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GE Medical Systems
Vivid 5 Service Manual

OPERATING DOCUMENTATION

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IMPORTANT PRECAUTIONS

LANGUAGE

WARNING

- THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY.
- IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.
- DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.
- FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.

AVERTISSEMENT

- CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.
- SI LE TECHNICIEN DU CLIENT A BESOIN DE CE MANUEL DANS UNE AUTRE LANGUE QUE L'ANGLAIS, C'EST AU CLIENT QU'IL INCOMBE DE LE FAIRE TRADUIRE.
- NE PAS TENTER D'INTERVENTION SUR LES ÉQUIPEMENTS TANT QUE LE MANUEL SERVICE N'A PAS ÉTÉ CONSULTÉ ET COMPRIS.
- LE NON-RESPECT DE CET AVERTISSEMENT PEUT ENTRAÎNER CHEZ LE TECHNICIEN, L'OPÉRATEUR OU LE PATIENT DES BLESSURES DUES À DES DANGERS ÉLECTRIQUES, MÉCANIQUES OU AUTRES.

WARNUNG

- DIESES KUNDENDIENST-HANDBUCH EXISTIERT NUR IN ENGLISCHER SPRACHE.
- FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.
- VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST-HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.
- WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.

AVISO

- ESTE MANUAL DE SERVICIO SÓLO EXISTE EN INGLÉS.
- SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.
- NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.
- LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.

ATENÇÃO

- ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.
- SE QUALQUER OUTRO SERVIÇO DE ASSISTÊNCIA TÉCNICA, QUE NÃO A GEMS, SOLICITAR ESTES MANUAIS NOUTRO IDIOMA, É DA RESPONSABILIDADE DO CLIENTE FORNECER OS SERVIÇOS DE TRADUÇÃO.
- NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.
- O NÃO CUMPRIMENTO DESTE AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A' CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.

AVVERTENZA

- IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLTANTO IN INGLESE.
- SE UN ADDETTO ALLA MANUTENZIONE ESTERNO ALLA GEMS RICHIEDE IL MANUALE IN UNA LINGUA DIVERSA, IL CLIENTE È TENUTO A PROVVEDERE DIRETTAMENTE ALLA TRADUZIONE.
- SI PROCEDA ALLA MANUTENZIONE DELL'APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.
- NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL'ADDETTO ALLA MANUTENZIONE, ALL'UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.

警告

このサービスマニュアルには英語版しかありません。

ＧＥＭＳ以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。

このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないで下さい。

この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

注意:

本维修手册仅存有英文本。

非 GEMS 公司的维修员要求非英文本的维修手册时，客户需自行负责翻译。

未详细阅读和完全了解本手册之前，不得进行维修。

忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent write "Damage In Shipment" on ALL copies of the freight or express bill BEFORE delivery is accepted or "signed for" by a GE representative or hospital receiving agent. Whether noted or concealed, damage MUST be reported to the carrier immediately upon discovery, or in any event, within 14 days after receipt, and the contents and containers held for inspection by the carrier. A transportation company will not pay a claim for damage if an inspection is not requested within this 14 day period.

CERTIFIED ELECTRICAL CONTRACTOR STATEMENT - FOR USA ONLY

All electrical Installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations and testing shall be performed by qualified GE Medical Systems personnel. In performing all electrical work on these products, GE will use its own specially trained field engineers. All of GE's electrical work on these products will comply with the requirements of the applicable electrical codes.

The purchaser of GE equipment shall only utilize qualified personnel (i.e., GE's field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

OMISSIONS & ERRORS

If there are any omissions, errors or suggestions for improving this documentation, please contact the GE Healthcare Global Documentation Group with specific information listing the system type, manual title, part number, revision number, page number and suggestion details. Mail the information to : Service Documentation, 4855 W. Electric Ave (EA-53), Milwaukee, WI 53219, USA.

GE Healthcare employees should use the iTrak System to report all documentation errors or omissions.

Revision History

REVISION	DATE	REASON FOR CHANGE
A	8. Aug. 2000	Initial release of manual
1	6. Jun. 2005	Updated with changes since the release of the first version of the manual.

List of Effected Pages

PAGES	REVISION	PAGES	REVISION	PAGES	REVISION
Title Page	1	5-1 to 5-20	1	Back Cover	N/A
i to xx	1	6-1 to 6-22	1		
1-1 to 1-14	1	7-1 to 7-22	1		
2-1 to 2-10	1	8-1 to 8-86	1		
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Chapter 1
Introduction

Section 1-1
Overview

1-1-1   Purpose of Chapter 1

This section describes important issues related to safely servicing this ultrasound machine. The service provider must read and understand all the information presented here before installing or servicing a unit.

Table 1-1 Contents in Chapter 1

Section	Description	Page Number
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1-1-2   Purpose of Service Manual

This Service Manual provides installation and service information for the **VIVID 5** Ultrasound Scanning unit and contains the following chapters:

1.) Chapter 1 - Introduction: Contains a content summary and warnings.
2.) Chapter 2 - Pre Installation: Contains any pre-installation requirements for the **VIVID 5**.
3.) Chapter 3 - Installation: Contains installation procedure with installation checklist.
4.) Chapter 4 - Functional Checks: Contains functional checks that must be performed as part of the installation, or as required during servicing and periodic maintenance.
5.) Chapter 5 - Theory: Contains block diagrams and functional explanations of the electronics.
6.) Chapter 6 - Service Adjustments: Contains instructions on how to make any available adjustments to the **VIVID 5**.
7.) Chapter 7 - Diagnostics: Provides procedures for running and diagnostic or related routines for the **VIVID 5**.
8.) Chapter 8 - Replacement Procedures: Provides disassembly procedures and reassembly procedures for changeable FRUs.
9.) Chapter 9 - Renewal Parts: Contains a complete list of replacement parts for **VIVID 5**.
10.) Chapter 10 - Care & Maintenance: Provides care and maintenance procedures for **VIVID 5**.

1-1-2-1   Typical Users of the Service Manual

- Service Personnel (installation, maintenance, etc.).
- Hospital's Service Personnel
- Architectural Planners/Installation Planners (some parts of Chapter 2, Pre-Installation)

1-1-3   Vivid 5 Models Covered by this Manual

Table 1-2 VIVID 5 Models Covered in this Manual

GE VINGMED PART NUMBER	DESCRIPTION	VOLTAGE
FB000223	**VIVID 5** (BT'00)	240V
FB000224	**VIVID 5** (BT'00)	110V
FB000225	**VIVID 5** (BT'00)	100V
FB000711	**VIVID 5** (BT'00)	120V
FB000712	**VIVID 5 U** with integrated EchoPAC	120V
FB000713	**VIVID 5**	230V
FB000714	**VIVID 5 U** with integrated EchoPAC	230V
FB000750	**VIVID 5** with NTSC	240V
FB000751	**VIVID 5 U** with integrated EchoPAC	100V
FB000753	**VIVID 5**	100V
FB000880	**VIVID 5** Pro	240V
FB000890	**VIVID 5** Expert	240V
FC000040	**VIVID 5** Pro US with integrated EchoPAC	110V
FC000050	**VIVID 5** Expert US with integrated EchoPAC	110V
FC000080	**VIVID 5** Eur.	230V

1-1-3-1   Overview

- **VIVID 5** is a phased and linear array ultrasound imaging scanner. It also has provisions for analog input sources like ECG and phono, and a Doppler probe may be connected and used too.
- The unit can be used for:
  - 2D Black and White imaging
  - 2D Color Flow
  - M-Mode Black and White imaging
  - Color M-Mode
  - Doppler
  - a number of combinations of the above
- **VIVID 5** is a digital beam forming unit and can handle up to 192 element linear probes by use of multiplexing.
- Signal flow from the Probe Connector Panel to the Front End, then to the Mid Processors and Backend Processor and finally to the monitor and peripherals.
- System configuration is stored on a hard disk and all necessary software is loaded from the hard disk on power up.

1-1-3-2   System History - Hardware/Software Versions

This procedure describes how to display the system software revision:

1.)   Press the **SETUP** button
2.)   Select **Configuration & Test**
3.)   Select **SW**

Both the system software revision and the revision of the local DSP software will be shown.

Use Table 1-1 to verify the correct/needed revision on each card in the Card Rack.

Note: **The Master Control Document (MCD) Revision is printed on a label on the board or module.**

Table 1-1   Required Revisions for Cards and Modules

CARDS AND MODULES				
Part Number	**Name**	**v2.0.6** **MCD**	**Latest MCD**	**Comments**
FA200890	RLY-2	A	B	
FA200799	RLY-PAL-PB2	A	A	Piggyback, ESD protection. Plugs into FA200890
FB200211	TX128-2	A	A	
FA200907	RX128-2	A	C	
FB200191	XD BUS	A	B	
FA200550	BF64-2	A	B	
FB200900	BF64-3	A	E	
FB200024	3.3V DC/DC	A	A	
FA200764	FEC	A	I	
FB200140	RFT	A	D	Rev B and Rev C can be interchanged.
FA200026	SDP	G	K	Rev. K includes a noise fix
FA200027	CFP	C	D	
FB200708	CFP-2	A	B	
FA200572	IMAGE PORT 2	A	E	
FA200030	GRAPH	K	M	
FB200818	GRAPH	B	B	
FA200029	SCONV	I	K	
066E2700	CPU	NO MCD REVISION ON THESE BOARDS. NEW PART NUMBER WAS PULLED FOR EACH CHANGE.		
066E2701				
066E2702				
FB200005	INT I/O	B	D	
FB200006	EXT I/O	B	D	
FB200196	PATIENT I/O MODULE 2, COMPLETE	A	A	
FA200063	HV POWER	F	G	
FA200107	AC CCTRL	D	E	
FA200191	FP MAIN BOARD-2	R	R	
Fb200245	FRONT PANEL	A	C	

Table 1-1 Required Revisions for Cards and Modules (cont'd)

		v2.0.6	Latest	
Part Number	**Name**	**MCD**	**MCD**	**Comments**
FB200246	FRONT PANEL W/LCD4"	A	D	
FB200177	ROTARY & DISPLAY BOARD 4	A	A	
FA200076	FP AUDIO AMPLIFIER BOARD	A	E	
FB200561	QWERTY KEYBOARD SUBASSY	A	A	
FB200172	MBD	A	A	
FA200248	IV & DP	F	F	
FA200075	VME BG/IACK JUMPER (VME JUMPER)	A	A	
FA200034	DC POWER	E	E	
FA200231	AC POWER SUPPLY	D	D	
FA200040	AC POWER SUPPLY, COMPLETE WITH BOX	J	K	
FA200114	HV POWER SUPPLY SUBASSEMBLY (BOX)	D	D	

| **CARDS AND MODULES** | | | | |

1-1-3-3   Supported Probes

Please refer to Section 9-18 "Probes" on page 9-34.

1-1-3-4   How to Turn the Scanner ON and OFF

- See 4-2-2 - Power On/Boot Up on page 4-1, for a detailed description of how to turn the scanner ON.
- See 4-2-3 - Stand By/Power OFF on page 4-1, for a detailed description of how to turn the scanner OFF.

1-1-4   Purpose of Operator Manual(s)

The Operator Manual(s) should be fully read and understood before operating the **VIVID 5** and also kept near the unit for quick reference.

Section 1-2
Important Conventions

1-2-1   Conventions Used in Book

Model Designations. This manual covers the **VIVID 5** scanners. (See Table 1-2 "VIVID 5 Models Covered in this Manual" on page 1-2. for a list of all **VIVID 5** scanners.)

Icons. Pictures, or icons, are used wherever they will reinforce the printed message. The icons, labels and conventions used on the product and in the service information are described in this chapter.

Safety Precaution Messages. Various levels of safety precaution messages may be found on the equipment and in the service information. The different levels of concern are identified by a flag word that precedes the precautionary message. Known or potential hazards are labeled in one of three ways:

- DANGER
- WARNING
- CAUTION

When a hazard is present that can cause property damage but has absolutely no personal injury risk, a NOTICE is used.

⚠ **DANGER**   **DANGER IS USED TO INDICATE THE PRESENCE OF A HAZARD THAT WILL CAUSE SEVERE PERSONAL INJURY OR DEATH IF THE INSTRUCTIONS ARE IGNORED.**

⚠ **WARNING**   **WARNING IS USED TO INDICATE THE PRESENCE OF A HAZARD THAT CAN CAUSE SEVERE PERSONAL INJURY AND PROPERTY DAMAGE IF INSTRUCTIONS ARE IGNORED.**

⚠ **CAUTION**   **Caution is used to indicate the presence of a hazard that will or can cause minor personal injury and property damage if instructions are ignored.**

⚠ **NOTICE**   **Equipment Damage Possible**

Notice is used when a hazard is present that can cause property damage but has absolutely <u>no personal injury risk</u>.

Example:

Disk drive will crash.

Note: **Notes are used to provide important information about an item or a procedure.**

Be sure to read the notes; the information contained in a note can often save you time or effort.

1-2-2 Standard Hazard Icons

Important information will always be preceded by the exclamation point ⚠ contained within a triangle, as seen throughout this chapter. In addition to text, several different graphical icons (symbols) may be used to make you aware of specific types of hazards that could possibly cause harm. Even if a symbol isn't used in this manual or on Vivid 5, it is included for your reference.

Table 1-2 Standard Hazard Icons

ELECTRICAL	MECHANICAL	RADIATION
LASER	HEAT	PINCH

Some others make you aware of specific procedures that should be followed.

Table 1-3 Standard Icons that indicates that a special procedure is to be used

AVOID STATIC ELECTRICITY	TLOCK-OUT, TAG-OUT	WEAR EYE PROTECTION
HAND PROTECTION	FOOT PROTECTION	

Section 1-3
Safety Considerations

1-3-1   Introduction

The following safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual, violates safety standards of design, manufacture and intended use of the equipment.

1-3-2   Human Safety

⚠️ **WARNING**   **BECAUSE OF THE LIMITED ACCESS TO CABINETS AND EQUIPMENT IN THE FIELD, PLACING PEOPLE IN AWKWARD POSITIONS, WE HAVE LIMITED THE LIFTING WEIGHT FOR ONE PERSON IN THE FIELD TO 16 KG (35 LBS). ANYTHING OVER 16 KG (35 LBS) REQUIRES 2 PEOPLE.**

Operating personnel must not remove the system covers.

Servicing should be performed by authorized personnel only.

Only personnel who have participated in a **VIVID 5** training seminar are authorized to service the equipment.

1-3-3 Mechanical Safety

⚠️ **WARNING** WHEN THE UNIT IS RAISED FOR A REPAIR OR MOVED ALONG ANY INCLINE, USE EXTREME CAUTION SINCE IT MAY BECOME UNSTABLE AND TIP OVER.

⚠️ **WARNING** ULTRASOUND PROBES ARE HIGHLY SENSITIVE MEDICAL INSTRUMENTS THAT CAN EASILY BE DAMAGED BY IMPROPER HANDLING. USE CARE WHEN HANDLING AND PROTECT FROM DAMAGE WHEN NOT IN USE. DO NOT USE A DAMAGED OR DEFECTIVE PROBE. FAILURE TO FOLLOW THESE PRECAUTIONS CAN RESULT IN SERIOUS INJURY AND EQUIPMENT DAMAGE.

⚠️ **WARNING** NEVER USE A PROBE THAT HAS FALLEN TO THE FLOOR. EVEN IF IT LOOKS OK, IT MAY BE DAMAGED.

⚠️ **CAUTION** Keep the heat venting holes on the monitor unobstructed to avoid overheating of the monitor.

⚠️ **CAUTION** The VIVID 5 weighs more than 200 kg (more than 440 lbs) when ready for use. Care must be used when moving it or replacing its parts. Failure to follow the precautions listed below could result in injury, uncontrolled motion and costly damage.
ALWAYS:
- **Be sure the pathway is clear.**
- **Use slow, careful motions.**
- **Use two people when moving on inclines or lifting more than 16 kg (35 lbs).**

⚠️ **CAUTION** Special care should be taken when transporting the unit in a vehicle:
- **Secure the unit in an upright position.**
- **Lock the casters (wheels)/brakes.**
- **DO NOT use the Control Panel as an anchor point.**
- **Place the probes in their carrying case.**
- **Eject any Magneto Optical disk from the MO Drive (if installed).**

⚠️ **CAUTION** Use Protective Glasses during Drilling, Filing and during all other work where eyes need protection.

⚠️ **CAUTION** Use Safety Shoes when doing work where there is any chance of foot damage.

⚠️ **CAUTION** Use Protective Gloves when drilling and cutting.

1-3-4   Temperature Safety

⚠ **CAUTION**   **Keep the heat venting holes on the monitor unobstructed to avoid overheating of the monitor.**

1-3-5   Electrical Safety

1-3-5-1   Safe Practices

Follow these guidelines to minimize shock hazards whenever you are using the scanner;

- The equipment chassis must be connected to an electrical ground.
- The unit is equipped with a three-conductor AC power cable. This must be plugged into an approved electrical outlet with safety ground.
- The power outlet used for this equipment should not be shared with other types of equipment.
- Both the system power cable and the power connector must meet international electrical standards.

1-3-6   Dangerous Procedure Warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

⚠ **WARNING**   **DANGEROUS VOLTAGES, CAPABLE OF CAUSING DEATH, ARE PRESENT IN THIS EQUIPMENT. USE EXTREME CAUTION WHEN HANDLING, TESTING AND ADJUSTING.**

⚠ **WARNING**   **EXPLOSION WARNING**

DO NOT OPERATE THE EQUIPMENT IN AN EXPLOSIVE ATMOSPHERE. OPERATION OF ANY ELECTRICAL EQUIPMENT IN SUCH AN ENVIRONMENT CONSTITUTES A DEFINITE SAFETY HAZARD.

⚠ **WARNING**   **DO NOT SUBSTITUTE PARTS OR MODIFY EQUIPMENT**

BECAUSE OF THE DANGER OF INTRODUCING ADDITIONAL HAZARDS, DO NOT INSTALL SUBSTITUTE PARTS OR PERFORM ANY UNAUTHORIZED MODIFICATION OF THE EQUIPMENT.

1-3-7   Lockout/Tagout Requirements (For USA Only)

Follow OSHA Lockout/Tagout or local requirements by ensuring you are in total control of the AC power plug at all times during the service process.

1-3-8   Returning/Shipping Probes and Repair Parts

Equipment being returned must be clean and free of blood and other infectious substances.

GEMS policy states that body fluids must be properly removed from any part or equipment prior to shipment. GEMS employees, as well as customers, are responsible for ensuring that parts/ equipment have been properly decontaminated prior to shipment. Under no circumstance should a part or equipment with visible body fluids be taken or shipped from a clinic or site (for example, body coils or an ultrasound probe).

The purpose of the regulation is to protect employees in the transportation industry, as well as the people who will receive or open this package.

Note: **The US Department of Transportation (DOT) has ruled that "items that were saturated and/ or dripping with human blood that are now caked with dried blood; or which were used or intended for use in patient care" are "regulated medical waste" for transportation purposes and must be transported as a hazardous material.**

Section 1-4
Electromagnetic Compatibility (EMC)

1-4-1   What is EMC?

Electromagnetic compatibility describes a level of performance of a device within its electromagnetic environment. This environment consists of the device itself and its surroundings including other equipment, power sources and persons with which the device must interface.

Inadequate compatibility results when a susceptible device fails to perform as intended due interference from its environment or when the device produces unacceptable levels of emission to its environment. This interference is often referred to as radio–frequency or electromagnetic interference (RFI/EMI) and can be radiated through space or conducted over interconnecting power of signal cables.

In addition to electromagnetic energy, EMC also includes possible effects from electrical fields, magnetic fields, electrostatic discharge and disturbances in the electrical power supply.

1-4-2   Compliance

Vivid 5 conforms to all applicable conducted and radiated emission limits and to immunity from electrostatic discharge, radiated and conducted RF fields, magnetic fields and power line transient requirements.

Applicable standards are: 47CFR Part 18, IEC60601–1–2:2001.

Note: **For CE Compliance, it is critical that all covers, screws, shielding, gaskets, mesh, clamps, are in good condition, installed tightly without skew or stress. Proper installation following all comments noted in this service manual is required in order to achieve full EMC performance.**

1-4-3   Electrostatic Discharge (ESD) Prevention

DO NOT TOUCH ANY BOARDS WITH INTEGRATED CIRCUITS PRIOR TO TAKING THE NECESSARY ESD PRECAUTIONS:

1. ALWAYS CONNECT YOURSELF, VIA AN ARM-WRIST STRAP, TO THE ADVISED ESD CONNECTION POINT LOCATED ON THE REAR OF THE SCANNER (TO THE RIGHT OF THE POWER CONNECTOR).

2. FOLLOW GENERAL GUIDELINES FOR HANDLING OF ELECTROSTATIC SENSITIVE EQUIPMENT.

Section 1-5
Customer Assistance

1-5-1 Contact Information

If this equipment does not work as indicated in this service manual or in the User Manual, or if you require additional assistance, please contact the local distributor or appropriate support resource, as listed below.

Prepare the following information before you call:

• System ID serial number, --see label on rear side of unit.

• Software version.

Table 1-4   Phone Numbers for Customer Assistance

Location	Phone Number
USA/ Canada GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 Customer Answer Center	Tel: 1-800-321-7937 1-800-682-5327 1-262-524-5698 Fax: +1-414-647-4125
Latin America GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 Customer Answer Center	Tel: 1-262-524-5300 1-262-524-5698 Fax: +1-414-647-4125
Europe GE Ultraschall Deutschland GmbH& Co. KG BeethovenstraBe 239 Postfach 11 05 60, D-42655 Solingen Germany	Tel: +49 212 2802 208 - CARDIAC +49 212 2802 207 - GENERAL IMAGING Fax: +49 212 2802 431
Asia (Singapore) GE Ultrasound Asia Service Department - Ultrasound 298 Tiong Bahru Road #15-01/06 Central Plaza Singapore 169730	Tel: +65-6277-3512 Fax: +65 6272-3997

1-5-2   System Manufacture

Table 1-5   System Manufacture

MANUFACTURER	PHONE NUMBER	FAX NUMBER
GE Vingmed Ultrasound A/S Strandpromenaden 45 P.O. Box 141 N-3191 HORTEN NORWAY	+47 3302 1100	+47 3302 1350

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Chapter 2
Pre Installation

Section 2-1
Purpose of Chapter

This chapter provides the information required to plan and prepare for the installation of a **VIVID 5**. Included are descriptions of the facility and electrical needs to be met by the purchaser of the unit. A checklist is also provided at the end of this chapter to help determine whether the proper planning and preparation is accomplished before the actual equipment installation is scheduled.

Section 2-2
General Information

2-2-1   Time and Manpower Requirements

Site preparation takes time. Begin Pre installation checks as soon as possible, if possible, six weeks before delivery, to allow enough time to make any changes.

⚠ **CAUTION** **Have two people available to deliver and unpack the VIVID 5.**
Attempts to move the unit considerable distances or on an incline by one person could result in injury or damage or both.

2-2-2   Important VIVID 5 Characteristics

2-2-2-1   Physical Dimensions

The physical dimensions of the **VIVID 5** unit are summarized in Table 2-1.

Size: (With monitor and without peripherals)

Height	Width	Depth	Unit
142	66	112	cm
55.9	26	44.1	Inches

Table 2-1 Physical dimensions of VIVID 5 (w/ monitor and without peripherals)

2-2-2-2 Weight without Monitor and Peripherals

The Weight of **VIVID 5** wo/ monitor and peripherals

Model	Weight [kg]	Weight [lbs]
VIVID 5	196	432

Table 2-2 Weight of VIVID 5 (wo/ monitor and peripherals)

2-2-2-3 Acoustic Noise Output:

Less than 70dB(A) according to DIN 45635 - 19 - 01 - KL2.

2-2-3 EMI Limitations

Ultrasound machines are susceptible to Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transients in the air or wiring. They also generate EMI. The **VIVID 5** complies with limits as stated on the EMC label. However there is no guarantee that interference will not occur in a particular installation.

Possible EMI sources should be identified before the unit is installed.

Electrical and electronic equipment may produce EMI unintentionally as the result of a defect. These sources include:

- medical lasers,
- scanners,
- cauterizing guns,
- computers,
- monitors,
- fans,
- gel warmers,
- microwave ovens,
- light dimmers
- portable phones.

The presence of a broadcast station or broadcast van may also cause interference.

See the table on page 2-3 for EMI Prevention tips.

2-2-3 EMI Limitations (cont'd)

.

EMI Rule	Details
Be aware of RF sources	Keep the unit at least 5 meters or 15 feet away from other EMI sources. Special shielding may be required to eliminate interference problems caused by high frequency, high powered radio or video broadcast signals.
Ground the unit	Poor grounding is the most likely reason a unit will have noisy images. Check grounding of the power cord and power outlet.
Replace all screws, RF gaskets, covers, cores	After you finish repairing or updating the system, replace all covers and tighten all screws. Any cable with an external connection requires a magnet wrap at each end. Install the shield over the front of card cage. Loose or missing covers or RF gaskets allow radio frequencies to interfere with the ultrasound signals.
Replace broken RF gaskets	If more than 20% or a pair of the fingers on an RF gasket are broken, replace the gasket. Do not turn on the unit until any loose metallic part is removed.
Do not place labels where RF gaskets touch metal	Never place a label where RF gaskets meet the unit. Otherwise, the gap created will permit RF leakage. Or, if a label has been found in such a position, move the label.
Use GE specified harnesses and peripherals	The interconnect cables are grounded and require ferrite beads and other shielding. Also, cable length, material, and routing are all important; do not change from what is specified.
Take care with cellular phones	Cellular phones may transmit a 5 V/m signal; that could cause image artifacts.
Properly dress peripheral cables	Do not allow cables to lie across the top of the card cage or hang out of the peripheral bays. Loop the excess length for peripheral cables inside the peripheral bays. Attach the monitor cables to the frame.

Table 2-3 EMI Prevention/abatement

2-2-4   Purchaser Responsibilities

The work and materials needed to prepare the site is the responsibility of the purchaser. Delay, confusion, and waste of manpower can be avoided by completing pre installation work before delivery. Use the Pre installation checklist to verify that all needed steps have been taken. Purchaser responsibility includes:

- Procuring the materials required.
- Completing the preparations before delivery of the ultrasound system.
- Paying the costs for any alterations and modifications not specifically provided in the sales contract.

Note: *All electrical installations that are preliminary to the positioning of the equipment at the site prepared for the equipment must be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations, and testing must also be performed by qualified personnel.*

The products involved (and the accompanying electrical installations) are highly sophisticated and special engineering competence is required. All electrical work on these products must comply with the requirements of applicable electrical codes. The purchaser of GE equipment must only utilize qualified personnel to perform electrical servicing on the equipment.

The desire to use a non–listed or customer provided product or to place an approved product further from the system than the interface kit allows presents challenges to the installation team. To avoid delays during installation, such variances should be made known to the individuals or group performing the installation at the earliest possible date (preferably prior to the purchase).

The ultrasound suite must be clean prior to delivery of the machine. Carpet is not recommended because it collects dust and creates static. Potential sources of EMI (electromagnetic interference) should also be investigated before delivery. Dirt, static, and EMI can negatively impact system reliability.

Section 2-3
Facility Needs

2-3-1   Required Features

- Dedicated single branch power outlet of adequate amperage (see *VIVID 5 Power Requirements on page 2-8*) meeting all local and national codes which is located less than 2.5 m (8 ft.) from the unit's proposed location
- Door opening is at least 76 cm (30 in) wide
- Proposed location for unit is at least 0.3 m (1 ft.) from the wall for cooling
- Clean and protected space to store transducers (in their cases or on a rack)
- Material to safely clean probes (done with a plastic container, never metal)

2-3-2   Desirable Features

- Door is at least 92 cm (3 ft.) wide
- Circuit breaker for dedicated power outlet is easily accessible
- Sink with hot and cold water
- Receptacle for bio–hazardous waste, like used probe sheaths
- Emergency oxygen supply
- Storage for linens and equipment
- Nearby waiting room, lavatory, and dressing room
- Dual level lighting (bright and dim)
- Lockable cabinet ordered by GE for its software and proprietary manuals

2-3-3   Minimal Floor Plan Suggestion
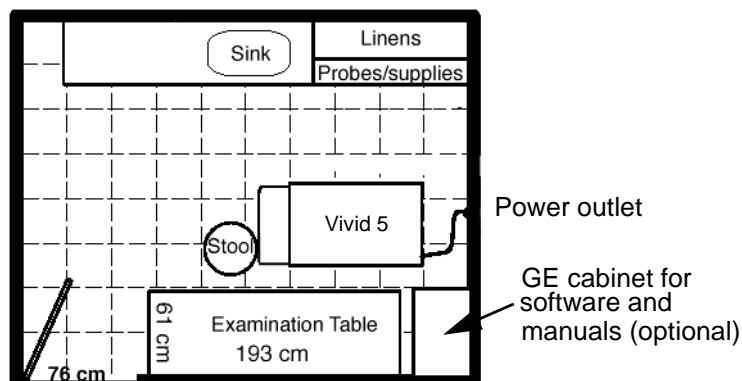
SCALE: EACH SQUARE EQUALS ONE SQUARE FOOT (APP. 31 X 31 CM)

Figure 2-1 A 2.5m x 3m (8 by 10 foot) Minimal Floor Plan

Section 2-4
Environmental Specifications

2-4-1   Systems

Operating temperature:	10 to 35 $^{\circ}$C (50 to 95 $^{\circ}$F)
Storage temperature:	-20 to 50 $^{\circ}$C (- 4 to 122 $^{\circ}$F)
Humidity:	< 90% rH non-condensing
Heat dissipation:	4500 BTU pr hour

Table 2-4 Environmental Specifications for VIVID 5 Scanners

2-4-2 Probes

	Electronic	PAMPTE
Operation:	10 to 40 ^{o}C	5 to 42.7 ^{o}C
Storage:	-20 to 50 ^{o}C	-20 to 50 ^{o}C
Temperatures in degrees C, conversion to degrees F = ^{o}C*(9/5) + 32)		

Table 2-5 Operation and Storage Temperatures for Probes.

⚠ **NOTICE:** **SYSTEMS AND ELECTRONIC PROBES ARE DESIGNED FOR STORAGE TEMPERATURES OF -20 TO + 50 deg C. WHEN EXPOSED TO LARGE TEMPERATURE VARIATIONS, THE PRODUCT SHOULD BE KEPT IN ROOM TEMPERATURE FOR 10 HOURS BEFORE USE.**

MECHANICAL PROBES MAY BE STORED BETWEEN ZERO AND +50 deg C DUE TO CONTENTS OF LIQUID. FACTORY PACKAGING ALLOWS TRANSPORTATION FOR SHORTER PERIODS (LESS THAN 6 HOURS) AT TEMPEREATURES DOWN TO -20 deg C.

MECHANICAL PROBES WITH AIR BUBBLES, A RESULT OF LOW TEMPERATURE STORAGE/TRANSPORTATION, SHOULD BE KEPT IN AN UPRIGHT POSITION UNDER TEMPERATURES BETWEEN + 20 and + 40 deg C UNTIL THE AIR BUBBLES DISSAPEAR.

2-4-3 Cooling

The cooling requirement for the **VIVID 5** is 4500 BTU/hr. This figure does not include cooling needed for lights, people, or other equipment in the room. Each person in the room places an additional 300 BTU/hr. demand on the cooling system.

2-4-4 Lighting

Bright light is needed for system installation, updates and repairs. However, operator and patient comfort may be optimized if the room light is subdued and indirect. Therefore a combination lighting system (dim/bright) is recommended. Keep in mind that lighting controls and dimmers can be a source of EMI which could degrade image quality. These controls should be selected to minimize possible interference.

Section 2-5
Electrical Needs

2-5-1 VIVID 5 Power Requirements

Note: *GE Medical Systems requires a dedicated power and ground for the proper operation of its Ultrasound equipment. This dedicated power shall originate at the last distribution panel before the system.*

Sites with a mains power system with defined Neutral and Live:
The dedicated line shall consist of one phase, a neutral (not shared with any other circuit), and a full size ground wire from the distribution panel to the Ultrasound outlet.

Sites with a mains power system without a defined Neutral:
The dedicated line shall consist of one phase (two lines), not shared with any other circuit, and a full size ground wire from the distribution panel to the Ultrasound outlet.

Please note that image artifacts can occur, if at any time within the facility, the ground from the main facility's incoming power source to the Ultrasound unit is only a conduit.

Electrical Specifications for **VIVID 5**.

GEVU P/N	Voltage	Tolerances	Current	Frequency
FB000223	230-240 VAC	±10%	8 A	50-60 Hz
FB000224	110-120 VAC	±5%	13,2 A	50-60 Hz
FB000225	100 VAC	±10%	13,5 A	50-60 Hz

Table 2-6 Electrical Specifications for VIVID 5

2-5-2   Site Circuit Breaker

It is recommended that the branch circuit breaker for the machine be readily accessible.

⚠ **CAUTION**   **POWER OUTAGE MAY OCCUR. The VIVID 5 requires a dedicated single branch circuit. To avoid circuit overload and possible loss of critical care equipment, make sure you DO NOT have any other equipment operating on the same circuit.**

2-5-3   Site Power Outlets

A dedicated AC power outlet must be within reach of the unit without extension cords. Electrical installation must meet all current local, state, and national electrical codes.

2-5-4   Unit Power Plug

If the unit arrives without a power plug, or with the wrong plug, the installation engineer must supply what is locally required.

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Chapter 3
Installation

Section 3-1
Purpose of Chapter

This chapter contains information needed to install the unit. Included are references to a procedure that describes how to receive and unpack the equipment and how to file a damage or loss claim.

How to prepare the facility and unit of the actual installation, and how to check and test the unit, probes, and external peripherals for electrical safety are included in this procedure. Also included in this chapter are guidelines for transporting the unit to a new site.

Section 3-2
General Information

3-2-1   Safety Reminders

⚠️ **DANGER**   **WHEN USING ANY TEST INSTRUMENT THAT IS CAPABLE OF OPENING THE AC GROUND LINE (I.E., METER'S GROUND SWITCH IS OPEN), DON'T TOUCH THE UNIT!**

⚠️ **CAUTION**   **Two people should unpack the unit because of its weight. Two people are required whenever a part weighing 16 kg (35 lbs) or more must be lifted.**

⚠️ **CAUTION**   **If the unit is very cold or hot, do not turn on its power until it has had a chance to acclimate to its operating environment.**

⚠️ **CAUTION**   **To prevent electrical shock, connect the unit to a properly grounded power outlet. Do not use a three to two prong adapter. This defeats safety grounding.**

⚠️ **CAUTION**   **Do not wear the ESD wrist strap when you work on live circuits and more than 30 V peak is present.**

⚠️ **CAUTION**   **Do not use a 20 Amp to 15 Amp adapter on the 120 Vac unit's power cord. This unit requires a dedicated 20 A circuit and can have a 15A plug if the on board peripherals do not cause the unit to draw more than 14.0 amps.**

⚠️ **CAUTION**   **Do not operate this unit unless all board covers and frame panels are securely in place. System performance and cooling require this.**

3-2-1   Safety Reminders (cont'd)

⚠️
CAUTION   Operator Manual

The User Manual should be fully read and understood before operating the VIVID 5 and kept near the unit for quick reference.

⚠️
CAUTION   **ACOUSTIC OUTPUT HAZARD**

Although the ultrasound energy transmitted from the VIVID 5 probe is within AIUM/NEMA standards, avoid unnecessary exposure. Ultrasound energy can produce heat and mechanical damage.

3-2-2   EMI Protection

This unit has been designed to minimize the effects of Electro Magnetic Interference (EMI). Many of the covers, shields, and screws are provided primarily to protect the system from image artifacts caused by this interference. For this reason, it is imperative that all covers and hardware are installed and secured before the unit is put into operation.

Section 3-3
Receiving and Unpacking the Equipment

The Packaging/Unpacking Procedure, GEVU Part Number FA050431, is included in the documentation package following each **VIVID 5**.

Topics discussed in the Packaging/Unpacking Procedure:

1.)   Check the Shipment,

2.)   Unpack the Unit,

3.)   Handling Incomplete or Damaged Shipment

Please read that procedure before packing/unpacking the **VIVID 5**.

We strongly advice you to store the **VIVID 5** packing material in undamaged condition in case of future transportation.

Section 3-4
Preparing the Unit for Installation

3-4-1   Check the Unit Configuration

3-4-1-1   Check Voltage Settings

The Voltage settings for the **VIVID 5** Scanner is found on a label above the Power switch, on the rear of the system.

⚠ **WARNING   CONNECTING A VIVID 5 SCANNER TO THE WRONG VOLTAGE LEVEL WILL MOST LIKELY DESTROY THE SCANNER.**

3-4-1-2   Video Formats

4.1.2.1   NTSC/PAL

Check that the video format is set to the locally used video standard, NTSC or PAL.

Section 3-5
Completing the Installation

3-5-1   Electrical Safety Test

All systems that are sent from the manufacturer have passed Electrical Safety Tests. This is documented in the product's Device History Record (DHR).

An Electrical Isolation Test should be done as part of the installation if possible. The Installation personnel can perform the test if he or she has been trained in performing Electrical Isolation Test and has proper equipment to perform the test, or a test using the customers personnel and equipment should be requested. If an Electric Isolation Test is not possible during installation this should be documented.

Results of any Electrical Isolation Test shall be documented.

If the equipment does not pass an Electrical Isolation Test, the equipment must not be used until the situation is rectified.

3-5-2   Paperwork

Note: **During and after installation, the documentation (i.e. user manuals, installation manuals ...) for the peripheral units must be kept as part of the original system documentation. This will ensure that all relevant safety and user information is available during the operation and service of the complete system.**

3-5-2-1   User Manual

Check that the correct User Manual, per software (sw) revision, for the system is included.

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Chapter 4
Functional Checks

Section 4-1
Purpose of chapter

This chapter provides procedures for quickly checking the major functions of the **VIVID 5**. The functional check procedures are also the basic checks to use before and after performing service.

This chapter also offers some pages that may be hard copied and used for a paper record of the service that has been done on the system.

Section 4-2
General Procedures

4-2-1   Connect a Probe

•   Connect an FPA probe to slot one on the **VIVID 5** scanner.

4-2-2   Power On/Boot Up

1.)   Switch on the **MAINS POWER**. The Mains Power switch is located on the scanner's rear side. This brings the **VIVID 5** scanner into Standby mode.

2.)   Press once on the **STANDBY** key on the front (next to the ECG connector) to turn the **VIVID 5** scanner on.

The **VIVID 5** scanner will boot.

The boot sequence includes a self test, and connected probe(s) will be initialized and calibrated.

Note: **For a more detailed description, please see the VIVID 5 User Manual.**

The available language versions and respective part numbers for the VIVID 5 User Manuals are listed in Table 9-21 on page 9-39.

4-2-3   Stand By/Power OFF

1.)   Press once on the **STANDBY** key to bring the scanner to standby mode.

2.)   Switch OFF the **MAINS POWER** to completely power down the unit.

Section 4-3
Functional Checks

4-3-1   Basic System Checks

Select the modes below, one by one, and briefly check that they function.

1.)   2D mode
2.)   Color Flow mode
3.)   M mode
4.)   Color M mode
5.)   Doppler mode

Note: **For a more detailed description, please see the VIVID 5 User Manual.**

4-3-2   Check of Options

Check that the installed option(s), if any, are functioning as intended.

Details about the Integrated EchoPAC is located in the EchoPAC Installation Manual, GEVU Part Number EP194010.

Section 4-4
Mechanical Adjustments

There are no Mechanical Adjustments on the **VIVID 5** scanner.

4-4-1   Check of Wheels/Locks/Brakes

Check that the Wheels/Locks/Brakes function as described in the User Manual.

Section 4-5
Site Log

Date	Service person	Problem	Comments

Table 4-1 Site Log

Date	Service person	Problem	Comments

Table 4-1 Site Log

Chapter 5
Theory

Section 5-1
Purpose of chapter

This chapter explains **VIVID 5**'s system concepts, component arrangement, and subsystem functions, including the internal Macintosh computer used for EchoPAC. It also describes the Power Distribution System (PDS) and probes.

Section 5-2
VIVID 5 Description

5-2-1   General Information

- **VIVID 5** is a phased and linear array ultrasound imaging scanner. It also has provisions for analog ECG and phono inputs.
- The system can be used for:
    - 2D Black and White imaging
    - 2D Color Flow
    - M-Mode Black and White imaging
    - Color M-Mode
    - Doppler
    - a number of combinations of the above

- **VIVID 5** is a digital beamforming system which can handle up to 192 element linear probes by use of multiplexing.
- System configuration is stored on a hard disk and all necessary software is loaded from the hard disk on power up.
- User interface via the keyboard initiates the system operation and set-up via two major bus structures interconnecting the different printed circuit boards residing in the Card Cage.
- Signal flow from the Probe Connector Panel to the Front End, then to the Mid Processors and Display/Control and finally to the monitor and peripherals. The signal flow is mainly done over a backplane, but the final path from the I/O section and up from the Card Cage is done via cables.

- Some models have the optional EchoPAC™ functionality, running on an integrated Apple® Macintosh® Computer, which receives the "new" ultrasound as digital videodata or digital rawdata from the system.

5-2-2 Major Components

High Resolution
Color Monitor

LCD-monitor
(systems with
integrated EchoPAC).

MO Drive (systems
with integrated
EchoPAC).

