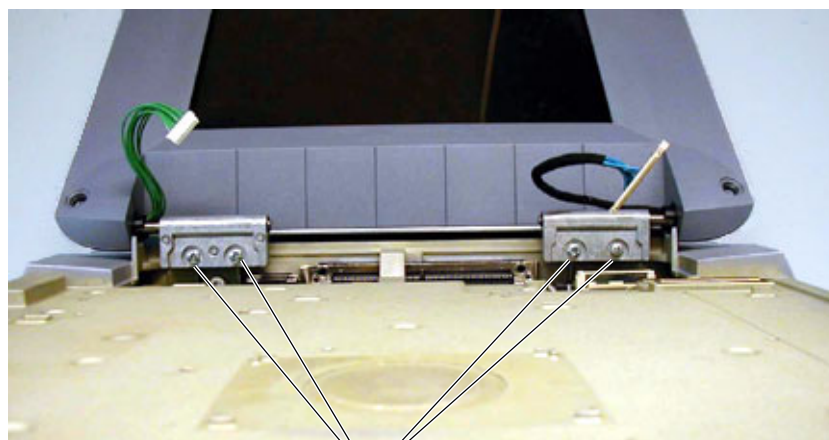
- 5 Disconnect the two connectors from the display to the Main PCBA per [Figure 7.3.3.5](#).



Connectors (2)

Figure 7.4 Display Connectors

- 6 Remove the four screws from the Display Hinges per [Figure 7.5](#).



Screws (4)

Figure 7.5 Display Screws

### 7.1.4 Display Replacement

- 1 Set the new display in place.
- 2 Install the four screws that hold the Display in place. Torque the screws to 5.5 inch pounds.
- 3 Connect the two connectors that connect the Display to the Main PCBA.
- 4 Place the Control Panel in place.
- 5 Reinstall the four screws that hold the Control Panel in place. Torque the screws to 5.5 inch pounds.

### 7.1.5 Test the Display

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

## 7.2 Control Panel Subassembly Replacement

### 7.2.1 Required Parts

- P03862 Service Assembly, Control Panel TITAN, English or
- P03863 Service Assembly, Control Panel TITAN, English, International, or
- P03864 Service Assembly, Control Panel TITAN, French, or
- P03865 Service Assembly, Control Panel TITAN, German, or
- P03866 Service Assembly, Control Panel TITAN, Italian, or
- P03867 Service Assembly, Control Panel TITAN, Spanish, or
- P03868 Service Assembly, Control Panel TITAN, Portuguese

### 7.2.2 Required Tools

- #1 Phillips screwdriver
- Torque screwdriver, 2.0–10.0 in./lb. (0.23–1.1 newton meter)
- 8 mm nut driver
- 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.

### 7.2.3 Control Panel Removal

- 1 Remove the two screws from the rear of the system per [Figure 7.1](#).
- 2 Remove the two screws from the bottom of the system per [Figure 7.2](#).
- 3 Turn the system over, fully open the display, and lift off the Control Panel per [Figure 7.3](#).

### 7.2.4 Control Panel Replacement

- 1 Place the new control panel in place.
- 2 Install the four screws removed in [Section 7.2.3](#). Torque the screws to 5.5 inch pounds.

## 7.3 Main System Disassembly for Repair and/or Replacement

### 7.3.1 Required Parts

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

- P03871 Service Assembly Main PCBA, TITAN
- P03870 Service Assembly Power Supply, TITAN
- P03869 Service Assembly TGC, TITAN
- P03872 Service Assembly Speaker, TITAN
- P03873 Service Assembly Upper Enclosure, TITAN
- P03874 Service Assembly Lower Enclosure, TITAN

*Note: Replacing the enclosure bottom requires printing a new label for the product. This must be printed prior to shipping the enclosure bottom. You will be required to provide the information to print this label.*

- Nest Frame Assembly, TITAN (order these parts individually)
  - P00364 Connector, Interposer
  - P00524 Screw, Shoulder, Thrust Plate
  - P00353 Wear Plate
  - P00646 Spring, Thrust Plate
  - P02860 Nest Plate, Interposer
  - P00352 Shield, Perimeter, Long
  - P00527 Shield, Perimeter, Short
  - P02861 Post, Mounting

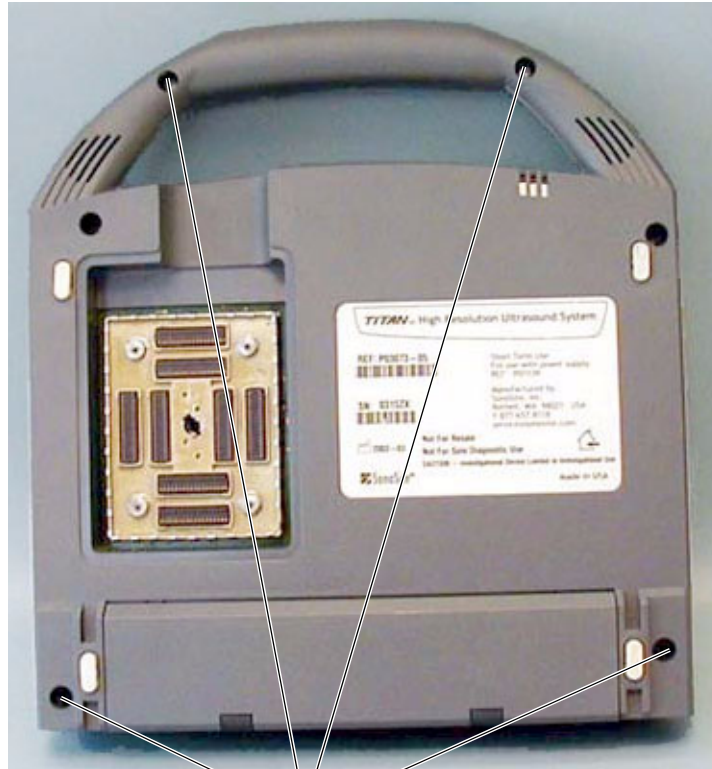
### 7.3.2 Required Tools

- #1 Phillips screwdriver
- Torque screwdriver, 2.0–10.0 in./lb. (0.23–1.1 newton meter)
- 8 mm nut driver
- 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.

### 7.3.3 Main PCBA Removal

- 1 Remove the display and the control panel from the system following the removal procedures in [Section 7.1.3](#) and [Section 7.2.3](#).
- 2 Remove the additional 4 screws from the bottom of the system per [Figure 7.6](#).



Screws (4)

Figure 7.6 Bottom Screws

- 3 Turn the system over and remove the top enclosure from the main PCBA. This exposes all of the replaceable parts for the main system per [Figure 7.7](#).



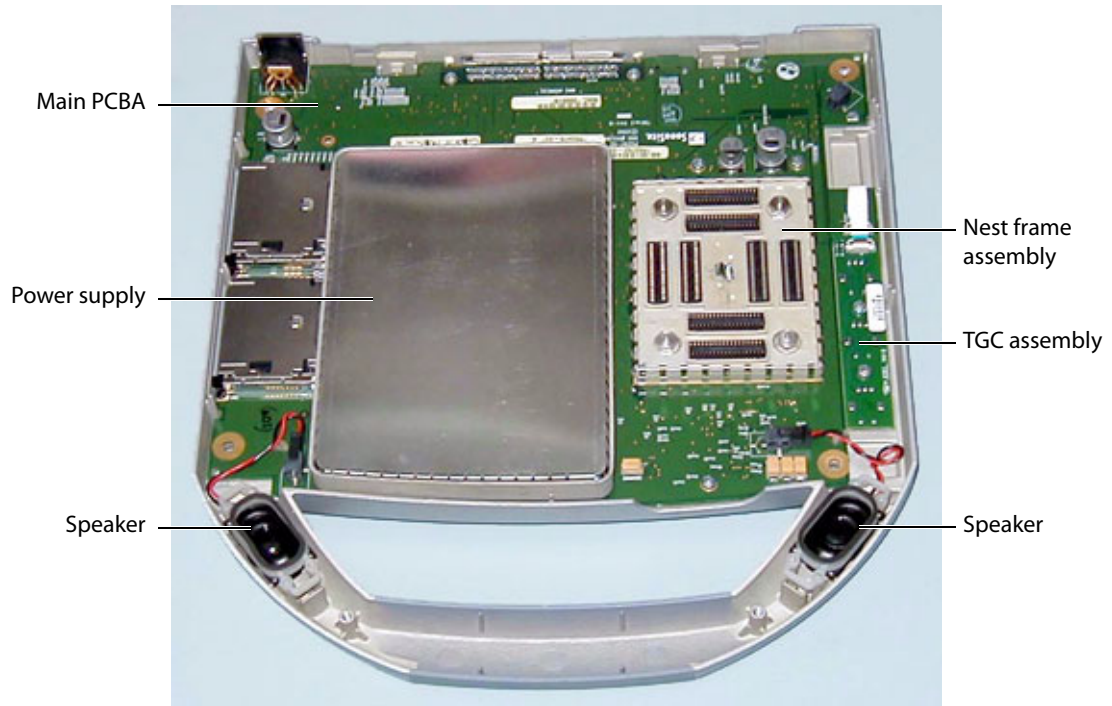


Figure 7.7 System Components

### 7.3.3.1 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 7.8](#).

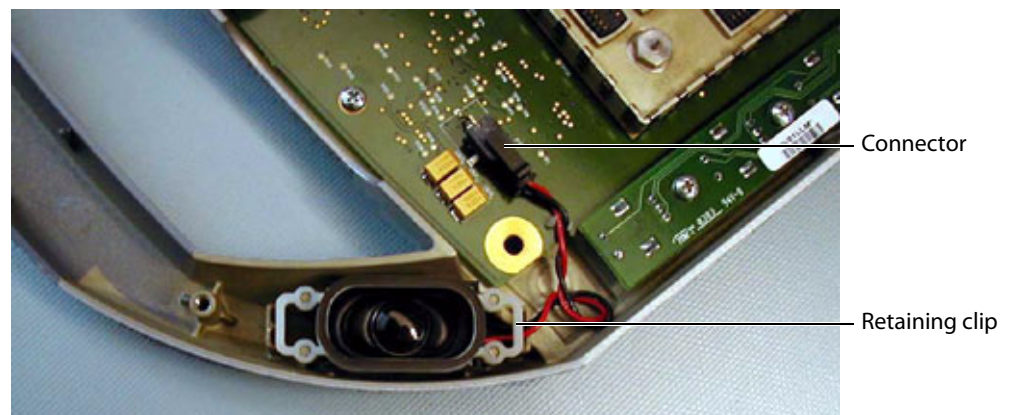


Figure 7.8 Speaker Replacement

### 7.3.3.2 Power Supply

- 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 7.9](#).