Brake pedal

Front Panel
(Operator Panel)

Probe Connector Panel
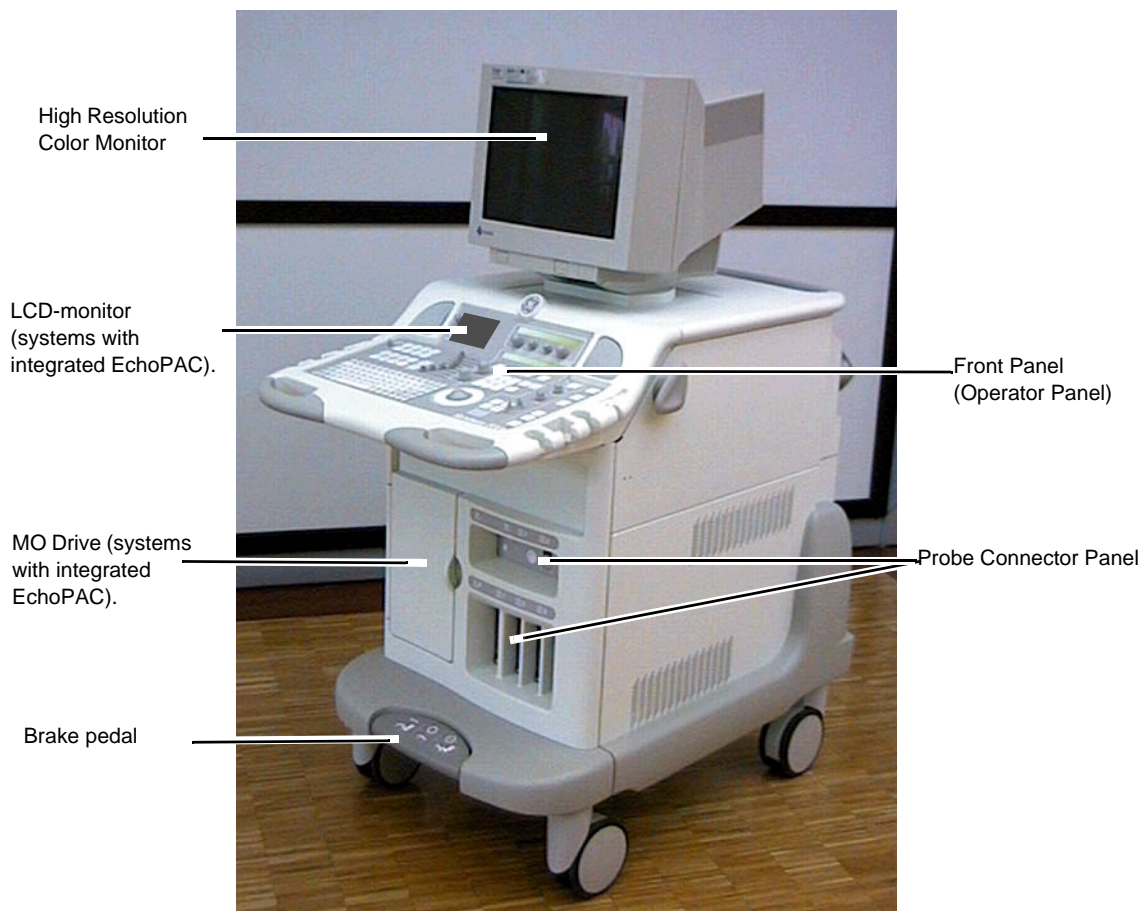
Figure 5-1 Major Components, VIVID 5

5-2-3   Ultrasound Data Path
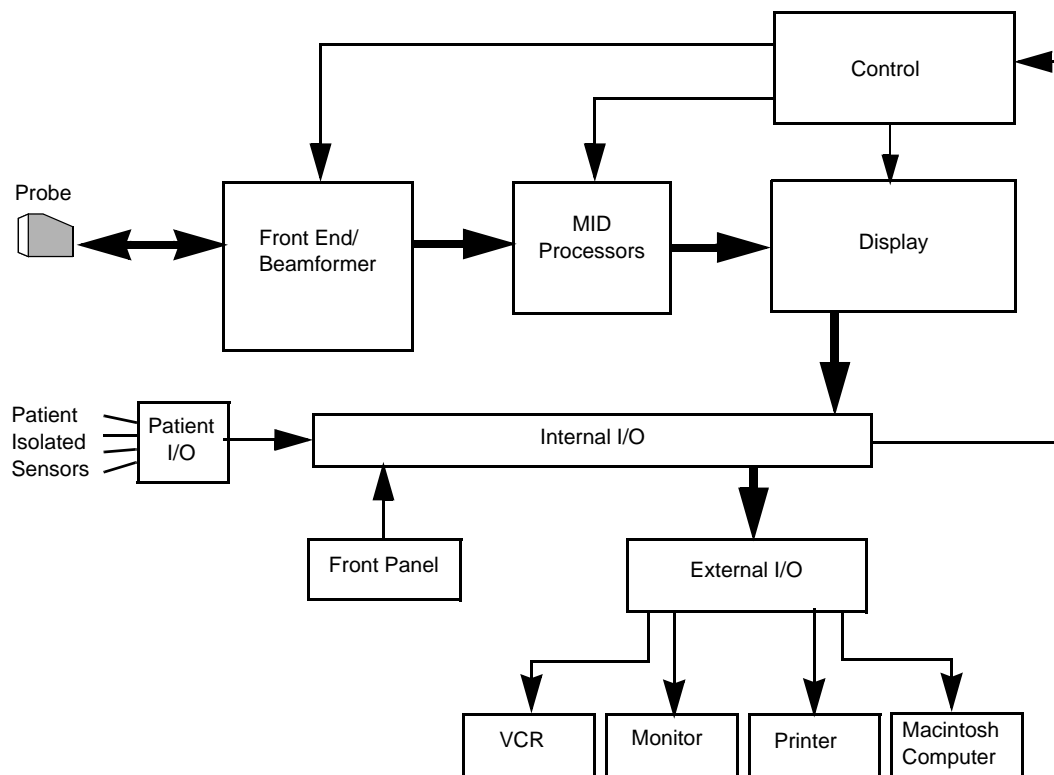
Figure 5-2 Ultrasound Data Path, VIVID 5

5-2-4   Functional Subsystems

5-2-4-1   Front End (FE)

The Front End generates the strong transmit bursts transmitted by the probes as ultrasound into the body. It also receives weak echoes from blood cells and body structure, amplifies the signals and convert them to a 18 bit digital signal.

The digital representation of the signal is presented to the Mid Processor section.

5-2-4-2   Mid Processors

These processors performs the adequate signal conditioning for the different data types; Tissue, Doppler and Flow.

5-2-4-3   Display and Control

The Display and Control block takes the data from the pipelink bus, stores it in a memory, performs scan conversion to pixel domain and drives the system RGB monitor.

5-2-4-4   Keyboard, I/O and Peripherals

Miscellaneous functions are located in this system block. The Internal I/O Board and External I/O Board are the interfaces between the Card Cage and the rest of the system, including the Front Panel and the Peripherals.

Section 5-3
Circuit Boards

5-3-1   Front End (FE) Boards

The VIVID 5 Front End consists of the following nine boards:
- Relay Board (RLY)
- Transmitter Board (TX)
- Receiver Board (RX)
- Beamformer Boards (BF) (2x)
- 3.3V DC/DC Converter Module (3.3V DC/DC)
- Front End Controller Board (FEC)
- Front End Bus (FE Bus)
- Patient I/O Board (Pat I/O)
- High Voltage Power Supply (HV) (Located below the CPU Board)

5-3-2   Mid Processor Boards

The current Mid Processors are the:
- RF & Tissue Processor board (RFT)
- Spectrum Doppler Processor board (SDP)
- 2D Flow Processor board (2DF (sometimes called CFP))

5-3-3   Display and Control Boards

The boards within the Display and Control block are:
- Image Port 2 Board (IP-2)
- Scan Converter Board
- Graphics Board
- System CPU Board

5-3-4   Keyboard, I/O and Peripherals

The boards/modules within this block:
- Internal I/O Board
- External I/O Board
- Front Panel Main Board
- Rotary Switch and Display Board
- Front Panel Audio Amplifier Board

Section 5-4
Power System

There are four types of power supplies in VIVID 5:

- AC Power Supply
- DC Power Supply
- 3.3V DC/DC Converter
- High Voltage Power Supply (also listed under *"Front End (FE) Boards" on page 5-4*)

5-4-1   AC Power Supply with ON/OFF Control

The mains power cable is fed to a combined on/off switch and circuit breaker located in the back of the system, in the AC Power Assembly.

From the circuit breaker, the mains is fed through an isolation transformer to the AC Controller Board. This board provides stand-by power for the power-switch in the front of the system and for e.g. a VCR's tape counter.

When pressing the stand-by power-switch, a power-off routine is started. Upon completion of this, the CPU returns a grant signal to the AC Controller which shuts off the relay for the power to the rack, monitor and peripherals (excluding the VCR).

Each outlet to internal peripherals is filtered.

The AC Controller also controls the speed of the fans. It senses the air temperature above the card rack, and adjusts the speed accordingly. If a high temperature reading occurs, maximum speed is selected.

5-4-2   AC Power Outlets

The Scanner has AC Power outlets for use by internal pheripherals only.

5-4-3   DC Power

Filtered 230 VAC is fed to the DC power supply, which is a GE Vingmed specified supply, designed and manufactured by Philips. The power supply has a modular design and provides the following voltages:

Voltage [VDC]	Nominal load [A]
+5(d)	120.0
+10	3.0
+12	4.0
-12	1.0
+15	4.0
-15	3.0
+5(a)	15.0
-5(a)	25.0

Table 5-1 DC Power output

+5V(d) [digital] and ground are fed from the Power Supply to the card cage's backplane through thick rails. The other voltages are routed via a DC Extension board which plugs into the motherboard. The Front Panel and disks are powered via the internal I/O board. The voltages to these devices are fed through recoverable PTC fuses.

5-4-4   3.3V DC/DC Converter

This board converts the +5(d) 5VDC voltage to +3.3VDC. The 3.3 VDC voltage is distributed via the backplane to the RFT and BF Boards.

5-4-5   High Voltage Power Supply

The input to this supply is filtered 230 VAC. A mains cable plugs into the front of the supply, which again plugs directly into the motherboard.

The HV supply consists of three dual modules, all linear supplies providing symmetrical outputs.

Output Name	Output Voltage	Power
HV1	0 to +/- 80V	maximum 10W
HV2	0 to +/- 40V	maximum 10W
HV_MUX	+/- 80V	maximum 8W

Table 5-2 High Voltage output

The high voltages HV1 and HV2 are fed to the transmitter on the TX board and to the PRC board. The HV_MUX voltages are fed to the multiplexers located in the connector housing of the 192 element linear probes.

The two HV1 and HV2 supplies are controlled serially by the Front End Controller board, which also surveils the voltage and current drawn. This is done for output power safety purposes.

5-4-6   Power Distribution
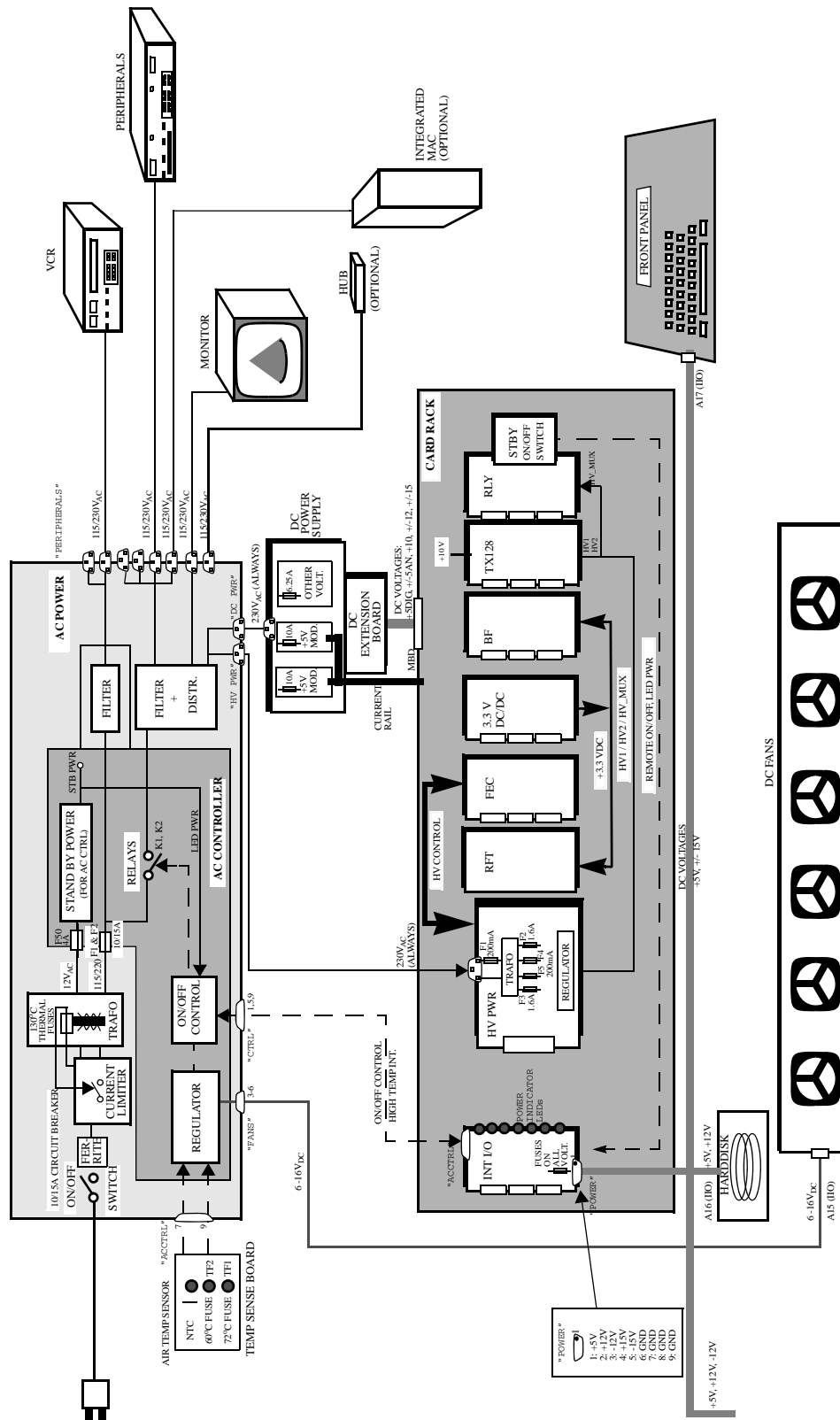
Figure 5-3 Power Destination Points

5-4-7 Front End and Mid. Processors Block Diagram

Figure 5-4 Front End and Mid. Processors Block Diagram

5-4-8 Display, Control and Input/Output (I/O) Block Diagram
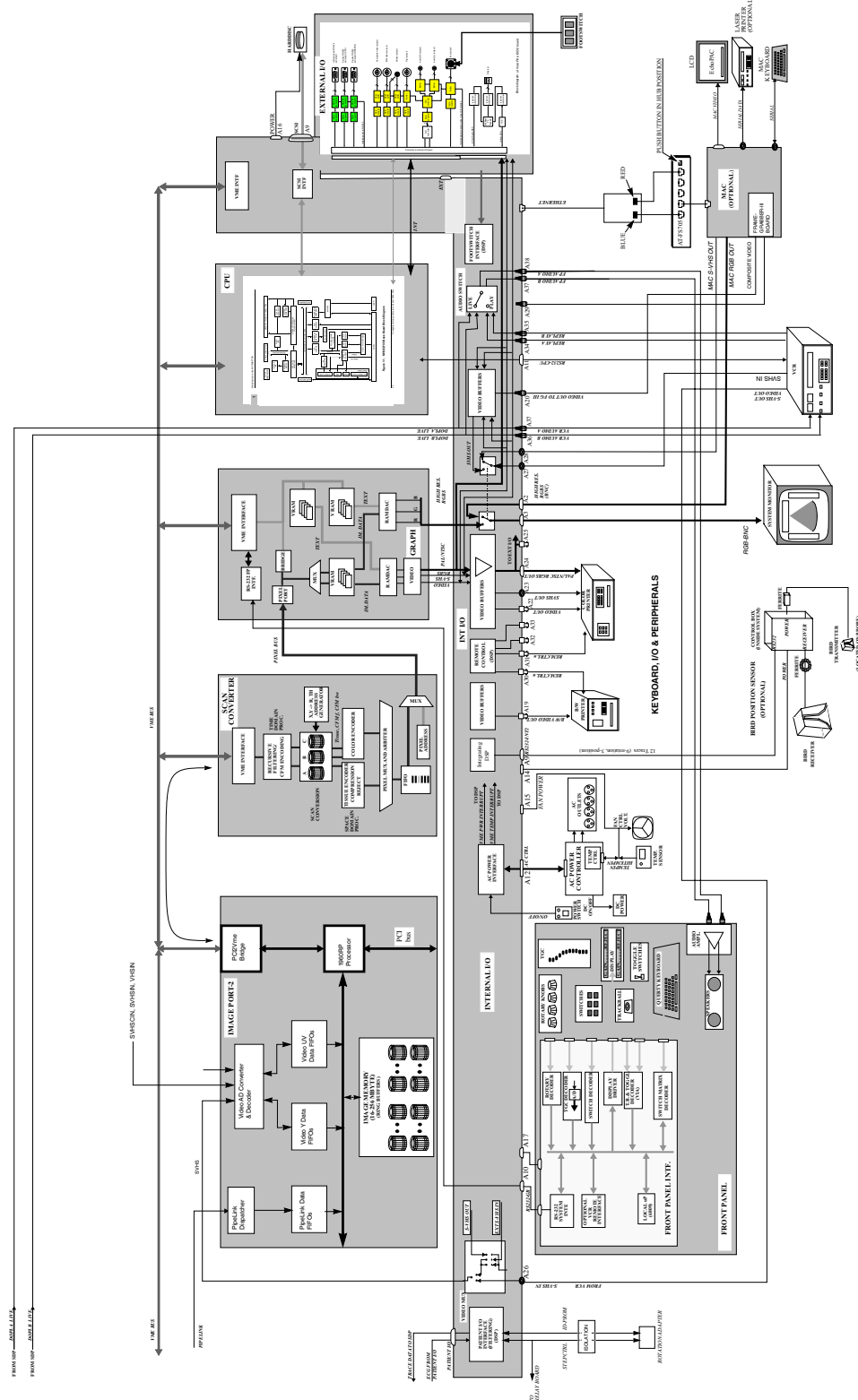
Figure 5-5 Display, Control and Input/Output (I/O) Block Diagram

5-4-9 Front End Block Diagram

Figure 5-6 Front End Block Diagram
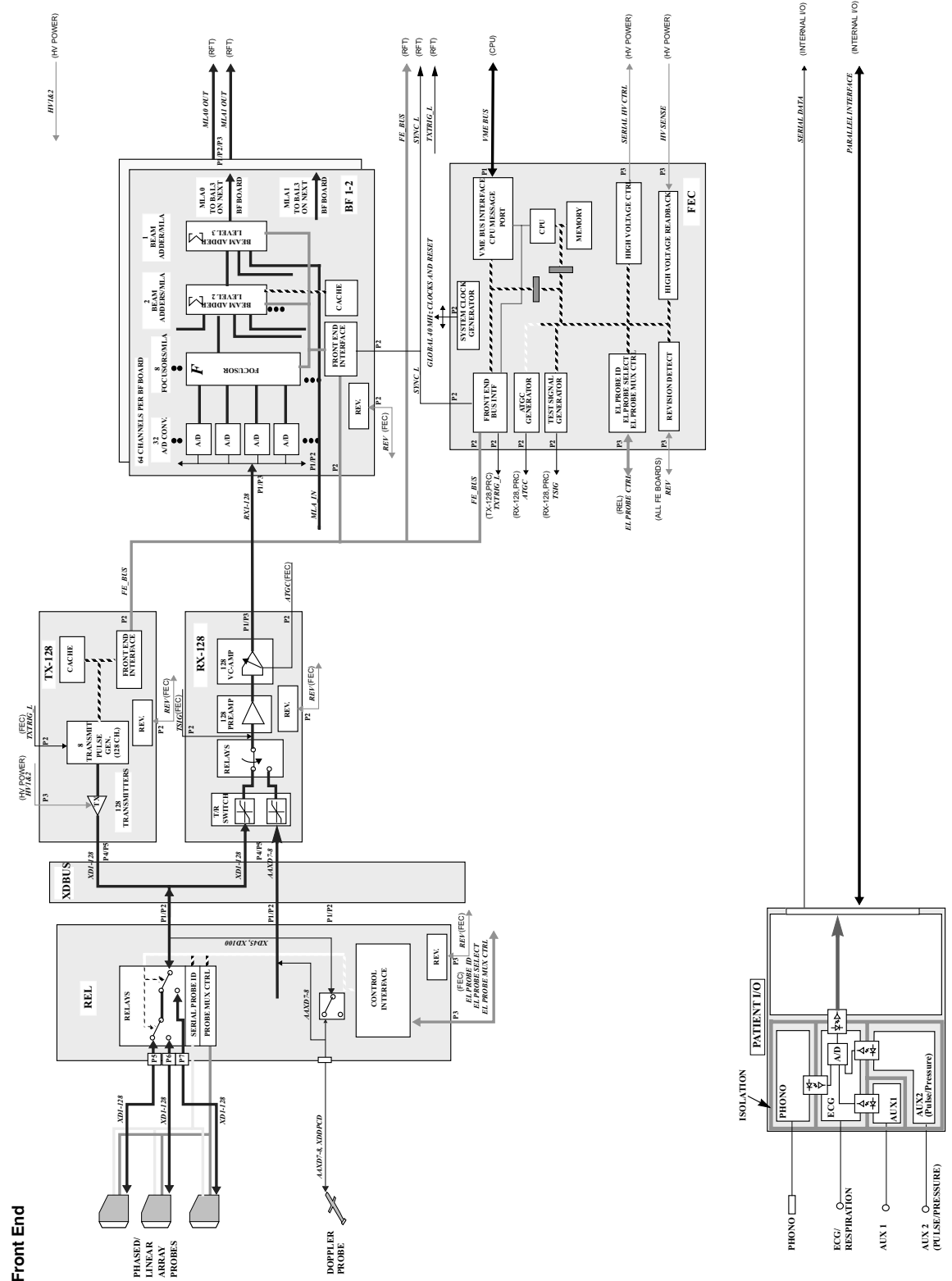
5-4-10   Mid Processor Block Diagram

Figure 5-7

5-4-11   Display Block Diagram

Figure 5-8 Display Block Diagram
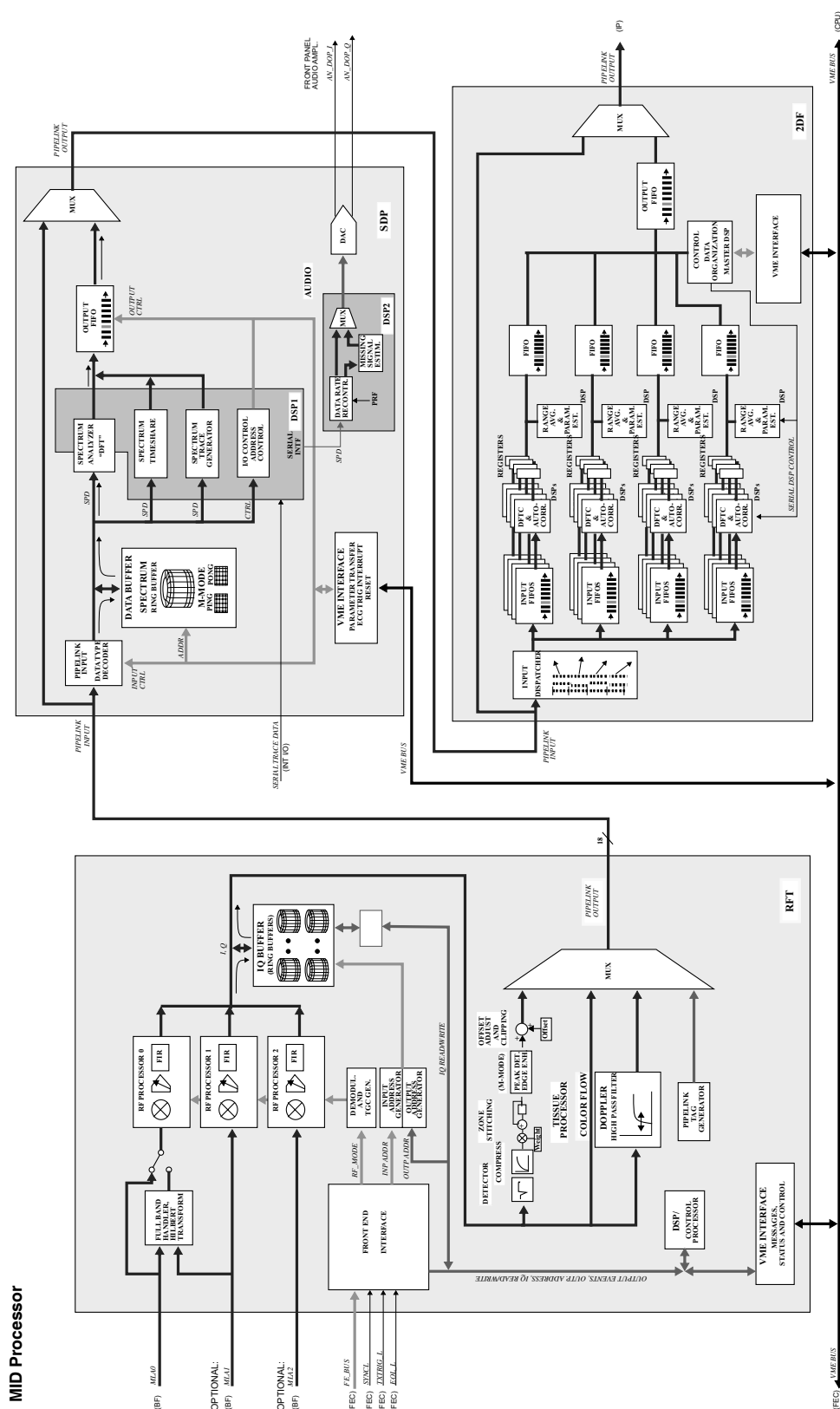
5-4-12   Internal I/O and External I/O Block Diagram
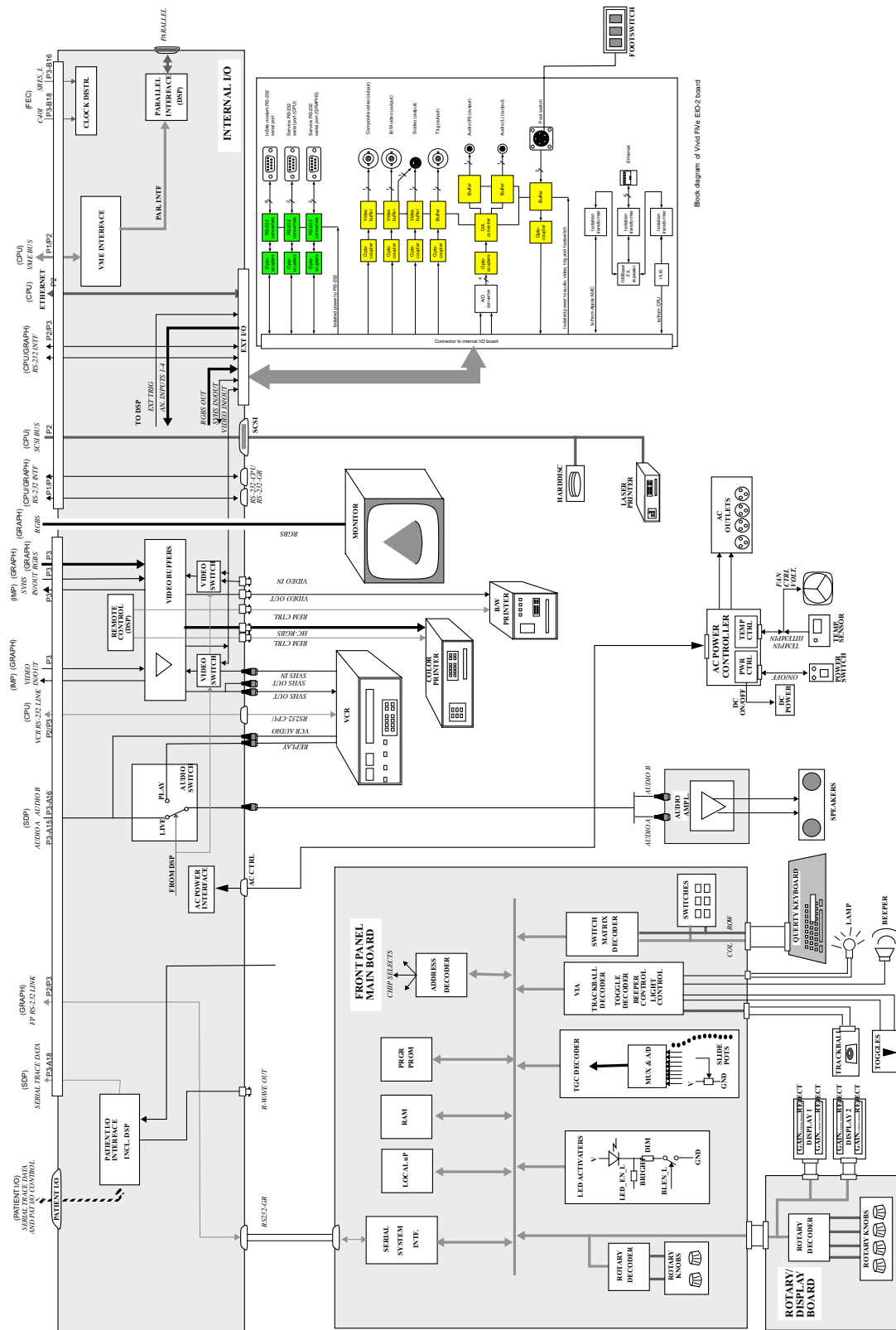
5-4-13   Connector Layout of Vivid 5 Internal I/O-2 Board (IIO-2)

(A1)   Ethernet to/from MAC
(A2)   HighRes RGB from MAC
(A3)   HighRes RGB to monitor
(A4)   HighRes RGB from GRAPH5
(A5)   StepCtrl (3D rotation adapter)
(A6)   Patient I/O
(A7)   SCSI to disk
(A8)   IIO-1 (RS232) Debug
(A9)   IIO-2 (RS232) Position sensor
(A10)   GRAPH5-1 (RS232) Front panel
(A11)   CPU-1 (RS232) VCR control
(A12)   AC power control
(A13)   Burn in power on/off control
(A14)   Power-1 (Position sensor)
(A15)   Power-2 (AC power fans)
(A16)   Power-3 (Disk)
(A17)   Power-4 (Front panel)
(A18)   Composite video from MAC
(A19)   BW video output to BW printer
(A20)   Composite video output to MAC FG-III
(A21)   Composite video output (not used)
(A22)   Color Printer - Sync
(A23)   Color Printer - Red
(A24)   Color Printer - Green
(A25)   Color Printer - Blue
(A26)   SVHS in from VCR (VCR replay)
(A27)   SVHS out to VCR (VCR record)
(A28)   SVHS out from MAC
(A29)   R-Wave out

(A30)   Remote control 1 (B/W printer)
(A31)   Remote control 2 (Color READY/BUSY)
(A32)   Remote control 3 (Color COPRINT)
(A33)   Remote control 4

(A34)   Audio Left from VCR (replay)
(A35)   Audio Right from VCR (replay)
(A36)   Audio Left to VCR (record)
(A37)   Audio Right to VCR (record)
(A38)   Audio Left to Front Panel
(A39)   Audio Right to Front Panel
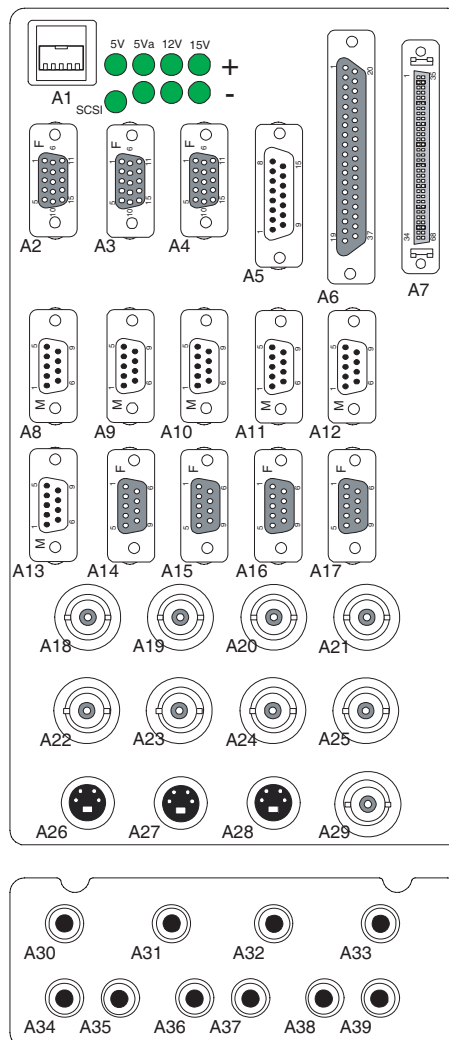
Figure 5-9 Connector Layout of Vivid 5 Internal I/O-2 Board (IIO-2)

5-4-14   Signal List, Internal I/O-2 (IIO-2)

IIO-2:			
Connector label	Connector type	Connector type	Connector sex M=Male, F=Female
(A1)	Ethernet to/from MAC	RJ-45	F
(A2)	HighRes RGB from MAC	HD22 DSUB 15pin	F
(A3)	HighRes RGB to monitor	HD22 DSUB 15pin	F
(A4)	HighRes RGB from GRAPH5	HD22 DSUB 15pin	F
(A5)	StepCtrl (3D rotation adapter)	DSUB 15 pin	M
(A6)	Patient I/O	DSUB 37 pin	F
(A7)	SCSI to disk	Mini DSUB 68 pin	F
(A8)	IIO-1 (RS232) Debug	DSUB 9 pin	M
(A9)	IIO-2 (RS232) Position sensor	DSUB 9 pin	M
(A10)	GRAPH5-1 (RS232) Front panel	DSUB 9 pin	M
(A11)	CPU-1 (RS232) VCR control	DSUB 9 pin	M
(A12)	AC power control	DSUB 9 pin	M
(A13)	Burn in power on/off control	DSUB 9 pin	M
(A14)	Power-1 (Position sensor)	DSUB 9 pin	F
(A15)	Power-2 (AC power fans)	DSUB 9 pin	F
(A16)	Power-3 (Disk)	DSUB 9 pin	F
(A17)	Power-4 (Front panel)	DSUB 9 pin	F
(A18)	Composite video from MAC	BNC	F
(A19)	BW video output to BW printer	BNC	F
(A20)	Composite video input (not used)	BNC	F
(A21)	Composite video output (not used)	BNC	F
(A22)	Color Printer - Sync	BNC	F
(A23)	Color Printer - Red	BNC	F
(A24)	Color Printer - Green	BNC	F
(A25)	Color Printer - Blue	BNC	F
(A26)	SVHS in from VCR (VCR replay)	MIN-DIN 4 pin	F
(A27)	SVHS out to VCR (VCR record)	MIN-DIN 4 pin	F
(A28)	SVHS out from MAC	MIN-DIN 4 pin	F
(A29)	R-Wave out	BNC	F
(A30)	Remote control 1 (B/W printer)	Phono	F
(A31)	Remote control 2 (Color READY/BUSY)	Phono	F
(A32)	Remote control 3 (Color COPRINT)	Phono	F
(A33)	Remote control 4	Phono	F
(A34)	Audio Left from VCR (replay)	Phono	F
(A35)	Audio Right from VCR (replay)	Phono	F
(A36)	Audio Left to VCR (record)	Phono	F
(A37)	Audio Right to VCR (record)	Phono	F
(A38)	Audio Left to Front Panel	Phono	F
(A39)	Audio Right to Front Panel	Phono	F

Table 5-3 Signal List, Internal I/O-2 (IIO-2)

5-4-15   Connector Layout of Vivid 5 External I/O-2 Board (EIO-2))
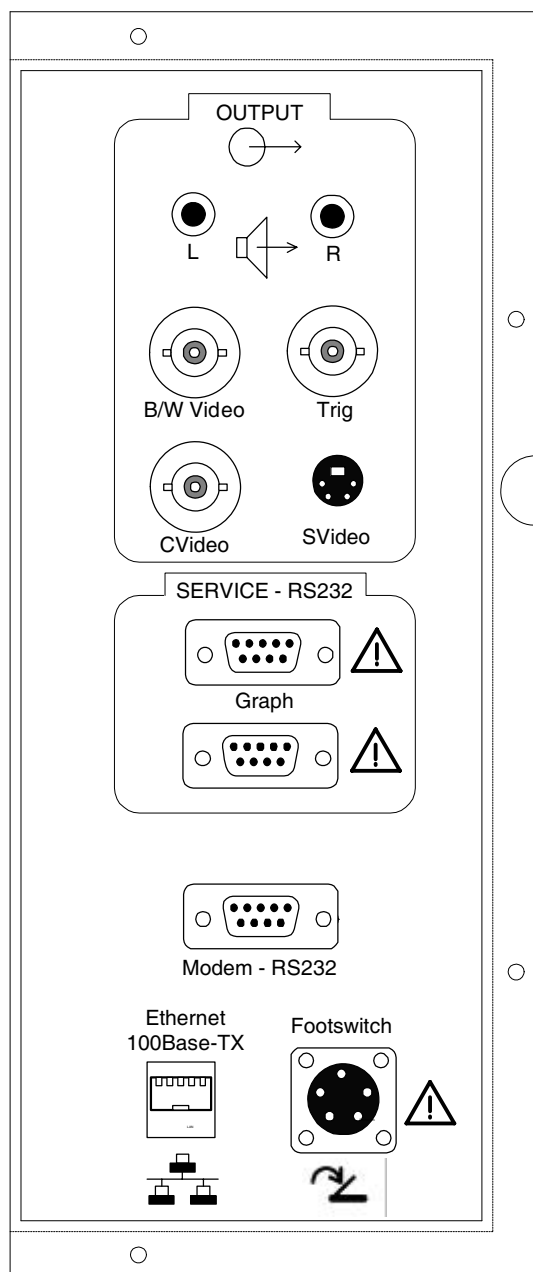
Figure 5-10 Connector Layout of Vivid 5 External I/O-2 Board (EIO-2)

5-4-16   Insulation Diagram, External I/O-2

Open air

RJ-45 Ethernet connector

Other signals (Uref=80Vac)
Enclosure, grounded

Enclosure, NOT grounded

LIVE PART

TX-power output
is +/- 80Vdc
with unsufficient
air clearence and
creepage distance
to other signals.

TX-128 board
generates 80Vac
with unsufficient
air clearence and
creepage distance
to other signals.

There are 3 serial port connectors on EIO-2,
shearing common floating ground.
Connector type is 9 pin male DSUB

Open air

Other signals (Uref=80Vac)
Enclosure, grounded

Enclosure, NOT grounded

Following connectors share common
floating ground: Audio (L), Audio (R), Video,
B/W video, SVideo, Trig and Foot Switch

Open air

Other signals (Uref=80Vac)
Enclosure, grounded

Enclosure, NOT grounded

Foot switch connector

Insulation diagram of EIO-2
Version : 4. April 2000, 10:03
File: D:\sys5_hw\int_io\doc\ghs\03\s5-ghs-io-boards-vsd.vsd:Page-7

File: s5-isolation.vsd:Page-2
Ref. file: s5-isolation.xls for requierments

Figure 5-11 Insulation Diagram, External I/O-2

5-4-17 Signal Insulation List, External I/O-2 (EIO-2)

EIO-2:

Signal name	Direction	Connector type	Connector sex	Signal level	Termination value needed	601-1 insulation
Audio - left	OUT	Phono	F		56 Kohm	Opto - 4000V
Audio - right	OUT	Phono	F		56 Kohm	Opto - 4000V
Trig	OUT	BNC	F	0 to +3.3V	N/A	Opto - 4000V
B/W video	OUT	BNC	F	Luminace video signal (Y) Y: 1Vp-p	75 ohm	Opto - 4000V
Composite video	OUT	BNC	F	PAL composite video signal 1Vp-p or NTSC composite video signal 1Vp-p (PAL or NTSC selected during manufacturing)	75 ohm	Opto - 4000V
S-Video	OUT	4 pin mini-DIN	F	Separate luminace (Y) and chrominance (C) signals: Y: 1Vp-p C: 0.3Vp-p color burst	75 ohm	Opto - 4000V
Modem	IN/OUT	DSUB 9-pin	M	RS-232 all 8 signals + GND are used, RS-232 level : typ. +/- 5.4V, max. +/- 13.2V (see note 1)	N/A	Opto - 4000V
Service terminal CPU	IN/OUT	DSUB 9-pin	M	RS-232 only RX/TX signals used + GND are used, RS-232 level : typ. +/- 5.4V, max. +/- 13.2V (see note 1)	N/A	Opto - 4000V
Service terminal GRAPH5	IN/OUT	DSUB 9-pin	M	RS-232 only RX/TX signals used + GND are used, RS-232 level : typ. +/- 5.4V, max. +/- 13.2V (see note 1)	N/A	Opto - 4000V
Ethernet	IN/OUT	RJ-45	F		N/A	Transformer - 1500V
Foot Switch	IN	Hirose Electric Co.RM12BRB-5S	F	Signal level is between 0 and +3.3V	N/A	Opto - 4000V
Notes:						
(1)				TIA/EIA-232-E specifications gives dirvers maximum output voltage to +/-25V, and drivers output signal level tp +/- 5 to +/- 15V loaded, and +/- 25V unloaded. The selected device have absolute maximum driver voltage to +/- 13.2V, and receiver voltage to +/- 25V.		

Table 5-4 Connector List, External I/O-2 (EIO-2)

Section 5-5
Video Specifications for VIVID 5

Note: **Video specifications may be needed to be able to connect video peripherals to the VIVID 5.**

5-5-1   PAL Video Specifications

Table 5-5 PAL Video Specifications

HORIZONTAL TIMING		
HORIZONTAL TOTAL (HT)	us	944 pixels
HORIZONTAL START (HS)	us	152 pixels
HORIZONTAL ACTIVE (HA)	us	768 pixels
PIXEL CLOCK FREQ.	14.7 MHz	(PAL)
VERTICAL TIMING (INTERLACED)		
VERTICAL START (VS)	53 Lines / field	
ACTIVE LINES (VA)	Lines / frame	(=PAL standard)
TOTAL LINES (VT)	625 Lines / frame	(=PAL standard)
FRAME RATE	25Hz	(=PAL standard)

5-5-2   NTSC Video Specifications

Table 5-6 NTSC Video Specifications

HORIZONTAL TIMING		
HORIZONTAL TOTAL (HT)	us	780 pixels
HORIZONTAL START (HS)	us	118 pixels
HORIZONTAL ACTIVE (HA)	us	640 pixels
PIXEL CLOCK FREQ.	12.272725 MHz	(NTSC)
VERTICAL TIMING (INTERLACED)		
VERTICAL START (VS)	17 Lines / field	
ACTIVE LINES (VA)	(525 - 17) Lines / frame	(=NTSC standard)
TOTAL LINES (VT)	525 Lines / frame	(=NTSC standard)
FRAME RATE	30Hz	(=NTSC standard)

Chapter 6
Service Adjustments

Section 6-1
Introduction

This chapter describes how to test and adjust the scanner. These tests are optional. You may use them to check the system for errors.

Section 6-2
Regulatory

Verify, where applicable, that any regulatory information or tests required by national law is present and accounted for, and any regulatory tests required by national law are performed and documented.

Section 6-3
Calibration

6-3-1   Setup Menu Selection

Setup and configuration of the scanner is performed from the Setup Menu.
Press the **SETUP** button on the keyboard to select the Setup Menu.

6-3-2   Date, Time and Hospital Name Verification

- Check that the *date*, *time* and *hospital name* are correctly set.

Please refer to the "Set Up" section in the Vivid 5 User Manual if you need to change these settings.

Section 6-4
Performance Test

6-4-1   Introduction

6-4-1-1   Abstract

This Performance Test Procedure is based on the Internal System Test Procedure, used prior to shipment from the factory.

Most of the specifications are not objective and require live scanning on yourself or an image phantom.

6-4-2   Scope

This procedure concerns systems with or without the EchoPAC™ option. There may, therefore, be some deviations in functions between systems.

6-4-3   Initial Checks

6-4-3-1   Configuration/Test Menu

This procedure describes how to select the Configuration/Test Menu.

1.) Press the **SETUP** button on the keyboard.

2.) Select Configuration & Test from the menu on the screen.

Setup Menu	Configuration/Test
User Interface	GE Service
Triggering	Diagnostic test
Configuration & Test	Network
Annotation	SW
VCR Configuration	HW
EchoPAC/Clipboard	Options
Date and Time	Done
Location	_ 5
Footswitch Mapping	_
Done	

Figure 6-1 Setup – Configuration & Test

6-4-3-2   Software

1.) Turn the system on and select Setup:Configuration & Test:SW

2.) Verify that the software (sw) version is at the level stated in the Device History Record (DHR).

6-4-3-3   Hardware

1.) Display Setup:Configuration & Test:HW.

2.) Verify that it matches the printed configuration data in the Device History Record.

6-4-3-4   User Interface

1.) Verify that the monitor is operational and properly adjusted.

2.) Verify that the Front Panel backlighting and LEDs are working. See section *6-4-5 - Front Panel Test*.

6-4-4   Automatic Tests

6-4-4-1   Diagnostic Test

Diagnostic Test of the scanner is performed from the Diagnostic Test Menu.

This procedure describes how to select the Diagnostic Test Menu and run the test.

1.) Press the **SETUP** button on the keyboard.

2.) Select `Configuration & Test` from the menu on the screen.

3.) Select `Diagnostic test`. The Diagnostic Test Menu appears on the screen.

4.) Select `Run test` to start the Diagnostic test.

Setup Menu	Configuration/Test
User Interface	GE Service
Triggering	**Diagnostic test**
Configuration & Test	Network
Annotation	SW
VCR Configuration	HW
EchoPAC/Clipboard	Options
Date and Time	Done
Location	_ 5
Footswitch Mapping	_
Done	

Figure 6-2 Setup – Configuration & Test – Diagnostic test

6-4-5   Front Panel Test

6-4-5-1   Start of Test

1.) Turn on the system.

2.) Wait a while until the Front Panel is reset by the system (until `GE VINGMED ULTRASOUND` is turned off in the display).

3.) Push down **ALT**, **SHIFT** and **1** after `GE VINGMED ULTRASOUND` is displayed.
(Release **1** first, then the other two buttons).
You should now have the following text in the two displays:

SW VER.	DATE	OK	CONN

EXIT	TEST	CLEAR	BOOT

Figure 6-3 Front Panel Test. Text in Front Panel Displays After Boot and Start of Test.

- *SW VER* is the current local Front Panel software version.
- *DATE* is the date of software release.
- *OK* is the status of a serial comm. test. Otherwise ERROR will be displayed.
- *CONN*
- *EXIT* test mode.
- *TEST* enters test mode.
- *CLEAR*
- *BOOT* is used during in-house module test of serial communication.

4.) Press **TEST** to enter test mode. You will now have the following text in the lower display:

DONE	DOTS	LEDS	KEYS

Figure 6-4 Front Panel Test. Text in Front Panel's Lower Display when Test Mode is entered.

6-4-5-2   Display Test

- Press **DOTS**
  All dots in the display should light up.

6-4-5-3   LED Test

- Press **LEDS**
  The backlighting LEDs for all keys (except ADD MODE/CURSOR and ACTIVE MODE) should be lit.

6-4-5-4   Key Test

- Press **KEYS** (the LED will blink):
- Pressing each of the keys will result in a beep and the hex code for that particular key will be displayed in the upper keyboard.

6-4-5-5   Rotary Knob Test

- Turn the rotary knobs. A 4-digit code in the upper display shows up. The first two digits is a code for the 8 rotaries. 00-03 are the knobs between the display. 04 is the ACTIVE MODE knob, 05 is the 2D GAIN knob, 06 is the ZOOM knob and 07 is the DEPTH knob. The last two digits indicates the speed of rotation: low numbers clockwise and high numbers counterclockwise.

6-4-5-6   Paddle Stick Test

- Move the paddle sticks. Another 4-digit code in the upper display shows up. The two left digits indicate the paddle stick number: 00 is the upper and 01 is the lower. The two right digits indicate the position of the paddle sticks: 00 is up (or left), 01 is center and 02 is down (or right).

6-4-5-7   TGC Slide pot. Test

- Move the TGC slide pots. A 16 digit code (divided in eight 2-digit sections) in the Upper Display shows up. The position of the upper slide pot. is displayed in the upper left section of the display code field, and the lower slide pot. is displayed in the lower right code field. Values range from 00 (slide pot. left) to 33 (slide pot. right).

6-4-5-8   Trackball Test

- Move the trackball up and down, left and right and verify the corresponding position of the arrow on the upper display.

6-4-6   Transmit Pulse Test

The purpose of this test is to verify that high-voltage transmit pulses are generated on the TX128 board.

- While the system is running in 2D mode, connect oscilloscope ch.A to e.g. pin D28 (channel 65) on the lower XDBUS board (on RLY or TX128 location)
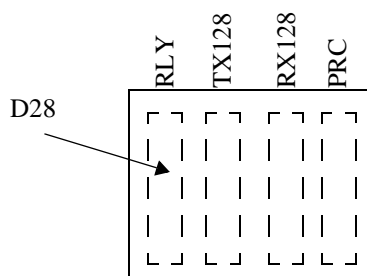
Figure 6-5 Transmit Pulse Test: Lower XD Bus Board

- The signal should be a high-voltage burst. Pulse width, amplitude and frequency will vary with probe type and mode. Amplitude can be controlled with Power.

6-4-7   Transmit Trigger (TXTRIG) Test

The purpose of this test is to verify that the FEC board generates TTL level transmit trigger pulses.

- Connect scope to coax connector P4 on FEC. (P4 is the lower connector).
- Enter 2D and verify a low TTL pulse of 50 ns width. Pulse Repetition Frequency (PRF) will vary with system setup.

6-4-8   ATGC Test

The purpose of this test is to verify that the FEC board generates the correct analog TGC control signals, ATGCVP and ATGCVN.

- Connect a scope to P5 (ATGCV) on FEC. (P5 is the upper connector).
- Enter 2D and verify a voltage ramp signal on the scope, typically ranging from 0V (+10dB) to +8V (+30dB). (The full range is from -10V to +10V).

6-4-9   High Voltage Test

6-4-9-1   HV1 and HV2 Tests

There are test points for the high voltages located between the two XDBUS boards.

Note: **The voltages on the test points are scaled down with a factor of 10.**

Voltage range	TX128 test points
HV1+ (0 to +80V)	4th from top
HV1- (-80 to 0V)	5th from top
HV2+ (0 - to 40V)	3rd from top
HV2- (-40 to 0V)	2nd from top

6-4-10   DC Voltage Test

6-4-10-1   Measuring DC Voltages on the INT I/O Power Connector(s):

Note: **Each output is protected with a recovery fuse.**

Note: **Pin 1 is the upper right pin.**

```
"POWER"
        ●1
1: +5V
2: +12V
3: -12V
4: +15V
5: -15V
6: GND
7: GND
8: GND
9: spare
```
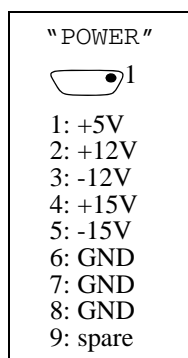
Figure 6-6 Internal I/O Power Connectors

6-4-10-2 Watching LEDs

- On the **INT I/O** there are seven LEDs, used as voltage indicators. They should be lit when the system is on. If any of the LEDs are off, please measure the voltage(s) as described above before replacing the DC Power Supply. (The LED could be bad). The only voltages which is not displayed here is +10 VDC and +3.3 VDC.
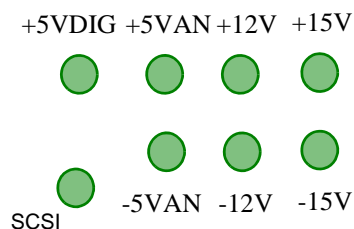
Figure 6-7 LEDs on the Internal I/O Board

All LEDs should have approximately the same intensity, and they should be stable.

6-4-10-3 Measuring DC Voltages on the Motherboard.

There are test points for all voltages on the motherboard. By ejecting the IP-2 and GRAPH boards, these test points (not pins, only holes) can be accessed with a voltmeter. They are located in a horizontal row between the P2 and P3 connectors. Starting from the right side, the voltages are:

Nominal Voltage [V DC]	Voltage Range [V DC]	Test Point Label on Motherboard (Backplane)
+5V DIG	4.75 - 5.25	P5V
+5V AN	4.75 - 5.25	AVCC
-5V AN	-(4.75 - 5.25)	AVEE
+10V	9.5 - 10.5	VDRIVER
+12V	11.4 - 12.6	P12V
-12V	-(11.4 - 12.6)	M12V
+15V	14.25 - 15.75	P15V
-15V	- (14.25 - 15.75)	M15V

Table 6-1 DC voltage on Motherboard (Backplane)

6-4-11   Peripheral and I/O Tests

6-4-11-1   PAL/NTSC Setting

Selection of PAL/NTSC must be done in the Video Settings menu (password: setfive).

• Set both Video Standard and External Video Input to the appropriate video standard.

(USA: NTSC, Europe: PAL, For other countries/territories: Contact the local GE Vingmed dealer for info.)

6-4-11-2   Record and Playback

1.) Record 2D and Color Flow alternately and then Doppler with audio.
2.) Play back the recorded tape and verify the quality of the picture. (Expect some degeneration of the picture, compared to the recorded one.)
3.) Verify clean unsaturated Doppler audio.
   If necessary, adjust the AUDIO LEVEL potentiometers on the VCR to avoid saturation.

If Remote Control is installed, use the assignable keys to operate the VCR functions.

6-4-11-3   Printer Test

1.) Connect a B/W printer to the Video Output connector.
2.) Enter 2D and obtain an image.
3.) Press **PRINT** (on Frontpanel), and verify the quality of the print.
   If necessary, adjust the printer controls.
4.) Connect a color printer to the RGBS output connector.
5.) Enter color flow and obtain an image.
6.) Press Print(Alt.) on Frontpanel, and verify quality of the print.
   If necessary, adjust the printer controls.

6-4-11-4   Footswitch

• Test the footswitch interface (use 2D mode for the test).

Default setup:

> Left:Rec/Pause,
> Middle: Full Freeze,
> Right: Image Store.

6-4-12   External I/O Tests

6-4-12-1   Video out

• With an oscilloscope, verify presence of video signal. Typical signal level: 2.2 Vpp.

6-4-12-2   S-VHS Out

• With an oscilloscope, verify presence of S-VHS signal. Typical signal level: 2.0 Vpp

6-4-12-3   RGBS Out

• With an oscilloscope, verify presence of RBG signals.Typical signal level: 1.8 - 1.9 Vpp

6-4-12-4   MAC Interface Test - Stand Alone MAC only

- If a Stand Alone MAC with EchoPAC is to be used with the system, test that Data Transfers work properly when using the Transfer Data Kit.
- Try both short-cut tests (with the F9 key) and transfers from the clipboard. If Standalone Mac has Continuous Capture option, refer to *"Macintosh with Continuous Capture" on page 6-9*.

6-4-12-5   ECG

1.) Connect ECG simulator or electrodes.
2.) Turn traces on.
3.) Verify an ECG trace on the monitor.

6-4-12-6   Phono

(Optional Test)

1.) Connect a Heart microphone and turn Phono on.
2.) Verify quality and presence of phono trace.

6-4-12-7   Respiration

(Optional Test)

1.) Connect a Respiration transducer and turn Respiration on.
2.) Verify quality and presence of respiration trace.

6-4-12-8   Pressure

(Optional Test)

1.) Connect a Pressure transducer and turn Pressure on.
2.) Verify quality and presence of pressure trace.

6-4-13   Integrated Mac

6-4-13-1   Setup Check

1.) Exit EchoPAC,
2.) Select EchoPAC Application in HD A and choose «Get Info» in the File-menu.
3.) See that EchoPAC has the correct preferred size of memory.
4.) When starting EchoPAC, verify that the EchoPAC modules specified on the packing list, are enabled with the password delivered.
5.) If systems is going to be used in USA:
  - Check that Ob/Gyn is not an option in the application menu.

6-4-13-2   Macintosh with Continuous Capture

You need the EchoStress option installed for this test to work.

1.) Select FPA probe
2.) Select Video Stress Application
3.) Enter live 2D tissue scanning mode on S5, make sure that there is an ECG signal to the scanner while doing the test.

a.) Switch to EchoPAC mode.

b.) Enter stress-test mode in EchoPAC.

c.) Turn "Continuous capture" on.

d.) Step on the middle footswitch. Verify that EchoPAC starts grabbing a new window with the live 2D scan pops up in the middle of the EchoPAC - screen.

e.) Verify that no lockups occurred when filling the hole memory, and verify that all the ECG traces are transferred during the capture.

f.) Finish Procedure and Delete Capture (Right footswitch)

6-4-13-3   Communication with Scanner

Use System Front Panel (not external keyboard) when doing this test to be sure communication is ok.

1.) Choose Patient IO on Scanner, verify screen switches to EchoPAC and create a new Patient.

2.) Enter some patient data, and click the «save» button.

3.) Verify screen switches to scanner and make sure the info window is updated with the same information you entered in EchoPAC.

4.) Transfer data by selecting Image Store key when;

a.) Scanner is running or replaying a cineloop,

b.) A frozen 2D tissue scan is present.

5.) Also transfer data from:

a.) Color Flow mode (CFM),

b.) M-mode,

c.) Doppler mode.

6-4-14   Mechanical Check

6-4-14-1   Checking Brakes

√	Step	Description	Verification
	1.	Position the Brake Pedal in its Upper position.	Check that the rear wheels are direction locked but rotate freely.
	2.	Position the Brake Pedal in its "Half Way Down" position.	Check that all the four wheels turn and rotate freely.
	3.	Position the Brake Pedal in its Lower position.	Check that the breaks are active on both rear wheels. (Use this position whenever parking the system).

Table 6-2 Checking the Brakes

6-4-14-2   Checking Monitor Tilt

√	Step	Description	Verification
	1.	Turn the monitor to the left and to the right.	Verify that it moves smoothly, but that some resistance is present.
	2.	Tilt the monitor up and down.	Verify that it moves smoothly, but that some resistance is present.

Table 6-3 Checking Monitor Tilt

6-4-15   Hardware Check

1.) Connect a mouse or keyboard to the keyboard port, and make sure it works properly.
2.) Connect a Stylewriter (printer) to the printer port and print a report from the patient archive. If a proper printer-driver is missing, install it from disk and delete it after the printer test is done (if necessary).
3.) Verify ability to save and recall to/from the MO-disk to verify proper functionality.
4.) Verify the eject function by pushing «Fn» and «E».

6-4-15-1   Screen Switching

1.) Switch to EchoPAC with the **ECHOPAC** button.
2.) See that the entire screen is used to display EchoPAC, and that track-ball works.
3.) See that help is displayed in EchoPAC when the **HELP**' button is used.
4.) Switch back to **VIVID 5**, and verify placement /image quality.

6-4-15-2   VCR Recording

1.) Start recording with VCR
2.) Switch between **VIVID 5** and **MACINTOSH (ECHOPAC)** via **ECHOPAC** key.
3.) Stop recording, rewind and play back the tape. See that the recorded data is the same that was shown on screen. Verify quality of recording.

6-4-15-3   EchoPac-3D

If EchoPAC-3D is installed, perform this test to make sure it works properly.

1.) According to EchoPAC-3D User Manual, FA292617, perform a 3D acquisition on a non-metallic phantom, make a cineloop and transfer it to the Macintosh through EchoPAC. The acquisition should be done with a slowly translated and/or tilted movement along the top of the phantom and by using the Long Acquisition application on Vivid 5.
2.) Exit EchoPAC and start EchoPAC-3D.
3.) Open the loop in EchoPAC-3D and verify correct representation by;

   a.) Looking at the geometry window and see that the acquisition geometry looks correct.
   b.) Measure a distance (5-10 cm) between two strings (horizontally) in the phantom in the plane normal to the middle scanning plane (select lower left window, use 2D M&A) and verify that it is correct (+/- 10%). This is to ensure that Bird System reports correct positions of each scanplane relative to each other
   c.) Select the upper right window and select "Raw Path" in the left dialog bar. By grabbing the slidebar in the window, it is possible to browse through the original 2D scan planes while looking at their positions in the geomtry window. Verify that the movement of the scanplanes is smooth like the movement that was done with the probe during acquisition. This is to ensure that there is no noise affecting the position sensor system (which would make the 3D data look "jumpy").

6-4-16   Monitor Setup (Adjust if Necessary, ONLY)

- If necessary, adjust the monitor.
This Procedure Can Be Used For the "Sony G200 (BT00) GEVU Modified" Monitor.

6-4-16-1 Screen Manager (Main Menu)

These choices are available via the Screen Manager's Main Menu:

- Center
- Size
- Geom
- Help
- Color
- Conv
- Lang
- Option
- Exit

6-4-16-2 Pre Settings

1.) Set the input switch in position 2 (Left side)
2.) Set Brightness to 50 (Touch the Control button)
3.) Set Contrast to 90 (Touch the Control button)

6-4-16-3 Adjust Convergence

Press the center of the control button to display the main MENY on your screen

Select the CONV menu to adjust the picture`s horizontal and vertical convergence.

Typical settings:

- Horizontal app. 35
- Vertical ca 55.

6-4-16-4 Geometry and Size

Adjust the geometry and size using "Geom", "Size", "Center" on the main MENY.

Adjust to fill the whole screen.

6-4-17 Functional Test

1.) Connect a 2.5 or 3.5 PA probe to the system.
2.) Reselect probe to obtain default settings.

6-4-17-1 2D Controls

1.) In 2D mode, set 2D Gain and the TGC knobs to get even signal distribution for all depths when measuring on a phantom.
2.) Vary depth from minimum to maximum and verify that the field of view changes accordingly.
3.) Vary Angle/Width and verify that there is no distortion for any combination of depth and width.
4.) The Freq. control.

   a.) Turn Freq counterclockwise and verify that the penetration increases.

   b.) Turn Freq clockwise and verify that the resolution increases. Pay special attention to the Octave settings.

5.) Turn Focus and verify improved image sharpness within the focused area.
6.) The Zoom control

      a.) Press Zoom once,

      b.) Adjust proper zoom span,

      c.) Press Zoom once more and verify a proper zoomed image.

      d.) Press Zoom a third time to exit.

7.) Change Reject and verify how low level echoes are rejected when Reject is increased.

8.) Change Compress and verify increased contrast for low compress settings and softer image for high compress settings. Verify functionality in Freeze.

9.) Change Dynamic Range and verify "soft" images for high settings and "harder" (increased contrast) images for lower settings.

10.) Verify performance of DDP on a moving target, no averaging at minimum DDP and increasing averaging with increasing DDP.

11.) Freeze the image, then use the trackball to scroll back into the memory.

12.) Press the Image Store button to store a frozen image to the hard disk clipboard. Press Image Recall to restore this image: (Must select this configuration in EchoPAC clipboard)

13.) Connect a 10 MHz FLA probe, press Compound and verify increased resolution (not available on FA000410).

6-4-17-2   Doppler Controls

1.) If necessary, reselect the probe to bring it to default settings, and select PW.

2.) Increase Gain to maximum and change the Horizontal sweep from minimum to maximum, and verify 1, 2, 3, 4, 6, 8, 12 and 16 seconds of data across the TM field. Freeze and check the scrolling memory using the trackball.

3.) Obtain a good Doppler spectrum measuring on yourself or on a flow phantom. Change Velocity Range and verify that the vertical scaling of the spectral display changes accordingly.

4.) Move Baseline up and down and verify proper response.

5.) Decrease LV Reject and verify that low velocities are displayed. Increase LV Reject and verify that the low velocities are rejected.

6.) Increase Compress and verify increased brightness in the spectrum.

7.) Increase Reject and verify that the low level signals (noise) are rejected.

8.) Increase Sample Volume from minimum to maximum and verify that the sensitivity increases.

9.) Obtain a strong and good signal. Increase Tracking and verify that the signal is getting weaker but the quality of the spectrum is getting better (not available on FA000410).

6-4-17-3   Color Flow controls

1.) If necessary, reselect the probe to bring it to default settings. Then obtain a good 2D image while scanning yourself or a flow phantom.

2.) Decrease PRF to minimum and verify that the Nyquist limit is decreased (aliasing) and that low flow filling is improved. With PRF to maximum, Nyquist is increased, but sensitivity appears to be less.

3.) With medium PRF, decrease LVreject and verify that the low flow signals are visible. With high LVreject settings, the low flow velocity components are rejected.

4.) Increase Gain and toggle Variance on and off. With Variance on the noise should be green.

5.) Increase Radial averaging from minimum to maximum and verify the effect of the averaging.

6.) Change Sample Volume from minimum to maximum and verify that the sensitivity increases and the axial resolution decreases.

7.) With maximum Tissue Priority, observe tissue priority over color (no color at max), and the opposite for minimum Tissue Priority.

8.) Increase Lateral averaging and observe increased averaging in the lateral direction.

6-4-17-4   MPTE Test (PAMPTE)

1.) Connect a MPTE-probe (KN100007/KN100006) or simulator (KZ206319).
2.) If probe, hold your hand on the probe tip and verify that the temperature increases.
If simulator, adjust temperature potentiometer and verify that the system enter freeze at 41.1ºC.
3.) Verify that the system's display of the scan plane, tracks the position of the wheel on the endoscope.

6-4-18   M-Mode Tests

6-4-18-1   Linearity

1.) With the system in 2D and the probe positioned on the phantom, press the add mode / cursor button to show the M-mode cursor.
2.) Position it so that it covers the reflectors that are found in the center of the standard phantom image.
3.) Adjust TGC and gain to get a good image of the reflectors, both in the 2D sector and in the TM field.
4.) Vary the depth setting and verify that the image changes accordingly.
5.) With the probe in the standard position, place the cursor on the string target found at 8 cm depth, 4 cm to the right of center.
6.) Enter M-mode and verify that the target is displayed in the TM field.

6-4-18-2   Color M-mode Test

1.) If necessary, reselect the probe to bring it to default settings.
2.) Obtain a proper 2D image, then enter Color M-Mode.
3.) Increase M-Mode gain and see how signal/noise is increased.
4.) Check that there are no signs of coherent noise.
5.) Switch to Color Flow settings and adjust color gain to verify response. The color noise intensity (in the color flow window) will increase when the color gain is increased. Look for color spots with higher intensity and size than the rest. If you find any, decrease the color gain slowly, until the color noise fades away. If the spot you noticed fades away after the rest of the color noise, you may have a noise problem in Color Flow.
6.) Vary depth span and see how the size of the color section can be altered.
7.) Increase sample volume and verify increased sensitivity.
8.) Verify all sweep speeds.

6-4-19   Image Quality and Noise

Image quality and noise tests must be done in all modes, with all available probes.

6-4-19-1   2D Mode

1.) In 2D mode, set 2D gain and the TGC knobs to get even signal distribution for all depths when measuring on a phantom.
2.) Pay careful attention to both axial and lateral resolution, as well as penetration.
3.) Note the shape and quality of density patches, ability to resolve nearby blips, far field blips.
4.) There should be no visible zone transitions.
5.) With maximum 2D gain, check the noise level when coupling the probe in your hand. Pay special attention to noise straight down through the image. With no external devices connected to the I/O panels, there should be no excessive coherent noise patterns.

6-4-19-2   Doppler Mode

1.) With default setup of each probe (not Pedof), obtain a good 2D image, enter CFM, press active mode / cursor and position the sample volume within an area with flow. Then enter Doppler.
2.) Verify good sensitivity and no excessive noise bands when velocity range is changed. Check both with and without 2D frozen. This applies to both PW and CW (not FLA and CLA).

6-4-19-3   Color Flow Mode

1.) With default setup of the actual probes, obtain a good 2D image on the appropriate anatomy and enter CFM mode.
2.) Verify good sensitivity and acceptable noise level (no coherent noise nor excessive white noise). A little noise straight down is currently normal, especially if external cables (e.g. ethernet) is connected to the system.

6-4-20   Options

- Check and confirm proper functionality on ordered options, listed on the packing list.

6-4-21   Hardware Revision Level

1.) Press the **SETUP** button
2.) Select the Configuration & Test menu
3.) Select HW.
4.) Verify that there is a match between the read-out of the hardware revision numbers and the information on the Configuration sheets.

Section 6-5
Probe Element Test

In order to identify bad elements in probes and bad transmit/receive channels in the system (verifying RLY/TX128/RX and BF), the following test procedure can be used:

1.) Put a little gel on the probe face, and slide the back of a scalpel (or another object with a sharp edge) across the elements, starting from element 1 (the LED side).

2.) As the scalpel is moved, watch the intensity of the echo in the 2D image. (At each end, the intensity will gradually drop). Bad elements (or channels) will cause a drop in the intensity. The problem might be the probe or a bad channel on one of the boards mentioned above.

3.) In order to distinguish between the probe and the system, try another probe. If you don't have another probe of the same type, you can use a different type together with the channel mapping drawings shown in section 6-6. The map shows the routing from an element to a channel and then to the BF board used. Thus, you should be able to tell if it is the probe, the RLY/TX128/RX boards or the BF boards that are the problem. If one of the BF boards has a failure, you can even determine which of the BF boards are bad.

Section 6-6
Element to Channel Mapping

6-6-1   Introduction

This section shows the mapping between probe element numbers and system channel numbers for the different types of probes. This information can be used for troubleshooting purposes. The 64 and 96 element probes exist in two channel mapping versions, here called old and new. The purpose of changing to the new type is to be able to run these probes on a 64-channel system.

6-6-2   192 Element Probes
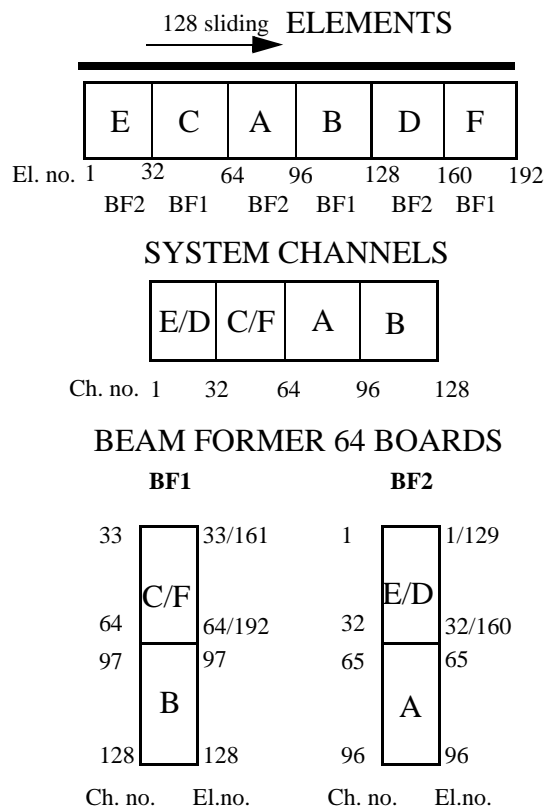
Figure 6-8 Mapping of 192 Element Probes to 128 Beam Former Channels
This mapping is true for:

- 5.0 FLA-192, KN100003 all rev's.
- 7.5 FLA-192, KT100001 all rev's.
- 10 FLA-192, KW100001 all rev's.
- 3.5 CLA-192, KK100004 all rev's.
- 5.0 CLA-192, KN100008 all rev's.

On a 192 element probe the 64 center elements are always routed to channels 65-128, while the first 64 elements are multiplexed with the last 64 elements onto channels 1-64. Element 1 is multiplexed with element 129, element 2 with 130 and so on.

On 192 Element Probes:

- All channels are used.
- Both BF-64 boards are used.

6-6-2-1 Troubleshooting Technique

One bad probe element (or e.g. one bad coax in the probe cable) will turn up as one point with less intensity in the scalpel test.

One bad channel (RLY/TX/RX, among channels 65-128) will turn up as one point with less intensity in the center part of the probe.

One bad channel (RLY, TX, RX, among channels 1-64) will turn up as two points with less intensity, one point on each side of the center part.

6-6-3   128 Element Probes

ELEMENTS

SYSTEM CHANNELS

BEAM FORMER-64 BOARDS
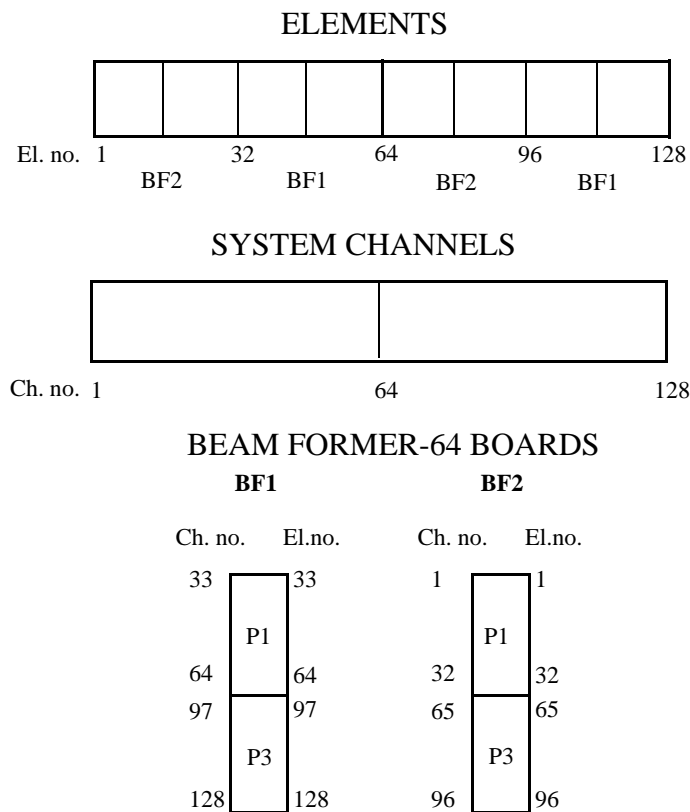
Figure 6-9 Mapping of 128 Element Probes to 128 Beam Former Channels
This mapping is true for:

- 5.0 FPA-128, KN100001 all revisions.

On a 128 element probe there is a one-to-one mapping between element numbers and channel numbers.

- All channels are used.
- Both BF-64 boards are used.

A bad element or a bad channel will turn up at the same spot in the test.

6-6-4   96 Element Probes

ELEMENTS

SYSTEM CHANNELS
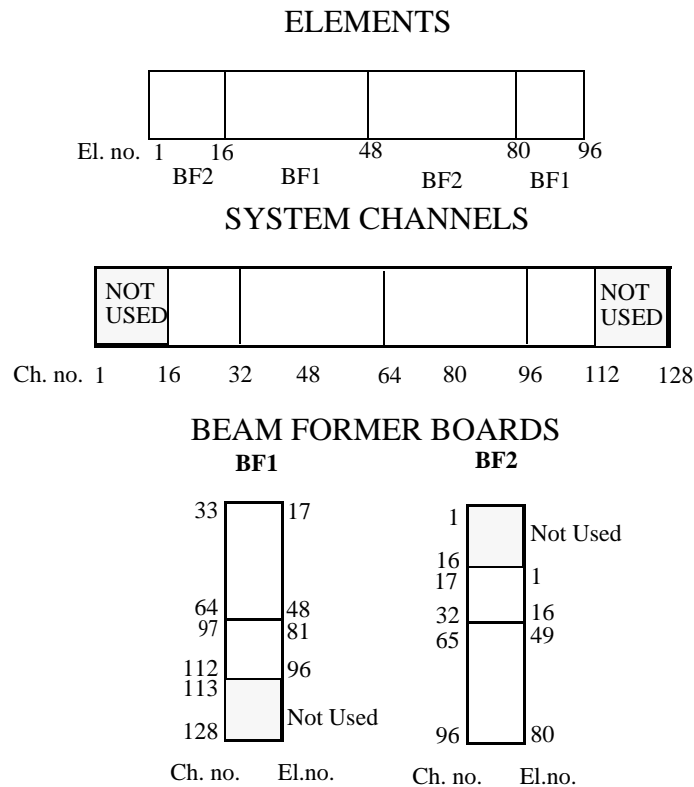
BEAM FORMER BOARDS

Figure 6-10 Mapping of 96 Element Probes to 128 Beam Former Channels
This mapping is true for:

- 3.5 FPA-96, KK100001 rev. B
- 3.5 FPA-96, KK100001 rev. C

On 96 element probes:

- 96 channels are used.
- Both BF-64 boards are used.

6-6-5   64 Element Probes

ELEMENTS

```
El. no.  1        32        64
          BF1      BF2
```

SYSTEM CHANNELS

NOT USED			NOT USED

```
Ch. no.  1      32      64      96      128
```

BEAM FORMER BOARDS

BF1

```
33 ┌──┐ 1
   │  │
64 │  │ 32
97 └──┘
   │NOT│
   │USED│
128└──┘
```

BF2

```
1  ┌──┐
   │NOT│
   │USED│
16 │  │
65 ├──┤ 33
   │  │
   │  │
96 └──┘ 64
```

```
Ch. no.   El.no.        Ch. no.   El.no.
```
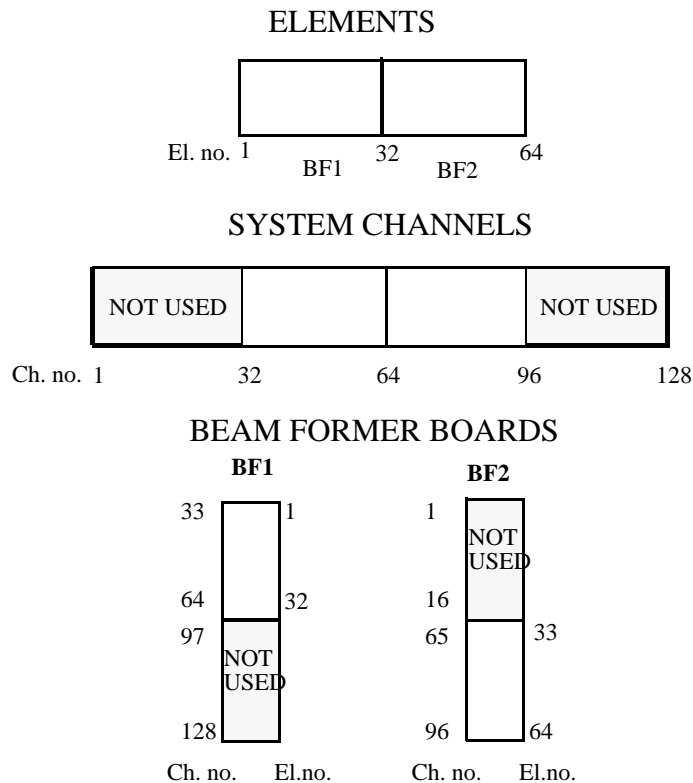
This mapping is true for:
- 2.5 FPA, KG100001 rev.B.
- 5.0 MPTE, KN100007 rev.B

On 64 Element Probes:
- 64 channels are used.
- Both BF-64 boards are used.

6-6-6   Stand Alone Doppler Probes

- Element 1 (AAXD6) is mapped to 16 receive channels, 8 on each BF-64 board.
- Element 2 (AAXD7) is mapped to 16 receive channels, 8 on each BF-64 board.

Chapter 7
Diagnostics

Section 7-1
Minimum Boot Configuration

7-1-1   Minimum Board Configuration for System to Boot

7-1-1-1   Boards Needed to Boot to the So-called "No-mode" Screen

(Disconnect all probes)

In order to get the system to boot to the so-called "No-mode" screen, the listed boards/parts are required:

- CPU board
- GRAPH board
- SCONV board
- FEC board (generates clocks for GRAPH).
- INT I/O (link between disks/ethernet and CPU, and required for on/off switching).
- Patient I/O box
- Front Panel
- RFT (must be in since we have no VME jumpers to install in this position).
- Hard disk with system software or connection to ethernet with server/MAC/PC with system software.

7-1-1-2   Boards Needed for 2D Mode

If you wish to run the system in 2D mode, the below boards must be added to the list.

- BF2 (can be left out if there are no probes connected during power-up).
- IP-2 (can be left out if there are no probes connected during power-up).

7-1-1-3   Boards Needed for Any Test Purposes

If you want to use the system for any **test purposes**, the following parts are also required:

- EXT I/O (is required only when booting from ethernet or if you want to connect a terminal to the RS-232 CPU connector).
- Terminal or PC (is required if you want to connect to the RS-232 CPU connector on the External I/O board.)

7-1-1-4   Boards That May be Left Out Without any Special Modifications

The following boards can be left out without having to do any special modifications:

- RLY
- TX128
- RX
- PRC
- BF1 and BF2
- HV-Supply.

7-1-1-5   Boards That Must be Replaced by a VME Jumper When Removed

If the following boards are pulled out, VME jumpers must be installed in the P1 (upper) connectors:

- SDP
- CFP
- IP2

7-1-2   Minimum Cable Configuration for System to Boot

The following cables must be connected between the INT I/O board and the rest of the system:

- SCSI-cable to hard disk.
- Patient I/O cable to Patient I/O box.
- I/O RS-232 GR1 serial cable to Front Panel.
- ACCTRL cable between INT I/O and ACCTRL (power-on signal).
- DC Power cable to hard disk
- DC Power cable to Front Panel.

All other cables including Macintosh cables, can be removed and the system will still boot.

Section 7-2
Faults Diagnosis

7-2-1   Instructions on How to Use This chapter

1.) Find the observed problem in *Fault Classification Overview* which follows below.
2.) Then, in the detailed fault diagrams, find the symptom description which matches the failure. Follow the suggested sequence of troubleshooting. Re-test after each replacement of parts.
3.) If the problem still exists after all recommended parts have been tested/replaced, contact technical support.