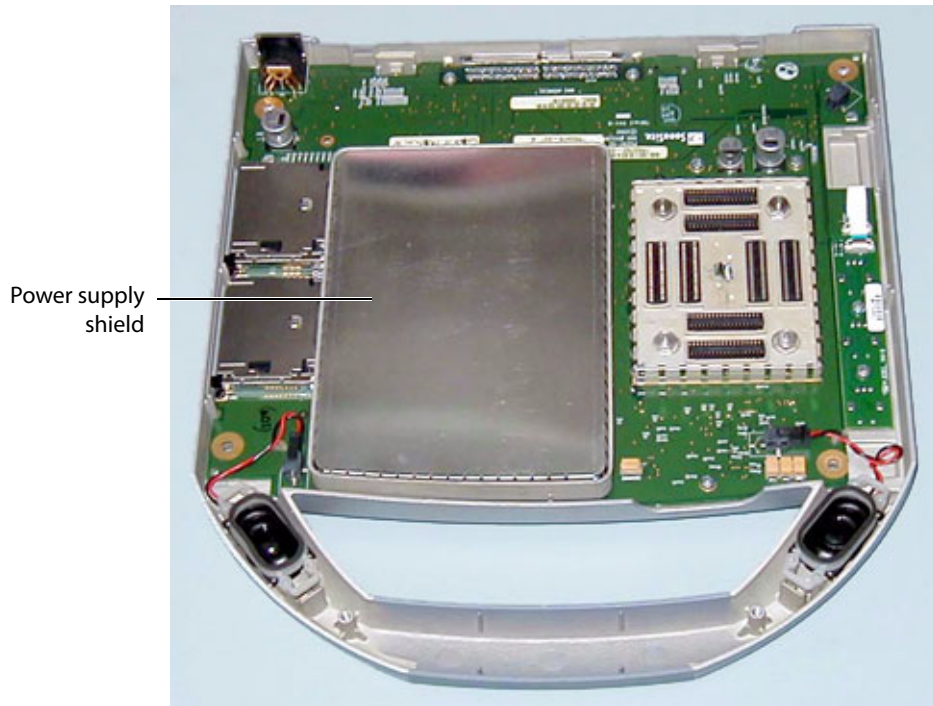


Figure 7.9 Power Supply Shield

- 2 Remove the 7 screws that hold down the power supply PCB per [Figure 7.10](#).
- 3 Gently lift the power supply and shield assembly away from the Main PCBA.

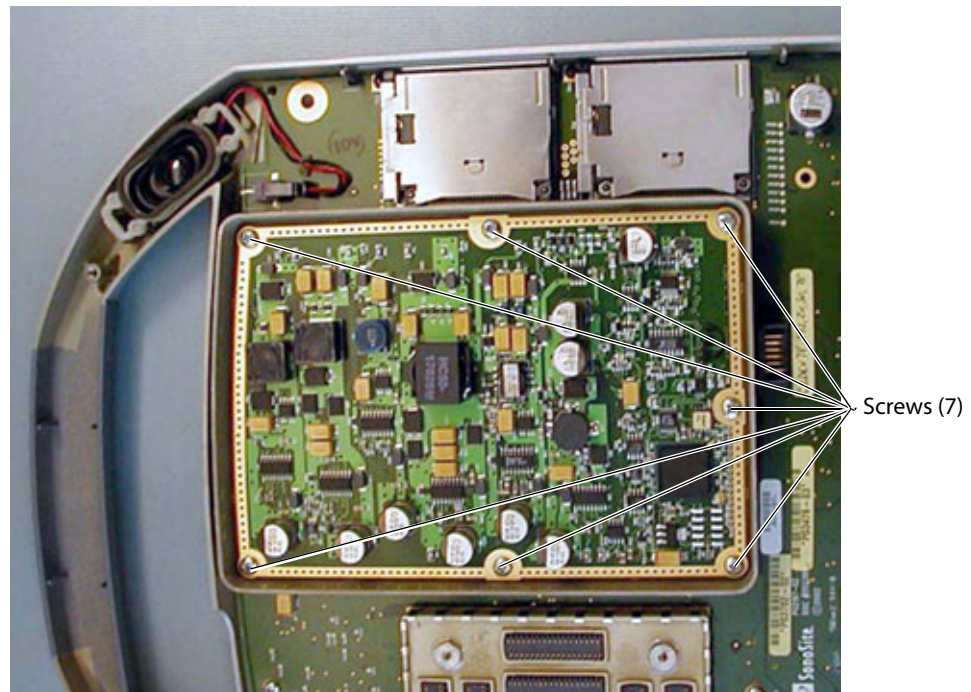


Figure 7.10 Power Supply Screws



### 7.3.3.3 TGC PCBA

- 1 Remove the TGC knobs identified in [Figure 7.11](#).

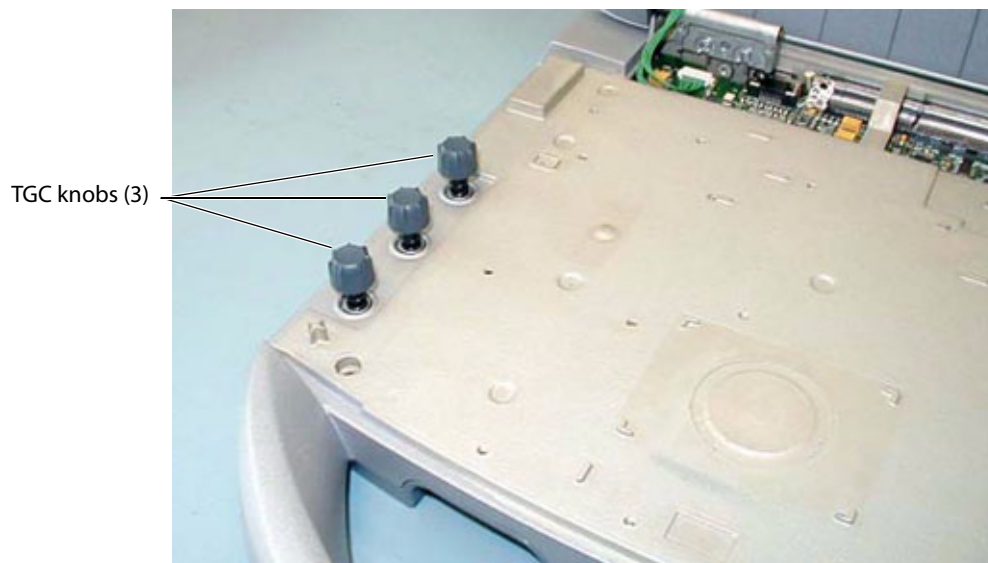


Figure 7.11 TGC Knobs

- 2 Remove the flex cable from the TGC PCB by lifting on the flex release tab. See [Figure 7.12](#).
- 3 Remove the flex cable from the Main PCBA by lifting gently on the flex release tab.
- 4 Remove the two screws holding the TGC PCBA in place.

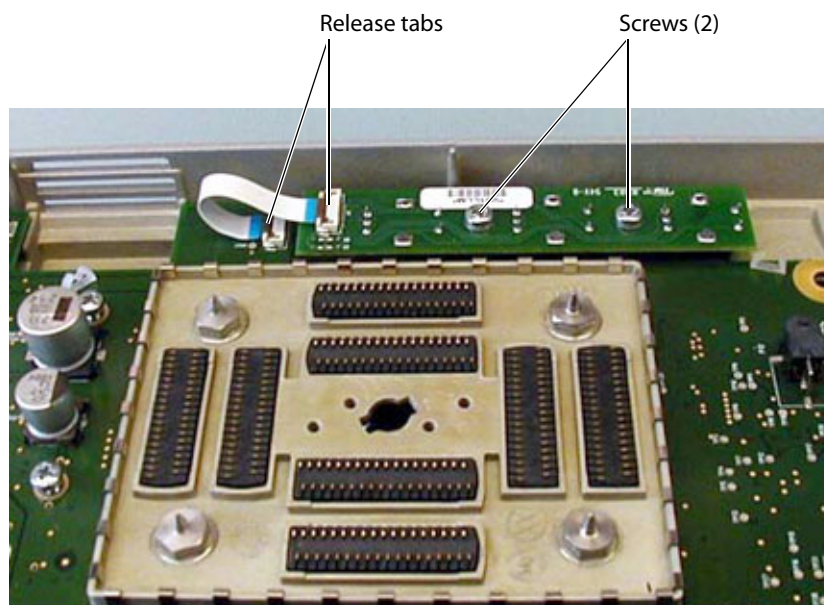


Figure 7.12 TGC Removal

### 7.3.3.4 Main PCBA

- 1 Remove the 3 screws holding the Main PCBA in place per [Figure 7.13](#).
- 2 Remove the 4 shoulder bolts holding the transducer nest frame assembly in place. 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.
- 3 Disconnect the speaker wires from the Main PCBA.
- 4 Remove the TGC PCBA following the procedure in [Section 7.3.3.3](#).