7-2-2   Fault Classification Overview

Fault Classification:	Starts at Page Number:
Start-up Problems	7-4
Display Problems	7-9
Peripheral Problems	7-13
Front Panel Problems	7-15
Probe Problems	7-16
Specific 2D Problems	7-17
Specific Color Flow Problems	7-19
Specific Doppler Problems	7-20
Analog Traces (ECG, Phono, Pressure, Respiration)	7-21
Misc. Problems	7-22

Table 7-1 Fault Classification Overview

Section 7-3
Start-up Problems

7-3-1   System Doesn't Boot

This is an overall diagram showing a recommended sequence for troubleshooting a no-boot situation.

```
                    ┌──────────────────────────┐
                    │   System doesn't boot!   │
                    └──────────────────────────┘
                                 │
                                 ▼
                    ┌──────────────────────────┐
                    │  Check AC Power voltages │
                    └──────────────────────────┘
                          See "Power Distribution" on page 5-8..
                                 │
                                 ▼
                    ┌──────────────────────────┐
                    │  Check DC Power voltages │
                    └──────────────────────────┘
                          See "DC Voltage Test" on page 6-6..
                                 │
                                 ▼
                    ┌──────────────────────────┐
                    │  Connect PC/terminal     │
                    │  and check messages,     │
                    │  observe where boot      │
                    │  process is halted.      │
                    └──────────────────────────┘
                      │                        │
                      ▼                        ▼
        ┌──────────────────────────┐   ┌──────────────────────────┐
        │ Check LEDs on the boards │   │ Check/replace hard disk  │
        └──────────────────────────┘   └──────────────────────────┘
                      │
                      ▼
        ┌──────────────────────────┐
        │  Replace the faulty board│
        └──────────────────────────┘
```
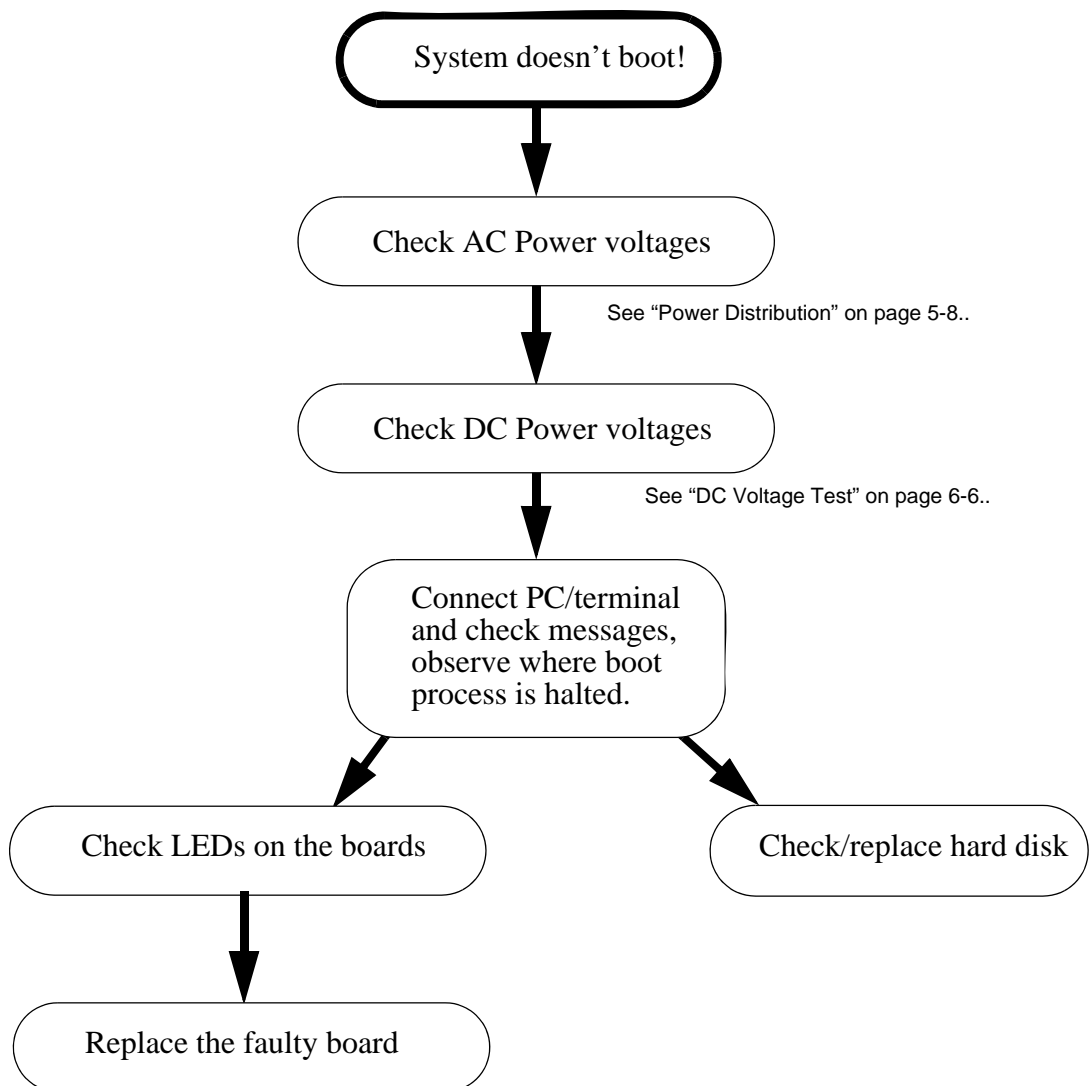
7-3-2 Start-up Problems, AC Power Related

See "Power Distribution" on page 5-8..

No yellow light in stand-by power switch,
and system is not turned on when switch
is pressed.

Yellow light is on,
but system does not
turn on when switch
is pressed.

Check that **circuit breaker**
switch is turned on.

Check that **Power Cable
Plug** is plugged into
the power outlet
and is ok.

Check that **cable between
ACPWR and INT I/O** is seated
(conn. labelled ACCTRL).

Check that the **10 A fuse F50**
on the ACCTRL board is ok.

Ref. *"AC Power Replacement
Procedure" on page 8-3.*

Check that the **15A fuses F1 and F2**
on the ACCTRL board are ok.
If ok, replace AC Controller board.

If still problems, replace
Internal I/O board.

Ref. *"Internal I/O Replacement
Procedure" on page 8-11.*

7-3-3   Start-up Problems, DC Power Related (AC Power ok).

See "Power Distribution" on page 5-8..

When the stand-by power switch is turned on, the green LED is lit, the green power indicator LED on the monitor is lit, fans are running but the system does not boot up.

Check that the **AC power cable** from ACPWR to the DC power supply is seated.

Check if any **LEDs** are lit in the card rack.

No light   *Light*

Pull out board by board. Check that **DC power** comes up. Replace board(s) causing power supply not to come up.

"Start-up Problems, System Doesn't Boot, Possible Hard Disk Problem." on page 7-7.

Check seating of **DC extension board.**

Replace **DC Power Supply**

Ref. *"DC Power Replacement Procedure" on page 8-6.*

7-3-4   Start-up Problems, System Doesn't Boot, Possible Hard Disk Problem.

System power is ok, i.e. light in board LEDs,
monitor power LED, fans are running,
but the system does not come up,
no response from keyboard.

Connect a PC to the RS232-
CPU conn. on EXT I/O
Observe messages on power-up.

Ref. the Booting that is listed in
"Software Loading Procedure"
on page 8-22.

The printout stops
when displaying "Attaching to ..."
or "Loading..."

The printout stops
at other stages than "Attaching.."
or "Loading..."

Check the hard disk
LEDs and power cable.

not ok   *ok*

Correct
cable problem.

Check that the disc spins

not ok   *ok*

Replace
hard disk

Ref. *"Start-up Problems, System*
Doesn't Boot, Possible Board Problem."
on page 7-8.

Ref. *"Hard Disk Replacement*
Procedure" on page 8-10.

7-3-5   Start-up Problems, System Doesn't Boot, Possible Board Problem.

System power is ok, i.e. light in board LEDs & monitor power LED.
Fans are running, but the system does not come up. No response from keyboard.

Replace the boards on the VME bus one by one. Start with the CPU board.

Section 7-4
Display Problems

7-4-1   No Display on Monitor, Monitor Display is Black (System Appears to Have Booted)

No light in monitor's power LED indicator after system is turned on. System otherwise seems to work (fans running, light in keyboard etc.).

Light in power indicator, but screen completely black, even with brightness turned up.

Check AC voltage in connector to monitor.

Check signals on RGB and S-connectors on rear of monitor with oscilloscope.

Ref. *"RGBS Out" on page 6-8.*

not ok

ok

Check that **AC power cable** from AC PWR to monitor is seated properly.

ok

not ok

Check seating of **RGBS cable** from card rack to monitor. Replace cable if necessary.

Replace **monitor.**

Ref. *"Monitor Replacement Procedure" on page 8-12.*

Check if system and **keyboard** appears to work properly.

ok

not ok

Replace **GRAPH** board.

See *"Start-up Problems" on page 7-4.*

7-4-2   No Display in the Image Field

```
┌──────────────────────────┐
│  There is no data at all in the │
│  image field.             │
└──────────────────────────┘
              │
              ▼
┌────────────────────────────────────────┐
│  Check LEDs supposed to be ON in the mode. │
│  Check specifically the "scan" LEDs on  FEC, BF │
│  and TX128, and the data transfer LED on the │
│  RFT, SDP and CF. Check that no red LEDs are lit. │
└────────────────────────────────────────┘
         │                        │
   LEDs not ok                LEDs ok
         ▼                        ▼
┌─────────────────┐    ┌─────────────────────┐
│ Replace board(s) with │    │ Use the Diagnostic Test in │
│ "LED" problems.   │    │ *"Automatic Tests" on page* │
│                   │    │ *6-2*.                │
└─────────────────┘    └─────────────────────┘
```

7-4-3   Data in Image Field Frozen

```
┌─────────────────────────┐
│  The image field appears │
│  to be frozen.           │
└─────────────────────────┘
             │
             ▼
┌──────────────────────────────────────┐
│  Check LEDs supposed to be on in 2D. Check │
│  specifically the "scan" LEDs on FEC, BF and │
│  TX128, and the data transfer LED on the RFT, │
│  SDP and 2DF. Check that no red LEDs are lit.  │
└──────────────────────────────────────┘
        ↙                          ↘
   LEDs                         LEDs
   not ok                        ok
┌──────────────────────┐   ┌──────────────────────────┐
│  Replace board(s) with │   │  Use the Diagnostic Test in │
│  "LED" problems.       │   │  "Automatic Tests" on page  │
└──────────────────────┘   │  6-2.                       │
                           └──────────────────────────┘
```

7-4-4 Only Noise in Image Field

Noise in 2D, no signal, (probably also in M-mode), LEDs ok.

Is probe selected? Move probe to different connector.

not ok

ok

If problems with probe select, replace **FEC** board, then **RLY** board if still problems.

If probe correctly selected, check transmit bursts.

Ref. *"Transmit Pulse Test" on page 6-5*

ok

not ok

Ref. *"ATGC Test" on page 6-5*

Check ATGC voltage.

Check TXTRIG_L signal.

Ref. *"Transmit Trigger (TXTRIG) Test" on page 6-5*

not ok

ok

not ok

ok

Replace **FEC** board

Replace **RX** board

Replace **FEC** board

Check high voltages

Ref. *"High Voltage Test" on page 6-6*

ok

Replace **FEC** board

not ok

Replace **HV power**

Replace **TX128**

Replace **FEC** board

Section 7-5
Peripheral Problems

7-5-1   VCR Related Problems

No video playback.

No video record.

Check jumper settings on VCR Front Panel.

Check that video is recorded onto the tape, by playing the tape on a different VCR, and by measuring the input signal to the VCR with oscilloscope.

Record ok

Record not ok, signals present

Record not ok, signals not present

Check cable from S-VHS out on VCR to S-VHS in on INT I/O.

Replace the **VCR**.

Check cable from S-VHS out on INT I/O to S-VHS in on VCR.

Check signals on S-VHS in at INT I/O with oscilloscope.

Check signals on S-VHS out at INT I/O with oscilloscope.

Replace **Image Port** board.

Replace **Graphics** board.

Replace **INT I/O** board.

Ref, *"Internal I/O Replacement Procedure" on page 8-11*

VCR related problems, (continued)

Ref, *"Internal I/O and External I/O Block Diagram" on page 5-14*

No audio in playback.
Audio in speakers during
record is ok.

↓

Check audio record
level on VCR Front Panel.

↓

Check that audio is recorded
onto the tape, by playing
the tape on a different VCR,
and by measuring the input signal
to the VCR with oscilloscope
or voltmeter (in mV AC).

Record ok

*Record not ok,
signals present*

*Record not ok,
signals not present*

Check cable from Audio
out on VCR to Replay
on INT I/O.

Replace the **VCR.**

Check cable from VCR audio
on INT I/O to Audio in
on VCR.

↓

Check signals on Replay
at INT I/O with oscilloscope
or voltmeter (in mV AC).
Signal is $1V_{rms}$ maximum.

Check signals on VCR audio
out at INT I/O with
oscilloscope or voltmeter.
Signal is $1V_{rms}$ maximum.

↓

Replace **INT I/O** board.

Ref, *"Internal I/O Replacement
Procedure" on page 8-11*

Section 7-6
Front Panel Problems

7-6-1   No Response to Front Panel Controls

    1.)   Test the Front Panel.

    2.)   If the Front Panel is ok, and only certain functions doesn't work, test the boards where the actual functions are performed.

Section 7-7
Probe Problems

7-7-1   Probe Recognition and Switching Problems

```
┌─────────────────────┐          ┌─────────────────────┐
│  PA/LA not recognized │          │   DP not recognized  │
└─────────────────────┘          └─────────────────────┘
           │                                │
           ▼                                ▼
┌─────────────────────┐          ┌─────────────────────┐
│ Replace probe or try │          │ Replace probe or try │
│ another probe. Move  │          │ another probe.       │
│ probe to a different │          │                      │
│ position.            │          │                      │
└─────────────────────┘          └─────────────────────┘
           │                                │
           ▼                                ▼
┌─────────────────────┐          ┌─────────────────────┐
│   Test the FEC board │          │ Check that the XDBUS │
│                      │          │ boards are seated    │
│                      │          │ properly             │
└─────────────────────┘          └─────────────────────┘
           │ ok                             │ ok
           ▼                                ▼
┌─────────────────────┐          ┌─────────────────────┐
│   Replace RLY board  │          │   Replace RLY board  │
│   assembly           │          │   assembly           │
└─────────────────────┘          └─────────────────────┘
```
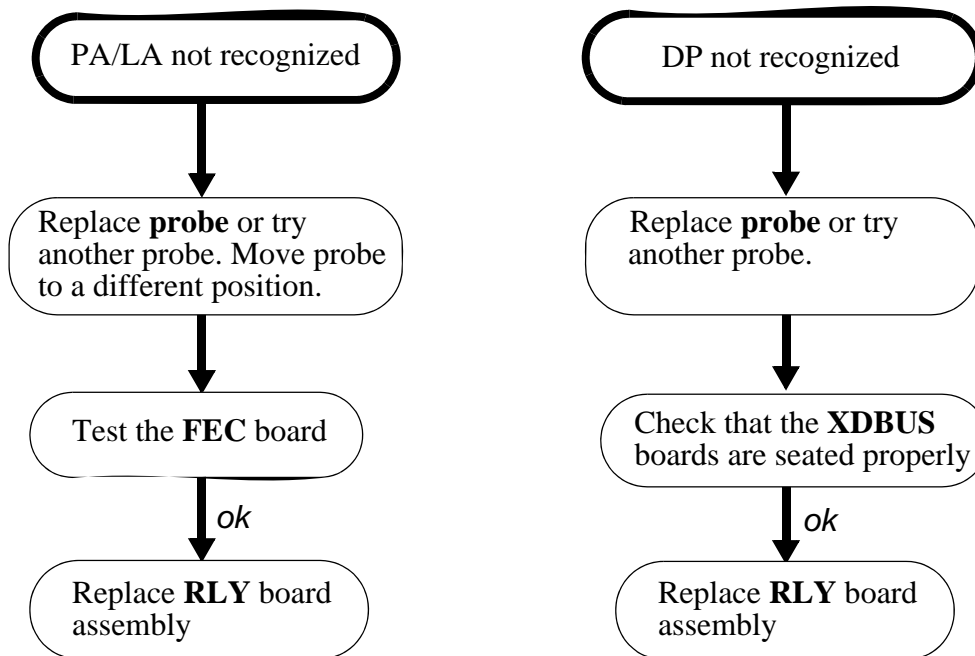
Ref. *"Relay Board Assembly,*
Replacement Procedure" on page 8-13

Section 7-8
Specific 2D Problems

7-8-1 "Frozen" Images, Images with Artifacts

- Run the Diagnostic test in *"Automatic Tests" on page 6-2*.
- Replace these boards, one by one.
    - RFT board
    - IP-2 board
    - SCONV board
    - GRAPH board
    - FEC board

7-8-2 Noisy Images

The most typical noise problem is coherent noise patterns straight down in the image field.

Usually the noise is only picked up when coupling the probe to your body.

1.) Disconnect all external cables to the EXT I/O board (if mounted) to establish whether the noise is due to interference from external devices. There are possible ferrite solutions to most of the cable connections.
    - On video cables:
      Wind the cable twice through a split ferrite, GE Vingmed Part Number 038X1012 / 038X1112.
    - On RS232 cables:
      Wind the cable 5-6 times trough a ferrite ring, GE Vingmed Part Number 038X0028.
2.) Try another probe.
3.) Disconnect all probes that are not in use (keep only the active probe connected).
4.) Is the FE Alignment performed?
5.) Make sure that the shield for the Patient I/O cable is connected to ground. Otherwise you may have flashes of noise straight down.
6.) Other possible internal noise sources:
    - HV Power Supply,
    - DC Power Supply,
    - Peripherals.

7-8-3   Poor Image Quality

1.)   Check setup of monitor according to setup procedure.

2.)   Perform the Probe Element Test. (See "Probe Element Test" on page 6-17.)

3.)   Try another probe.

4.)   Disconnect all probes that are not in use (keep only the active probe connected).

5.)   Test FEC board (and BF cache and TX128 cache and TPGs).

6.)   Check ATGC voltage (*Ref. Test Procedure, ATGC Voltage*).

7.)   Test HV Supply (*Ref. Test Procedure, HV Supply*).

8.)   Test BF boards (digital FE tests).

7-8-4   Only Center Part of FLA Probes Image Shown

If in 2D with a linear probe only one third of the image is shown and the rest is black, this could be the problems:

•   All multiplexers in the probe connector could be bad (not very likely).

•   +/- 80 V from the TX Supply feeding the multiplexers could be missing.

•   +15 V from the RLY board to the multiplexers could be missing.

To check the last to points:

*Pull out the probe in connector 1, insert a strap between pin AA10 and AA9 in order to enable the probe present signal. (See I/O section in service manual for location of pins).

•   +80V should be present on pin X10.

•   -80V should be present on pin Z10.

•   +15V should be present on pin V10.

Section 7-9
Specific Color Flow Problems

7-9-1   No Color Flow (2D ok) or Frozen Color Flow

1.) Test CFP board.
2.) Test RFT board (IQ buffer may fail).
3.) Test IP-2 board.
4.) Test SCONV board.

7-9-2   Noise Problems

The most typical noise problem is coherent noise patterns straight down in the image field. Usually the noise is only picked up when coupling the probe to your body.

1.) Disconnect all external cables to the EXT I/O board (if mounted) to establish whether the noise is due to interference from external devices. There are possible ferrite solutions to most of the cable connections.
   - On video cables: Wind the cable twice through a split ferrite, 038X1012/038X1112.
   - On RS232 cables: Wind the cable 5-6 times trough a ferrite ring, 038X0028.
2.) Try another probe.
3.) Disconnect all probes that are not in use (keep only the active probe connected).
4.) Make sure that the shield for the Patient I/O cable is connected to ground. Otherwise you may have flashes of noise straight down.
5.) Other possible internal noise sources: HV Power Supply, DC Power Supply, peripherals.

7-9-3   Poor Flow Quality

1.) Try another probe
2.) Test FEC board (and BF cache and TX128 cache and TPGs).
3.) Check ATGC voltage (*Ref. Test Procedure, ATGC Voltage*).
4.) Test HV Supply.

Section 7-10
Specific Doppler Problems

7-10-1 No Doppler (2D ok)

1.) Test SPD board. (*Ref. "Diagnostic Test" on page 6-2*).

2.) Test RFT board. (LV reject function performed on RFT) (*Ref. "Diagnostic Test" on page 6-2*).

3.) Test FEC board. (*Ref. "Diagnostic Test" on page 6-2*).

4.) If no CW only (PW ok), check HV Supply (HV2). (*Ref. "High Voltage Test" on page 6-6*).

7-10-2 Noisy Doppler

The most typical noise problem is horizontal lines. Usually the noise is only picked up when coupling the probe to your body.

1.) Disconnect all external cables to the EXT I/O board (if mounted) to establish whether the noise is due to interference from external devices.
There are possible ferrite solutions to most of the cable connections:

- On video cables: Wind the cable twice through a split ferrite,
GEVU part number: 038X1012/038X1112.

- On RS232 cables: Wind the cable 5-6 times trough a ferrite ring, 038X0028.

2.) Try another probe.

3.) Disconnect all probes that are not in use (keep only the active probe connected).

4.) Make sure that the shield for the Patient I/O cable is connected to ground. Otherwise you may excessive noise lines when the cursor is placed straight down.

5.) Adjust Accoustic Power a few dB down in order to determine if the noise is coming from the HV Supply,
If the noise disappears, the source is the HV Supply.

6.) Other possible internal noise sources:

- DC Power Supply

- Peripherals.

Section 7-11
Analog Traces (ECG, Phono, Pressure, Respiration)

7-11-1   Unstable ECG

The quality and stability of the ECG is directly related to the cable being used (impedance is important).

For optimum performance the correct cables should be used. See 9.14.3 - ECG Cables for the correct type and part number.

Section 7-12
Misc. Problems

7-12-1   Fan Related Problems

See "Power Distribution" on page 5-8.

When the stand-by power switch is turned on, the green LED is lit, the green power indicator LED on the monitor is lit, fans are not running but the system boots up.

The fans are always running at full speed.

Check that cable between ACPWR, fans and Temp. sensor is seated.
Check fuses on Temp Sense.

Replace AC Controller board.

Ref. *"AC Power Replacement Procedure" on page 8-3.*

Replace Temp. sense board.

Ref. *"Temperature Sense Board Replacement Procedure" on page 8-14.*

Chapter 8
Replacement Procedures

Section 8-1
Overview

8-1-1   Purpose of Chapter 8

This chapter holds replacement procedures for the following modules/subsystems.

Table 8-1 Contents in Chapter 8

SECTION	DESCRIPTION	PAGE NUMBER
8-1	Overview	8-1
8-2	AC Power Replacement Procedure	8-3
8-3	External I/O Replacement Procedure	8-5
8-4	DC Power Replacement Procedure	8-6
8-5	Front Panel Assembly & Trackball Replacement Procedure	8-7
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8-1-2   Returning/Shipping Probes and Repair Parts

Equipment being returned must be clean and free of blood and other infectious substances.

GEMS policy states that body fluids must be properly removed from any part or equipment prior to shipment. GEMS employees, as well as customers, are responsible for ensuring that parts/ equipment have been properly decontaminated prior to shipment. Under no circumstance should a part or equipment with visible body fluids be taken or shipped from a clinic or site (for example, body coils or an ultrasound probe). The purpose of the regulation is to protect employees in the transportation industry, as well as the people who will receive or open this package.

Note: The US Department of Transportation (DOT) has ruled that "items that were saturated and/or dripping with human blood that are now caked with dried blood; or which were used or intended for use in patient care" are "regulated medical waste" for transportation purposes and must be transported as a hazardous material.

8-1-3   Warnings

⚠ **WARNING**   **BECAUSE OF THE LIMITED ACCESS TO CABINETS AND EQUIPMENT IN THE FIELD, PLACING PEOPLE IN AWKWARD POSITIONS, WE HAVE LIMITED THE LIFTING WEIGHT FOR ONE PERSON IN THE FIELD TO 16 KG (35 LBS) ANYTHING OVER 16 KG (35 LBS) REQUIRES 2 PEOPLE.**

⚠ **WARNING**   **AT LEAST TWO PERSONS ARE NEEDED WHEN REPLACING HEAVY PARTS LIKE THE MONITOR.**

⚠ **WARNING**   **AT LEAST TWO PERSONS ARE NEEDED WHEN REPLACING CASTERS (WHEELS) OR ADJUSTING BRAKES.**

Section 8-2
AC Power Replacement Procedure

8-2-1   Introduction

This procedure describes how to replace the AC Power Supply assembly.

The AC Power supply is located in the back of the system, on the right side viewed from the rear.

8-2-2   Tool Requirements

- •   - Phillips screwdriver, size 2.
- •   - Flat screwdriver.

8-2-3   Description

8-2-3-1   Prepare the system for AC Power Replacement

Task	Description
1.	Disconnect the mains connector from the wall outlet.
2.	Remove the Side Bumpers. See "Side Bumper Replacement Procedure" on page 8-20.
3.	Unscrew the four screws holding the Lower Side Panels and the Lower Rear Panel. (The screws are located on the back of the system)
4.	Also unscrew the four screws holding the Upper Side Panels and the upper Rear Cover.
5.	Remove all covers.
6.	Pull both Lower Side Panels slightly out sidewards. It's not necessary to fully remove them.
7.	Unscrew the three screws holding the bottom part of the Rear Cover.
8.	Disconnect all cables from the External I/O panel.
9.	Pull the Rear Cover straight out.

Table 8-2 Prepare the system for AC Power Replacement

8-2-3-2   Remove the AC Power

Task	Description
1.	Unscrew the one screw on the bottom of the AC power, and remove the AC power cover by lifting the cover out and up.
2.	Press a flat screwdriver underneath the flange on the lower part of the AC power, and loosen it.
3.	Disconnect the power cables plugging into the top connectors on the power. Pay attention to where the connectors are plugged in
4.	• Lift the AC power partly out, and disconnect the power connectors and the two D-connectors. • Then lift the AC power fully out.

Table 8-3 Remove the AC Power

8-2-3-3   Install the New AC Power

Task	Description
1.	• Install the new AC Power Supply partly. • Connect the power cables and the two D-connectors. • Then install it fully, paying attention to the hooks on the bottom of the supply fitting the slots in the frame.
2.	• Install the AC power cover. • Mount the AC power with one screw (the left one)
3.	A.) Mount the Upper Rear Cover. B.) Mount the Lower Rear Cover. Before pushing the Lower Rear Cover all the way in, make sure the power cable to the DC power is properly secured. C.) Mount the Side Bumpers. See "Side Bumper Mounting Procedure" on page 8-21. D.) Mount the Side Panels.
4.	Connect the mains cable to the wall outlet.
5.	Connect the cables to the External I/O.

Table 8-4 Install the New AC Power

Section 8-3
External I/O Replacement Procedure

8-3-1   Introduction

This procedure describes how to replace the External I/O subassembly.

8-3-2   Tool requirements

- Phillips screwdriver, size 2.

8-3-3   Description

The External I/O subassembly is located on the left side of the system, in the rear.

1.) Remove the Side Bumpers. See "Side Bumper Replacement Procedure" on page 8-20.
2.) From the back of the system, unscrew the 4 screws holding the Lower Side Panels and the Lower Rear Panel.
3.) Pull both Lower Side Panels slightly out sidewards.
4.) Unscrew the 3 screws holding the bottom part of the Rear Cover.
5.) Disconnect all cables from the External I/O panel.
6.) Pull the Rear Cover straight out.
7.) Unscrew the three countersunk screws holding the External I/O subassy to the vertical frame bar. The assembly is now loose.
8.) Pull the subassy out towards the back, and lift it away from the system.
9.) Install the new External I/O subassembly by pushing it into the Internal I/O connectors.
10.) Mount it with the three countersunk screws.
11.) Mount the Rear Cover. The top part of the cover should slide into the slot in the plate between the DC power and the AC power. Before pushing it all the way in, make sure the power cable to the DC power is properly secured.
12.) Connect all cables to the External I/O panel.
13.) Mount the Side Bumpers. See "Side Bumper Mounting Procedure" on page 8-21.
14.) Mount the Lower Side Panels.

Section 8-4
DC Power Replacement Procedure

8-4-1   Introduction

This procedure describes how to replace the DC Power Supply module.

8-4-2   Tool requirements

- Phillips screwdriver, size 2.
- Flat screwdriver, any size.
- Allen wrench (Umbrako/hex screw wrench), size 5 mm.

8-4-3   Description

The DC Power supply is located in the back of the system, on the left side viewed from the rear.

1.) Turn off the power switch on the Rear Panel.
2.) Remove the Side Bumpers. See "Side Bumper Replacement Procedure" on page 8-20.
3.) From the back of the system, unscrew the four screws holding the Lower Side Panels and the Lower Rear Panel.
4.) Pull both side panels slightly out sidewards. It's not necessary to fully remove them.
5.) Unscrew the three screws holding the bottom part of the Rear Cover.
6.) Disconnect all cables from the External I/O panel.
7.) Pull the Rear Cover straight out.
8.) Unscrew the two allen screws holding the +5V power terminals to the current rails on the rack.
9.) Disconnect the AC power cable plugged into the DC power supply.
10.) Press the flat screwdriver underneath the flange on the lower part of the DC power supply, and loosen it.
11.) The power supply can now be lifted out and replaced.
12.) Install the new power supply. Pay special attention to hooks on the bottom of the power supply fitting the slots in the frame. Align the connectors and push until the angled bracket is flush with the frame.
13.) Screw the +5V terminals into the current rails.
14.) Connect the AC power plug.
15.) Mount the Side Bumpers. See "Side Bumper Mounting Procedure" on page 8-21.
16.) Mount the Rear Cover. The top part of the cover should slide into the slot in the plate between the DC power and the AC power. Before pushing it all the way in, make sure the power cable to the DC power is properly secured.
17.) Mount the side covers.
18.) Turn on the power switch.

Section 8-5
Front Panel Assembly & Trackball Replacement Procedure

8-5-1   Introduction

This procedure describes how to replace the Vivid 5 Front Panel Assembly.

8-5-2   Tool Requirements

- Phillips screwdriver, size 2.
- Flat screwdriver, size 2
- Hex key 6 mm.
- Socket wrench M4
- Adjustable wrench.

8-5-3   Front Panel Replacement

1.) Unscrew the five screws holding the upper left side panel.
2.) Disconnect the audio cable (phono jacks) to the front panel.
3.) Loosen the four 6 mm hex screws securing the Front Handles (located under the fixing areas of the handles). Do not unscrew completely. Let the handles fall down 15-20 mm.
4.) Loosen and unscrew two M4 nuts securing the front part of the panel (the screws are located under the front part of the panel between the handles).
5.) Lift the whole plastic console including the Front Panel up in the front. Note that the console is hinged on top, by two angles fitting two slots in the frame and plastic tags fitting tracks in the plastic parts surrounding the monitor.
6.) Disconnect the ribbon cable and the power cables, and also the video cable if the Front Panel has an integrated LCD display, before lifting the console fully out.
7.) Replace the whole Front Panel assembly (fixed by three M4 screws securing the upper part of the Front Panel, five M4 screws securing the lower part of the Front Panel and two M4 screws securing the middle part of the Front Panel) or parts of the assembly, depending on nature of problem.
8.) When installing the console including the Front Panel, first insert the top hinges and plastic tags into the slots before connecting the ribbon cable and power cables (and video cable). Then carefully lower the console down.
9.) Secure the front part of the panel by the two M4 nuts.
10.) Lift up the front handles by tightening the four 6 mm hex screws.
11.) Connect the audio cable.
12.) Install the Side Panel.
13.) Test the new Front Panel. *See "Front Panel Problems" on page 7-15.*

8-5-4   Trackball Replacement Description

When the plastic console including the Front Panel is lifted fully out (ref. step 1 to 6 above) the trackball can be replaced by unscrewing the three M3 nuts holding the trackball module and disconnecting the trackball cable from the main board.

Section 8-6
QWERTY (Alphanumeric) Keyboard Replacement Description

Note: This Procedure describes how to change the QWERTY Keyboard Without Dismounting the Entire Front Panel.

1.) Unscrew the four M4 screws holding the QWERTY covering plate underneath the Front Panel.

2.) Unscrew the two M3 screws holding the right part of the QWERTY keyboard assembly. When removing these screws be care of the two free spacers which are mounted between the support bracket and the QWERTY keyboard assembly.
Then unscrew the two M3 screws holding the left part of the keyboard assembly.
Lower the QWERTY keyboard assembly 10-15mm and take it out through the open hole in the Front Panel frame bottom.
Remember to disconnect the ribbon cable.

3.) Replace the QWERTY keyboard assembly. After entering the new assembly, first install the two left M3 screws, then place the spacers between the support bracket and the QWERTY assembly before mounting the two right M3 screws. Remember to connect the ribbon cable.

4.) Mount the QWERTY covering plate underneath the front panel with the four M4 screws.

5.) In order to test the new QWERTY keyboard, see Front Panel Test Procedure in the Troubleshooting Guide.

6.) When replacing the QWERTY keyboard assembly in a freestanding Front Panel go through items 2, 3 and 5.

Section 8-7
Fan Replacement Procedure

8-7-1   Introduction

This procedure describes how to replace fans.

8-7-2   Tool requirements

- Phillips screwdriver, size 2.

8-7-3   Description

The fans are located in the bottom of the system.

1.) Turn the system mains power off with the circuit breaker in the rear.
2.) Loosen the 3 screws holding the air filter cover. This cover is located on the right lower side below the Lower Side Panel.
3.) Remove the cover.
4.) Pull out the air filter. You have now full access to the fans from underneath the system.
5.) Replace the bad fan(s).

Section 8-8
Hard Disk Replacement Procedure

8-8-1   Introduction

This procedure describes how to replace the hard disk.

8-8-2   Tool requirements

Special key to unlock the Hard Disk Drawer. (Two keys are attached to each scanner when leaving the factory.)

8-8-3   Description

⚠   **NOTICE   Hard Disks are fragile. Avoid mechanical shocks when handling.**

🖐   **NOTICE   Always use a static wrist strap when handling Hard Disks.**

1.)   Open the Frond Cover Door (below the Front Panel).
2.)   Use the special Unlock key to unlock the Hard Disk Drawer.
3.)   Pull out the Hard Disk Drawer, from the system.
4.)   Push a replacement Hard Disk drawer into the system and secure it in position by locking it.

Note: For configuration of the hard disk, see Software Loading Procedure on page 8-22.

Section 8-9
Internal I/O Replacement Procedure

8-9-1   Introduction

This procedure describes how to replace the Internal I/O subassembly.

The Internal I/O subassembly is located on the left side of the system, in the rear, inside the peripherals compartment.

8-9-2   Tool requirements

- Phillips screwdriver, size 2.

8-9-3   Description

1.) Remove the Left Side Bumper. See "Side Bumper Replacement Procedure" on page 8-20.
2.) From the back of the system, unscrew the 2 screws holding the left Lower Side Panel.
3.) Remove the side cover.
4.) Disconnect all cables from the Internal I/O panel. Pay attention to where they were mounted in case labelling is unclear.
5.) Unscrew the three pan-head phillips screws holding the Internal I/O subassy to the vertical frame bar. The assembly is now loose in the sense that it is connected to both the motherboard and the External I/O subassembly via connectors.
6.) Pull the subassy slightly forward to get it clear the External I/O connectors. Then pull it straight out of the motherboard.
7.) Install the new Internal I/O subassembly by first pushing it into the motherboard, then into the External I/O connectors.
8.) Mount it with the three pan-head screws.
9.) Connect all cables. See Internal Wiring Diagram if uncertain where to connect.
10.) Mount the Side Bumper. See "Side Bumper Mounting Procedure" on page 8-21.
11.) Mount the left Lower Side Panel.

Section 8-10
Monitor Replacement Procedure

8-10-1   Introduction

This procedure describes how to replace the monitor.

8-10-2   Tool requirements

- Phillips screwdriver, size 2.

8-10-3   Description

1.)   From the back of the system, unscrew the 2 screws on the top attaching the small rear top cover.

2.)   Unscrew the four countersunk screws holding the monitor mounting plate to the top of the frame.

3.)   Disconnect the cables to the monitor.

4.)   Pull the mounting plate (including the monitor/pedestal) backwards until you can lift the whole assembly off the top of the system.

5.)   Replace the monitor.

6.)   Install the assembly in the opposite sequence.

Section 8-11
Relay Board Assembly, Replacement Procedure

8-11-1 Introduction

This procedure describes how to replace the Relay Board subassembly, i.e. the assembly with the probe connectors.

8-11-2 Tool requirements

- Phillips screwdriver, size 2.
- Flat screwdriver, size 2.
- Adjustable wrench.

8-11-3 Description

The Relay Board subassembly is located in the front side of the system, on the right side.

1.) Remove the Side Bumpers. See "Side Bumper Replacement Procedure" on page 8-20.
2.) From the back of the system, unscrew the screws holding the Lower and Upper Side Panels.
3.) Remove the Side Covers.
4.) Disconnect all cables from the probe connector panel.
5.) Pull the front cover straight forward.
6.) Unscrew the shield plate in front of the boards.
7.) Unscrew the M3-screws (12) holding each 260 pin connector (except 2 on the left spare/ parking connector, upper right and lower left).
8.) Unscrew the M3-screws through the APAT connectors.
9.) Unscrew the M4 phillips pan-head screws attaching the front plate to the frame.
10.) Unscrew the nuts on the Doppler (and Catheter if mounted) connector.
11.) Disconnect the two XDBUS boards between RLY/TX/RX/PRC.
12.) Unscrew the screws holding the small IV&DP connector board onto the RLY board.
13.) The RLY assembly is now only connected to the motherboard. In order to loosen it, slide the whole assembly out of the MBD connector to the right. Then, when it's loose, slide it out leftward.
14.) Install the IV&DP connector board.
15.) Install the new Relay Board subassembly in the opposite sequence. Mount the upper connector (IV/DP first, then position the lower RLY board connector).
16.) Connect the two XDBUS boards between RLY/TX/RX.
17.) First screw the M3 screws into the 260 pin connectors. (For noise purposes, it is very important that these screws are mounted). Then screw the M4 screws and mount the connector nuts.
18.) Mount the Front Cover,
19.) Mount the Side Bumpers See "Side Bumper Mounting Procedure" on page 8-21.
20.) Mount the Side Covers.
21.) Reconnect all cables to the connectors.

Section 8-12
Temperature Sense Board Replacement Procedure

8-12-1 Introduction

This procedure describes how to replace the Temperature Sense board controlling the fan speed (it has nothing to do with the TE probe temperature reading).

8-12-2 Tool requirements

Phillips screwdriver, size 1.

8-12-3 Description

The Tempsense board is located above the CPU and MEMORY boards, mounted up underneath the peripheral plate.

1.) Remove the Side Bumpers. See "Side Bumper Replacement Procedure" on page 8-20.
2.) Unscrew the two screws holding the right side panel and remove it.
3.) Disconnect the cable plugging into the Tempsense board.
4.) Unscrew the two screws holding the board to the peripheral plate. To get to the inner screw you might have to pull out the CPU and the MEMORY boards (which are screwed in place).
5.) Replace the Tempsense board and attach all the parts in the opposite sequence.

Section 8-13
Rear Wheels Replacement Procedure

8-13-1   Parts

Seen from the backside of the system.
Rear, Left   PN FB200045
Rear, Right   PN FB200046

8-13-2   Tools

- Philips driver
- Jack
- 6 mm Umbrako wrench
- 11 and 13 mm wrench
- Marker
- Locktite® screw lock

8-13-3   Preparation

Move the lever back and forth to make sure of that the brakes and swivel lock are applied.

8-13-4   Disassembly

1.) Remove the Side Bumper(s), see Side Bumper Replacement Procedure on page 8-20
2.) Use the jack to lift up the system
3.) Use umbrako wrench and unscrew wheel screw
4.) Use the market to make a mark the rod just behind the lock nut
5.) Use 11 and 13 mm wrench to open the lock nut, unscrew rod

8-13-5   Assembly

1.) Assemble the rods and make sure of that locknut are in correct position by the marker when it is tighten
2.) Have some Loctite on the umbrako screw and assemble the wheel to the frame.
   Make sure that the screw is tightened.
3.) Remove the jack
4.) Test the functions for the pedal by moving it up and down.
   Make sure that brake and swivel lock are properly, if not adjust length of rods.

8-13-6   Adjustment

Adjust length of rods until pedal is in correct neutral position.

Section 8-14
Front Wheels Replacement Procedure

8-14-1 Parts

Front wheel   PN FB200044

8-14-2 Tools

- Jack
- 5 mm Umbrako wrench
- 10 and 13 mm wrench
- Loctite screw lock

8-14-3 Preparation

None

8-14-4 Disassembly

1.) Use the jack to lift up the system
2.) Locate and unscrew 5 pc of nut at the underside of the Front Bumper
3.) Gently pull of bumper
4.) Use 5 mm umbrako wrench to disassemble wheel

8-14-5 Assembly

1.) Have some Loctite on the umbrako screw and assemble the wheel to the frame, make sure that the screw is tightened.
2.) Gently put front bumper back into place and tighten nuts
3.) Remove the jack

8-14-6 Adjustment

- Align front bumper with side bumpers before tighten nuts.

Section 8-15
Front Bumper Support, Replacement Procedure

8-15-1   Parts

Front bumper support   PN: FB200115

8-15-2   Tools

- 10 and 13 mm wrench
- Large Phillips screw driver

8-15-3   Preparation

None

8-15-4   Disassembly

1.) Unscrew front part of rod that is located under the front bumper
2.) Locate and unscrew 5 pc of nut at the underside of the front bumper
3.) Gently pull of bumper
4.) Locate 4 pc nuts on inner surface and disassemble the bumper
5.) Locate 2 pc screw at the underside of pedal and disassemble pedal

8-15-5   Assembly

1.) Assemble bumper on bumper support and tighten nuts
2.) Assemble pedal on bumper support and tighten nuts
3.) Gently put front bumper back into place and tighten nuts

8-15-6   Adjustment

1.) Align gap between pedal and support.
2.) Align pedal in neutral position by adjusting rod length
3.) Align front bumper with side bumpers and then tighten nuts.

Section 8-16
Macintosh Replacement Procedure

Purpose: This procedure describes how to replace an integrated Macintosh computer.

8-16-1   Removal Procedure

Step	Description
1.	Make sure that the **VIVID 5** is disconnected from the power mains.
2.	Remove the left Side Bumper. See "Side Bumper Replacement Procedure" on page 8-20.
3.	Unscrew and remove the lower left side panel.
4.	Remove the USB cables from the side panel.
5.	Remove the screw connecting the grounding strap (copper) to the Macintosh.
6.	Remove the bracket marked FB307074.
7.	Disconnect the following cables from the rear of the Macintosh: • Power cable • Ethernet cable • Both USB cables • Monitor cable • SCSI connector cable • ATI cable
8.	Slide the Macintosh out of the **VIVID 5**.
9.	Cut the strap holding the 2 USB cables on top of the Macintosh.
10.	Remove the USB HUB from top of the Macintosh.

Table 8-5 Macintosh Removal Procedure

8-16-2   Assembly Procedure

Step	Description
1.	Mount the USB HUB onto the new Macintosh.
2.	Strap the USB cables to the top of the Macintosh in the same position as from which they were removed.
3.	Slide the Macintosh into the **VIVID 5**.
4.	Connect the grounding strap to the Macintosh.
5.	Connect the following cables to the rear of the Macintosh. • Power cable • Ethernet cable • Both USB cables • Monitor cable • SCSI connector cable • ATI cable
6.	Mount the bracket marked FB307074, which will secure the Macintosh.
7.	Connect the USB cables to the Lower Left Side Panel USB connectors. Take care as to connect the USB cable, from the USB HUB output, to the printer connection (innermost connector).
8.	Mount the Side Bumper See "Side Bumper Mounting Procedure" on page 8-21.
9.	Mount the lower left side panel to the scanner.