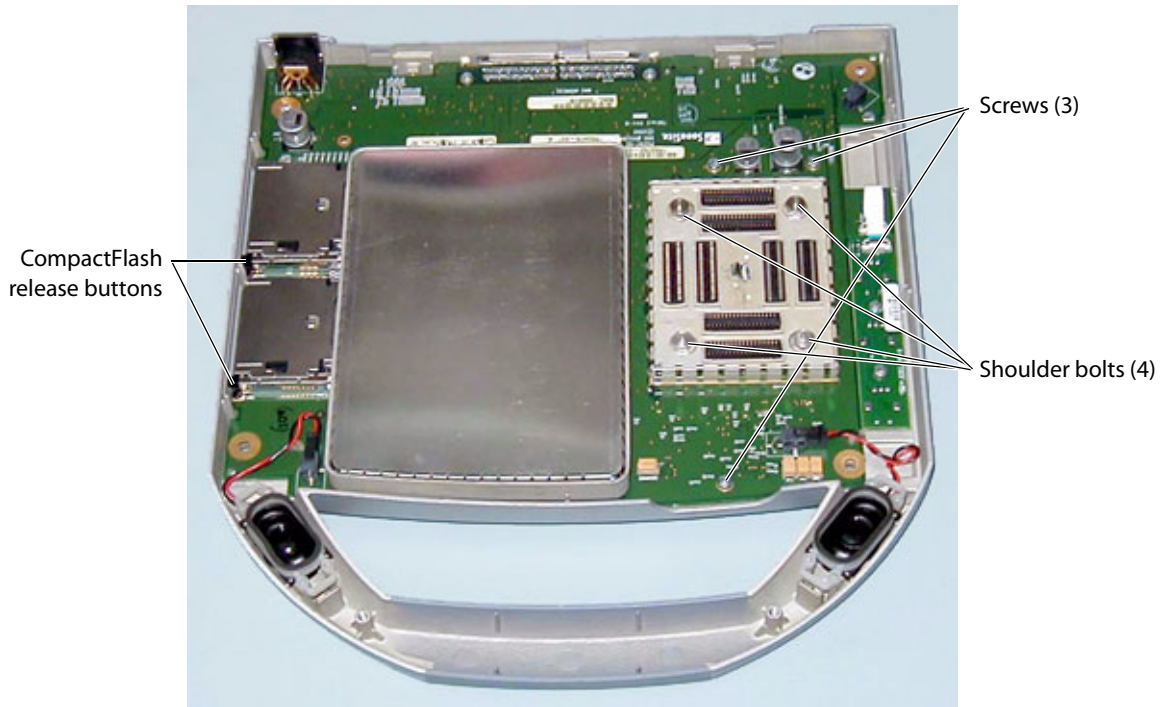


Figure 7.13 Main PCBA Screws

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

*Note: As the Main PCBA is removed press in on the CompactFlash release buttons so they clear the opening in the bottom enclosure.*

### 7.3.3.5 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 Replace the Nest Frame Assembly.
- 3 Reconnect the speaker wires.
- 4 Replace the power supply assembly.
- 5 Replace the TGC assembly.
- 6 Reinstall the shield to the Power Supply.
- 7 Tighten all screws to their specified torque of 5.5 inch pounds.

## Chapter 8: Performance Testing

### 8.1 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.

- Verify that all controls operate smoothly over their full range and that the system responds properly.
- To obtain 2D images, SonoSite recommends using the RMI 413A Soft Tissue Phantom or the RMI 403 GS Multipurpose Phantom. Any equivalent Phantom is acceptable.
- To obtain Power Doppler images, SonoSite recommends using the RMI 425 Doppler Phantom or the RMI 1425A Doppler Phantom. Any equivalent Phantom is acceptable.
- When making penetration measurements on a phantom, apply the phantom reference value and tolerance to the measurement.

### 8.2 Test Equipment

- SonoSite ultrasound system under test
- C60/5-2 MHz transducer
- C15/4-2 MHz transducer
- RMI 413A Soft Tissue Phantom, RMI 403 GS Multipurpose Phantom, or the equivalent
- RMI 425 Doppler Phantom, RMI 1425A Doppler Phantom, or the equivalent
- Video Printer
- External Monitor
- Acoustic gel

### 8.3 Setting Up Performance Tests

**To set up the performance tests:**

- 1 Attach the C60/5-2 MHz transducer to the system.
- 2 Select general 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).

### 8.3.1 Scan Reference Orientation

---

**To set up the scan reference orientation:**

- 1 Verify that the correct transducer name appears in the upper right corner of the system display.
- 2 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.
- 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.

## 8.4 Testing 2D Performance

---

**To test 2D performance:**

- 1 Use a C60/5-2 MHz transducer in 2D mode.
- 2 Adjust the position of the C60/5-2 MHz transducer on the phantom.
- 3 Use the 2D system controls to obtain a clear image that shows both the horizontal and vertical rows of pins.

### 8.4.1 2D Image Quality

---

**To test 2D image quality:**

- 1 Verify that the ultrasound image appears uniform in both the axial and lateral direction, with no dropouts or intensity variations.
- 2 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.

### 8.4.2 Axial Measurement Accuracy

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

---

**To set up axial accuracy:**

- 1 Acquire the image.
- 2 Press the **Freeze** key.
- 3 Press the **Caliper** key. The caliper appears on the image display. The screen menu indicates Cal 1, Cal 2, and Ellipse. (If the caliper line setup is on, then a dotted line connects the two calipers. See the *TITAN Ultrasound System User Guide*, if necessary.) The Cal 1 caliper is active by default.
- 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.)
- 7 To perform another distance measurement on the image, select the other distance icon and repeat the preceding steps.

**To test axial 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 8.1](#).

**8.4.3 Lateral Measurement Accuracy****To set up the lateral measurement accuracy:**

Perform steps 1 through 7 in [Section 8.4.2](#).

**To test the 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 8.1](#).
- 3 Press the **Freeze** key to return the system to live 2D mode.

**Table 8.1: System Measurement Accuracy**

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

**8.4.4 Penetration****To test penetration:**

- 1 Adjust the system controls to obtain a clear image that shows the limits of echo penetration as shown in [Table 8.2](#).
- 2 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.

**Table 8.2: Imaging Performance**

Imaging Performance	C60	ICT	C15	L38	C11
2D Penetration	11.5 cm	5.0 cm	19.0 cm	6.0 cm	5.0 cm

## 8.5 Additional Performance Tests

### 8.5.1 CPD

---

#### To test CPD:

*Note: Use the RMI 425 Doppler Phantom or the RMI 1425A Doppler Phantom.*

- 1 Connect any transducer and set up the system for CPD mode.
- 2 Acquire the image.
- 3 Press and release the **Color** key for CPD/DCPD mode. Select CPD from the on-screen menu. A Region of Interest (ROI) box is displayed on top of the grayscale image. (Press the **2D** key to return to 2D imaging.)

---

#### To move the CPD image:

- Use the touchpad to move the CPD ROI. While you are moving the CPD ROI, you will see an outline of the new position moving on the display. When you stop moving, the new position will display the CPD ROI. (The size of the CPD ROI is fixed. There is no control to change it.)

---

#### To adjust CPD gain:

Turn gain clockwise to increase the amount of CPD gain. (While in CPD imaging, near and far affect only the 2D image; they do not affect the CPD image.)

Turn gain counterclockwise to decrease the amount of CPD gain.

- 1 Image the vessel using a Doppler phantom. Verify that as the gain controls increase and decrease, Doppler echo intensity increases and decreases to correspond. Verify that no flow exists outside the vessel.
- 2 Save a CPD image by pressing the **Freeze** key and then the **Save** key.

### 8.5.2 Directional Color Power Doppler (DCPD)

---

#### To test DCPD:

*Note: Use the RMI 425 Doppler Phantom or the RMI 1425A Doppler Phantom.*

- 1 Set up the system per [Section 8.5.1](#) for CPD mode.
- 2 Select DCPD. Press DCPD on the on-screen menu while in CPD mode. A Region of Interest (ROI) box is displayed on top of the 2D grayscale. (Press the **2D** key to return to 2D imaging.)

---

#### To move the DCPD image:

- Use the touchpad to move the DCPD ROI. While you are moving the DCPD ROI, you will see an outline of the new position moving on the display. When you stop moving, the new position will display the DCPD ROI. (The size of the DCPD image is fixed. There is no control to change it.)

**To adjust DCPD gain:**

- Turn gain clockwise to increase the amount of DCPD gain. (While in DCPD imaging, near and far affect only the 2D image; they do not affect the DCPD image.)
  - Turn gain counterclockwise to decrease the amount of DCPD gain.
- 1 Image the vessel using a Doppler phantom. Verify that as the gain controls increase and decrease, Doppler echo intensity increases and decreases to correspond. Verify that no flow exists outside the vessel.
  - 2 Save a DCPD image by pressing the **Freeze** key and then the **Save** key.

### 8.5.3 M Mode Imaging

**To test M Mode Imaging:**

- 1 Attach a C60 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. Press it again to return to live imaging.
- 7 Press the **2D** key to return to 2D imaging.

### 8.5.4 Tissue Harmonic Imaging

**To test THI Imaging:**

- 1 Attach the C60 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 is 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 **THI** key again to turn off Tissue Harmonic Imaging.

### 8.5.5 Pulsed Wave (PW) Doppler Imaging

**To test PW Doppler Imaging:**

- 1 Attach the C15 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 Gently tap the top of the gel and observe a reflection on the spectral trace and the sound from the speakers.
- 6 Press the **2D** key to return to 2D imaging.



### 8.5.6 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 [Section 8.3, “Setting Up Performance Tests,” on page 59](#) and [Section 8.5.1, “CPD,” on page 62](#).
- 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.

### 8.5.7 Image Review

Review all saved images and verify that the images are displayed properly.

### 8.5.8 Printer

---

**To test printer operation:**

- 1 Print two images in rapid succession and verify proper operation.
- 2 Verify that the print control on the system functions correctly.

### 8.5.9 Battery Charging

---

**To 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 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.
- 5 If charging is not evident, see [Chapter 6, “Troubleshooting”](#) for troubleshooting procedures.

### 8.5.10 Video Output

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

---

**To test the 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 6, “Troubleshooting”](#) for troubleshooting procedures.



## **8.6 Returning Products to SonoSite**

### **8.6.1 Contacting SonoSite Technical Support**

For technical support of any SonoSite product, do one of the following:

- USA/Canada customers: 1-877-657-8118
- International customers: 425-951-1330
- Technical support fax: 1-425-951-6700
- Technical support e-mail: [service@sonosite.com](mailto:service@sonosite.com)
- SonoSite website: [www.sonosite.com](http://www.sonosite.com) and select Products & Solutions and then Technical Support

You will be asked to provide the following information by telephone or e-mail:

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

### **8.6.2 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



## Chapter 9: Accessory Service

This chapter contains information on servicing the *TITAN* mobile docking system (docking system) and the *TITAN* mini-dock. For information about installation and operating instructions for these peripherals consult the *TITAN* Ultrasound System User Guide.

### 9.1 Mobile Docking System

The docking system provides a mobile work platform and recharges the internal battery. The docking system includes the *TITAN* mini-dock with connections to an external printer and/or monitors, power supply, USB connection to SiteLink Image Manager, VGA connection, and S-Video connection. The docking system provides a storage area for the transducers and other supplies.

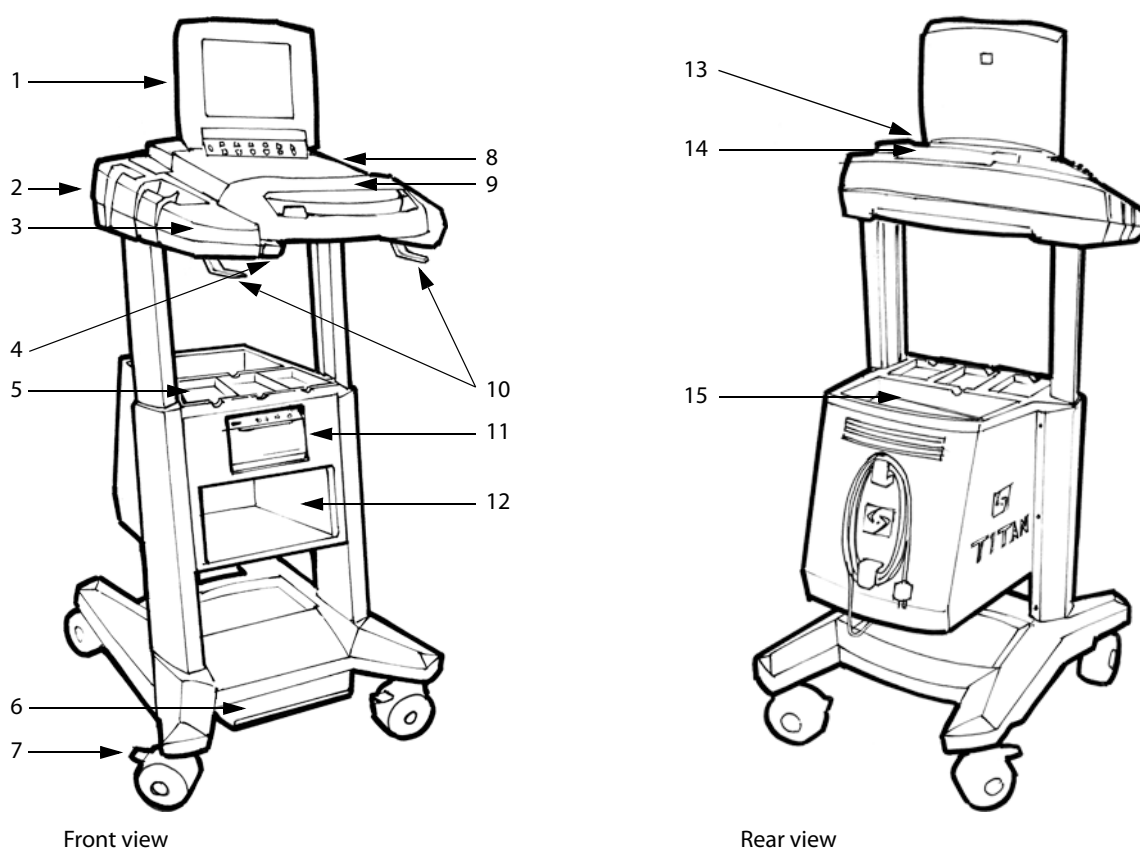


Figure 9.1 Docking System, Front and Rear Views

**Table 9.1: Docking System Features**

Number	Description
1	Ultrasound system
2	Transducer, connector, and gel storage on both sides of docking system

**Table 9.1: Docking System Features (Continued)**

Number	Description
3	Side panels (Use to lift, raise, or transport the docking system)
4	Handle release button
5	Transducer storage
6	Height adjustment pedal (Press down on foot pedal, grab sides and raise/lower)
7	Locking wheels (Press down/pull up on locks to lock/unlock)
8	CompactFlash shield
9	Wrist rest/handle
10	Cable hooks
11	Printer bay (black/white only)
12	VCR bay
13	Mini-dock cable cover
14	Mini-dock
15	Storage

**To insert system:**

- 1 Push in the handle release button and lift the handle to the upper most position.
- 2 Close the lid on the ultrasound system and slide into the docking system. Connection will be made when handle is pushed down.
- 3 Press the handle down until an audible click is heard.

**Warning:** To prevent injury, do not use the handle to lift the docking system over an obstacle or threshold. Use the side panels to lift over an obstacle or threshold.

**To remove system:**

- 1 Close the lid on the ultrasound system.
- 2 Push in the handle release button and lift the handle to the upper most position.
- 3 Remove the ultrasound system.

## 9.2 Mini-Dock

The TITAN mini-dock (mini-dock) provides connectivity for the TITAN ultrasound system when the system is out of the docking system. The mini-dock provides connections to an external printer and/or monitors, a power supply, USB connection to SiteLink Image Manager, VGA connection, and S-video connection.

## 9.3 Connectivity

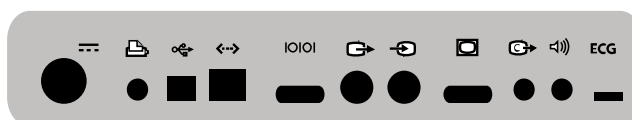










Figure 9.2 Mini-Dock Connections

**Table 9.2: Mini-Dock Connections**

Symbol	Definition
---	DC input
	Print control
	USB
	Ethernet (available on future releases)
IOIOI	RS-232 (VCR control/audio)
	S-video out
	S-video in (available on future releases)
	RGB video out
	Composite video out
	Audio out
ECG	ECG (available on future releases)