Table 8-6 Macintosh Assembly Procedure

Note: Refer to the EchoPAC Installation Manual (IMAN), Part Number: EP194010, for a detailed software installation procedure.

Section 8-17
Side Bumper Replacement Procedure

8-17-1   Side Bumper Removal Procedure
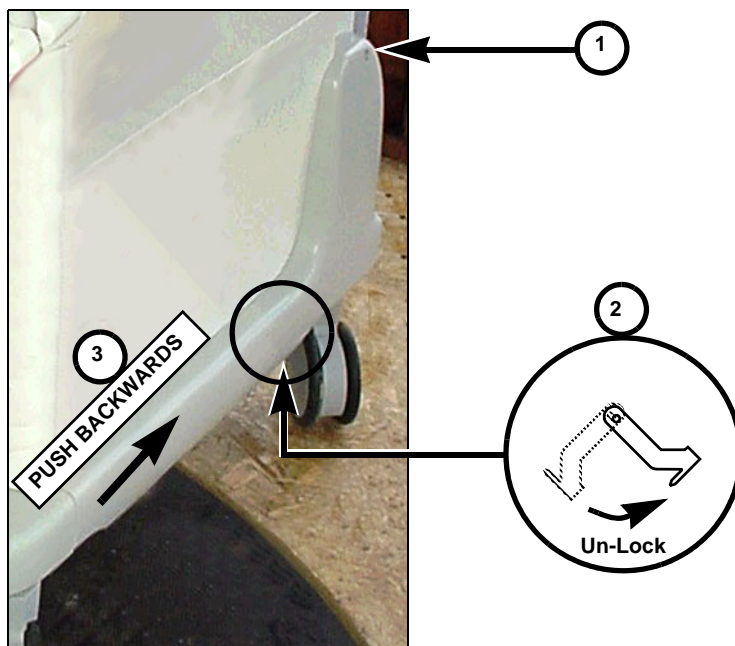
Figure 8-1 Right Side Bumper with Bumper Lock. (Left side is similar, but mirrored.)

Step	Description
1.	Loosen and remove the Phillips screw (see 1 in the illustration)
2.	A Bumper Lock is located underneath the Side Bumper (see 2 in the illustration) • Unlock the Bumper Lock by pulling its end down. If you can't grab it with your fingers, you may need to use a flat blade screwdriver to start to turn it.
3.	Pull the Bumper approximately 10mm backwards and remove it, starting with the front.

Table 8-7 Side Bumper Removal Procedure

8-17-2 Side Bumper Mounting Procedure

Step	Description
1.	Turn the rear wheels so they point backwards before starting to mount the bumpers.
2.	Push bumper in place.
3.	Push Bumper Lock upwards until the tab on the bumper lock is parallel with the bumper
4.	Locate key stud on the backside of the bumper, place it into keyhole at the side of the system and gently push it in place. Note: Do not tighten bumper screw to hard.
5.	Place one hand in the front of the bumper and the other in the back (of the bumper) and pull the bumper backwards to verify that it is fastened in position.

Table 8-8 Side Bumper Mounting Procedure

Section 8-18
Software Loading Procedure

8-18-1   Overview

Software loading must be performed either when the hard drive has been replaced, when the software on the hard drive needs to be reloaded or during a software upgrade.

The software installation procedure is using a ftp server for uploading the software from the laptop to the Vivid 5.

During a software reload or software upgrade, the built-in ftp server in Vivid 5 can be used. See the instructions starting in 8-18-2 "Introduction to Software Re-load or Upgrade" on page 8-23.

If the hard drive has been replaced, Vivid 5's onboard ftp server software is missing, and an external ftp server must be used. The procedure starting in Section 8-19 "Using a Hummingbird FTP Server for the Software Upgrade" on page 8-58 is using a Hummingbird ftp server on the laptop.

Table 8-9 Contents in the Software re-loading/upgrade procedure

SECTION	DESCRIPTION	PAGE
8-18-1	Overview	8-22
8-18-2	Introduction to Software Re-load or Upgrade	8-23
8-18-3	Preparations Prior to Upgrade	8-24
8-18-4	Identify the Vivid 5 Scanner's IP Address and Netmask	8-40
8-18-5	Software Upgrade	8-49
8-18-6	Unpack the Scanner Software Files	8-55
8-18-7	Verification	8-56
8-18-8	Finalizing Software Upgrade	8-56
8-18-9	Complete the Upgrade	8-56
8-18-10	Functional Checkout	8-57

8-18-2   Introduction to Software Re-load or Upgrade

8-18-2-1   Purpose

The purpose of this procedure is to load the system software on Vivid 5 systems.

8-18-2-2   Effectivity

This procedure is valid for all Vivid 5.

8-18-2-3   Time to Complete

One person, three hours + travel

8-18-2-4   Tools and Test Equipment

- Standard Service Laptop with Microsoft Windows 2000.
- Terminal emulation program (part of Microsoft Windows 2000).
- Standard Field Service Tool Kit.
- Non-Modem (null modem RS-232C) cable, Part Number 2117638-3 or Part Number 070M0009.
- Crossed Ethernet Cable (crossed, twisted pair - cat 5), Part Number 070D2951.
- 10 BaseT Ethernet Adaptor, Part Number 066E0708 (System FiVe ONLY).
- Vivid 5 Service Manual, FB091565, latest revision (this manual).
- Vivid 5 User Manual, see Section 9-21 "Product Manuals" on page 9-39.
- If a 10 MBit LAN Card installed on your PC, use:
    - Two Ethernet cables (non-crossed, twisted pair, Cat 5), Part Number: 070D2950.
    - 10/100 Mbit swich, Part Number: 066E0741 or Part Number: 066E0743.

8-18-2-5   EchoPAC Compatibility

Vivid 5 software v2.0.6 is compatible with EchoPAC for Macintosh, software 6.4.2.

8-18-3   Preparations Prior to Upgrade

⚠️ **NOTICE**   Throughout this procedure you will be instructed to enter information into the laptop. Pay strict attention to how it is shown in the procedure and type the information in exactly as it is presented. If for instance if it shows quotes, use quotes.

Most errors in performing this procedure occur when the information is entered incorrectly.

8-18-3-1   Overview

In this procedure, two connections are needed, an ethernet connection used for moving the files and a serial (RS-232C) connection for controlling and monitoring the scanner's CPU.

The section describes how to connect a laptop or PC to the scanner and how to set up the needed communication. It also instructs you to verify the contents of the software CD.

8-18-3-2   RS-232C "Non Modem" Connection to a Vivid 5 Scanner

Use a null modem cable ("non modem cable") to communicate with the scanner's CPU. This will give you the ability to communicate directly with the scanner's CPU, at all time.

1.)   If present, remove the **EMC Cover** from the RS-232 CPU connector on the lower left side of the scanner.

2.)   Connect the null modem cable from the COM1 port on the laptop to the 9-pin RS-232C, male connector, marked either "**CPU**" or **"SERVICE - RS232"** on the external I/O port on the Vivid 5.

Figure 8-2 Location of RS-232 connector on Vivid 5 scanner

8-18-3-3 Ethernet Connection to Scanner

There are two ways of connecting to the scanner, you can either connect directly, or through a 10/100 Mbit Switch.

The one to choose is dependent on what type of PC LAN Card you have installed on your laptop.

- If you have a 10Mbit LAN Card go to 8-18-3-4 "Laptop with 10 Mbit PC LAN Card" on page 8-25.
- If you have a 10/100Mbit LAN Card go to 8-18-3-5 "Laptop with 10/100 Mbit PC LAN Card" on page 8-26.

8-18-3-4 Laptop with 10 Mbit PC LAN Card

1.) Connect a non-crossed ethernet cable from the PC Card LAN cable adapter to a 10/100 switch, port 1.
2.) Connect another non-crossed ethernet cable from the 10/100 switch, port 2 to the Ethernet Strain Relief adaptor, if present, or directly to the ethernet connector on Vivid 5's External I/O.
3.) Connect the power cord to the 10/100 switch.
4.) Verify link light on PC Card LAN cable adapter.
5.) Verify a link light at Vivid 5's ethernet connector.
6.) Verify a link light at port 1 and port 2 on the 10/100 switch.
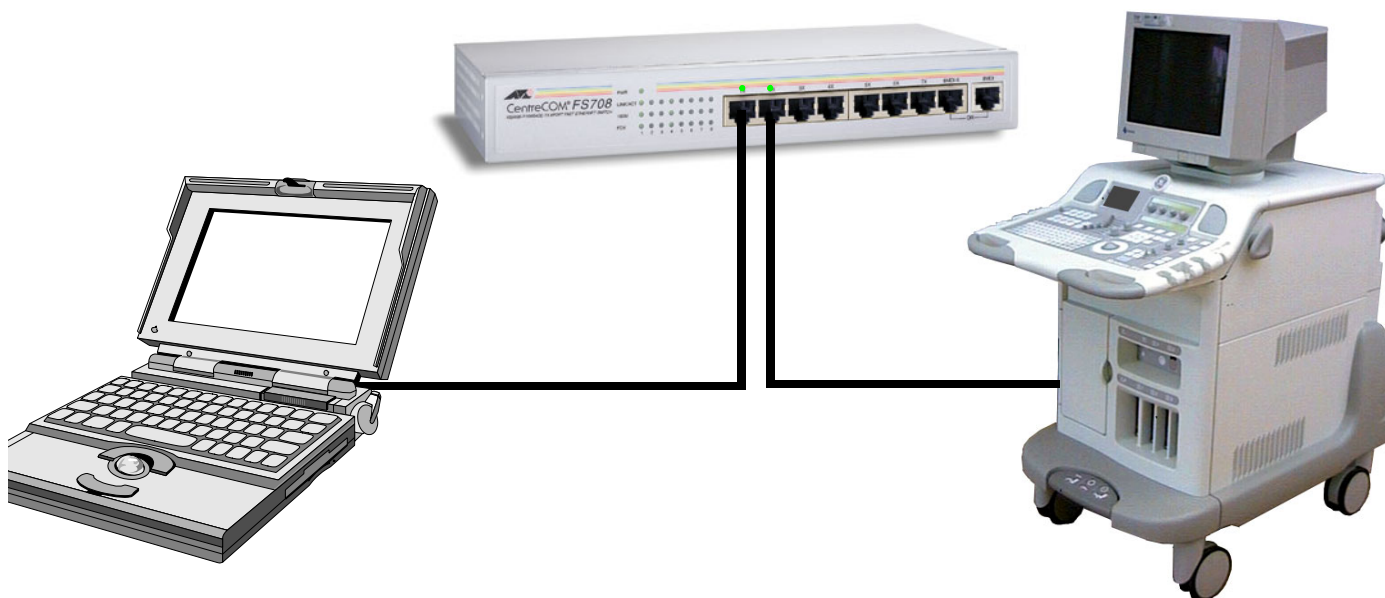
Figure 8-3 Connect your laptop via a 10/100 ethernet switch to Vivid 5 scanner

8-18-3-5   Laptop with 10/100 Mbit PC LAN Card

1.) Connect a crossed ethernet cable from your laptop to:
   - the ethernet Strain Relief Adaptor, if present, or directly to the ethernet connector on Vivid 5's External I/O.
   - the ethernet adaptor, if present on System FiVe, or via an AIUM ethernet adaptor to System FiVe's External I/O.
2.) Verify that the link light on PC Card LAN adaptor is lit.
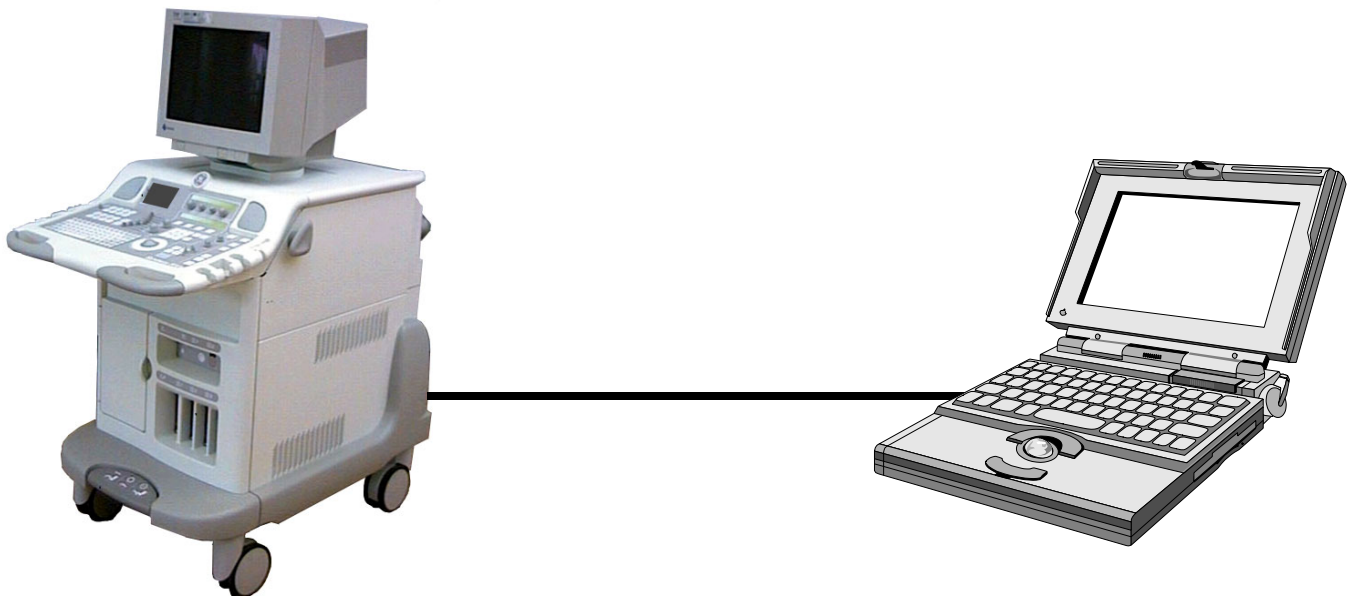
Figure 8-4 Connect your laptop to the scanner

8-18-3-6   Laptop Power ON

1.) Power ON the **Laptop.**
2.) When the laptop is up and running, insert the System Software CD for the scanner you are going to upgrade, in the CD ROM on your laptop.
   - For Vivid 5 scanners, use CD Part Number FB200394G.
   - For System FiVe, use CD Part Number FC200051.

8-18-3-7   Verify Contents on the System Software CD

⚠️ **NOTICE** **Don't remove the CD from the laptop after the software verification! It is needed later on in the procedure.**

1.) Double-click on **My Computer** on the desktop.
2.) Double-click on the CD ROM icon to display the contents of the CD.
   - The contents on the v2.0.6 CD (for Vivid 5) is described in 8-18-3-7 "Verify Contents on the System Software CD" on page 8-27.

The software CD's contents is illustrated below.

💿 **FB200394G**

```
├── 📁 hd0
│          vxWorks.st
├── 📁 S5NetInstall
│          v2.0.6.tar.gz
│          v2.0.6_svision.tar.gz
│          v2.0.6_us.tar.gz
└── 📁 Documents
           FMI76013 Vivid FiVe SW upgrade.pdf
```
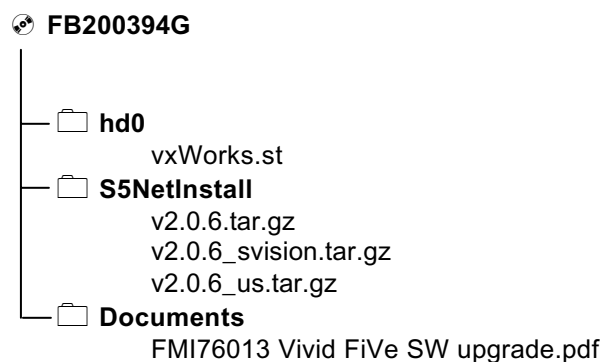
Figure 8-5 Vivid 5 software CD contents

8-18-3-8   Create Work Folder on the Laptop

1.) Open **My Computer** on the desktop.
2.) Open the **C:** drive.
3.) Select **New** from the File menu.
4.) Select **Folder.**
5.) Give the new folder the name **work**
6.) Open the **work** folder.

8-18-3-9   Start the Terminal Program

This procedure uses HyperTerminal software to serve as a VT220 or VT100 terminal emulator, but any VT220 or VT100 terminal emulator can be used, as long as the settings from Table 8-10 "Hyper Terminal Settings" on page 8-34 are entered correct into the alternative terminal.

- If a *V5 (or S5) communication profile* already exists, continue with 8-18-3-10 "Open an Already Existing V5 Communication Profile" on page 8-28.
- If a *V5 (or S5) communication profile* doesn't exists, continue with 8-18-3-11 "Open Hyper Terminal and Make a New Communication Profile" on page 8-30.

8-18-3-10   Open an Already Existing *V5 Communication Profile*

Follow these steps if a *V5 (or S5) communication profile* already exists,

1.) Select: **Start** > **Programs** > **Accessories** > **Communications** > **Hyper Terminal** (the Folder)

2.) Select the Communication Profile in the *Hyper Terminal* folder (**s5_v5.ht** in the illustration below).
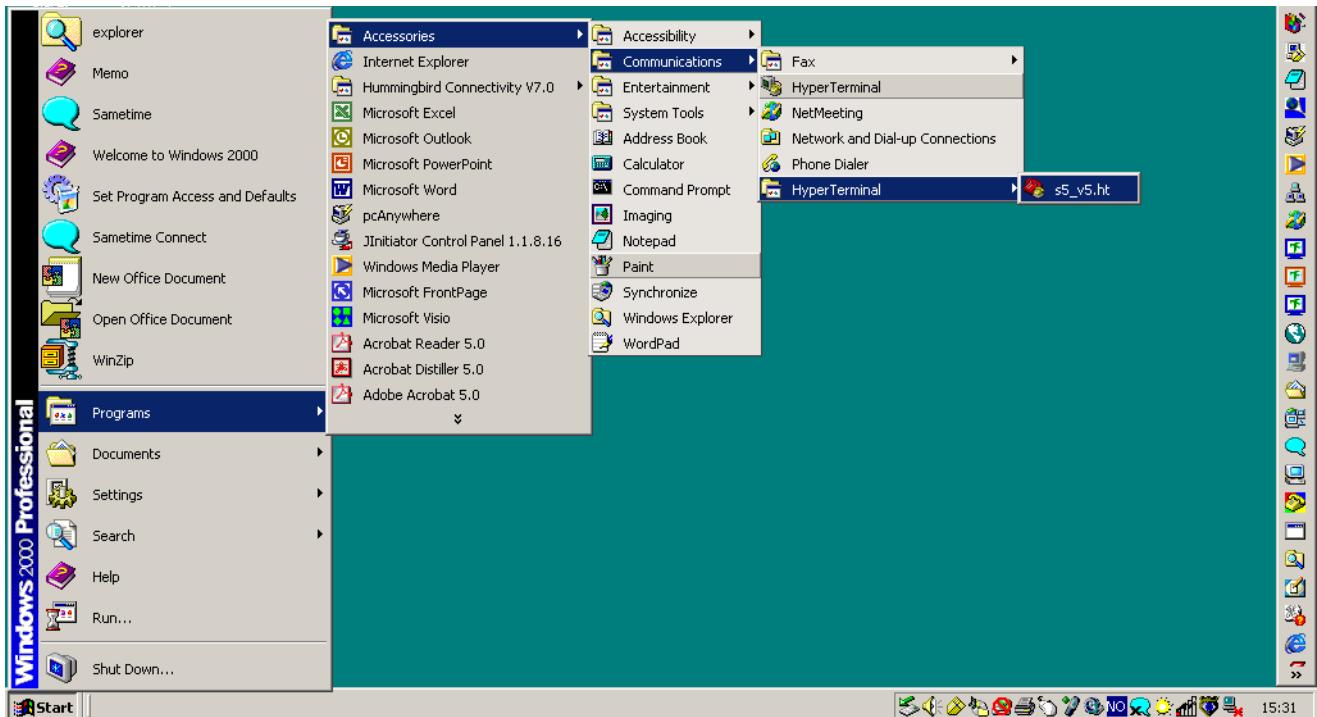
Figure 8-6 Start Hyper Terminal with a V5 profile

8-18-3-10   Open an Already Existing V5 Communication Profile (cont'd)

First, the Hyper Terminal splash screen will be displayed on the screen for a few seconds, then ...

Figure 8-7 Hyper Terminal splash screen

... the *Hyper Terminal* window will open.
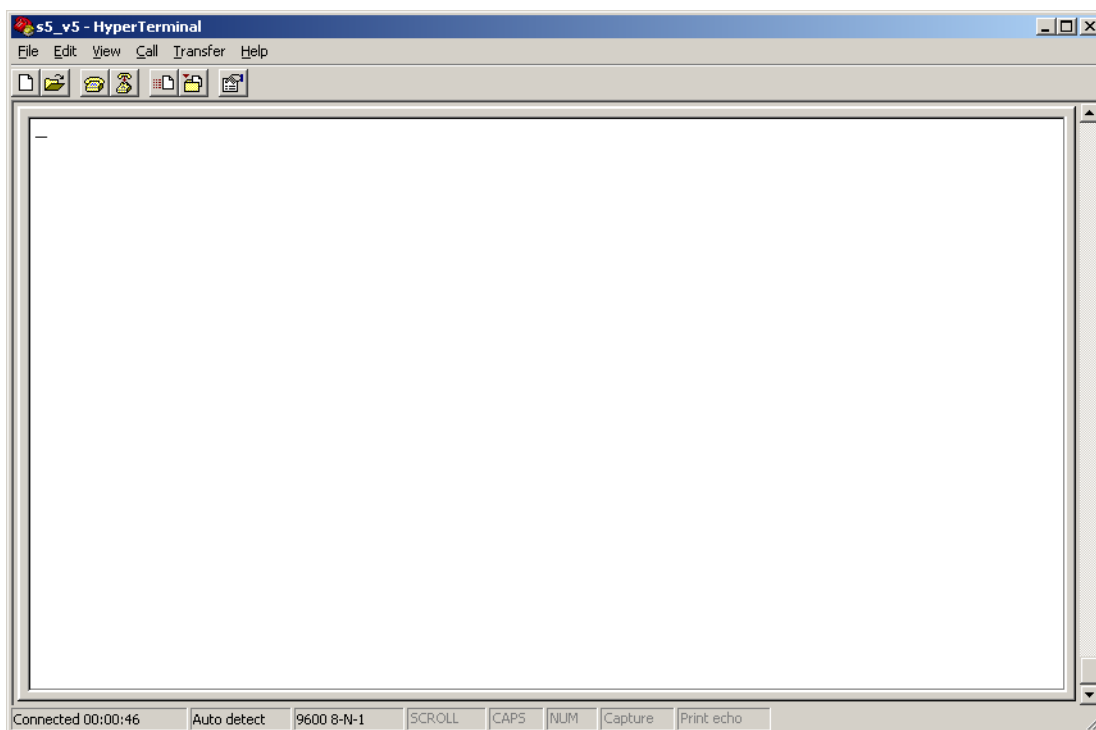
Figure 8-8 Terminal window is ready for use

Next, continue with: .

8-18-3-11 Open Hyper Terminal and Make a New *Communication Profile*

Follow this procedure if a *V5 (or S5) communication profile* is missing:

1.) Select **Start** > **Programs** > **Accessories** > **Communications** > **Hyper Terminal** (the application), as illustrated below.
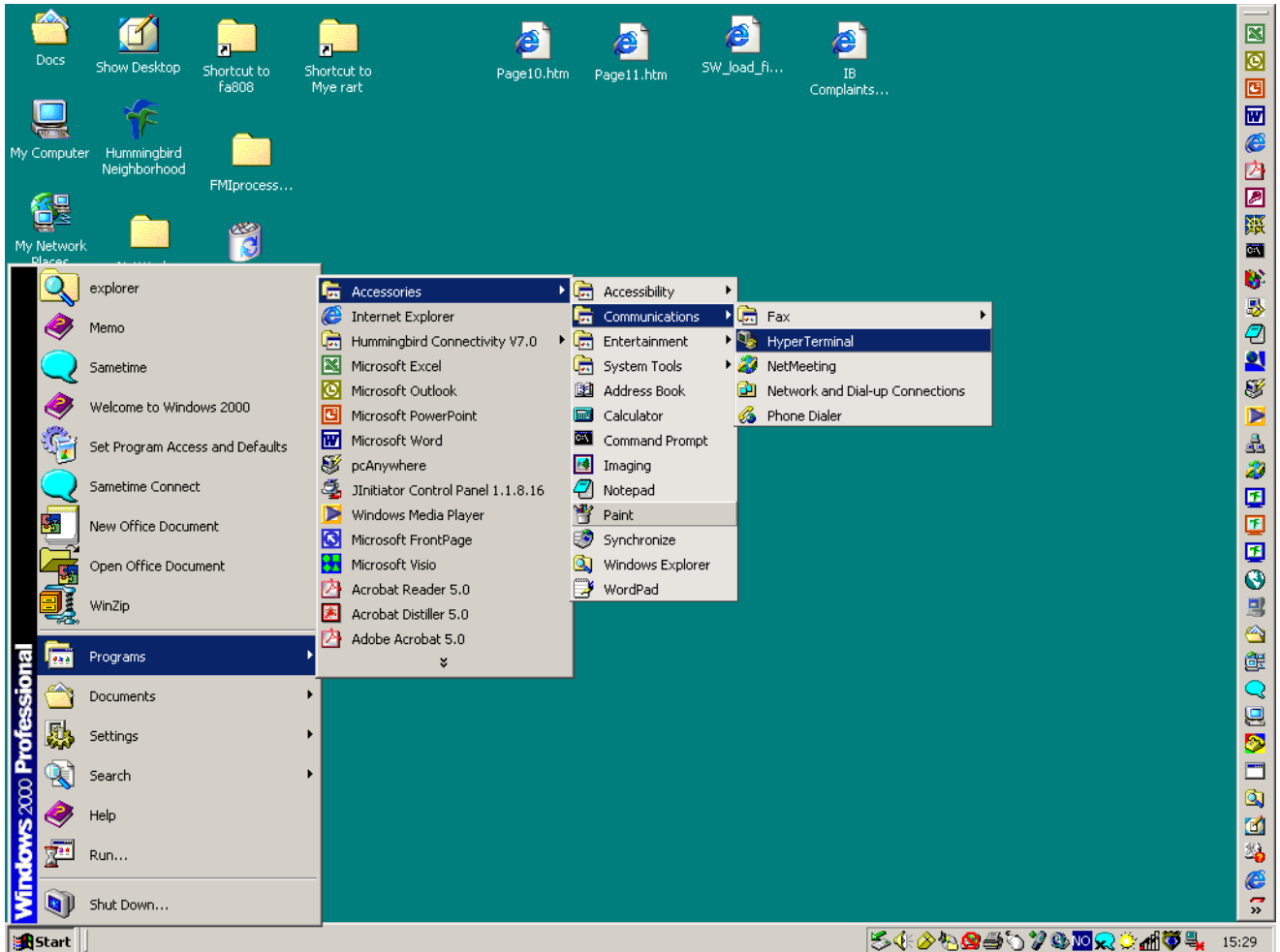
Figure 8-9 Start Hyper Terminal application

8-18-3-11 Open Hyper Terminal and Make a New Communication Profile (cont'd)

First, the Hyper Terminal splash screen will be displayed on the screen for a few seconds, then ...

Figure 8-10 Hyper Terminal splash screen

... the HyperTerminal window will open on the screen.

Next step is to enter the name of the communication profile. In this procedure, the name *s5_v5* is used:

2.) Type **s5_v5** in the *Name* field.

3.) Select a suitable icon from the provided list. In this procedure, the "Two Phones" icon is used.
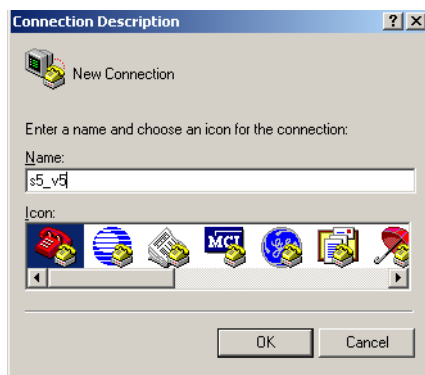
Figure 8-11 New Connection window

4.) Select **OK** to display the next window**.**

8-18-3-12   Adjust Communication Parameters

NOTE: *Some of the fields may look different on your laptop, depending on earlier use and setup.*
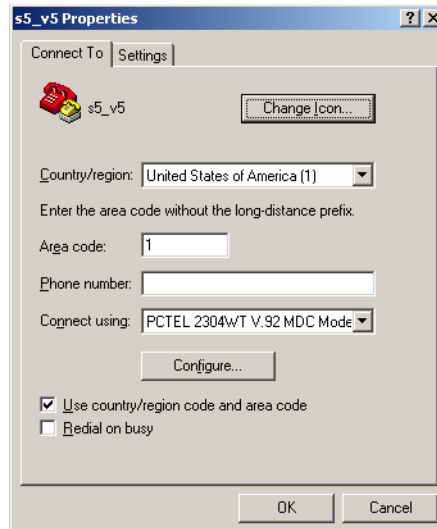
Figure 8-12 *The s5_v5 Properties* window

1.)   If needed, select **COM1** from the *Connect using:* pull-down menu.
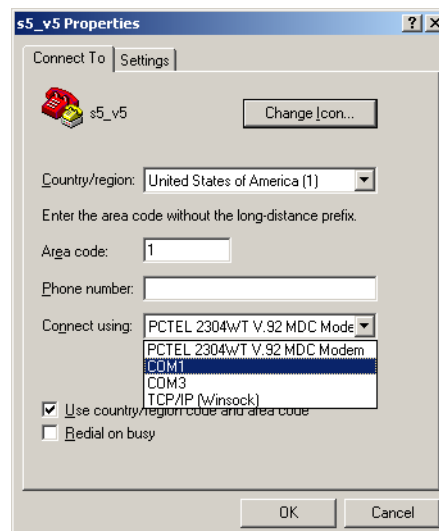
Figure 8-13 Select COM1

2.)   Select **OK** to save and close this window and display the *Port Settings* menu.

8-18-3-12   Adjust Communication Parameters (cont'd)
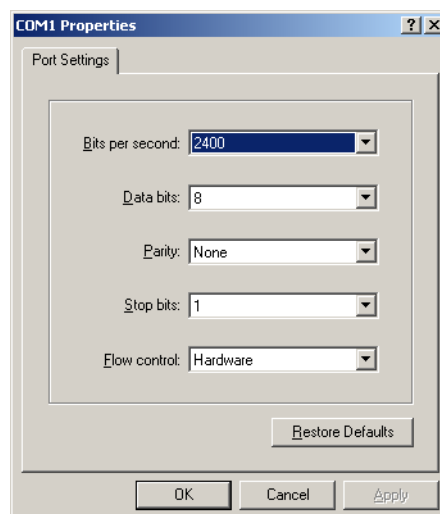
Figure 8-14 Port Settings window

3.)   Select **9600** from the *Bits per second* pull-down menu.
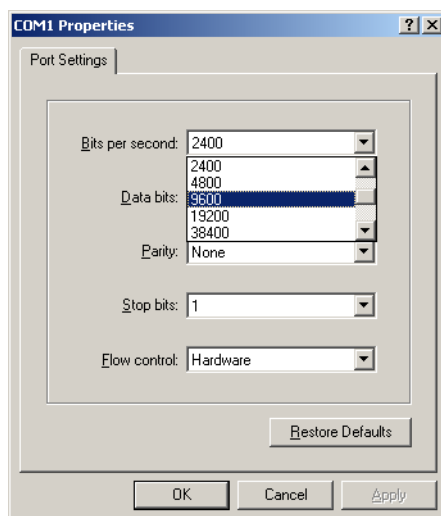
Figure 8-15 Select 9600 bits per second as data rate

4.)   Select **Xon/Xoff** from the *Flow control* pull-down menu.

8-18-3-12   Adjust Communication Parameters (cont'd)
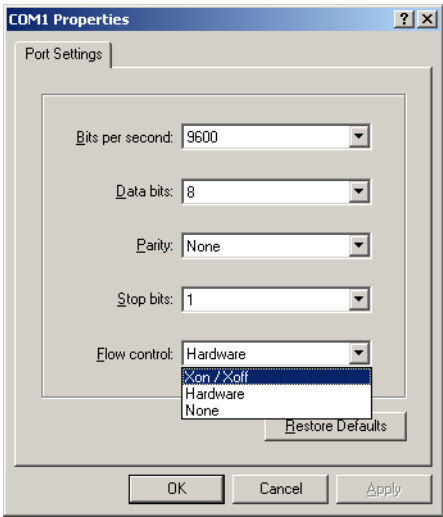
Figure 8-16 Select Xon/Xoff

5.) Verify that the terminal settings are as indicated in Table 8-10 "Hyper Terminal Settings" on page 8-34 and in Figure 8-17 "Port Settings adjustment completed" on page 8-35.

Table 8-10 Hyper Terminal Settings

PARAMETERS	SETTINGS
Bits per second	9600
Data bits	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff

8-18-3-12   Adjust Communication Parameters (cont'd)

Figure 8-17 Port Settings adjustment completed
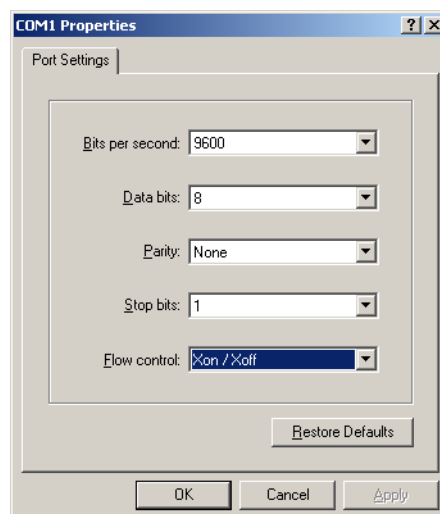
6.)   Select OK to confirm your settings and display a terminal window.
        A blinking underscore indicates that the terminal is ready for use.

**BLINKING
UNDERSCORE**
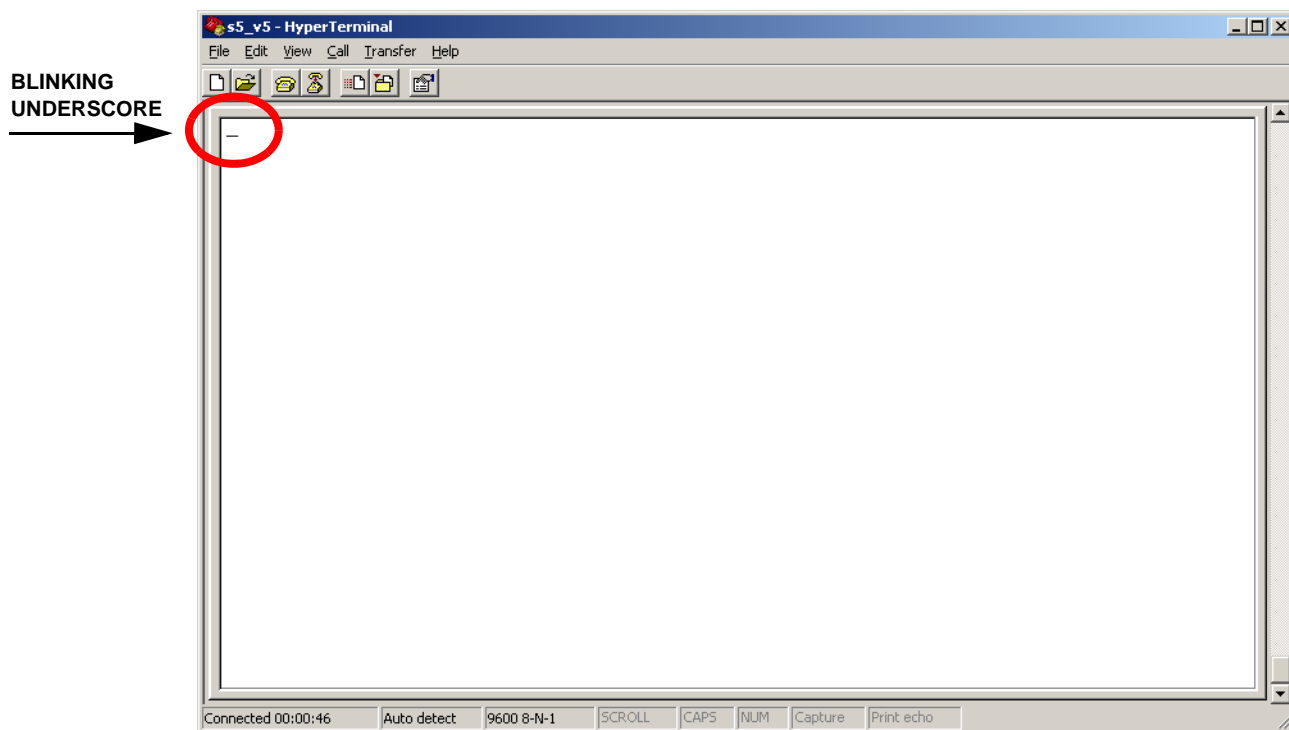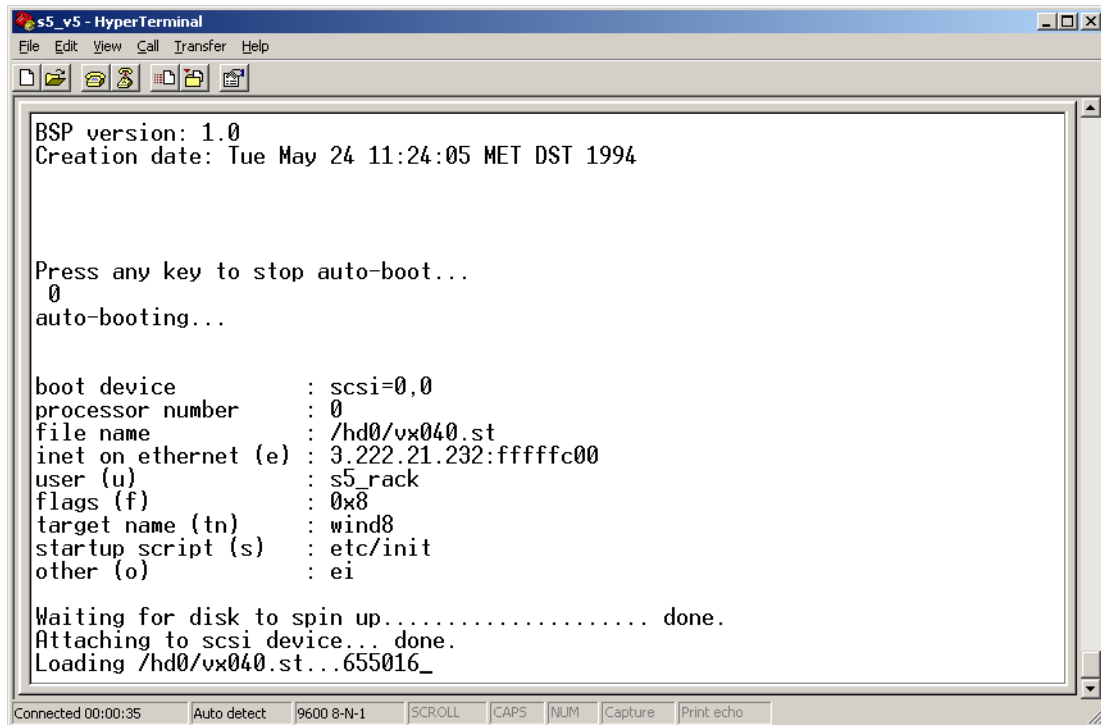
Figure 8-18 Terminal window is ready for use

8-18-3-13   Scanner Power ON

1.) Insert a probe in connector 1 on the scanner.

2.) Turn ON the scanner.
When the scanner is powered on, a boot sequence, similar to the one illustrated in Figure 8-19 "Scanner startup" on page 8-36, will appear in the terminal's window on your laptop.

Figure 8-19 Scanner startup

3.) Verify that Scanner is booting successfully.

8-18-3-14   Verify and Record the Scanner's Software Version

1. From the Front Panel (Operator Panel), select **Setup.**

2. From the Setup menu, select **Configuration & Test > SW**
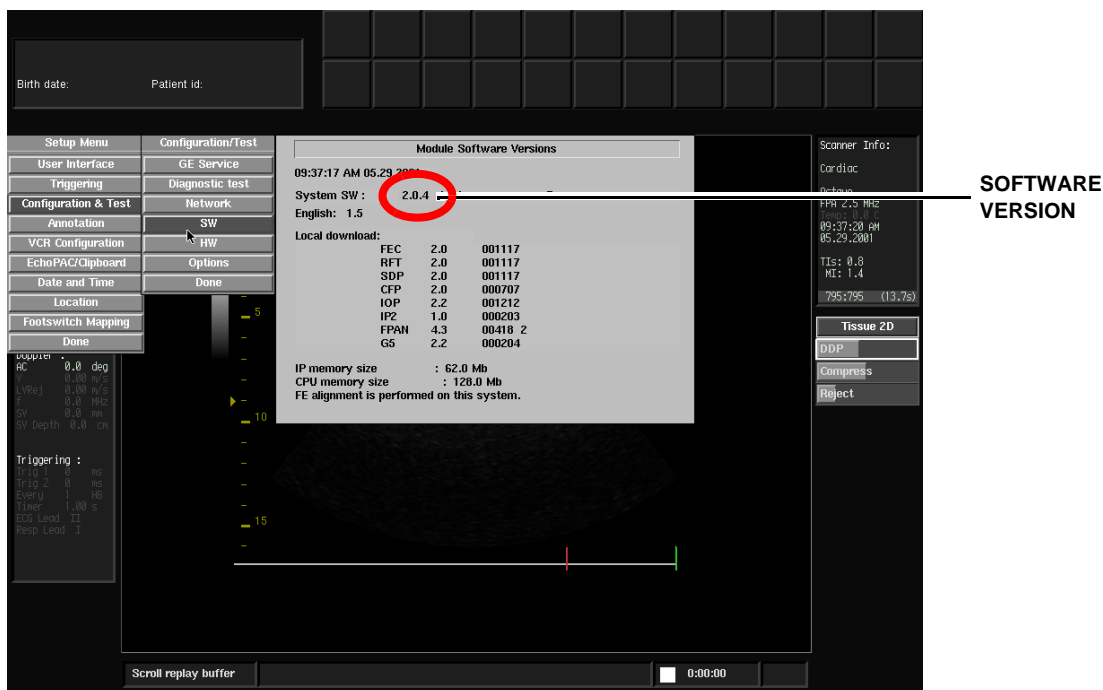
Figure 8-20 Scanner's software version

5. Record the scanner's software version below:

Software Version: _____

Example: In Figure 8-20 the Software Version is: *2.0.4.*

8-18-3-15   Record VCR Parameters

See the Vivid 5 User Manual.