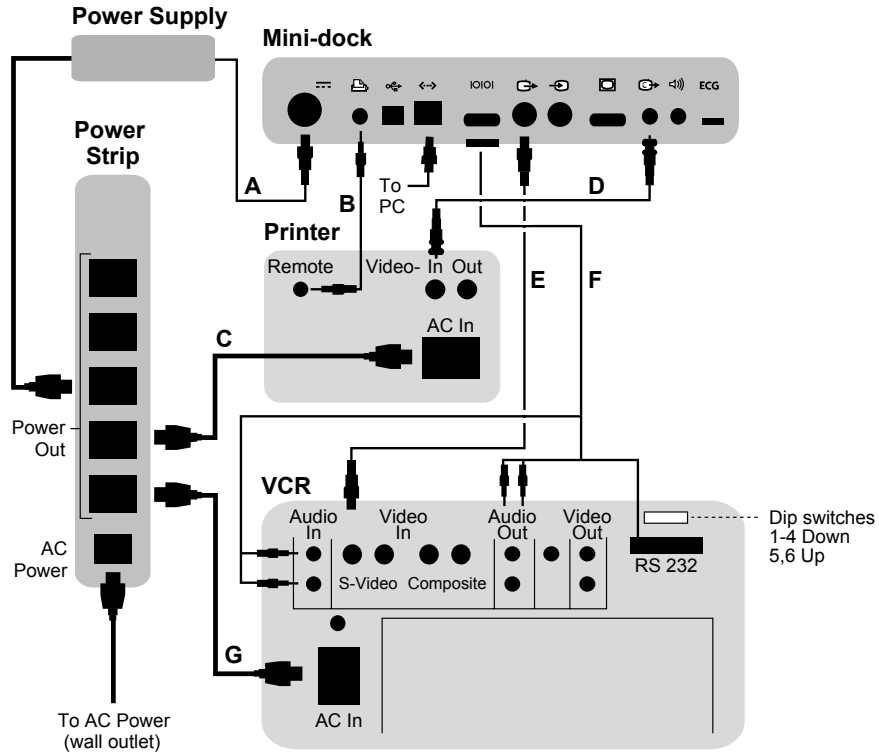


Figure 9.3 Connectivity Diagram

## 9.4 Block Diagrams and Schematics

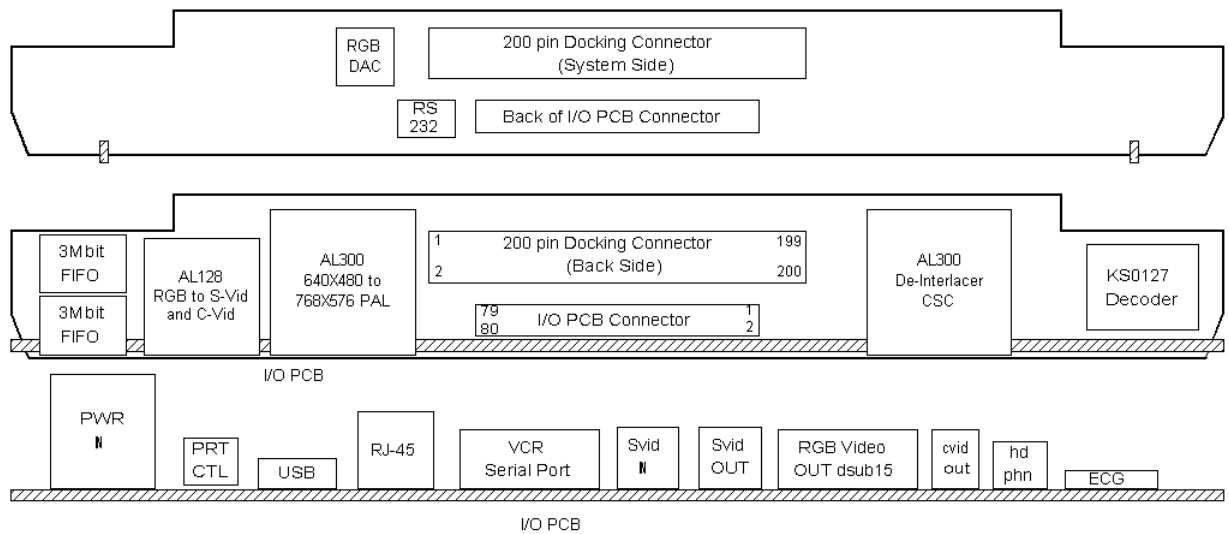


Figure 9.4 Mini-Dock PCB and I/O PCB Component Placement

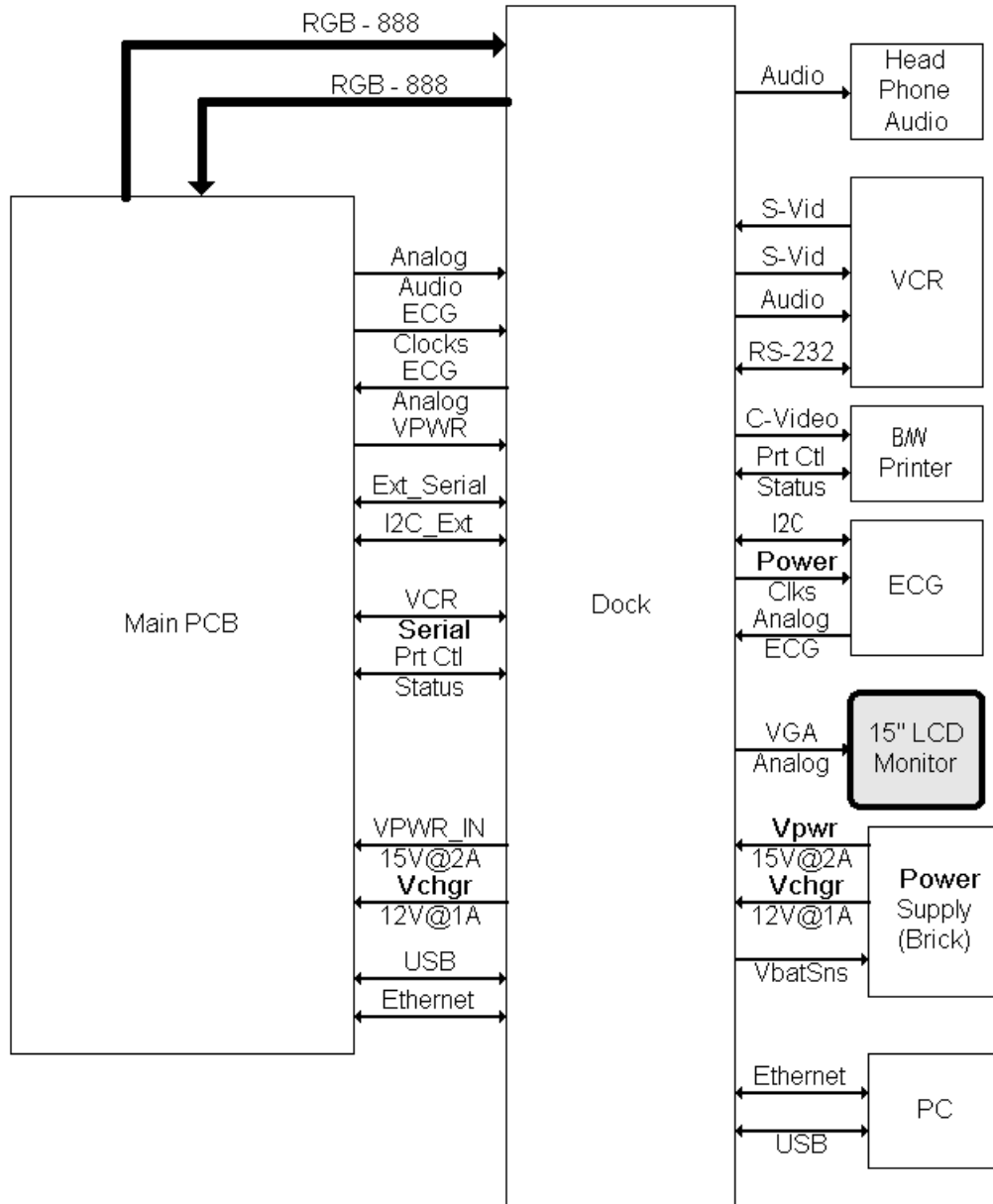


Figure 9.5 TITAN Dock Interface Diagram

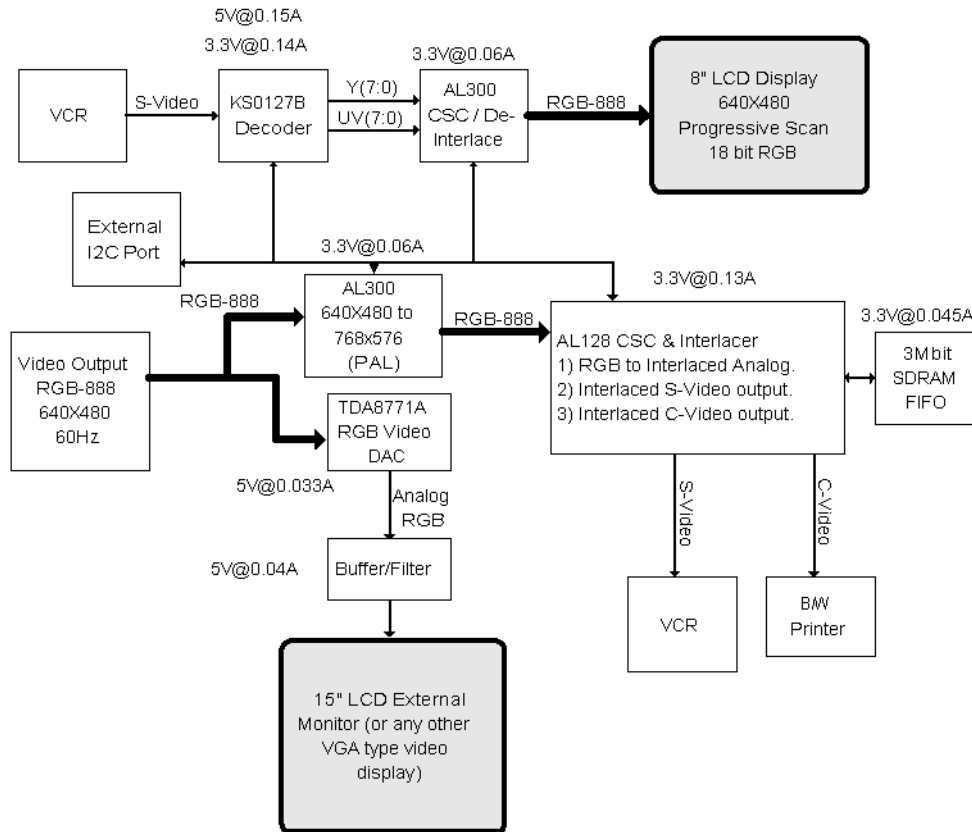
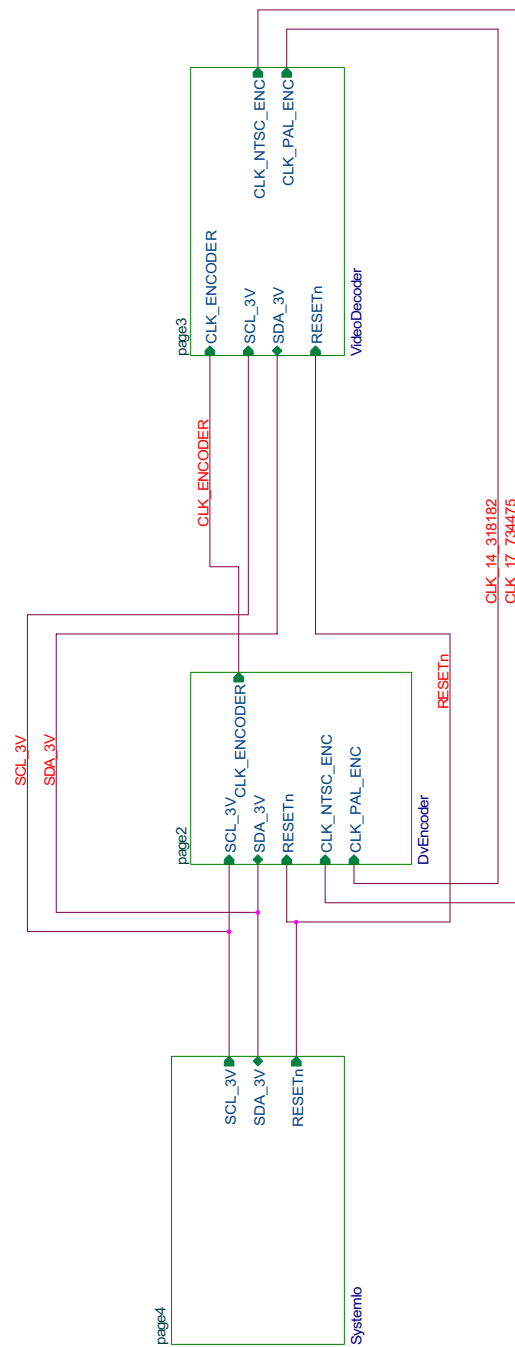


Figure 9.6 Mini-Dock Video Distribution





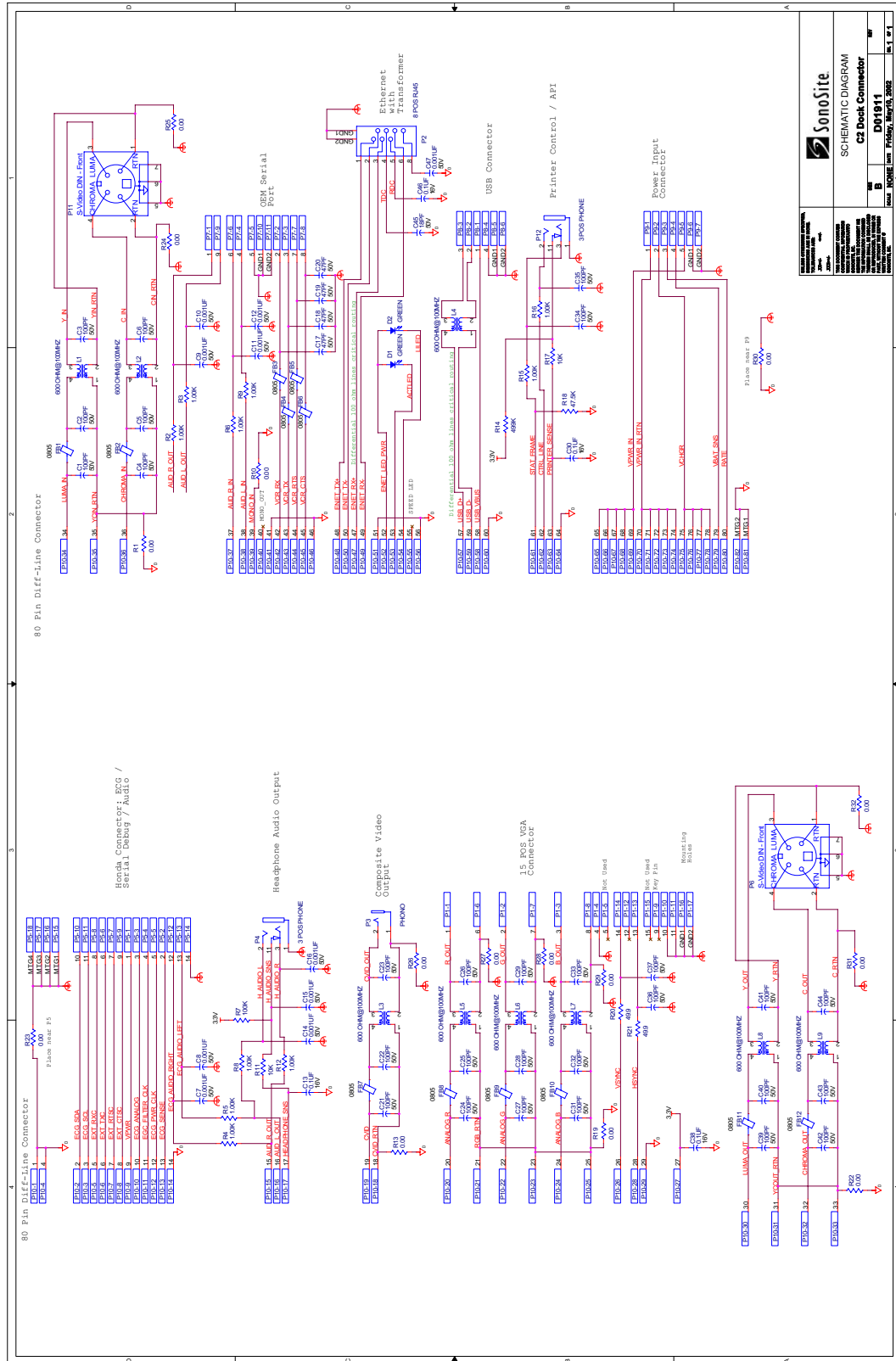
PAL Frequency is 17.734475  
 NTSC Frequency is 14.318182  
 Signals are connected properly, with net names reversed.