8-18-3-16   Record EchoPAC Related Parameters (Supervision ONLY)

See the Vivid 5 User Manual.

8-18-3-17   Locate the Correct System Software File for the Upgrade

Three versions of the Vivid 5 System Software are available

- Vivid 5 (without internal Macintosh), used in Europe and Asia: Use the file: *v2.0.6.tar.gz*.
- Vivid 5 Supervision (with internal Macintosh): *v2.0.6_svision.tar.gz*.
- Vivid 5 (without internal Macintosh), used in Americas: *v2.0.6_us.tar.gz*.

Add a check mark in front of the correct file for the upgrade in .

Table 8-11 Vivid 5 System Software v2.0.6

CHECK THE CORRECT FILE	FILE NAME	DESCRIPTION	LISTED IN THE SOFTWARE REVISION WINDOW	POLES
	v2.0.6.tar.gz		v2.0.6	EUROPE AND ASIA
	v2.0.6_svision.tar.gz	For units with internal EchoPAC (Supervision) running on a Macintosh computer.	v2.0.6_svision	ALL
	v2.0.6_us.tar.gz		v2.0.6_us	AMERICAS

8-18-3-18   Create User Defined Settings and System Settings File

1.)   Select **Setup** on the Operator Panel (Front Panel).

2.)   Select **Configuration& Test.**

3.)   Select **GE Service** (Vivid 5),
       or
       Select **Options** (System FiVe with software v1.9.x)

4.)   Enter the password. Use either **setfive** or **service** (both passwords are valid and may be used).

5.)   Select **User Defaults.**
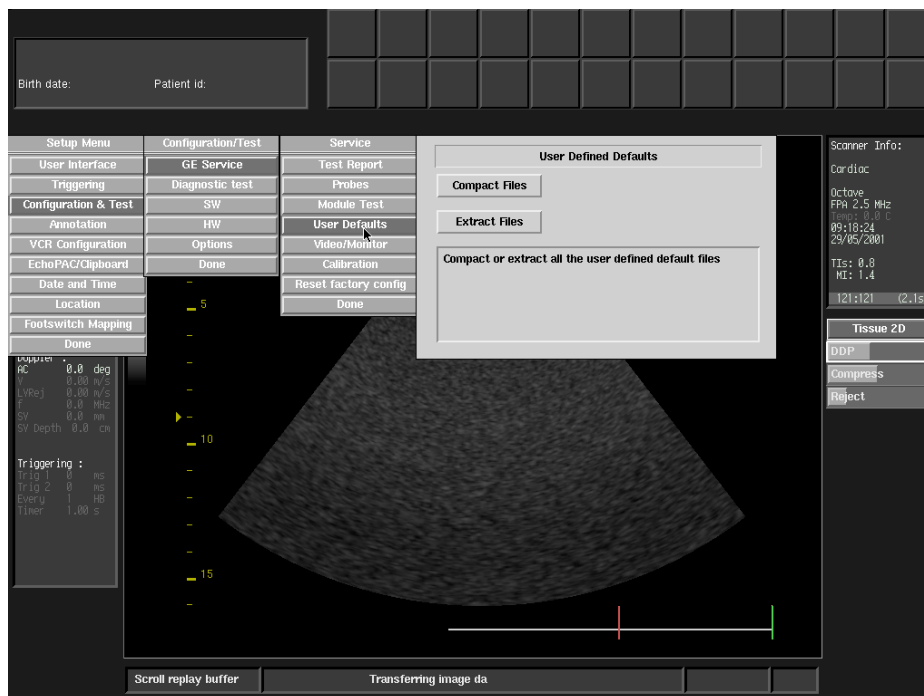
Figure 8-21 User Defined Defaults (Vivid 5)

6.)   Select **Compact Files.**

*NOTE: A file called **udd.tar.gz** has now been generated by the scanner and placed in the root directory.*

8-18-4   Identify the Vivid 5 Scanner's IP Address and Netmask

1.)   Select **Setup** button on front panel.

2.)   Select **Configuration & Test** submenu.

3.)   Select **GE Service.**

4.)   Select **Network Settings** to display the **Network Configuration** menu.

5.)   Record the **IP address**. This is the scanner's IP address.
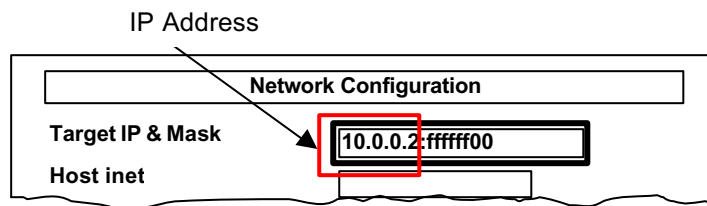
Figure 8-22 Vivid 5 Network Configuration Menu

Scanner IP Address: _____._____._____._____ : **ffffff00**

8-18-4-1   Identify Vivid 5's Version via the Terminal (optional)

1.)   Press **Enter** on the laptop's keyboard, when the scanner is fully booted, to get the command prompt "**–>"** in the terminal window.

2.)   Type **version** after the command prompt and press **Enter.**
A text similar to the one below, will appear in the terminal window:

```
-> version
VxWorks (for Motorola MVME167) version 5.2.
Kernel: WIND version 2.4.
Made on Thu Nov 12 17:38:17 MET 1999.
Boot line:
scsi=0,0(0,0):/hd0/vxWorks.st e=3.222.21.232:fffffc00 u=s5_rack f=0x0
tn=wind8 s=etc/init o=dc
value = 103 = 0x67 = 'g'
->
```

Figure 8-23 Scanner's *Bootline Data*

3. When structuring the **Bootline** in a matrix, it will look like this:

Table 8-12 Scanner's *Boot Line Data*

ENTRY	DATA - Vivid 5
Boot device	scsi=0,0
Processor number	0
Host name	
File name	/hd0/vxWorks.st
Inet on ethernet (e) *NOTE! Another address than illustrated here may be in use* DEFAULT FROM FACTORY: 10.0.0.2	3.222.21.232:fffffc00
Inet on backplane (b)	
Host inet (h)	
Gateway inet (g)	
User (u) NOTE! MAY BE SOMETHING ELSE)	s5_rack
Ftp password (pw) (blank=use rsh) (MAY HAVE BEEN SET TO SOMETHIBNG)	
Flags (f)	0x0
Target Name (tn)	wind8
Startup script (s)	etc/init
Other (o)	dc

8-18-4-2   Record and Change the Laptop's Native IP Address

18.4.2.1   Exit BlackICE on Laptop

To be sure that BlackICE don't interfere during the next steps, you should stop it.

1.) Right-click on the BlackICE icon in the application field on the laptop's screen.
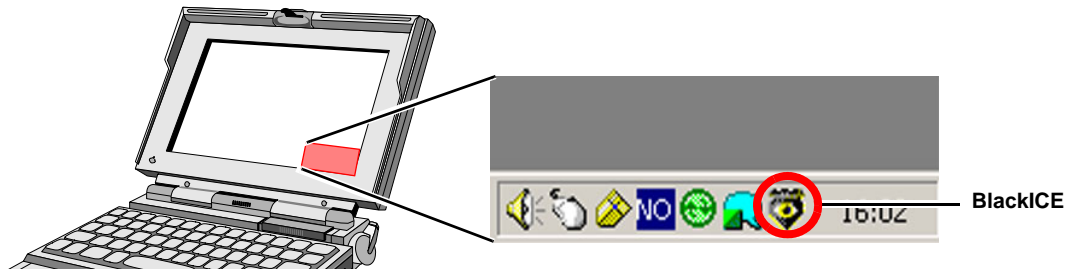
Figure 8-24 Disable BlackICE

2.) From the pop-up menu, select **Stop BlackICE Engine**.
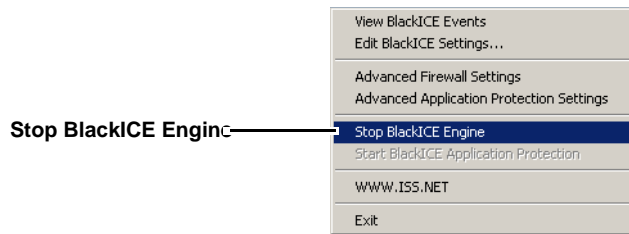
Figure 8-25 Stop BlackICE Engine

3.) Select **Exit**.
Black-ICE stops. It will be restarted next time you restart the laptop.
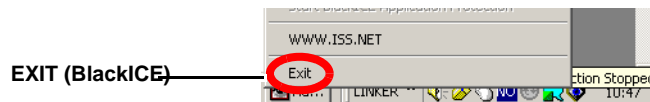
Figure 8-26 Exit BlackICE

8-18-4-3 Record Laptop's Native IP Address

1.) On the Windows desktop open **My Computer.**
2.) Open **Control Panel.**
3.) Open **Network and Dialup Connections.**
4.) Open **Local Area Connection.**
5.) Open **Internet Protocol (TCP/IP)**.
6.) Select **Properties.**
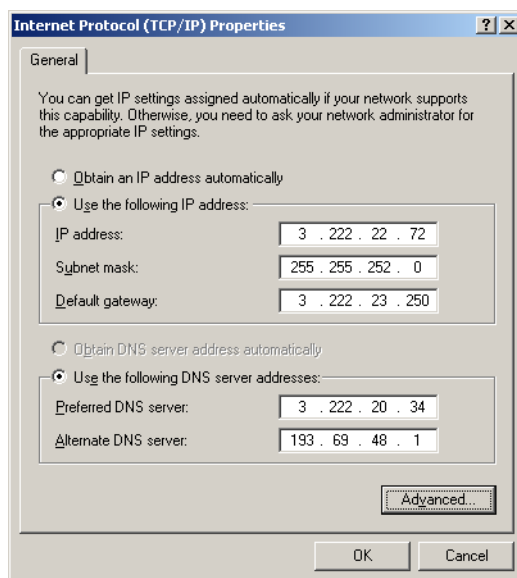
Figure 8-27 Network and Dialup Connections

Record the IP address and Subnet mask in the provided space below:

Laptop original IP address: _____._____._____._____

Laptop original Subnet mask: _____._____._____._____

8-18-4-4   Change Laptop's IP Address

1.)   Change your laptop's IP address to match the scanner's IP address, see Figure 8-28 and Figure 8-29.

Scanner's IP address: ____.____.____.____

Laptop's IP address: ____.____.____.__5_

Figure 8-28 Change laptop's IP address to match the scanner's IP address

Scanner's IP address: _3_.222._21.232

Laptop's IP address: _3_.222._21._5_

THE LAST DIGIT GROUP MUST BE DIFFERENT BETWEEN THE SCANNER THE MACINTOSH COMPUTER (IF PRESENT) AND THE LAPTOP!
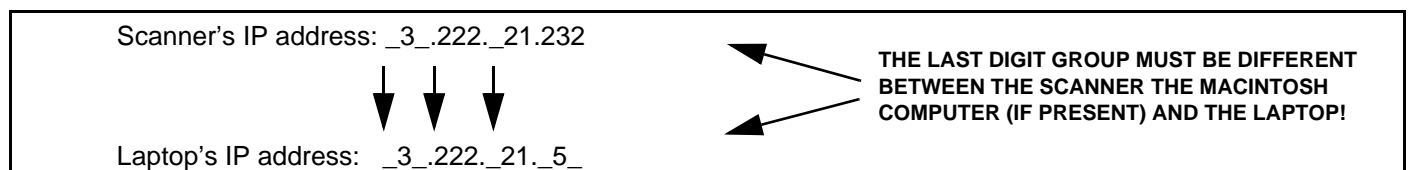
Figure 8-29 EXAMPLE: Laptop's IP address changed to match the scanner's IP address

2.)   Close all the network related windows to save your changes.

8-18-4-5   Copy Correct Software Files to the *work* Folder

1.)   Record the name of the software files you're going to use, in the table below.

Table 8-13 New Software

FILE TYPE	FILE NAME	COMMENTS
SCANFILE	.tar.gz	
ECHOPAC FILE (Supervision file)	.tar.gz	FOR SCANNERS WITH INTEGRATED MACINTOSH (ECHOPAC) / (SUPERVISION) ONLY

Refer to: Figure 8-5 "Vivid 5 software CD contents" on page 8-27

2.)   Copy the files you need for the upgrade, see your record in Table 8-13 "New Software" on page 8-45, from the CD to the laptop's **work** folder.

Copy the files you need for the upgrade, from the CD to the work folder
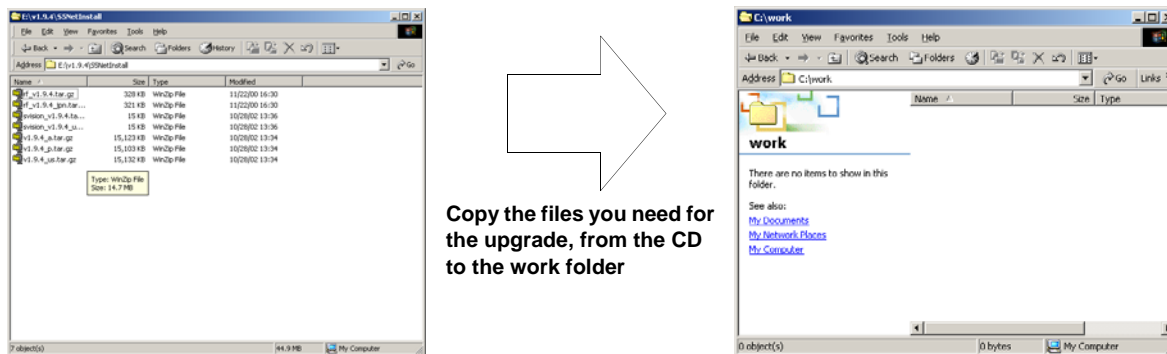
Figure 8-30 Copy the needed files from CD to *work* folder

3.)   Remove the CD from the laptop.

8-18-4-6   Open Command Window

4.) Select **Start > Run**...

5.) Type **cmd** in the *Open* field.

6.) Press **Return** to open a *Command Prompt* window.
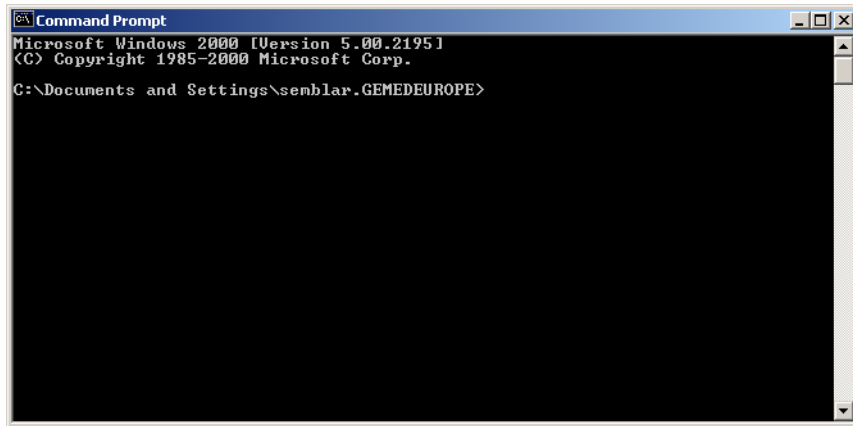
Figure 8-31 Open a Command Prompt window

18.4.6.1   Change Path to the Work Folder

1.) With the **Command Prompt** window active, type: **cd "c:\work"**

Figure 8-32 Change path

2.) Press **Enter** to change the active directory to *work*.

Figure 8-33 The new path has been selected

8-18-4-7 Verify Change of Laptop IP Address

1.) Type the following command:
ipconfig
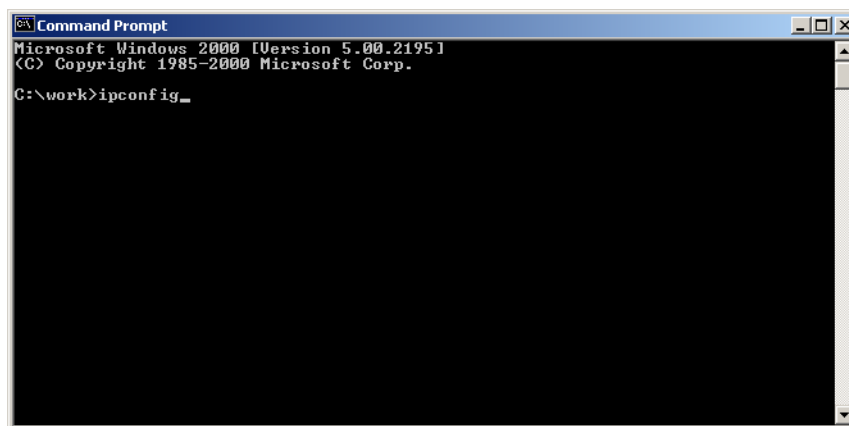
Figure 8-34 Command Prompt terminal window

2.) Press **Enter**
The laptop's ip address and subnet mask will be printed on the screen as illustrated below.
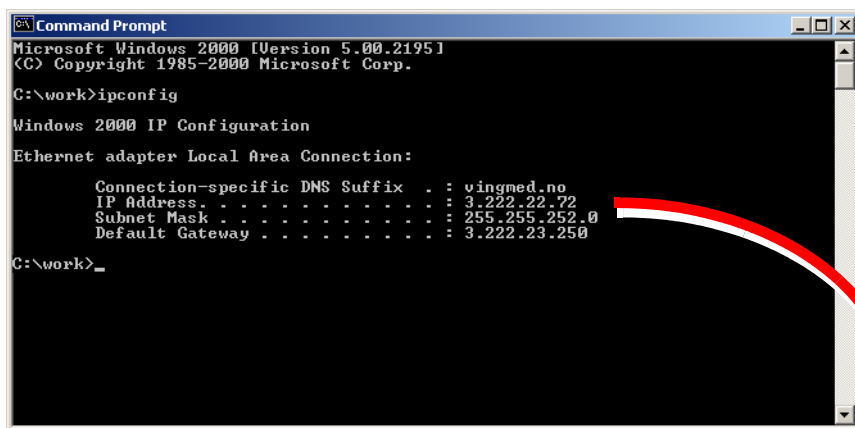
Figure 8-35 Display IP Address and Subnet Mask (Example)
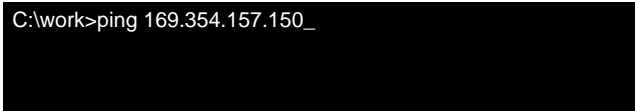
3.) Verify that the IP Address and Subnet Mask is the same as you set earlier.

8-18-4-8   Verify Connection Between Laptop and Scanner

1.) Verify that the link light on the PC Card LAN cable adapter is lit. It will flash during network traffic.

2.) Verify that the link light on the 10 base-T Ethernet adapter on the System FiVe is lit (or flashing).

3.) Type **ping** in the *Command Prompt* window.

4.) Type a space.

5.) Type the **ip address** for the scanner.

Note: The IP address must be on the form: **xxx.xxx.xxx.xxx** where **xxx** is a number between 0 and 255.

Example: **ping 169.254.157.150**

```
C:\work>ping 169.354.157.150_
```

Figure 8-36 The Ping command [Example]
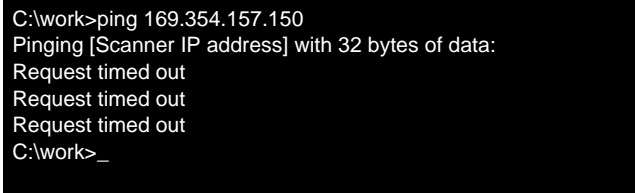
6.) Press **Return** to start pinging the scanner.

7.) Verify a successful ping between the laptop and the scanner, similar to what is shown in Figure 8-37 "Ping results (Ping succeeded)" on page 8-48.

```
C:\work>ping 169.354.157.150
Pinging [Scanner IP address] with 32 bytes of data:
Reply from [Scanner IP address]: bytes=32 time<=10ms TTL=128
Reply from [Scanner IP address]: bytes=32 time<=10ms TTL=128
Reply from [Scanner IP address]: bytes=32 time<=10ms TTL=128
C:\work>_
```

Figure 8-37 Ping results (Ping succeeded)

If the pinging of the scanner fails, a result as indicated in Figure 8-38 "Ping results (Ping failed)" on page 8-48, will be displayed on the screen.

```
C:\work>ping 169.354.157.150
Pinging [Scanner IP address] with 32 bytes of data:
Request timed out
Request timed out
Request timed out
C:\work>_
```

Figure 8-38 Ping results (Ping failed)

If pinging fails, verify that:

• the scanner's IP address was entered correct in the ping command.

• the ethernet cable from PC to scanner is OK.

• link lights are lit (as verified before)

8-18-5 Software Upgrade

8-18-5-1 Start FTP Session

1.) Type **ftp <IP address>** where <IP address> is the network address for the scanner.

NOTE: *The IP address must be on the form: **xxx.xxx.xxx.xxx** where **xxx** is a number between 0 and 255.*

Example: **ftp 169.254.157.150**

2.) Press **Enter** to connect to the scanner's built-in ftp server.

```
C:\work>ftp 169.254.157.150
Connected to 169.254.157.150.
220 VxWorks (5.2) FTP server ready
User (169.254.157.150:(none)):
```

Figure 8-39 Start FTP session

3.) Press **Enter** both when asked for **User** and when asked for **Password**.
The illustration below illustrates a connection that succeeded.

```
C:\work>ftp 169.254.157.150
Connected to 169.254.157.150.
220 VxWorks (5.2) FTP server ready
User (169.254.157.150:(none)):
331 Password required
Password:
230 User logged in
ftp>
```

Figure 8-40 FTP connection to server succeded

8-18-5-1   Start FTP Session (cont'd)

You may want to ensure that your local directory is still the one you made earlier, named work:

NOTE: The "l" in the command "lcd" in the next step, is a lower case "L".

4.)   Type **lcd** and press **Enter**.

```
Microsoft Windows 2000 [Version 5.00.2195]
<C> Copyright 1985-2000 Microsoft Corp.

C:\Documents and Settings\something>cd c:\work

C:\work>ftp 169.254.157.150
Connected to 169.254.157.150.Connected to 169.254.157.150.
220 VxWorks (5.2) FTP server ready
User (169.254.157.150:(none)):
331 Password required
Password:
230 User logged in
ftp>lcd

ftp>
```

Figure 8-41 FTP connection to server succeeded

⚠ **NOTICE When transferring data via FTP, you can choose between Binary or ASCII data format. When moving software, you must select Binary transfer.**

5.)   Type: **bin**
6.)   Press **Enter**.

```
Microsoft Windows 2000 [Version 5.00.2195]
<C> Copyright 1985-2000 Microsoft Corp.

C:\Documents and Settings\something>cd c:\work

C:\work>ftp 169.254.157.150
Connected to 169.254.157.150.Connected to 169.254.157.150.
220 VxWorks (5.2) FTP server ready
User (169.254.157.150:(none)):
331 Password required
Password:
230 User logged in
ftp>lcd

ftp>bin
mode set to binary
```

Figure 8-42 Mode change to Binary succeeded

The FTP connection is now ready for use.

8-18-5-2   Copy the User Defined Settings From the Scanner

You have already made the **udd.tar.gz** file earlier. It is located on the root folder on the scanner's hard drive.

1.)   On the laptop: Make the **Command Prompt** window active.

2.)   On the laptop, type: **get udd.tar.gz** and press **Enter** to download the User Defined Settings file to the **work** folder on your laptop.

```
Microsoft Windows 2000 [Version 5.00.2195]
<C> Copyright 1985-2000 Microsoft Corp.

C:\Documents and Settings\something>cd c:\work

C:\work>ftp 169.254.157.150
Connected to 169.254.157.150.Connected to 169.254.157.150.
220 VxWorks (5.2) FTP server ready
User (169.254.157.150:(none)):
331 Password required
Password:
230 User logged in
ftp>lcd

ftp>bin
mode set to binary
ftp>get "udd.tar.gz"
200 Port set okay
150 Opening BINARY mode data connection
226 Transfer complete
ftp: 7278 bytes received in 0.04Seconds 181.95Kbytes/sec.
ftp> _
```

Figure 8-43 Download User Defined Settings file from scanner to laptop

8-18-5-3   Erase/Initialize the Scanner's Hard Drive

⚠ **NOTICE** This is the point of NO RETURN.
DO NO TURN OFF or REBOOT the scanner when erasing the scanner's hard drive. If the scanner's power is lost (or turned off) during this step, the communication with the scanner will be lost, and you will not be able to continue the upgrade.

NOTE: *These commands are Case Sensitive.*

NOTE: *In the next step the "0" is a "zero".*

1.)   Type: **diskInit "/hd0"** at the *Hyper Terminal* prompt.

The following is displayed on the laptop:

"/hd0" initialized.

value = 0 = 0x0

8-18-5-4   Transfer System Software File to Scanner

NOTE: *Always transfer the system software file first, then the EchoPAC file (if the scanner has internal EchoPAC).*

To transfer a file from the laptop to the scanner, you must use the **put** command at the FTP prompt in the *Command Prompt* window.

NOTE: *"filename", as used below, is the name of the file you want to transfer (upload) to the scanner. Remember to type the real name of the file you are going to upload.*

Syntax: **put "filename"**

See Table 8-13 "New Software" on page 8-45 where you recorded the file names (or open the **work** folder (C:\\work) in *Windows Explorer*).

1.)   At the ftp prompt, type: **put "filename"**

   Example: Type: **put "v2.0.6.tar.gz"** to upload the *v2.0.6.tar.gz* file to the scanner.

2.)   Press **Enter** to start to upload the file.

In the illustration below, a *v2.0.6.tar.gz* file, is being uploaded to the scanner.

```
226 Transfer complete
ftp: 7278 bytes received in 0.04Seconds 181.95Kbytes/sec.
ftp> put "v2.0.6.tar.gz"
200 Port set okay
150 Opening BINARY mode data connection
```

Figure 8-44 Uploading system software file from laptop to scanner

Note: When transferring big files like the system software file, it looks like the laptop stops working. It is because there is no feedback during the software transfer. Depending on the size of the file and the network speed, the transfer may last for half a minute, or more.

```
200 Port set okay
150 Opening BINARY mode data connection
226 Transfer complete
ftp: 7278 bytes received in 0.04Seconds 181.95Kbytes/sec.
ftp> put "v2.0.6.tar.gz"
200 Port set okay
150 Opening BINARY mode data connection
226 Transfaer complete
ftp: 15465035 bytes sent in 31.30Seconds 494.17Kbytes/sec.
ftp>
```

Figure 8-45 Uploading of the system file from laptop to scanner has been completed
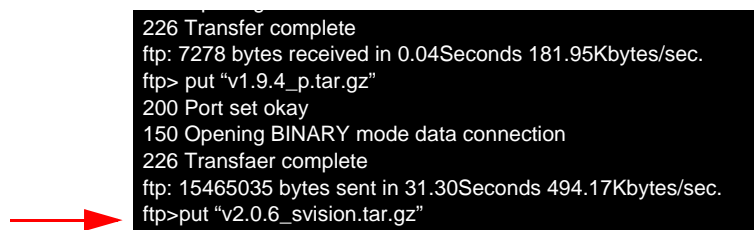
8-18-5-5   Transfer Supervision File

NOTE: *The "svision" file should only be uploaded if the scanner has an internal*
               Macintosh computer with EchoPAC.

Use the **put** command to upload the "svision" file to the scanner.

See where you recorded the file names (or open the **work**
folder (C:\\work) in *Windows Explorer*).

Example: Type **put "v2.0.6_svision.tar.gz"**

```
226 Transfer complete
ftp: 7278 bytes received in 0.04Seconds 181.95Kbytes/sec.
ftp> put "v1.9.4_p.tar.gz"
200 Port set okay
150 Opening BINARY mode data connection
226 Transfaer complete
ftp: 15465035 bytes sent in 31.30Seconds 494.17Kbytes/sec.
ftp>put "v2.0.6_svision.tar.gz"
```

Figure 8-46 Upload the "svision" file from the laptop to the scanner.

NOTE: *When transferring big files, it looks like the laptop stops working. It is*
               because there is no feedback during the software transfer. Depending on
               the size of the file and the network speed, the transfer may last for half a
               minute, or more.

```
ftp>put "v2.0.6_svision.tar.gz"
```

Figure 8-47 Upload of the "svision" file from the laptop to scanner has been completed.

8-18-5-6   Transfer User Defined Settings File

Type **put "udd.tar.gz"** and press **Enter** to upload the User Defined Settings file.
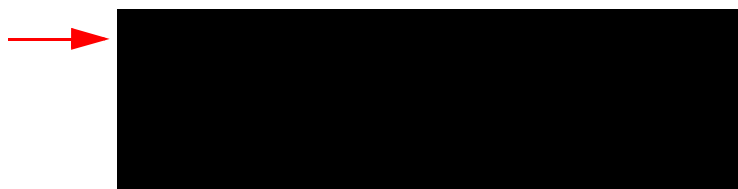
Figure 8-48 Uploading the User Defined Settings file from laptop to scanner

8-18-5-7   Verify the File Transfer

1.) Make the *HyperTerminal* window active.

2.) Press Enter to get a prompt.

Note: The "ll" in the next command are two lower case "L". The command asks for a Long Listing.

3.) At the prompt, type: **ll**

4.) Press **Enter** to display the contents on the scanner's hard drive.

5.) Verify that you can find the files you uploaded, see example below.

6.) Also compare the file size of each file listed in the terminal window to the file size in the work folder. The file sizes should be reported at similar values in both plazes.

Figure 8-49 Example: Long Listing

8-18-5-8   Close the FTP Session

1.) Make the *Command Prompt* window active.

2.) Type **quit** and press **Enter** to end the ftp session.

Figure 8-50 Close the FTP session.

8-18-6   Unpack the Scanner Software Files

8-18-6-1   Unpack the System Software File

1.)   Make the *HyperTerminal* window active.

NOTE: *The largest software "tar.gz" file, named "<filename>.tar gz" in the next step, must be unpacked/installed prior to all the other software files.*

See Table 8-13 "New Software" on page 8-45 where you recorded the file names (or open the **work** folder (C:\\work) in *Windows Explorer*).

2.)   Type **unpack "<filename>.tar.gz"** and press **Enter** to start the unpacking/installation of the system files.

8-18-6-2   Unpack the "svision" File (if needed)

Use the **unpack** command to unpack and install the "svision" file.

8-18-6-3   Unpack the User Defined Settings File

Use the **unpack** command to unpack and install the *User Defined Settings (*"**udd.tar.gz**"*)* file.

8-18-6-4   Reboot the Scanner

⚠ **NOTICE** Be sure to complete ALL previous steps before you continue!
DO NO TURN OFF or REBOOT the scanner when erasing the scanner's hard drive.
If the scanner's power is lost (or turned off) during the previous steps, the communication with the scanner will be lost, and you will not be able to continue the upgrade.

Type: **"reboot"** in the terminal window to reboot the scanner.

8-18-7   Verification

8-18-7-1   Verify Successful Software Upgrade

1.) Switch ON the scanner and verify a normal booting sequence in the terminal window.
2.) When fully booted, press **Setup** on the Operator Panel.
3.) Select: **Configuration & Test > SW** .
4.) Verify that the new software version is displayed.

8-18-7-2   Verify the VCR Settings

Verify that the the VCR Settings are as before the upgrade. Adjust if needed. See Chapter A in the Vivid FiVe User Manual, if you need more details.

8-18-7-3   Verify the EchoPAC Parameters (Supervision ONLY)

Verify that the EchoPAC Parameters are set as before the upgrade. Adjust if needed. See Chapter A in the Vivid FiVe User Manual if you need more details.

8-18-8   Finalizing Software Upgrade

8-18-8-1   Close and Disconnect

1.) Close all open windows on the laptop.
2.) Turn OFF the laptop.
3.) Shutdown/Power Down the scanner. (Use the switch on the rear of the scanner.)
4.) Disconnect the RS-232 (null modem) cable from both the scanner and the laptop.
5.) Insert the *DSUB shield* cover on the RS-232C connector (if it was removed earlier).
6.) Disconnect the ethernet cable(s) from both the laptop and the scanner.

8-18-9   Complete the Upgrade

8-18-9-1   Set Spectrum Caliper

1.) Place a probe in Connector 1, if a probe has been inserted during the upgrade, reconnect it.
2.) Press the **Measure** button on the Operator Panel.
3.) Select the **Config** submenu.
4.) Select **SP Caliper Config.**
5.) Select **Exit.**
6.) Activate the *Spectrum caliper as point* box.
7.) Select **Save.**

8-18-9-2   FE Calibration

1.) Enter the **Setup** menu.
2.) Select **GE Service** submenu.
3.) Select **Configuration&Test.**
4.) Select **Calibration** submenu.
5.) Select **Front End Alignment.**
6.) Reboot the scanner and verify the user defaults to be restored.

8-18-10 Functional Checkout

Note: Not all tests are applicable for all system configurations (with/without MAC, with/without Continuous Capture).

1.) Verify all Vivid 5 modalities (2D, CFM, Doppler, M–mode etc.)

2.) Verify full–screen switching between Macintosh (EchoPAC) and System when pressing EchoPAC key (Insite only).

3.) Verify VCR record and playback of both Vivid 5 RGB (all scanners) and EchoPAC RGB (Supervision only).

4.) Verify Color print and B/W print when applicable.

5.) Verify Vivid 5 to EchoPAC **digital** and **video** transfer if continuos capture is installed

6.) Enter Setup menu, and verify that the software revision has changed.

7.) Perform an actual stress test to verify customer acceptance of the improved interface abilities.

8.) Do functional checkout according to chapter 4 in the Vivid 5 Service Manual, Direction Number FB091565.

9.) Run diagnostic tests as described in the Vivid 5 Service Manual, Direction Number FB091565.

Section 8-19
Using a Hummingbird FTP Server for the Software Upgrade

⚠ **NOTICE** Throughout this procedure you will be instructed to enter information into the laptop. Pay strict attention to how it is shown in the procedure and type the information in exactly as it is presented. If for instance if it shows quotes, use quotes.

Most errors in performing this procedure occur when the information is entered incorrectly.

8-19-1 Overview

In this procedure, two connections are needed, an ethernet connection used for moving the files and a serial (RS-232C) connection for controlling and monitoring the scanner's CPU.

The section describes how to connect a laptop or PC to the scanner and how to set up the needed communication. It also instructs you to verify the contents of the software CD.

Section 8-20 RS-232C "Non Modem" Connection to a Vivid 5 Scanner

Use a null modem cable ("non modem cable") to communicate with the scanner's CPU. This will give you the ability to communicate directly with the scanner's CPU, at all time.

1.) If present, remove the **EMC Cover** from the RS-232 CPU connector on the lower left side of the scanner.

2.) Connect the null modem cable from the COM1 port on the laptop to the 9-pin RS-232C, male connector, marked either "**CPU**" or **"SERVICE - RS232"** on the external I/O port on the Vivid 5.

USE THIS CONNECTOR.

EXTERNAL I/O WITH RS-232C CONNECTOR TO USE IS LOCATED BEHIND THIS DOOR.
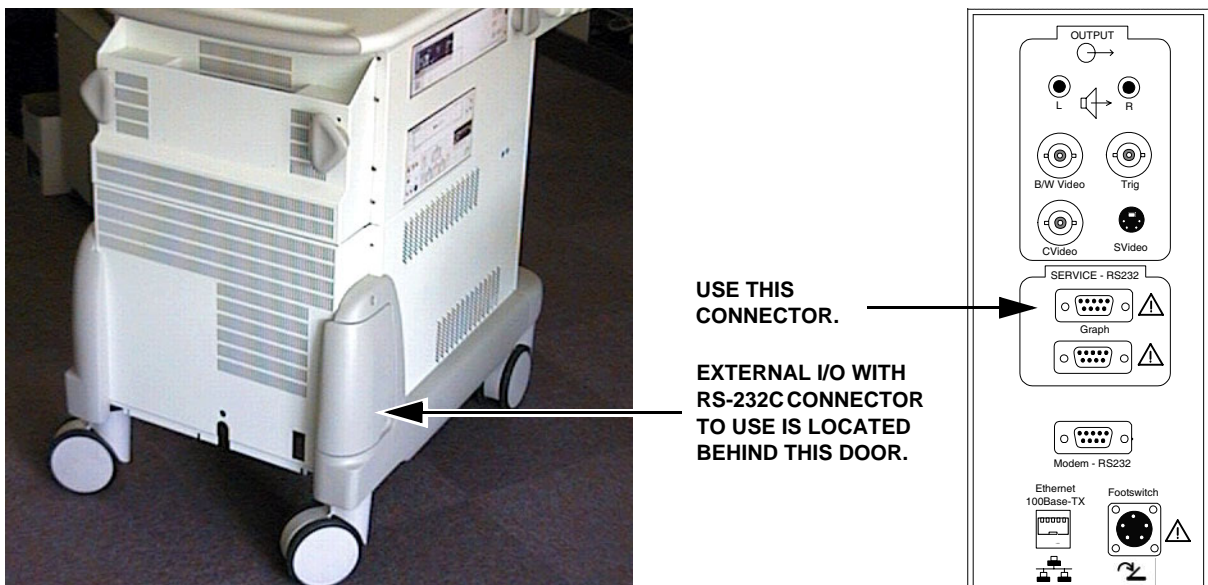
Figure 8-1   Location of RS-232 connector on Vivid 5 scanner

8-20-1   Ethernet Connection to Scanner

There are two ways of connecting to the scanner, you can either connect directly, or through a 10/100 Mbit Switch.

The one to choose is dependent on what type of PC LAN Card you have installed on your laptop.

- If you have a 10Mbit LAN Card go to 8-18-3-4 "Laptop with 10 Mbit PC LAN Card" on page 8-25.
- If you have a 10/100Mbit LAN Card go to 8-18-3-5 "Laptop with 10/100 Mbit PC LAN Card" on page 8-26.

8-20-1-1   Laptop with 10 Mbit PC LAN Card

1.) Connect a non-crossed ethernet cable from the PC Card LAN cable adapter to a 10/100 switch, port 1.
2.) Connect another non-crossed ethernet cable from the 10/100 switch, port 2 to the Ethernet Strain Relief adaptor, if present, or directly to the ethernet connector on Vivid 5's External I/O.
3.) Connect the power cord to the 10/100 switch.
4.) Verify link light on PC Card LAN cable adapter.
5.) Verify a link light at Vivid 5's ethernet connector.
6.) Verify a link light at port 1 and port 2 on the 10/100 switch.
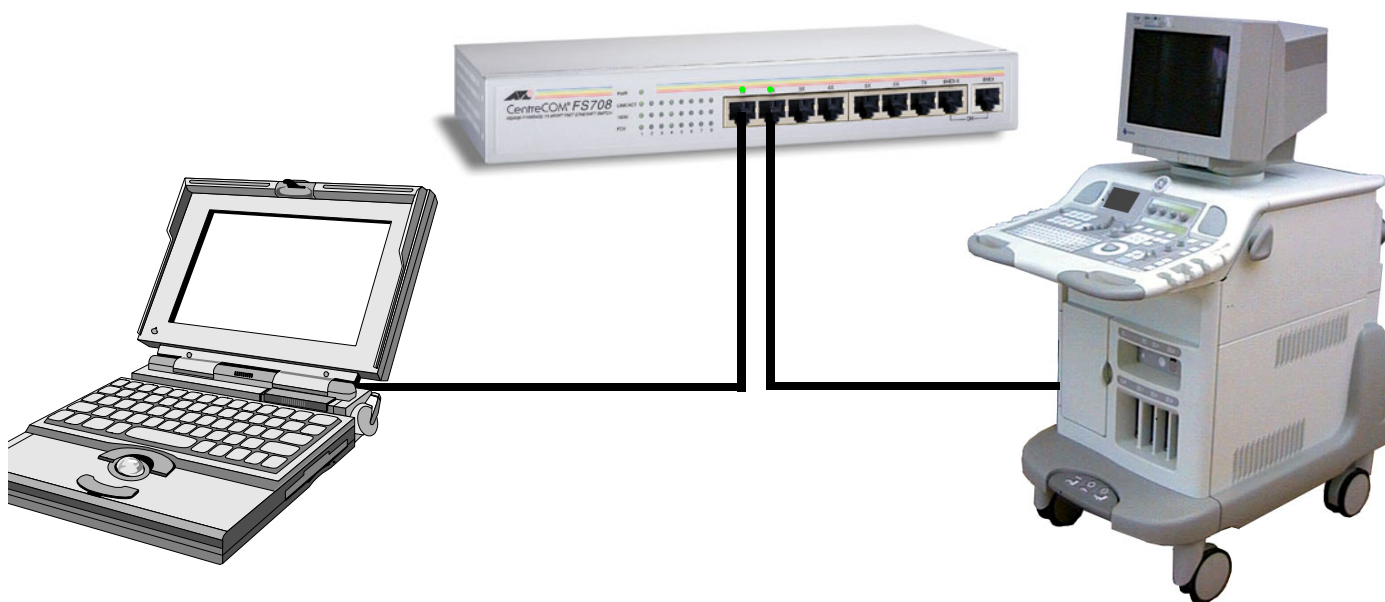
Figure 8-2   Connect your laptop via a 10/100 ethernet switch to Vivid 5 scanner

8-20-1-2 Laptop with 10/100 Mbit PC LAN Card

1.) Connect a crossed ethernet cable from your laptop to:
   - the ethernet Strain Relief Adaptor, if present, or directly to the ethernet connector on Vivid 5's External I/O.
   - the ethernet adaptor, if present on System FiVe, or via an AIUM ethernet adaptor to System FiVe's External I/O.
2.) Verify that the link light on PC Card LAN adaptor is lit.
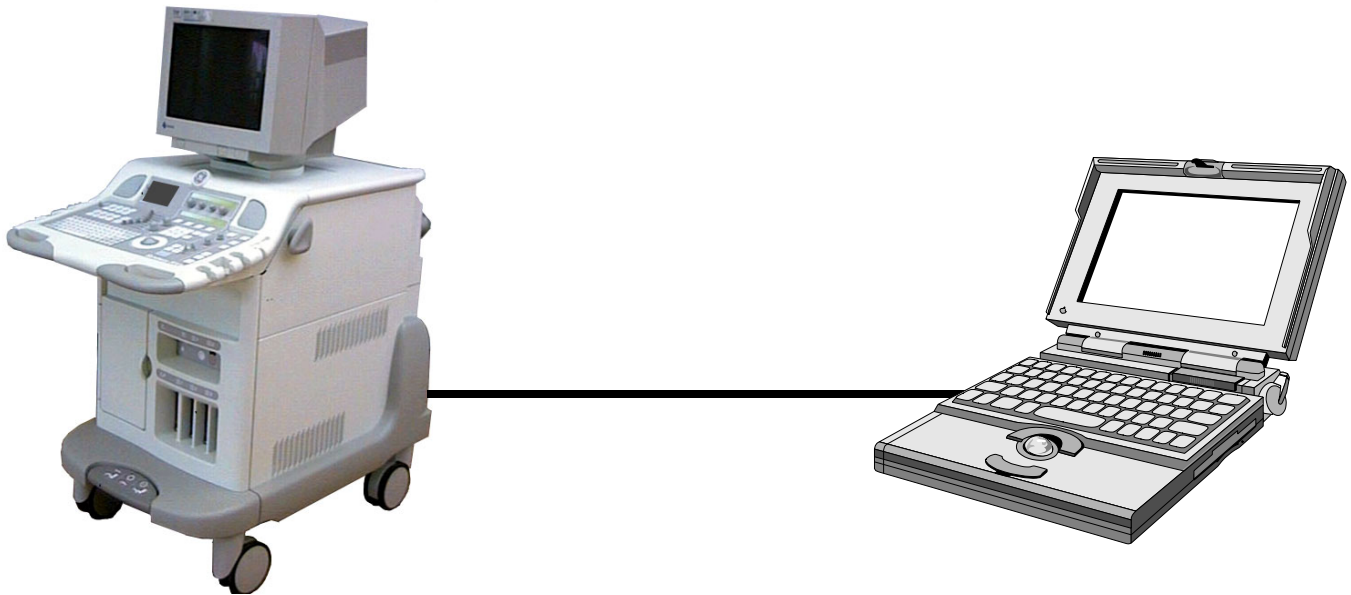
Figure 8-3   Connect your laptop to the scanner

8-20-2 Laptop Power ON

1.) Power ON the **Laptop.**
2.) When the laptop is up and running, insert the System Software CD for the scanner you are going to upgrade, in the CD ROM on your laptop.
   - For Vivid 5 scanners, use CD Part Number FB200394G.
   - For System FiVe, use CD Part Number FC200051.