Figure 9.7 Mini-Dock Connectors Schematic, Page 1









**SonoSite**  
 SCHEMATIC DIAGRAM  
 C2 Dock Connector  
 D01911  
 Rev. 001  
 Date: 08/01/01  
 Author: [Name]

Figure 9.11 Dock Connectors Schematic

## 9.5 Theory of Operation

### 9.5.1 Video

The video data originates on the main PCBA in  $640 \times 480$ , RGB-888 square pixel format at 60Hz refresh rate NTSC and 50Hz for PAL video.

#### 9.5.1.1 VGA Video Output

The digital RGB data is converted to progressive scan analog RGB on the dock PCB. The analog RGB drives a VGA style connector and is also the input for the video encoder.

#### 9.5.1.2 Analog Interlaced Video Outputs

The digital RGB data is converted to analog interlaced composite and S-Video outputs on the dock PCB. A video processor converts RGB and output in the selected video format.

For NTSC video mode, the processor is converting from progressive scan to interlaced and is responsible for the color space conversion converting from RGB to composite and S-Video.

For PAL video mode, the processor is doing the interlacing and color space conversion and outputs  $768 \times 576$  lines at 50Hz.

#### 9.5.1.3 Video Decoders

A video decoder digitizes the input S-Video data. A separate component performs the de-interlace and converts to digital RGB data.

### 9.5.2 Power Distribution

The battery charger and VPWR signals provided by the AC power supply are intended to be passed through the dock so that the system behaves the same whether the AC power supply is plugged into the dock or directly to the system (with no dock).

The dock uses the 3.3V and 5V power supplies available on the Main PCB. When the dock is connected, the dock provides necessary surge limiting and reset circuitry necessary to ensure proper operation of all components.

The dock provides the capability to turn OFF 3.3V and 5V power supplies to as much of the dock as possible to allow for a minimum power state.

## 9.6 Replacement Procedures

Replacement procedures for all replaceable parts are not discussed in this manual. Replacement of many mechanical parts is intuitive to properly trained service personnel and due to the simple nature of these kinds of repairs procedures are determined to be not necessary.

### 9.6.1 Required Tools

- #1 Phillips screwdriver
- 1/8 inch, 5/32 inch, and 1/4 inch hex wrench, ball type
- 3/8 inch and 1/2 inch wrench or socket
- 13/16 inch and 3/4 inch open end wrench

### 9.6.2 Cup Surround

- 1 Remove the six (6) screws attaching the cup surround to the top of the docking system.



Figure 9.12 Cup Surround Screws

- 2 Lift the cup surround from the docking system.

### 9.6.3 Casters

- 1 Tilt the docking system in any direction and lay it on its side.
- 2 Remove the caster by turning the 13/16 inch nut on the caster shaft counter-clockwise until the caster is removed from the docking system base.
- 3 Install the new caster in the same manner.

### 9.6.4 Power Supply

- 1 Remove the rear cover on the docking system by pressing on the black lever at the bottom of the cover per [Figure 9.13](#).



Figure 9.13 Mobile Docking System Rear Cover

- 2 Pull the cover down and away from the docking system.
- 3 The power supply is located on the upper shelf on the left side.



Figure 9.14 Mobile Docking System Power Supply



- 4 Unplug the power connector from the power strip and from the power supply per [Figure 9.14](#).
- 5 Remove cable cover from top rear of docking system to expose mini-dock wiring.
- 6 Remove the power supply from the docking system by unplugging the cable from the mini-dock per [Figure 9.15](#) and removing the cable tie that attaches it to the docking system.



Figure 9.15 Mini-Dock Connectors

- 7 The power supply cable is threaded through the TITAN support leg from the power supply in the rear up to the mini-dock.
- 8 Lower the docking system to the lowest point.
- 9 Tilt the docking system toward the rear and carefully lower it so it lays on the ground.
- 10 In the right support leg, as you face it from the bottom, you will notice the cables attached to a cable tie. Remove the cable tie and the tape from around the cables.
- 11 Separate the cables and pull the cable from the power supply down to the bottom of the docking system support leg.
- 12 Tilt the docking system back to the upright position and pull the power supply from the rear of the docking system, pulling the cable up from the support leg.
- 13 Install the new power supply into the rear of the docking system and thread the cable down the support leg.
- 14 Lay the docking system back down, pull the excess cable free then thread the cable up the support leg to the top of the docking system.
- 15 Attach the power supply connector to the mini-dock and replace the cable tie.
- 16 Retape the wires and reattach the wires to the support leg with a new cable tie.
- 17 Install the power supply power cord.

### 9.6.5 Locking Handle

- 1 Remove the six (6) screws attaching the cup surround to the top of the docking system per [Figure 9.12](#).
- 2 Lift the cup surround from the docking system.
- 3 Remove the two 3/8 inch locking nuts from the handle screws per [Figure 9.12](#).
- 4 Remove the two 1/8 inch hex screws holding the handle in place per [Figure 9.16](#).



Figure 9.16 Handle Screws

- 5 Lift the handle from the docking system. Remove the retaining clip from the latch link assembly and remove the handle.
- 6 Install the new handle and reassemble the docking system in the reverse order.

### 9.6.6 Deflector

- 1 Remove the six (6) screws attaching the cup surround to the top of the docking system per [Figure 9.12](#).
- 2 Lift the cup surround from the docking system.
- 3 Peel the old deflector from the frame per [Figure 9.16](#).
- 4 Clean any adhesive residue from the frame.
- 5 Install the new deflector in place of the old deflector noting the notches cut out for the attaching hardware.
- 6 Reinstall the cup surround.

### 9.6.7 Mini-Dock

- 1 Remove the cover from the top of the docking system just behind the mini-dock per [Figure 9.17](#) to expose the cables attached to the mini-dock.
- 2 Disconnect all of the cables.



Figure 9.17 Mobile Docking System Cable Cover

- 3 Raise the docking system to the highest point by pressing on the foot pedal and lifting on the outer edges of the cup surround.
- 4 Looking under the top of the docking system note two access holes per [Figure 9.18](#). These access holes are to remove the two (2) screws holding the mini-dock in place.

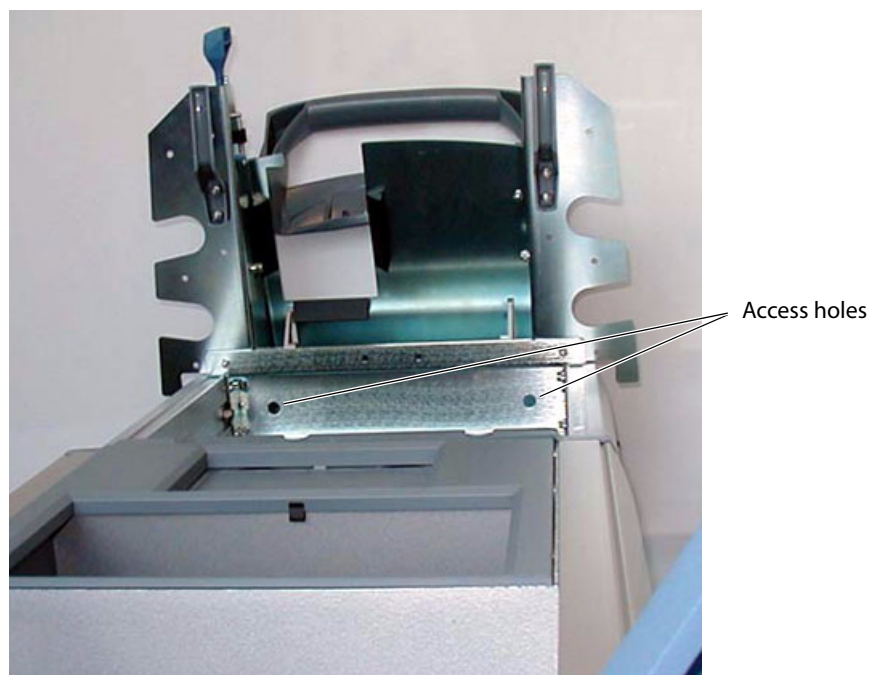


Figure 9.18 Mini-Dock Access Holes

- 5 Looking from the front of the docking system find the two screws holding the mini-dock in place and remove them using a Phillips screwdriver.



Figure 9.19 Mini-Dock Screws

- 6 Lift the mini-dock from the docking system.
- 7 Reinstall the mini-dock by following these steps in reverse order.

## Appendix A: Parts List

This section contains a list of field-replaceable parts.

### A.1 Replacement Parts List

The following tables contain all the replaceable parts for the TITAN Ultrasound System. All quantities are one unless otherwise noted.

#### A.1.1 Display



**Table A.1: Display**

Part Number	Description
P03861	Service Assembly Display TITAN

A.1.2 Control Panel

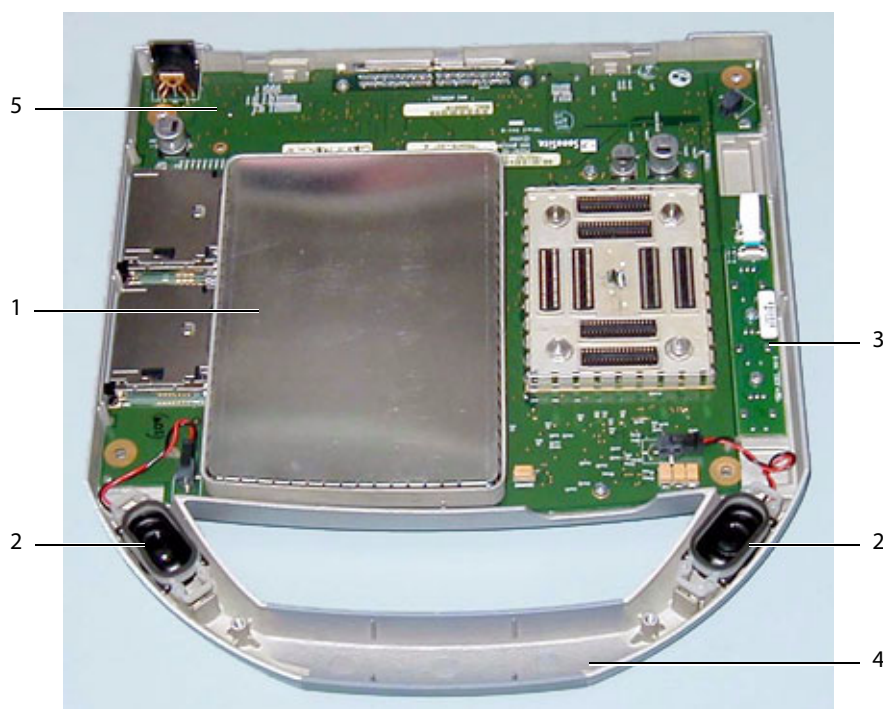


Table A.2: Control Panel

Part Number	Description
P03862	Service Assembly Control Panel, TITAN, English
P03863	Service Assembly Control Panel, TITAN, English, International
P03864	Service Assembly Control Panel, TITAN, French
P03865	Service Assembly Control Panel, TITAN, German
P03866	Service Assembly Control Panel, TITAN, Italian
P03867	Service Assembly Control Panel, TITAN, Spanish
P03868	Service Assembly Control Panel, TITAN, Portuguese



### A.1.3 Replacement Parts, System



**Table A.3: System**

Find Number	Part Number	Description
1	P03870	Service Assembly Power Supply, TITAN
2	P03872	Service Assembly Speaker, TITAN
3	P03869	Service Assembly TGC, TITAN
4	P03873	Service Assembly Upper Enclosure, TITAN
not shown	P03874	Service Assembly Lower Enclosure, TITAN Note: This part requires printing a replacement label for the product. Contact SonoSite Technical Support when ordering this part to have the label printed and placed on the part.
5	P03871	Service Assembly Main PCBA, TITAN 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.

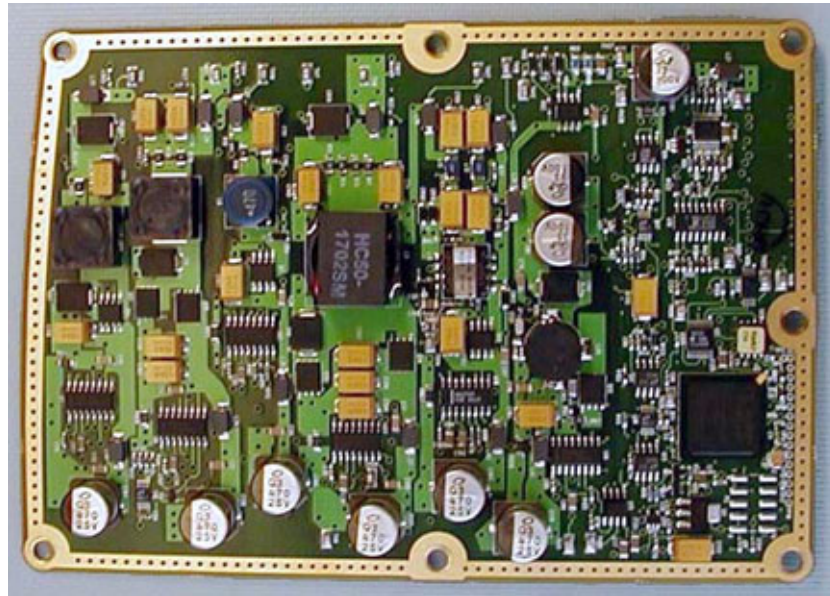


Figure A.1 Power Supply, P03870

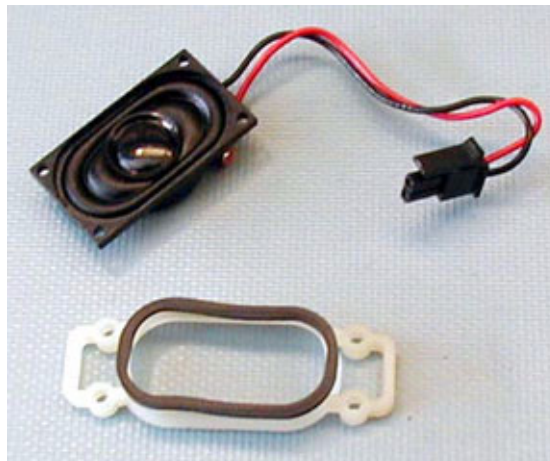


Figure A.2 Speaker Assembly, P03872



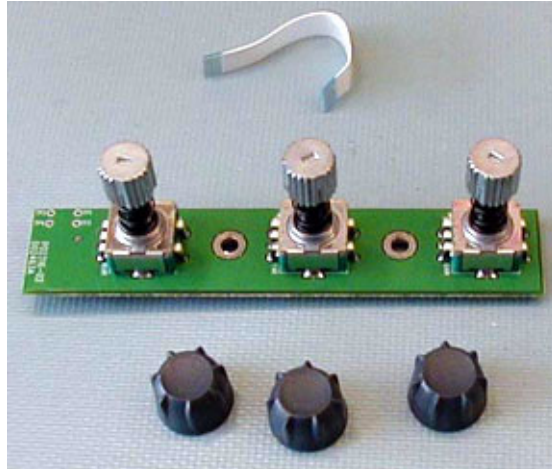


Figure A.3 TGC Assembly, P03869

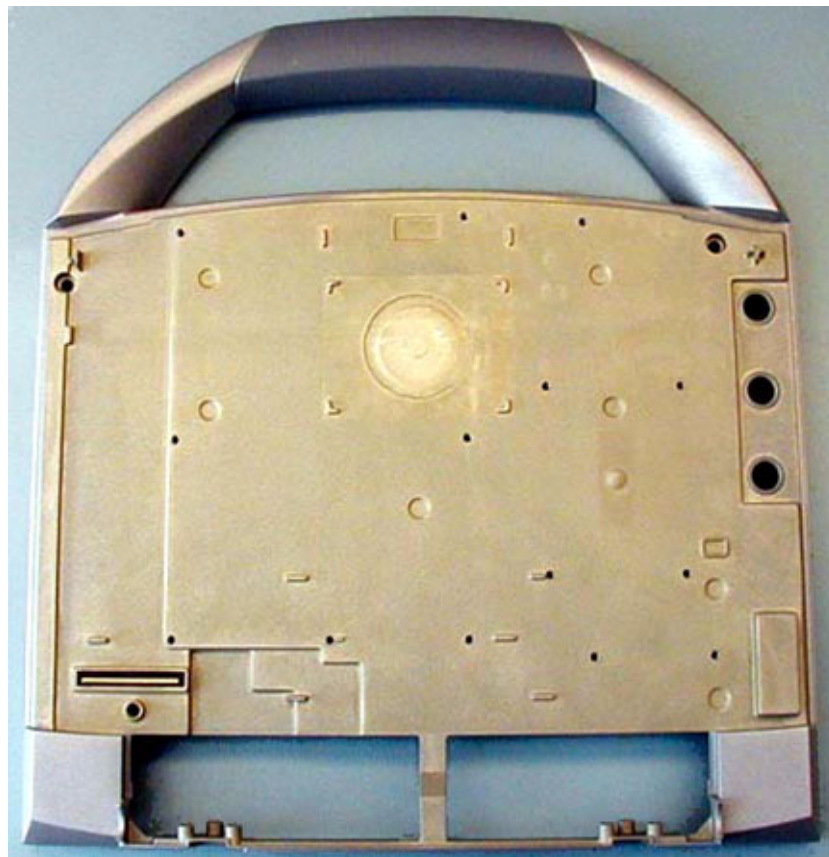


Figure A.4 Upper Enclosure, P03873

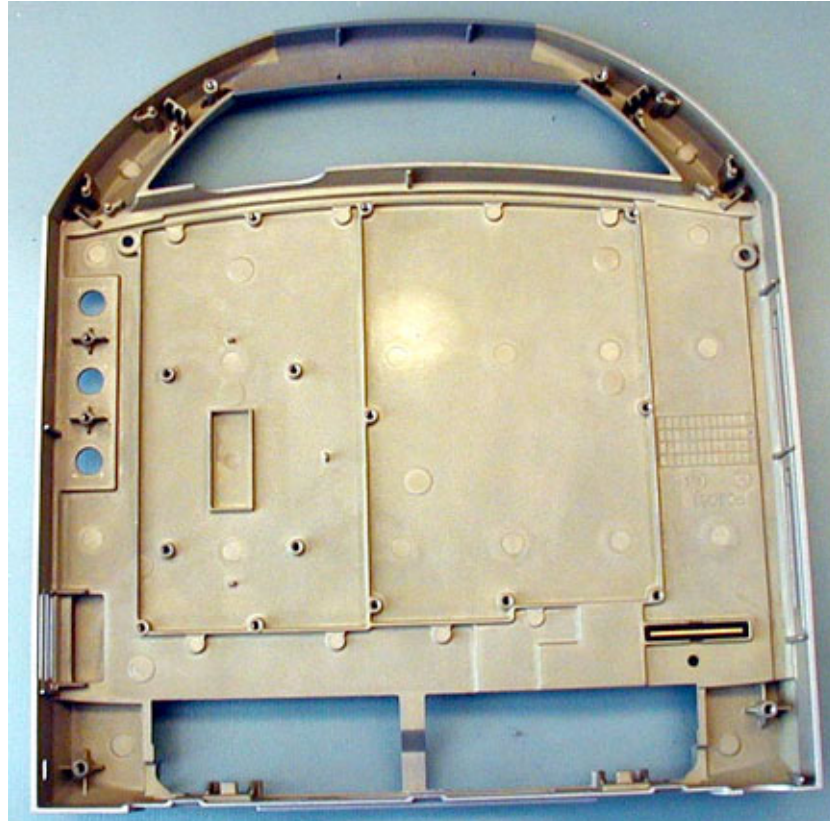


Figure A.5 Lower Enclosure Assembly, P03874 (top view)



Figure A.6 Lower Enclosure, P03874 (bottom view)