8-20-3   Create Directories

Note: If having more than one harddrive on your computer, it is recommended to create this file structure on all harddrives, as the FTP Server may not be connected to C:\ drive and installation will fail.

1.)   On C:\ root select New Folder
2.)   Change name to **hd0**
3.)   On C:\ root select New Folder
4.)   Change name to **S5NetInstall**
5.)   Repeat step 1 to 4 for other hardrives or partitioned harddrives
6.)   Insert vx040.st for System FiVe or vxWorks.st for Vivid FiVe into **hd0** folder
7.)   Insert SW files into the **S5NetInstall** folder

8-20-4   Create Work Folder on the Laptop

1.)   Open **My Computer** on the desktop.
2.)   Open the **C:** drive.
3.)   Select **New** from the File menu.
4.)   Select **Folder.**
5.)   Give the new folder the name **work**
6.)   Open the **work** folder.

8-20-5   Configure and Start the Terminal Program (Hyper Terminal)

8-20-5-1   Start the Terminal Program

This procedure uses HyperTerminal software to serve as a VT220 or VT100 terminal emulator, but any VT220 or VT100 terminal emulator can be used, as long as the settings from Table 8-10 "Hyper Terminal Settings" on page 8-34 are entered correct into the alternative terminal.

- If a *V5 communication profile* already exists, continue with 8-18-3-10 "Open an Already Existing V5 Communication Profile" on page 8-28.
- If a *V5 communication profile* doesn't exists, continue with 8-18-3-11 "Open Hyper Terminal and Make a New Communication Profile" on page 8-30.

8-20-5-2   Open an Already Existing *V5 Communication Profile*

Follow these steps if a *V5 or S5 communication profile* already exists,

1.) Select: **Start** > **Programs** > **Accessories** > **Communications** > **Hyper Terminal** (the Folder)

2.) Select the Communication Profile in the *Hyper Terminal* folder (**s5_v5.ht** in the illustration below).
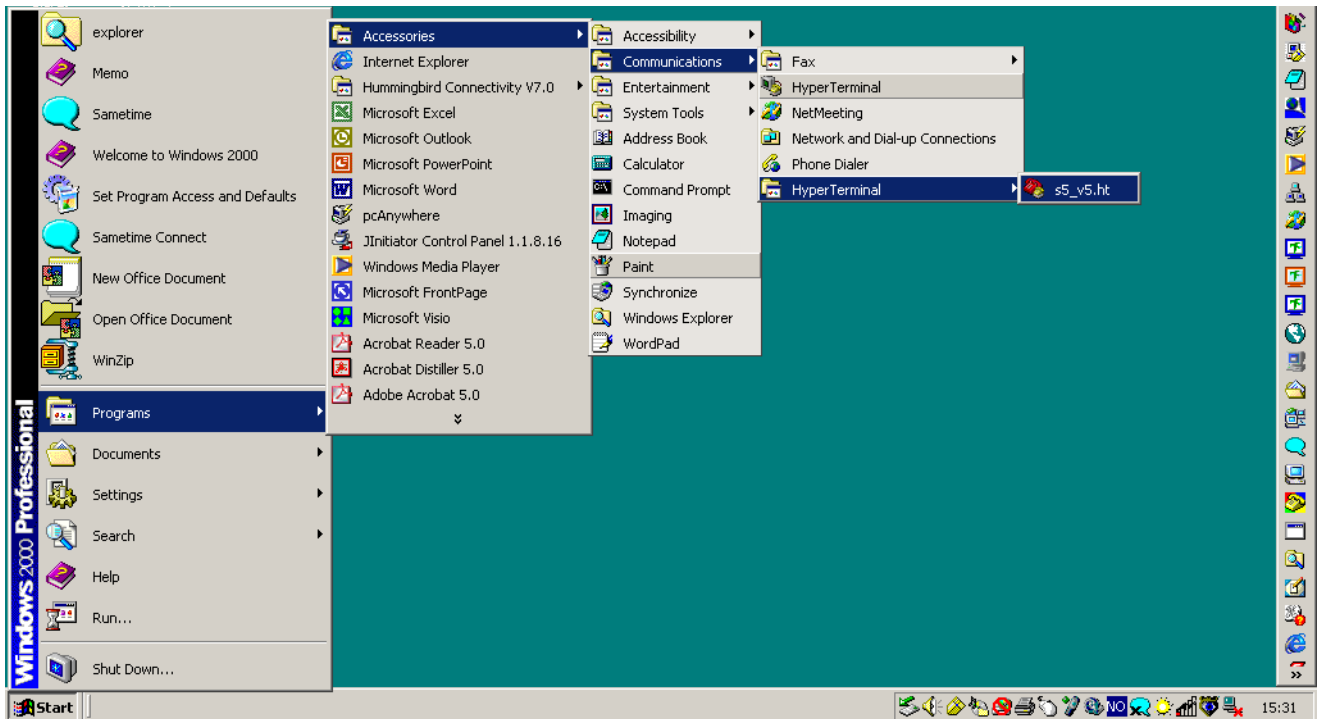
Figure 8-4   Start Hyper Terminal with a V5 profile

8-18-3-10   Open an Already Existing V5 Communication Profile (cont'd)

First, the Hyper Terminal splash screen will be displayed on the screen for a few seconds, then ...

Figure 8-5   Hyper Terminal splash screen

... the *Hyper Terminal* window will open.
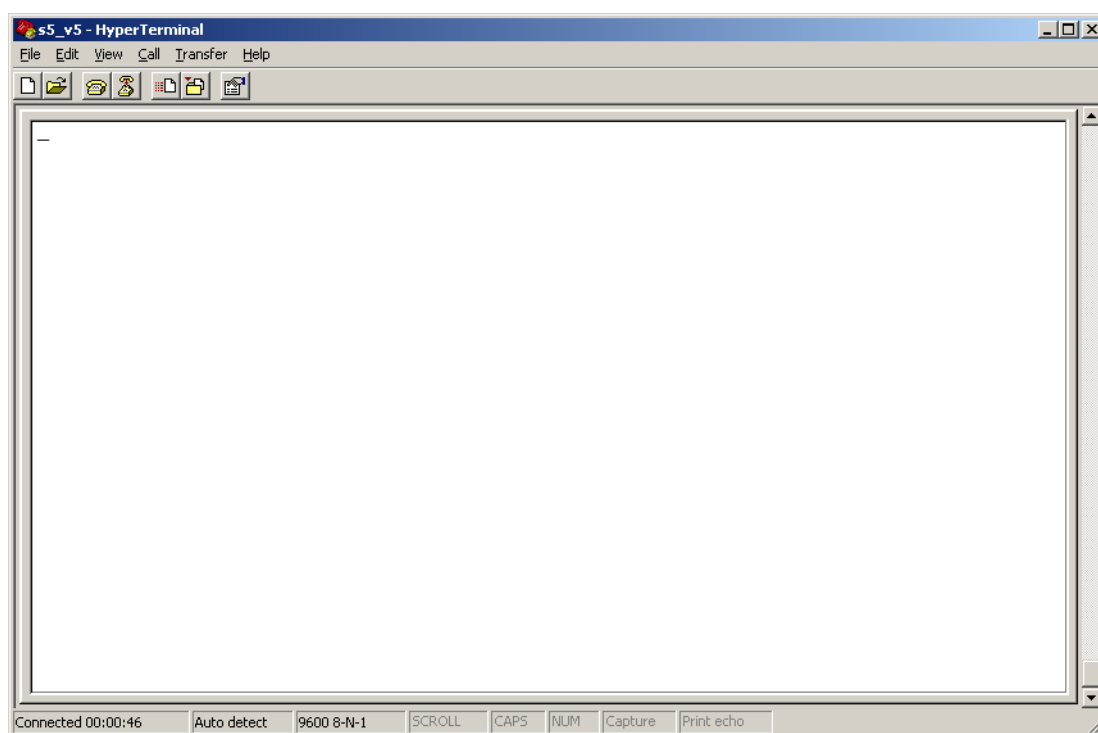
Figure 8-6   Terminal window is ready for use

Next, continue with: .

8-20-5-3   Open Hyper Terminal and Make a New *Communication Profile*

Follow this procedure if a *V5 or S5 communication profile* is missing:

1.)   Select **Start** > **Programs** > **Accessories** > **Communications** > **Hyper Terminal** (the application), as illustrated below.
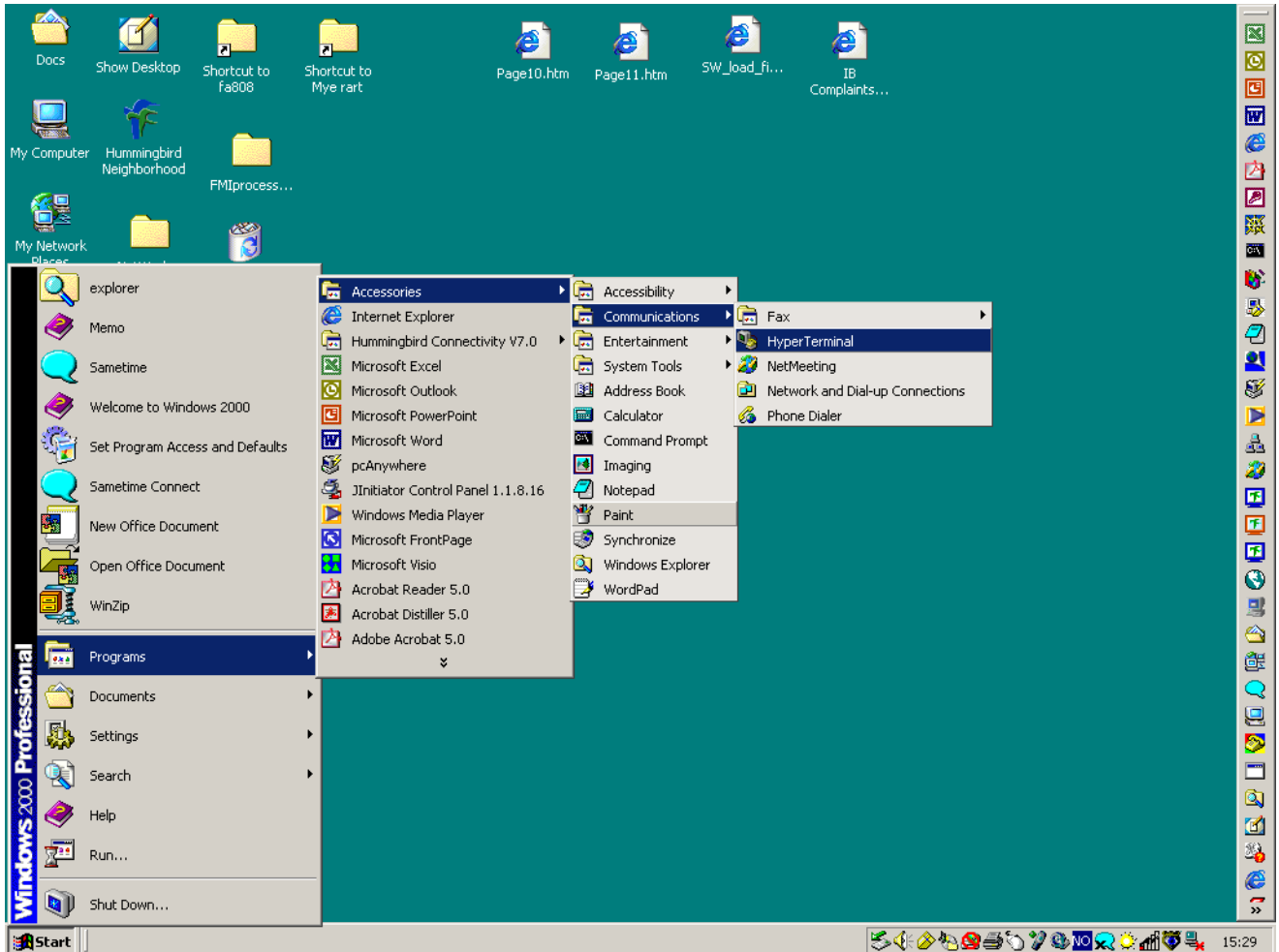
Figure 8-7   Start Hyper Terminal application

8-18-3-11   Open Hyper Terminal and Make a New Communication Profile (cont'd)

First, the Hyper Terminal splash screen will be displayed on the screen for a few seconds, then ...

Figure 8-8   Hyper Terminal splash screen

... the HyperTerminal window will open on the screen.

Next step is to enter the name of the communication profile. In this procedure, the name *s5_v5* is used:

2.)   Type **s5_v5** in the *Name* field.

3.)   Select a suitable icon from the provided list. In this procedure, the "Two Phones" icon is used.
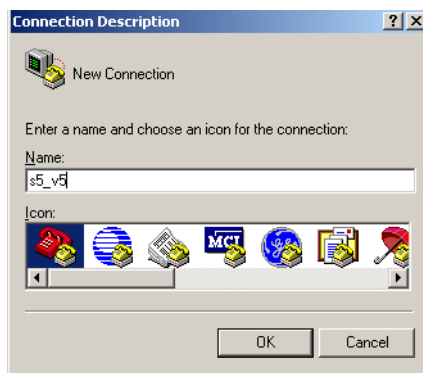
Figure 8-9   New Connection window

4.)   Select **OK** to display the next window**.**

8-20-5-4   Adjust Communication Parameters

NOTE: Some of the fields may look different on your laptop, depending on earlier use and setup.
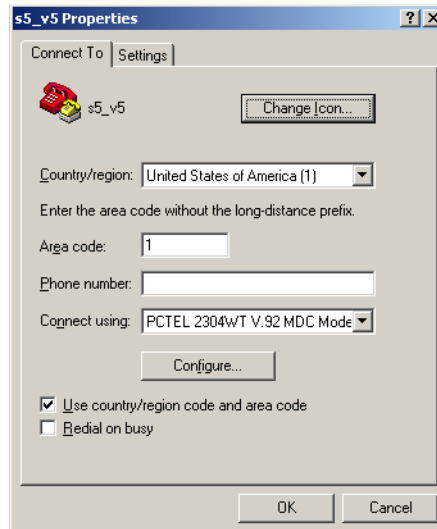
Figure 8-10   *The s5_v5 Properties* window

1.)   If needed, select **COM1** from the *Connect using:* pull-down menu.
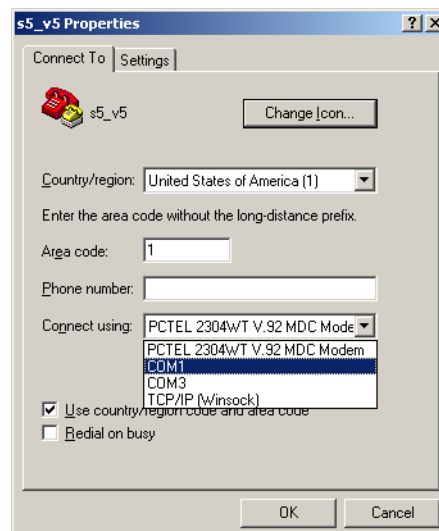
Figure 8-11   Select COM1

2.)   Select **OK** to save and close this window and display the *Port Settings* menu.

8-18-3-12   Adjust Communication Parameters (cont'd)
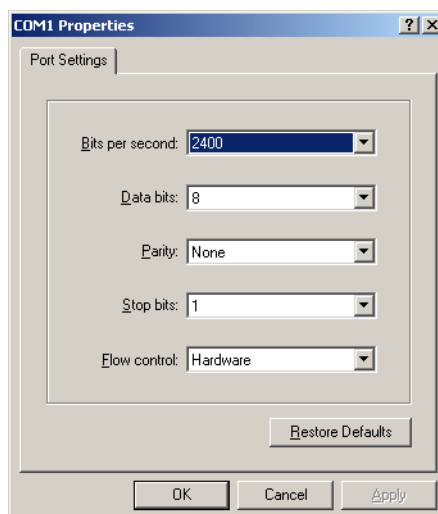
Figure 8-12   Port Settings window

3.)   Select **9600** from the *Bits per second* pull-down menu.
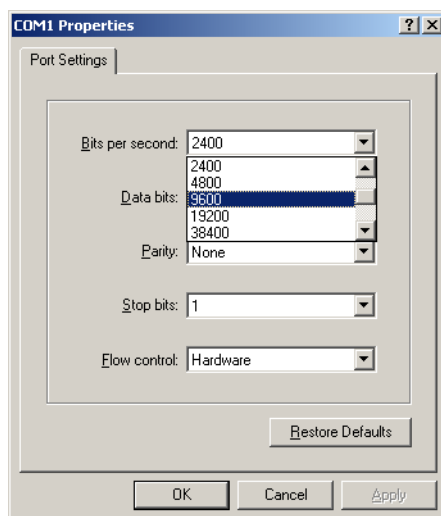
Figure 8-13   Select 9600 bits per second as data rate

4.)   Select **Xon/Xoff** from the *Flow control* pull-down menu.

8-18-3-12   Adjust Communication Parameters (cont'd)
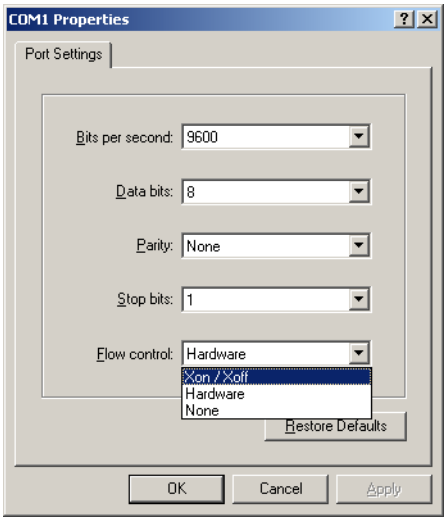
Figure 8-14   Select Xon/Xoff

5.) Verify that the terminal settings are as indicated in Table 8-10 "Hyper Terminal Settings" on page 8-34 and in Figure 8-17 "Port Settings adjustment completed" on page 8-35.

Table 8-14 Hyper Terminal Settings

PARAMETERS	SETTINGS
Bits per second	9600
Data bits	8
Parity	None
Stop bit	1
Flow Control	Xon/Xoff

8-18-3-12   Adjust Communication Parameters (cont'd)
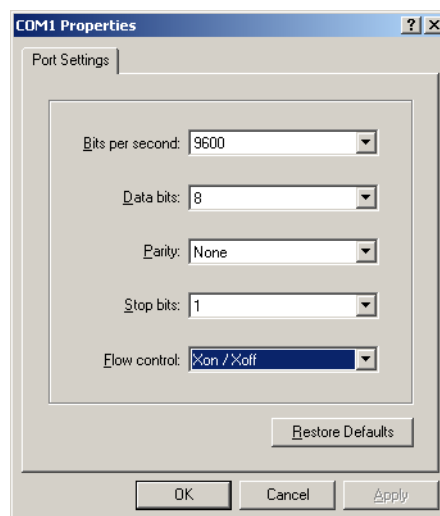
Figure 8-15   Port Settings adjustment completed

6.)   Select OK to confirm your settings and display a terminal window.
A blinking underscore indicates that the terminal is ready for use.

**BLINKING
UNDERSCORE**
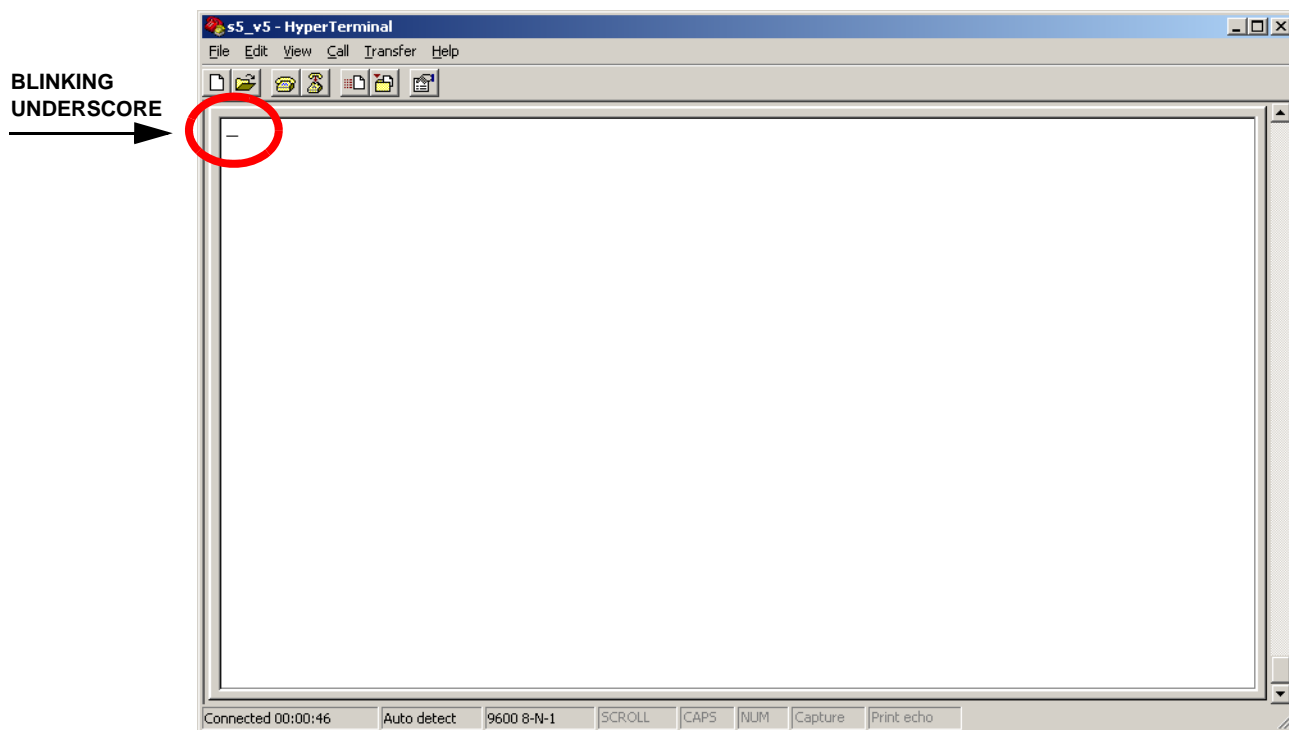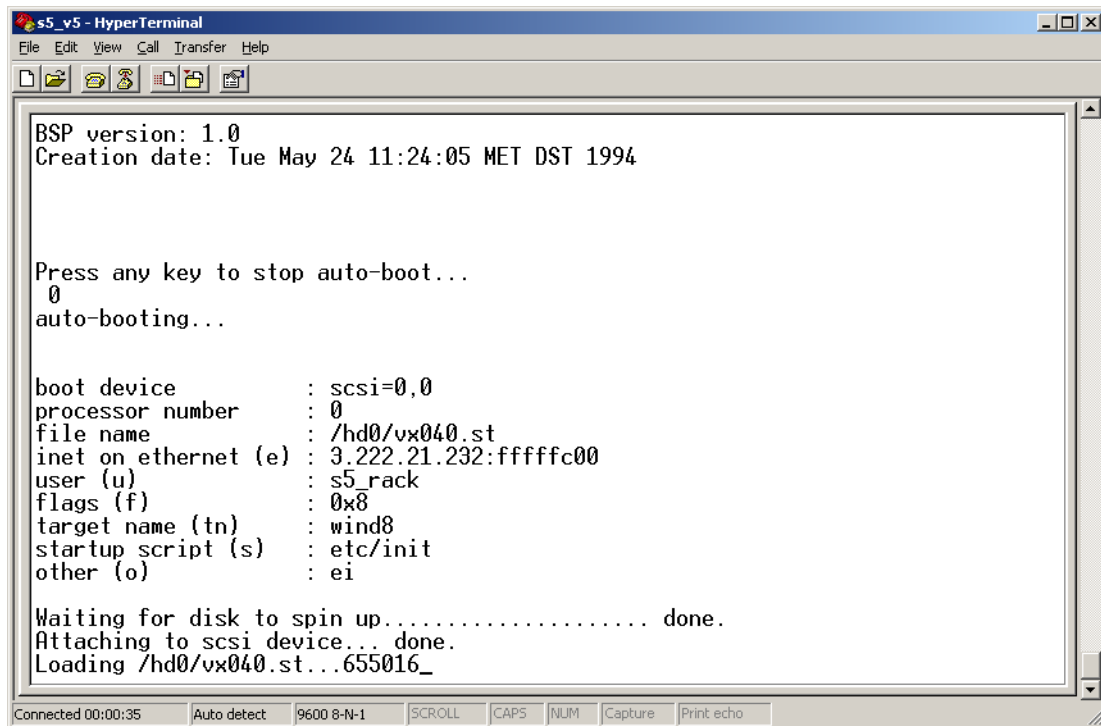
Figure 8-16   Terminal window is ready for use

8-20-6 Scanner Power ON

1.) Insert a probe in connector 1 on the scanner.

2.) Turn ON the scanner.
When the scanner is powered on, a boot sequence, similar to the one illustrated in Figure 8-19 "Scanner startup" on page 8-36, will appear in the terminal's window on your laptop.

Figure 8-17   Scanner startup

3.) Verify that Scanner is booting successfully.

8-20-7   Identify the Vivid 5 Scanner's IP Address and Netmask

1.)   Select **Setup** button on front panel.

2.)   Select **Configuration & Test** submenu.

3.)   Select **GE Service.**

4.)   Select **Network Settings** to display the **Network Configuration** menu.

5.)   Record the **IP address**. This is the scanner's IP address.
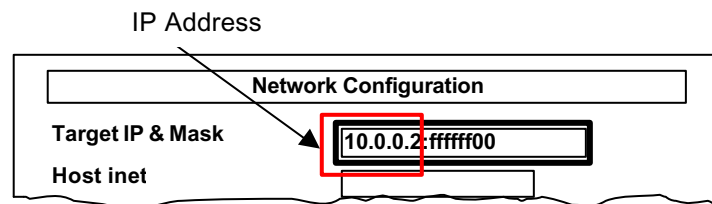
Figure 8-18   Vivid 5 Network Configuration Menu

Scanner IP Address: _____._____._____._____ : **ffffff00**

8-20-8   Identify Vivid 5's Version via the Terminal (optional)

1.) Press **Enter** on the laptop's keyboard, when the scanner is fully booted, to get the command prompt "**–>**" in the terminal window.

2.) Type **version** after the command prompt and press **Enter.**
A text similar to the one below, will appear in the terminal window:

```
-> version
VxWorks (for Motorola MVME167) version 5.2.
Kernel: WIND version 2.4.
Made on Thu Nov 12 17:38:17 MET 1999.
Boot line:
scsi=0,0(0,0):/hd0/vxWorks.st e=3.222.21.232:fffffc00 u=s5_rack
f=0x0
tn=wind8 s=etc/init o=dc
value = 103 = 0x67 = 'g'
```

Figure 8-19   Scanner's *Bootline Data*

3. When structuring the **Bootline** in a matrix, it will look like this:

Table 8-15 Scanner's *Bootline Data*

ENTRY	DATA - Vivid 5
Boot device	scsi=0,0
Processor number	0
Host name	
File name	/hd0/vxWorks.st
Inet on ethernet (e) *NOTE! Another address than illustrated here may be in use* DEFAULT FROM FACTORY: 10.0.0.2	3.222.21.232:fffffc00
Inet on backplane (b)	
Host inet (h)	
Gateway inet (g)	
User (u) NOTE! MAY BE SOMETHING ELSE)	s5_rack
Ftp password (pw) (blank=use rsh) (MAY HAVE BEEN SET TO SOMETHIBNG)	
Flags (f)	0x0
Target Name (tn)	wind8
Startup script (s)	etc/init
Other (o)	dc

8-20-9   Record and Change the Laptop's Native IP Address

8-20-9-1   Exit BlackICE on Laptop

To be sure that BlackICE don't interfere during the next steps, you should stop it.

1.)   Right-click on the BlackICE icon in the application field on the laptop's screen.
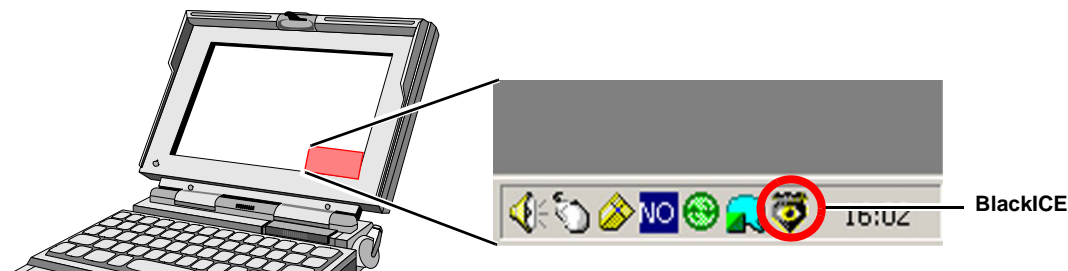
BlackICE

Figure 8-20   Disable BlackICE

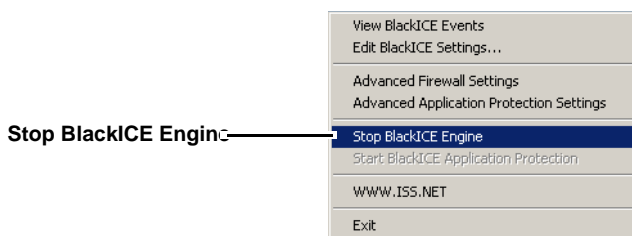2.)   From the pop-up menu, select **Stop BlackICE Engine**.

Stop BlackICE Engine

Figure 8-21   Stop BlackICE Engine

3.)   Select **Exit**.
Black-ICE stops. It will be restarted next time you restart the laptop.

EXIT (BlackICE)

Figure 8-22   Exit BlackICE

8-20-9-2   Record Laptop's Native IP Address

1.) On the Windows desktop open **My Computer.**

2.) Open **Control Panel.**

3.) Open **Network and Dialup Connections.**

4.) Open **Local Area Connection.**

5.) Open **Internet Protocol (TCP/IP)**.

6.) Select **Properties.**
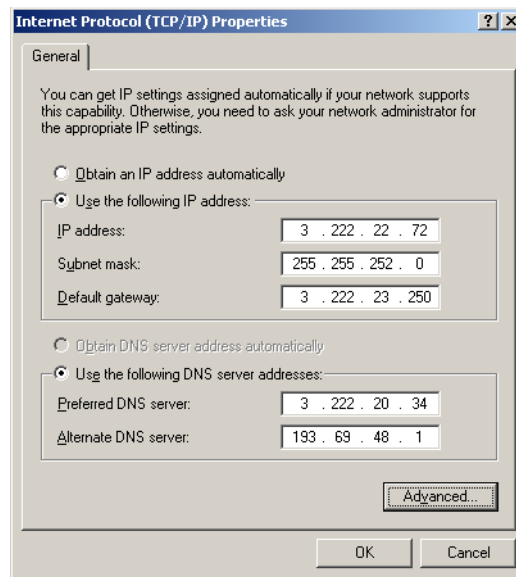
Figure 8-23   Network and Dialup Connections

Record the IP address and Subnet mask in the provided space below:

Laptop original IP address: _____._____._____._____

Laptop original Subnet mask: _____._____._____._____

8-20-9-3   Change Laptop's IP Address

1.)   Change your laptop's IP address to match the scanner's IP address, see Figure 8-28 and Figure 8-29.

Scanner's IP address: ____.____.____.____

Laptop's IP address: ____.____.____.__5_

Figure 8-24   Change laptop's IP address to match the scanner's IP address

Example: Scanner's IP address: _3_.222._21.232

THE LAST DIGIT GROUP MUST BE DIFFERENT BETWEEN THE SCANNER THE MACINTOSH COMPUTER (IF PRESENT) AND THE LAPTOP!

Laptop's IP address: _3_.222._21._5_

Figure 8-25   EXAMPLE: Laptop's IP address changed to match the scanner's IP address

2.)   Close all the network related windows to save your changes.

8-20-10 Copy Correct Software Files to the *work* Folder

1.) Record the name of the software files you're going to use, in the table below.

Table 8-16 New Software

FILE TYPE	FILE NAME	COMMENTS
SCANFILE	.tar.gz	
ECHOPAC FILE (Supervision file)	.tar.gz	FOR SCANNERS WITH INTEGRATED MACINTOSH (ECHOPAC) / (SUPERVISION) ONLY
OPTION-1 FILE	.tar.gz	
OPTION-2 FILE	.tar.gz	
OPTION-3 FILE	.tar.gz	

2.) Copy the files you need for the upgrade, see your record in Table 8-13 "New Software" on page 8-45, from the CD to the laptop's **work** folder.

8-20-10   Copy Correct Software Files to the work Folder (cont'd)
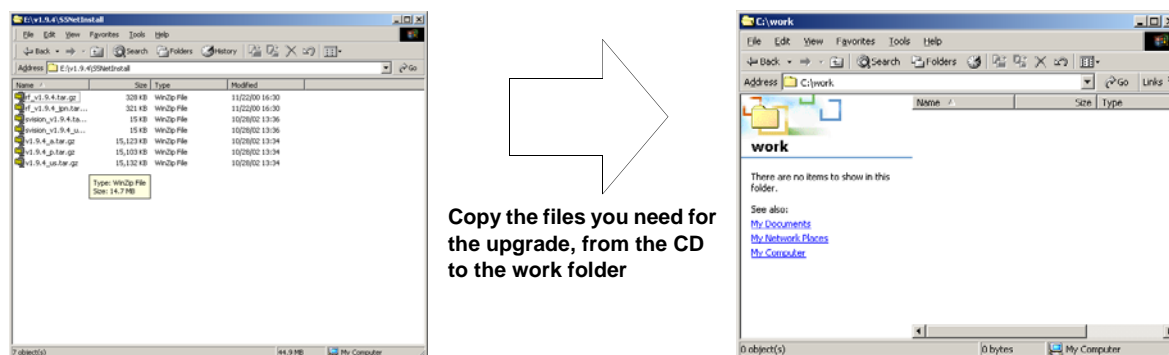
Figure 8-26   Copy the needed files from CD to *work* folder

3.)   Remove the CD from the laptop.

8-20-11 Open Command Window

4.)   Select **Start > Run**...

5.)   Type **cmd** in the *Open* field.

6.)   Press **Return** to open a *Command Prompt* window.
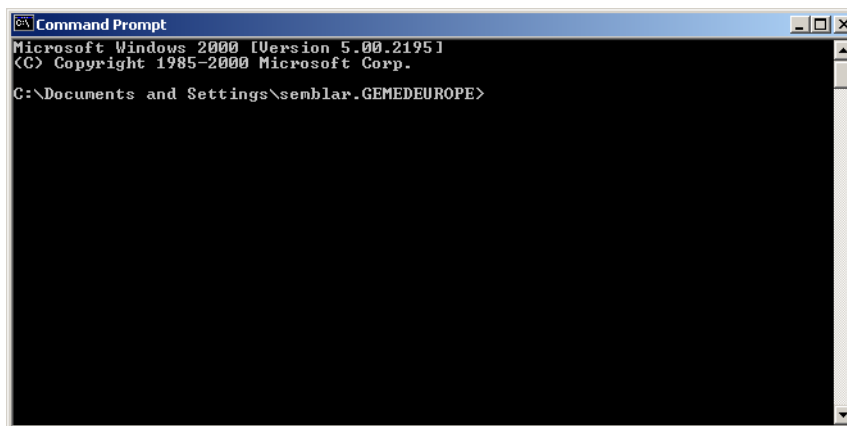
Figure 8-27   Open a Command Prompt window

8-20-11-1   Change Path to the Work Folder

1.)   With the **Command Prompt** window active, type: **cd "c:\work"**

```
C:\Documents and Settings\semblar.GEMEDEUROPE>cd "c:\work"
```

Figure 8-28   Change path

2.)   Press **Enter** to change the active directory to *work*.

```
C:\Documents and Settings\semblar.GEMEDEUROPE>cd "c:\work"

C:\work>_
```

Figure 8-29   The new path has been selected

8-20-12 Verify Change of Laptop IP Address

1.)   Type the following command:
ipconfig

```
Command Prompt                                                    _ □ ×
Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

C:\work>ipconfig_
```
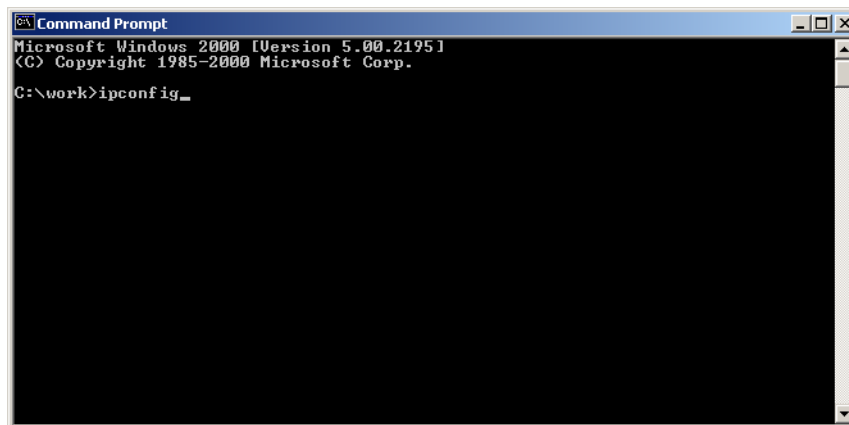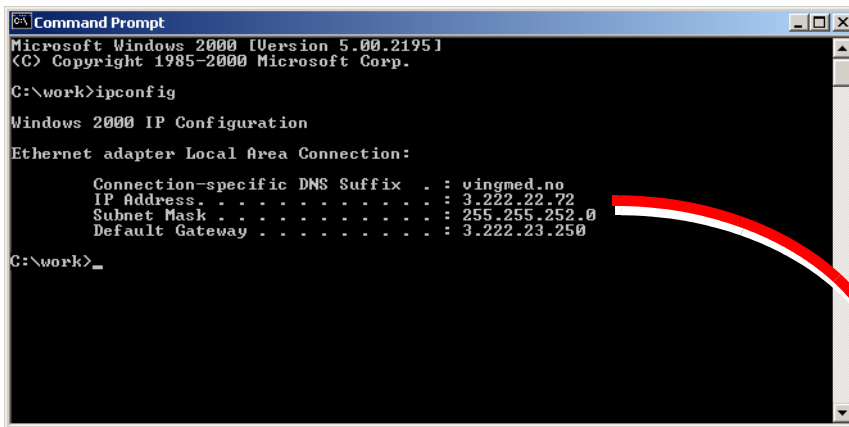
Figure 8-30   Command Prompt terminal window

2.)   Press **Enter**
The laptop's ip address and subnet mask will be printed on the screen as illustrated below.

8-18-4-7 Verify Change of Laptop IP Address (cont'd)

Figure 8-31   Display IP Address and Subnet Mask (Example)

3.)   Verify that the IP Address and Subnet Mask is the same as you set earlier.