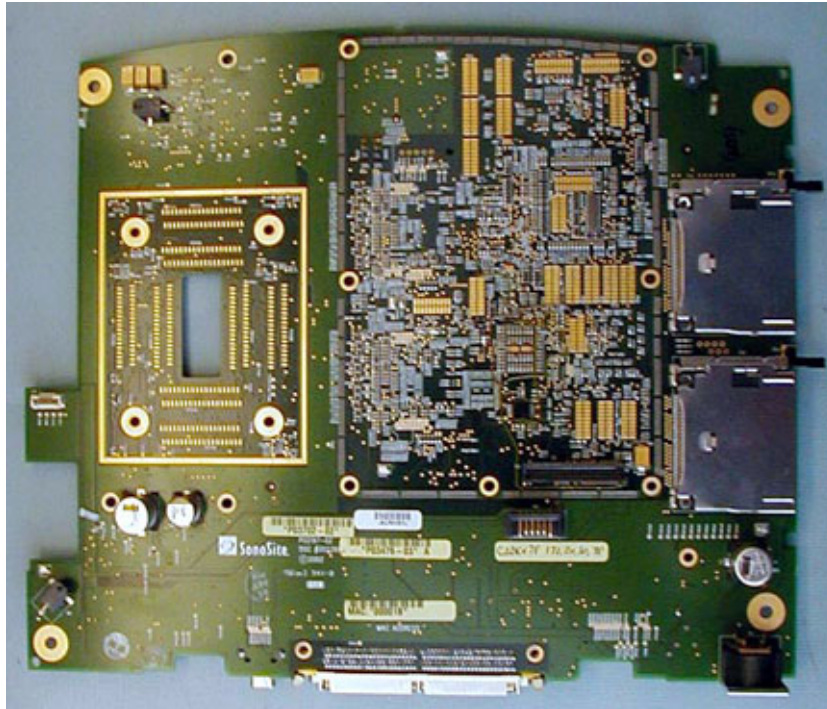


Figure A.7 Main PCB Assembly, P03871

### A.1.4 Transducer Nest Frame Assembly

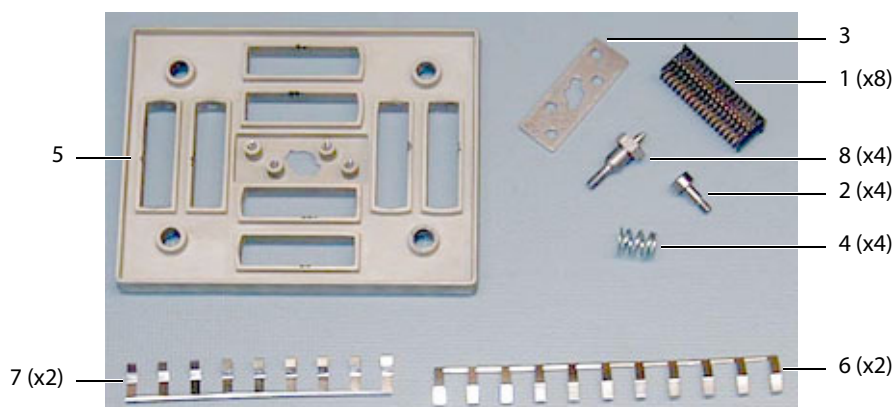


Figure A.8 Nest Frame Parts

**Table A.4: Nest Frame Assembly**

Find Number	Part Number	Description
1	P00364	Connector, Interposer
2	P00524	Screw, Shoulder, Thrust Plate
3	P00353	Wear Plate
4	P00646	Spring, Thrust Plate, .047 wire
5	P02860	Nest Plate, Interposer, TITAN
6	P00352	Shield, Perimeter, Long
7	P00525	Shield, Perimeter, Short
8	P02861	Post, Mounting, TITAN



### A.1.5 AC Adapter



Figure A.9 Power Supply/Battery Charger, P01139

Part Number	Description
P01139	Power Supply/Battery Charger

## A.1.6 Mini-Dock



Figure A.10 Mini-Dock Assembly, P03875



Figure A.11 Mini-Dock Rear Connector, P03875

**Table A.5: Mini-Dock**

Part Number	Description
P03875	Service Assembly Mini-Dock, TITAN

### A.1.7 Mobile Docking System



Figure A.12 Mobile Docking System Front View





Figure A.13 Mobile Docking System Rear View

**Table 2: Replaceable Parts List**

Find Number	Part Number	Part Description
	P00536	Cable, RCA/BNC Video (not shown)
	P00537	Cable, Printer Control (not shown)
	P01139	Power Supply/Battery Charger (not shown)
1	P02491	Base, TITAN MDS
2	P02500	VCR/Printer Enclosure, TITAN MDS
3	P02505	Tray, TITAN MDS

**Table 2: Replaceable Parts List (Continued)**

Find Number	Part Number	Part Description
4	P02506	Front Panel, TITAN MDS
5	P02507	Rear Door, TITAN MDS
6	P02952	Foot Pedal, TITAN MDS
7	P03132	Cable Cover, TITAN MDS
8	P03133	Cup Surround, TITAN MDS
	P03300	Gas Spring, TITAN MDS (not shown)
9	P03301	Hook, Cable, TITAN MDS
	P03302	Outlet Strip, IEC
10	P03303	Button, Release, TITAN MDS
11	P03304	Printer Strap, TITAN MDS
12	P03306	Handle, TITAN MDS
13	P03307	Head Support, TITAN MDS
14	P03310	Caster, Total Lock
15	P03418	Shelf, VCR
	P03443	Assembly, Latch Link (not shown)
16	P03499	Release, Back Door
17	P03500	Caster, Swivel
18	P03595	Deflector, Ejector
	P03610	Latch Spindle, Machined (not shown)
19	P03611	Latch Hook, Machined
	P03613	Latch Lever, Machined (not shown)
	P03653	Spring, Cover (not shown)

## A.2 Ordering Replacement Parts

To order parts, contact SonoSite Technical Support as indicated in [Section 8.6, “Returning Products to SonoSite,”](#) on page 65.

## 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

- USA/Canada customers: 1-877-657-8118
- International customers: 425-951-1330
- Technical support fax: 1-425-951-6700
- Technical support e-mail: [service@sonosite.com](mailto:service@sonosite.com)
- SonoSite website: [www.sonosite.com](http://www.sonosite.com) and select Products & Solutions and then Technical Support

# Service Event Report

## Service Provider

Name:		Date:
Company:		
Address:		
Phone Number:	Fax Number:	
E-mail address:		

## Device Description

Name:	Serial Number:	
Part Number:	Lot Number:	Revision:
Software Version:	Other Identifiers:	

## Event Description


## Diagnosis


## Service Performed

Performed By:	Date:
Actions:	

## 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"/>

*Attach additional sheets as required*

Page \_\_\_ of \_\_\_

F00019 Rev B

# Index

## Numerics

- 2D performance tests
  - axial measurement accuracy 60
  - image quality 60
  - lateral measurement accuracy 61
  - penetration 61

## A

- AC power indicator 22
- accessories 16
- acquisition subsystem 10
- alphanumeric 21
- annotation 21
- assert code 42
- assistance, customer 1

## B

- battery
  - installation 25
  - safety 7
  - specifications 18
  - storage and shipping 18
  - troubleshooting diagram 46
- battery charging test 64

## C

- cable specifications 17
- cable, connect mobile docking system 69
- cautions 5
- connectivity 69
- control panel assembly
  - replacement procedure 52
  - troubleshooting diagram 44
- control subsystem 14
- conventions used 1

## D

- depth 21
- display
  - failures 41
  - subsystem 12
- display assembly
  - replacement procedure 49
  - troubleshooting diagram 43

## E

- error message 6
- external power 25

## F

- forms 22
- freeze 22

## G

- gain 21
- grace period 4

## I

- image
  - problem 39
  - quality verification test 64
  - review 64

## L

- license key
  - install 33
  - obtain 32
- license update screen, display 35

## M

- main PCBA
  - failures 42
  - replacement procedure 53
- measurements/calculations 22
- mini-dock
  - connectivity 27, 69
  - description 69
  - service 69
  - troubleshooting diagram 47
- mobile docking system
  - connectivity 69
  - description 67
  - service 67
  - troubleshooting diagram 47
- mobile docking system connectivity 27
- modes 22
- monitor 16
- moving image 62

## P

- performance tests
  - 2D 60
  - battery 64
  - CPD 62
  - DCPD 62
  - M mode 63
  - overview 59
  - printer 64
  - PW 63
  - THI 63
  - video output 64
- peripherals 17
- phantoms
  - RMI 1425A Doppler 59
  - RMI 403 GS Multipurpose 59
  - RMI 413A Soft Tissue 59
  - RMI 425 Doppler 59
- power
  - battery charge indicators 26
  - battery pack 25
  - subsystem 15
- power supply replacement procedure 56
- print 22
- printer
  - problem 39
  - test 64
- processing subsystem 12
- product failures, reporting 99
- products, returning 65

## R

- recording problem 40
- replacement parts
  - list 85
  - ordering 98
- return material authorization number (RMA) 65

## S

- safety, ergonomic 5
- save image 22
- service event report 99
- shipping instructions 65
- software
  - license 4, 32
  - upgrade 29
- SonoSite technical support, contact 65
- speaker replacement 55
- subassembly replacement 41

- system
  - charging requirements 26
  - dimensions 16
  - information screen 34
  - insert 68
  - measurement accuracy 61
  - overview 9
  - remove 68
  - software 4
  - specifications 16, 18
  - troubleshooting diagram 45
  - upgrade software 29
- system control
  - AC power indicator 22
  - alphanumeric 21
  - annotation 21
  - depth 21
  - forms 22
  - freeze 22
  - gain 21
  - measurements/calculations 22
  - modes 22
  - power 21
  - print 22
  - remappable controls 22
  - save 22
  - select 22
  - THI 21
  - touchpad 22
  - update 22
  - video recording 22
  - zoom 21
- system setup
  - beep alert 23
  - date 23
  - delta key 23
  - Doppler scale 23
  - F keys 24
  - key click 23
  - mode data 24
  - OB authors 23
  - patient header 24
  - power delay 23
  - printer 23
  - sleep delay 23
  - system information 24
  - system status 24
  - thermal index 23
  - time 23
  - video mode 23

**T**

technical support, contact 65  
THI 21  
touchpad 22  
transducer  
    acquisition subsystem 10  
    problems 40  
    specifications 16, 18  
    storage and shipping 18  
troubleshooting symptoms table 39

**U**

update 22

**V**

VCR problem 40  
video output tests 64  
video recording 22

**W**

warnings 5

**Z**

zoom  
    description 21  
    problem 39