8-20-13 Verify Connection Between Laptop and Scanner

1.) Verify that the link light on the PC Card LAN cable adapter is lit. It will flash during network traffic.

2.) Verify that the link light on the 10 base-T Ethernet adapter on the System FiVe is lit (or flashing).

3.) Type **ping** in the *Command Prompt* window.

4.) Type a space.

5.) Type the **ip address** for the scanner.

NOTE: *The IP address must be on the form: **xxx.xxx.xxx.xxx** where **xxx** is a number between 0 and 255.*
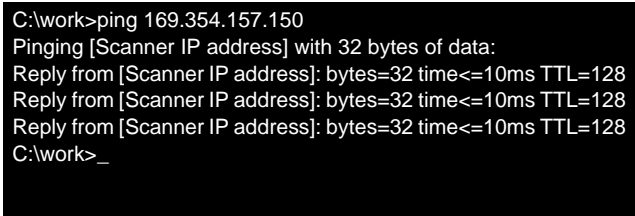
Example: **ping 169.254.157.150**

```
C:\work>ping 169.354.157.150_
```

Figure 8-32 The Ping command [Example]
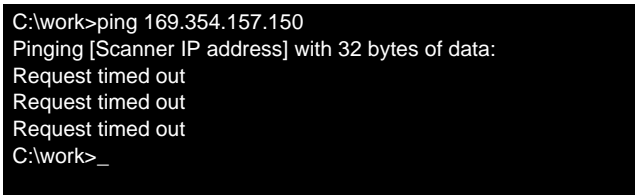
e.) Press **Return** to start pinging the scanner.

6.) Verify a successful ping between the laptop and the scanner, similar to what is shown in Figure 8-37 "Ping results (Ping succeeded)" on page 8-48.

```
C:\work>ping 169.354.157.150
Pinging [Scanner IP address] with 32 bytes of data:
Reply from [Scanner IP address]: bytes=32 time<=10ms TTL=128
Reply from [Scanner IP address]: bytes=32 time<=10ms TTL=128
Reply from [Scanner IP address]: bytes=32 time<=10ms TTL=128
C:\work>_
```

Figure 8-33 Ping results (Ping succeeded)

If the pinging of the scanner fails, a result as indicated in Figure 8-38 "Ping results (Ping failed)" on page 8-48, will be displayed on the screen.

```
C:\work>ping 169.354.157.150
Pinging [Scanner IP address] with 32 bytes of data:
Request timed out
Request timed out
Request timed out
C:\work>_
```

Figure 8-34 Ping results (Ping failed)

If pinging fails, verify that:

• the scanner's IP address was entered correct in the ping command.

• the ethernet cable from PC to scanner is OK.

• link lights are lit (as verified before)

8-20-13   Verify Connection Between Laptop and Scanner (cont'd)

Note: Don't forget to stop your FTP server when you no longer need to access data on your computer.

8-20-14 Enable Hummingbird FTP Server :

1.) Enter Windows desktop
2.) Select START
3.) Select SETTINGS
4.) Select CONTROL PANEL
5.) Select HUMMINGBIRD INETD CONFIGURATION

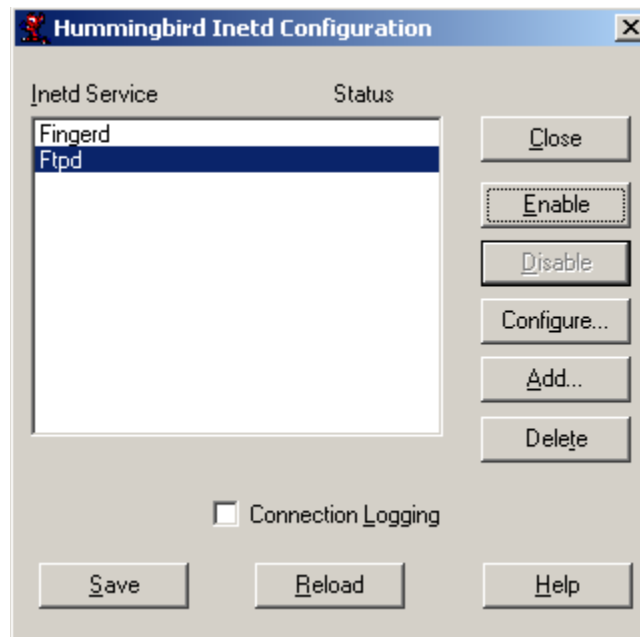**Figure 8-35   Hummingbird Inetd Configuration Dialog**

8-20-14 Enable Hummingbird FTP Server : (cont'd)

6.) Select FTPD

7.) Select ENABLE

8.) Select SAVE

A message box appears:

Figure 8-36   INETD Message

9.) Select OK

10.) Select CLOSE

8-20-15 Change BootSequence

1.) Activate terminal window.
2.) Press the **Enter** key to get the **vxWorks** prompt.
3.) Type **BootChange** to change **Bootsettings**.
4.) Change **Bootsetting** to:

Table 8-17 Boot Settings overview

	Vivid FiVe
boot device	dc
processor number	0
host name	
file name	/hd0/vxWorks.st
inet on ethernet (e)	3.222.21.232:ffffc00
inet on backplane (b)	
host inet (h)	[Laptop IP address]
gateway inet (g)	
user (u)	ftp
ftp password (pw) (blank = use rsh)	ftp
flags (f)	0x8
target name (tn)	wind8
startup script (s)	
other (o)	

- To change value in **BootSequence** type new value next to old value, then press the Enter Key.
- To delete value in **BootSequence** type . (period) next to the old value, then press the Enter Key.
- To ignore value in **BootSequence** press the Enter Key.

8-20-16 Formatting the Hard Disk

1.) Type

dosVolMake 0
at the HyperAccess terminal prompt.
(Separate dosVolMake and 0 with a space.)
The following is displayed on the laptop:
value = 847828 = 0xcefd4
followed by the command prompt

–>

Note: Please note that the value above may be different from 847828.

2.) Type

diskInit *"/hd0"*
at the HyperAccess terminal prompt.
The following is displayed on the laptop:
"/hd0" initialized.
value = 0 = 0x0

8-20-17 Install the New Software

Note: The largest software "tar.gz" file must be installed prior to all other software files.

1.) Type

netinstall *"filename.tar.gz"*

(where "filename.tar.gz" is a software file from Table 8-13 "New Software" on page 8-45.),

2.) Press **ENTER** at the HyperAccess terminal prompt.

The following is displayed on the laptop:
Connecting.... done.
Receiving.... _+++++++++++++++++++++++++++++++++++++] 39 13.4 351
Expanding.... _+++++++++++++++++++++++++++++++++++++] 126 48.2 391
Extracting.... _+++++++++++++++++++++++++++++++++++++] 215 46.8 223
Installation completed in 381 seconds (1740f/264d).
value=0=0X0
->

3.) Repeat Steps 1 and 2 for all files listed in Table 8-13 "New Software" on page 8-45

8-20-18 Disable Hummingbird FTP Server

Note: Don't forget to stop your FTP server when you no longer need to access data on your computer.

1.) Enter Windows desktop
2.) Select START
3.) Select PROGRAMS
4.) Select HUMMINGBIRD CONNECTIVITY V7.0
5.) Select SYSTEM ADMINISTRATION
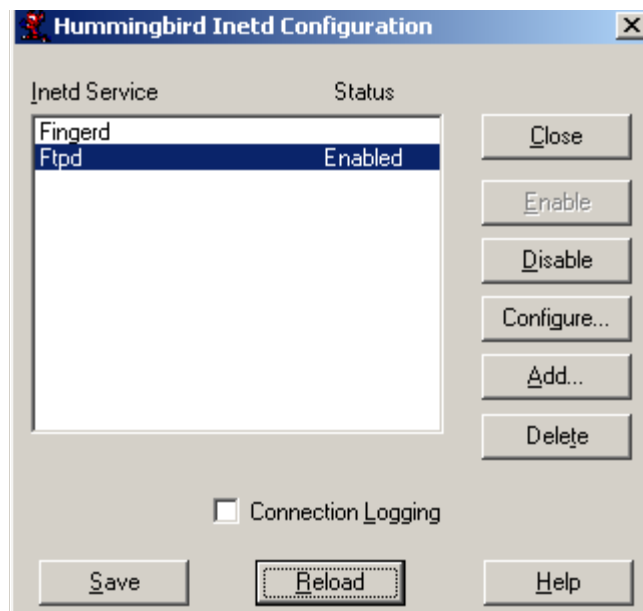6.) Select HUMMINGBIRD INETD CONFIGURATION

Figure 8-37   Hummingbird Inetd Configuration Dialog

Note: Don't forget to stop your FTP server when you no longer need to access data on your computer.

7.) Select FTPD
8.) Select DISABLE
9.) Select SAVE

A message box appears
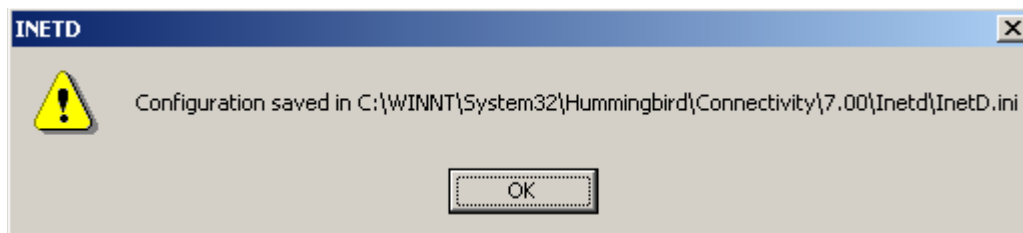
Figure 8-38   Inetd Message

10.) Select OK
11.) Select CLOSE

Chapter 9
Renewal Parts

Section 9-1
Overview

9-1-1   Purpose of Chapter 9

This chapter lists the Renewal Parts/Field Replacement Units (FRU) for the **VIVID 5** ultrasound scanners, and gives you an overview of Spare Parts for:

- Vivid 5, Vivid 5 Expert, Vivid 5 Pro
- Integrated EchoPAC (Macintosh Computer with EchoPAC software)
- EchoPAC 3D for Windows

Table 9-1 Contents in Chapter 9

SECTION	DESCRIPTION	PAGE NUMBER
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9-20	Other Parts	9-38

Table 9-1 Contents in Chapter 9 (cont'd)

9-1-2 Equipment Models Covered by this Chapter

The table below lists the **VIVID 5** models covered in this version of Chapter 9.

Table 9-2 VIVID 5 Models Covered by this Chapter

GE VINGMED PART NUMBER	DESCRIPTION	VOLTAGE
FB000223	**VIVID 5** (BT"00)	240 VAC
FB000224	**VIVID 5** (BT"00)	110 VAC
FB000225	**VIVID 5** (BT"00)	100 VAC
FB000711	**VIVID 5** (BT"00)	120 VAC
FB000712	**VIVID 5 U** with integrated EchoPAC	120 VAC
FB000713	**VIVID 5**	230 VAC
FB000714	**VIVID 5 U** with integrated EchoPAC	230 VAC
FB000750	**VIVID 5**, with NTSC	240 VAC
FB000751	**VIVID 5 U** with integrated EchoPAC	100 VAC
FB000753	**VIVID 5**	100 VAC
FB000880	**VIVID 5** Pro Europe	240 VAC
FB000890	**VIVID 5** Expert	240 VAC
FC000040	**VIVID 5** Pro US with integrated EchoPAC	110 VAC
FC000050	**VIVID 5** Expert US with integrated EchoPAC	110 VAC
FC000080	**VIVID 5** Eur.	230 VAC

Section 9-2
List of Abbrevations

Table 9-3 Abbrevations

ABBREVATION	DESCRIPTION
3D	THREE DIMENSIONAL
4D	FOUR DIMENSIONAL (3-D WITH MOVEMENT. THE TIME IS THE 4TH DIMENTION)
ASSY	ASSEMBLY
CTRL	CONTROL
EP	EchoPAC
EPM	EchoPAC MAC
EP 3D	EchoPAC 3D (three dimensional). Application on a computer with Windows OS.
FRU 1	REPLACEMENT PART AVAILABLE IN PARTS HUB
FRU 2	REPLACEMENT PART AVAILABLE FROM THE MANUFACTORER (LEAD TIME INVOLVED)
FRU N	NOT A FRU
LCD	LIQUID CRYSTAL DISPLAY
MAC	MACINTOSH COMPUTER
INT	INTERNAL
I/O	INPUT/OUTPUT
PS	POWER SUPPLY
QTY	QUANTITY USED PER SCANNER/SYSTEM

Section 9-3
Parts List Groups

Table 9-4 Parts List Groups

Table 9-4 Parts List Groups (cont'd)

TABLE NO.	DESCRIPTION	PAGE NUMBER
9-34	Intraoperative Probes	9-37
9-35	Kits	9-38
9-36	Other Parts	9-38
9-37	Product Manuals for Vivid 5	9-39
9-38	Product Manuals for EchoPAC	9-40
9-39	Product Manuals for EchoPAC 3D	9-40
9-40	Service Parts for 3D and 4D Options	9-41

Section 9-4
Software Overview

9-4-1   VIVID 5 Software

Table 9-5 Vivid 5 Software (latest versions)

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Vivid 5 v2.0.x SW CD	FB200394	Vivid 5 software	1	2

9-4-2   EchoPAC MAC Software and MAC OS (for Internal Macintosh)

Table 9-6 EchoPAC MAC Software and MAC OS (for Internal Macintosh)

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	EchoPAC SW 6.4.x	EP200464	EchoPAC SOFTWARE FOR MACINTOSH COMPUTER	1	2
2	MAC OS INSTALLATION KIT	EP200105	COMPLETE	1	1
3	MAC OS V9.x, ENGLISH	EP200138	OPERATING SYSTEM FOR INTEGRATED APPLE MACINTOSH COMPUTER	1	1
4	MAC OS V9.x, GERMAN	EP200139	OPERATING SYSTEM FOR INTEGRATED APPLE MACINTOSH COMPUTER		2
5	ECHOPAC REPORT SYNCRONIZING CD	EP200596	PART OF FMI 76038	1	1

9.4.3   EchoPAC 3D for Windows

Table 9-7 EchoPAC 3D For Windows Software Overview (latest versions)

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	ECHOPAC 3D FOR WINDOWS V1.0.2	EP200271		1	2

Section 9-5
Plastic Parts, Console, Top and Front
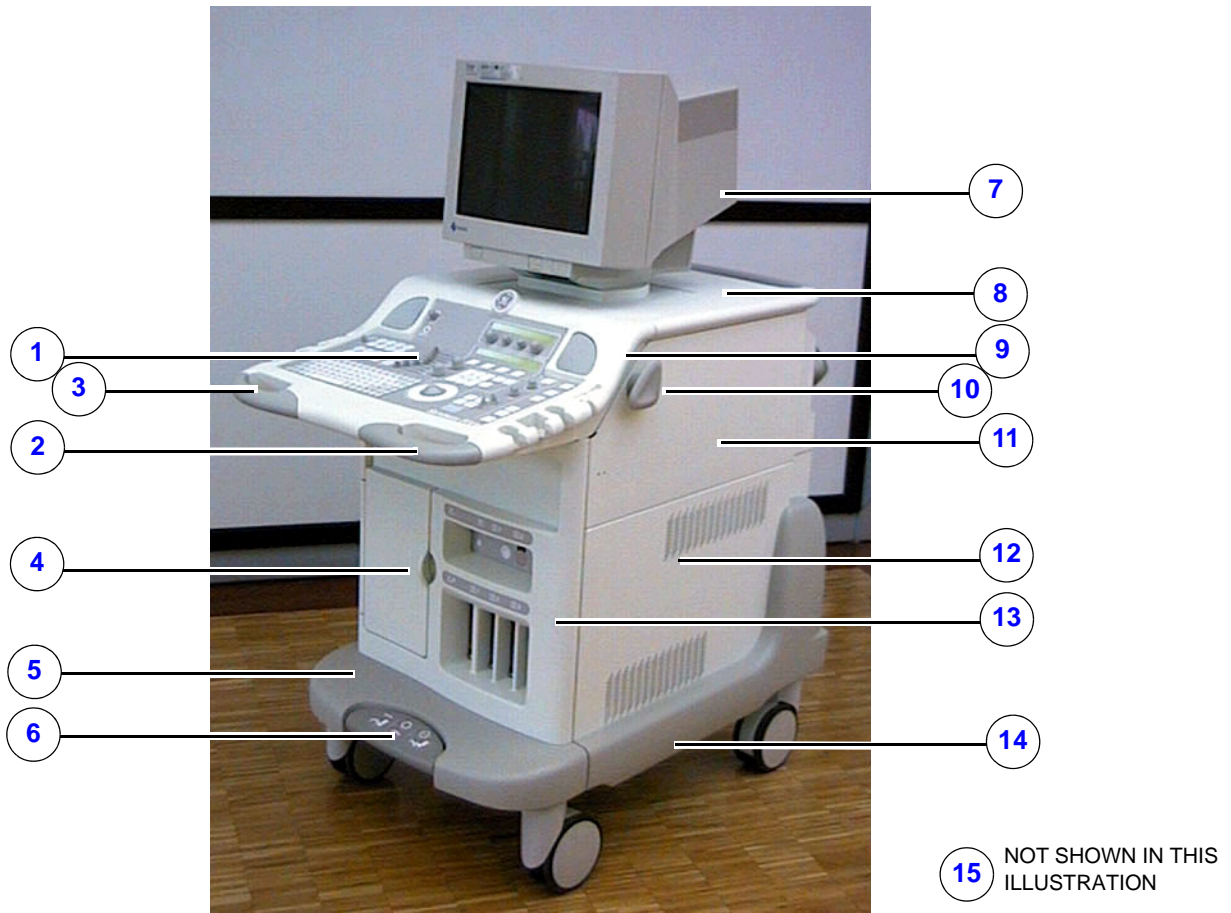
9-5-1   External Details, Front and Right Side, VIVID 5

Figure 9-1 External Details, Front and Right Side, VIVID 5 (with SONY monitor)

Table 9-8 External Details, Front and Right Side, VIVID 5

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	FRONT PANEL: *See Figure 9-3 on page 9-12.*				
2	TOP FRONT HANDLE, RIGHT	FB200135		1	1
3	TOP FRONT HANDLE, LEFT	FB200692		1	1
4	FRONT COVER DOOR	FB307126		1	1
5	FRONT BUMPER	FB200113		1	1
6	PEDAL	FB307116	(BRAKE)	1	2

Table 9-8 External Details, Front and Right Side, VIVID 5 (cont'd)

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
7	MONITOR: Please refer to *Table 9-11 - CRT Monitors* on page *9-15*				
8	TOP COVER	FB307131		1	1
9	TOP FRONT PANEL	FC200114		1	1
10	CABLE HOLDER	FB200137		4	1
11	RIGHT SIDE COVER, UPPER BASIC	FB307238		1	2
12	RIGHT SIDE COVER, LOWER	FB307239		1	1
13	FRONT COVER	FB307125		1	1
14	RIGHT BUMPER COMPLETE	FC200388	Includes Bumper Locks	1	1
15	LEFT BUMPER COMPLETE	FC200115	Includes Bumper Locks	1	1

9.5.2   External Details, Rear and Left Side, VIVID 5
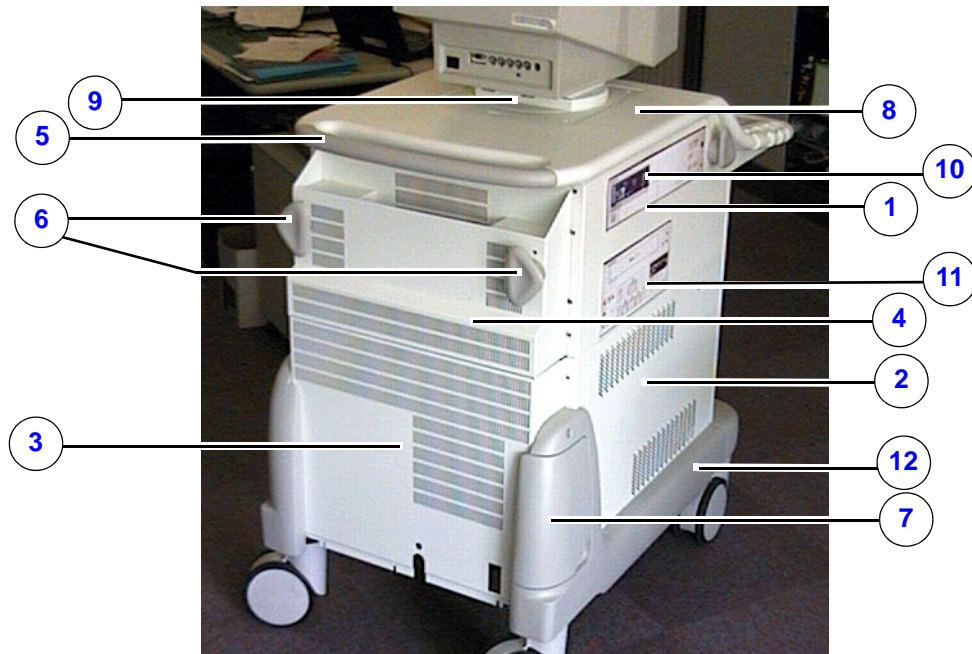
Figure 9-2 External Details, Rear and Left Side

Table 9-9 External Details, Rear and Left Side

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	UPPER SIDE COVER LEFT	FB307234		1	2
	UPPER SIDE COVER LEFT F.2800/2950-9500	FB307235	With opening for Color Printer & VCR	1	1
	UPPER SIDE COVER LEFT F.2800/2950	FB307236	With opening for Color Printer	1	1
	UPPER SIDE COVER LEFT F.9500	FB307237	With opening for VCR	1	1
2	LOWER SIDE COVER LEFT			1	N
3	REPLACEMENT LOWER REAR COVER	FC200145	With Labels	1	1
4	REAR COVER, UPPER	FB307242		1	1
5	REAR HANDLE	FB200129		1	2
6	CABLE HOLDER	FB200137		1	1
7	DOOR LEFT B	FB200120		1	1
8	TOP COVER			1	N
9	PEDESTAL SUBASSY	FB200285		1	1

Table 9-9 External Details, Rear and Left Side (cont'd)

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
10	PRINTER UP-2800P	066E2800	SONY Color printer UP-2800P (Incl. Man) 220V, PAL	1	2
	PRINTER UP-2950MD	066E2950	SONY Color printer UP-2950MD (Incl. Man) 100-220V, NTSC/PAL SONY	1	2
11	VCR SVO9500 PAL	066E9510	Video System: PAL	1	1
	VCR SVO9500 NTSC	066E9511	Video System: NTSC	1	1
12	Left Bumper Complete	FC200115	Includes Bumper Locks	1	1
	Right Bumper Complete	FC200388	Includes Bumper Locks	1	1

Section 9-6
Operator Panel Parts

9-6-1   Front Panel

Figure 9-3 Operator Panel (Front Panel)

Table 9-10 Operator Panel Parts   1 of 3
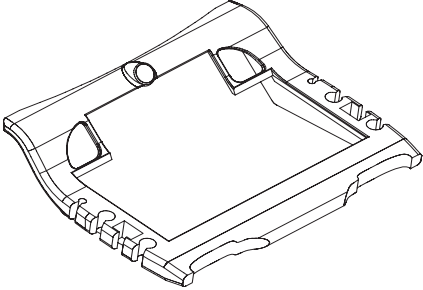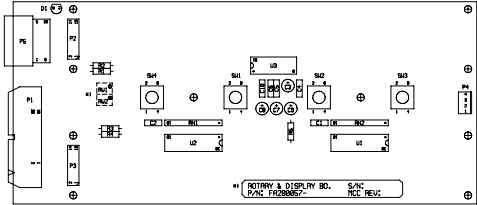
ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	REPLACEMENT, TOP FRONT PANEL	FC200114	TOP FRONT PANEL + LABEL	1	1
2	FP ROTARY/DISPLAY BOARD	FA200057	FP ROTARY/DISPLAY BOARD	1	1

Table 9-10 Operator Panel Parts (cont'd) 2 of 3
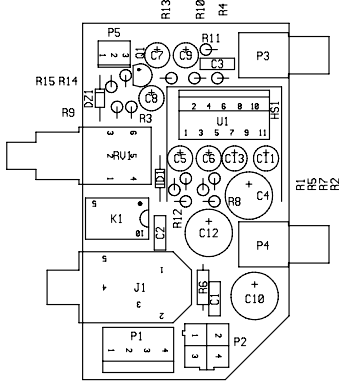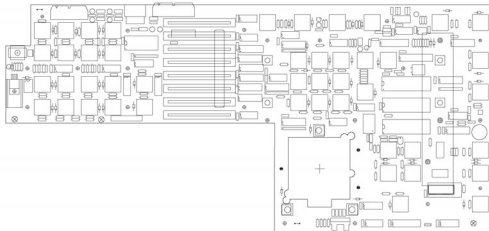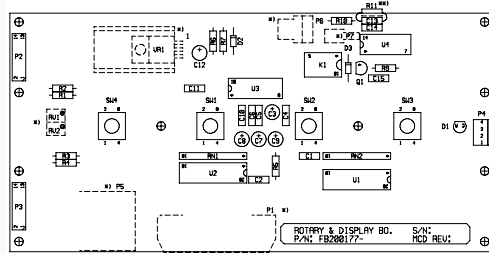
ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
3	FP AUDIO AMPLIFIER BOARD	FA200076	FP AUDIO AMPLIFIER BOARD	1	1
4	FP MAIN BOARD 2	FA200191	FP MAIN BOARD 2	1	1
5	ROTARY & DISPLAY BD. 4	FB200177	ROTARY & DISPLAY BD. 4	1	1
6	QWERTY KEYBOARD SUBASSY	FA200360-01 FA200360-02 FA200360-03	ALPHANUMERIC KEYBOARD, US ALPHANUMERIC KEYBOARD, FRENCH ALPHANUMERIC KEYBOARD, GERMAN	1	1
7	GOOSENECK LAMP 2.4W	058B0060	GOOSENECK LAMP 2.4W	1	1
8	OPTO LCD-DISPL. 2*40CH. POS.	058Y4020	OPTO LCD-DISPL. 2*40CH. POS.	1	N
9	TRACKERBALL PANEL 38mm GRAY	066C8340	TRACKERBALL PANEL 38mm GRAY	1	1
10	SPEAKER 3-1/2" U/FESTEBR.	160A0005	SPEAKER 3-1/2" WITHOUT FIXING BRACKET.	1	1
11	LCD 4" HC461, MODIFIED	FA200953	LCD 4" HC461, MODIFIED	1	2
12	KNOB F/SLIDE POT (4 X 1.2)	MN307427	KNOB F/SLIDE POT (4 X 1.2)	8	1

Table 9-10 Operator Panel Parts (cont'd) 3 of 3

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
13	FP GRAPHIC PLATE, ENGLISH /BT00	FB200247-01		1	1
	FP GRAPHIC PLATE, FRENCH /BT00	FB200247-02			2
	FP GRAPHIC PLATE, GERMAN /BT00	FB200247-03			1
	FP GRAPHIC PLATE W/LCD 4", ENGL / BT00	FB200248-01			1
	FP GRAPHIC PLATE W/LCD 4", FR / BT00	FB200248-02			1
	FP GRAPHIC PLATE W/LCD 4", GERM / BT00	FB200248-03			1
14	FRONT PANEL, ENGLISH /BT00	FB200245-01	Front Panel (without LCD screen)	1	1
15	FRONT PANEL, FRENCH /BT00	FB200245-02			
16	FRONT PANEL, GERMAN /BT00	FB200245-03			
17	FRONT PANEL W/LCD 4" PAL, ENGL / BT00	FB200246-01	Front Panel with LCD screen. Support for both PAL and NTSC introduced at revision C of the module. (Used for the EchoPAC option.)		
18	FRONT PANEL W/LCD 4" PAL, FR /BT00	FB200246-02	Front Panel with LCD screen. (Used for the EchoPAC option.)		
19	FRONT PANEL W/LCD 4" PAL, GERM / BT00	FB200246-03			
20	FRONT PANEL W/LCD 4" NTSC, ENGL / BT00	FB200246-04	OBSOLETE Use FB200246-01 as Replacement Part		N
2|	GEL HOLDER	FA307681	Holder for Gel Bottle	1	1

Section 9-7
Monitors

9-7-1 Monitors - Cathode Ray Tube (CRT)

Table 9-11 CRT Monitors

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
6	S5/V5 MONITOR REPLACEMENT ASSEMBLY	FC200537	REPLACEMENT MONITOR WITH INSTALLATION PARTS, VIVID 5 REPLACEMENT FOR THE OBSOLETE MONITORS: FC200267, FC200113, FB200987, 066E0082, 066E0080	1	1

9.7.2   S5/V5 Monitor Replacement Assembly, FC200537

Table 9-12 S5/V5 Monitor Replacement Assembly, FC200537
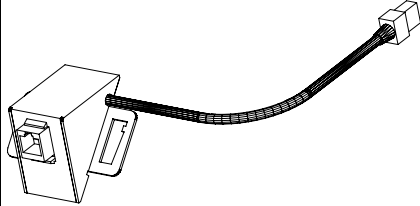
ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	MONITOR ASSY IDUNN	FB200590	Same as used on VIVID 7	1	1
2	TRANSFORMER 230-115V 300VA	FC200263		1	N
3	PEDESTAL V5, BASE F/TOTUKU MON	FC307505		1	N
4	PEDESTAL V5, SPACER F/TOT. MON	FC307506		1	N
5	CABLE, AC-ADAPTER	FC200538		1	N
6	CABLE TIE 140*2.5MM	068B0001		4	N
7	CABLE TIE 290*3.6MM	068B0004		3	N
8	CABLE TIE MOUNT W=4.8MM	068B1001		2	N
9	CABLE CONVERTER BNC to VGA	070M0022		1	N
10	ADHESIVE TAPE DOUBLE	074E4950		1	N
11	SCREW UNBRACO M6*30MM	080A630U		4	N

9-7-3   Monitors - Liquid Crystal Display (LCD)

For LCD replacement parts, see Table 9-10 - Operator Panel Parts on page 9-12.

Section 9-8
Input/Output Modules

Table 9-13 I/O Parts

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	ETHERNET ADAPTER	FB200985	USED TO AVOID MECHANICAL DAMAGE ON EXTERNAL I/O BOARD WHEN PULLING ETHERNET CABLE BY AN ACCIDENT	1	1
2	ADAPTOR ECG BOX	AB200053	"BLACK BOX ECG ADAPTER"	1	1
3	INT.I/O SUBASSEMBLY (II/O-II)	FB200005	INTERNAL I/O	1	1
4	EXT.I/O SUBASSEMBLY	FB200006	EXTERNAL I/O	1	1

Section 9-9
PCB Boards - Card Cage

9-9-1   Card Cage's Location
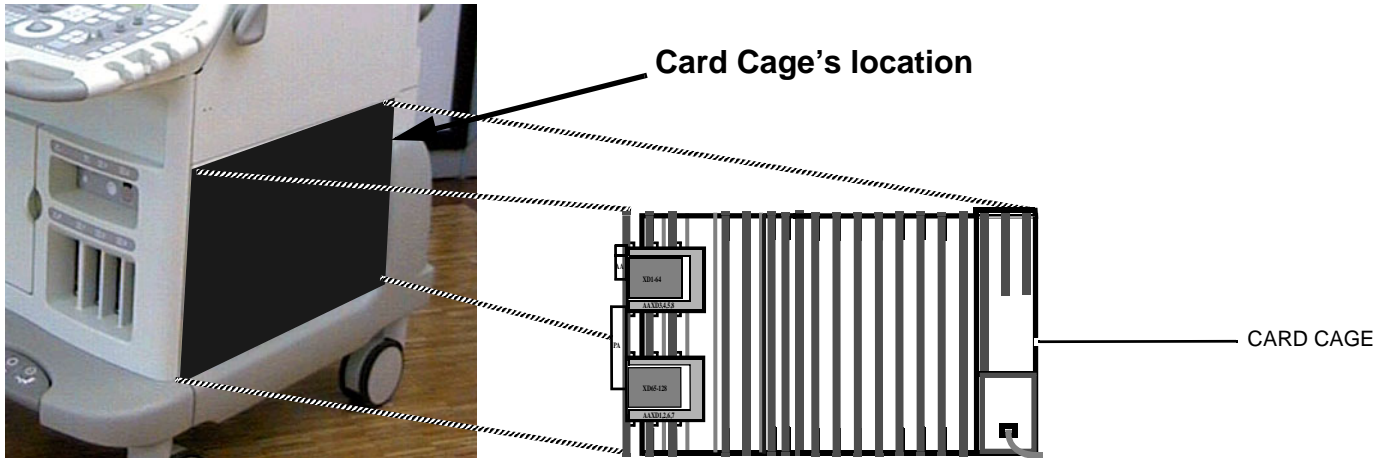
Figure 9-4 Card Cage's Location

9.9.2   Front End Modules
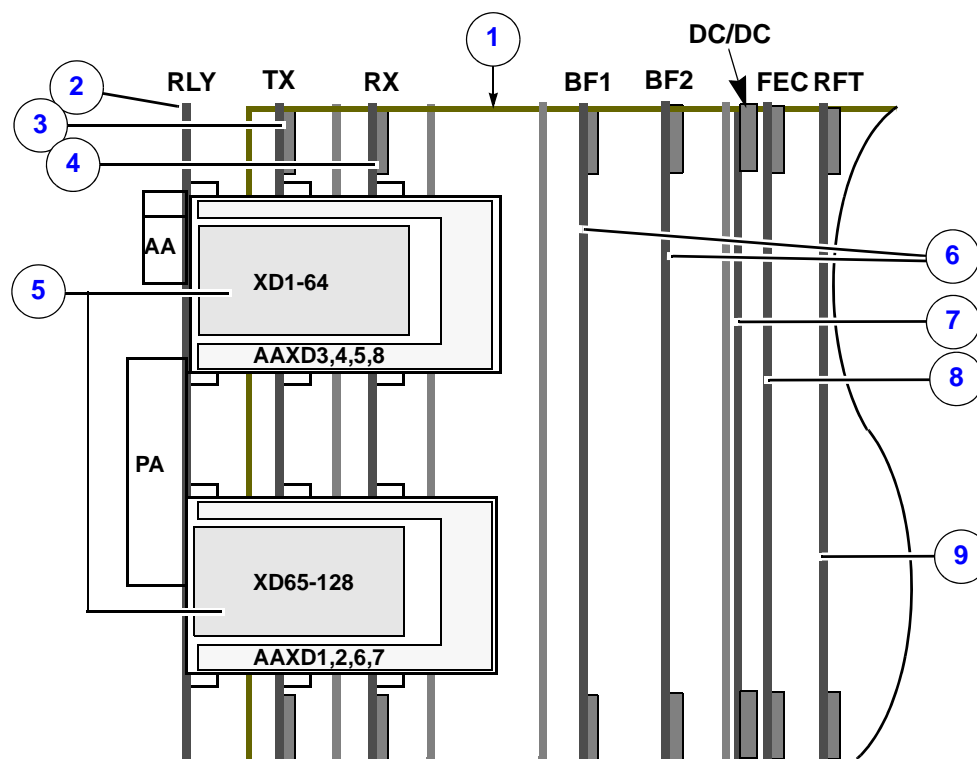
Figure 9-5 Card Cage, Front End (FE) Boards

Table 9-14 Card Cage, Front End (FE) Boards

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CARD RACK	FB200204	Card Cage with backplane	1	2
2	RLY-2 - RELAY BOARD	FA200890	RELAY 2. Located outside the Card Cage, but connected to XDBUS Boards.	1	1
3	PCB TX128BC.	FB200211	TX-128-II Board with Bipolar Clamp	1	1
4	RX - RX128 BOARD	FA200907		1	1
5	PCB XDBUS	FB200191	Transducer Bus Board. 2x in each scanner.	2	1
6	PCB BEAM FORMER 64	FA200550	BF1/BF2 - BF 64/2, BEAM FORMER BOARD 64	2	1
6	PCB BEAM FORMER 64 FOC32	FB200900	2x used in each system	2	1
7	DC Power 3.3V	FB200024	3.3V DC-DC Converter Module	1	1
8	FEC - FRONT END CONTROLLER BOARD	FA200764		1	1
9	PCB RF Tissue	FB200140	RFT - RFT1 ^{W}/2mm CONNECTOR	1	1

9.9.3 MID and Control Boards
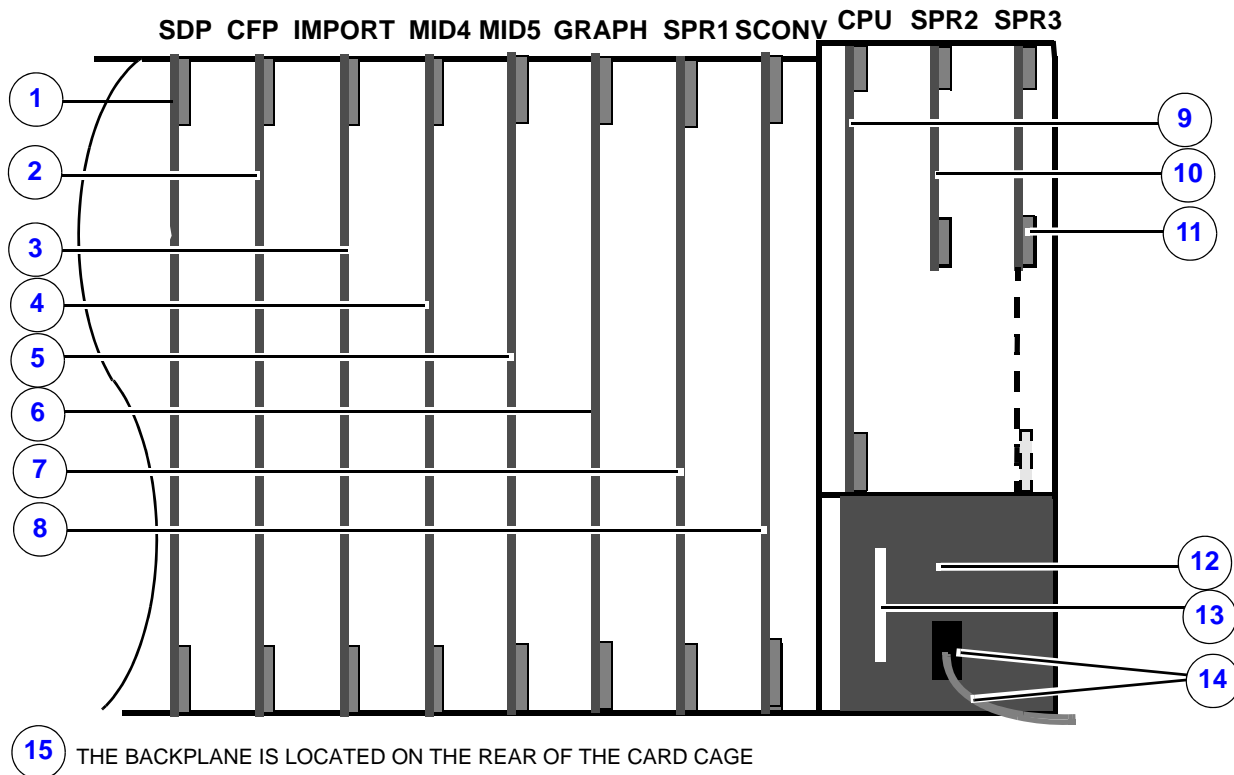
Figure 9-6 Card Cage, MID and Control Boards

Table 9-15 Card Cage, MID and Control Boards

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	SDP - SPECTRAL DOPPLER PROCESSOR	FA200026		1	1
2	CFP-2 - COLOR FLOW PROCESSOR 2	FB200708	Replacement for FA200027. Needs sw. v.2.0.2 or above. Warning during boot-up removed in sw. v2.0.5.	1	1
3	IP 2 - IMAGE PORT 2	FA200572		1	1
4	Not Used				
5	Not Used				
6	GRAPH - GRAPHIC-5	FB200818	Replacement for FA200030	1	1
7	Not Used				
8	SCONV - SCAN CONVERTER	FA200029		1	1

Table 9-15 Card Cage, MID and Control Boards

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
9	CPU - CPU BOARD VME 64/PPC266 VIVID	066E2702	MAY BE LOCATED IN SPR3 POSITION ON SOME SYSTEMS REPLACEMENT FOR 066E2700 AND 066E2701	1	1
10	Jumper Board	FA200075	BG/IACK VME JUMPER board Used if CPU is housed in SPR3 position	1	1
11	Alternative position for the CPU board	-			
12	HV Power Supply Subassy	FA200114-C		1	1
13	Handle	Part of the HV Power Supply			
14	Cable w/plug	-	230 VAC (from AC Power)		
15	Backplane Replacement kit	FB200954		1	1

Section 9-10
Power Distribution Parts

Table 9-16 Power Distribution Parts

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	DC POWER SUPPLY	FB200967	REPLACEMENT FOR FA200034	1	1
2	3.3V DC/DC CONVERTER MODULE	FB200024	3.3V DC/DC CONVERTER MODULE	1	1
3	HV POWER SUPPLY SUBASSY	FA200114-C		1	1
4	AC POWER SUPPLY 230 VAC	FA200040		1	1
		FB200809	REPLACEMENT FOR FA200040		1
	AC POWER SUPPLY 115 VAC	FA200231			1
5	115 TO 100V TRANSF. MODULE	FB200054	115 TO 100V TRANSFORMER MODULE	1	2

Section 9-11
Mechanical Parts

Table 9-17 Mechanical Parts

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	LOCK F/ADAPTERPLATE	FA307589		1	2
2	GEL HOLDER, ELITE	FA307681		1	1
3	EMC PLATE, LOWER LEFT	FA307713		1	2
4	COVER F/BIRD RECEIVER CABLE	FA307733		1	2
5	DC POWER DUST FILTER	FA307888		1	2
6	Qwerty Base Plate	FB307286		1	2
7	Qwerty Support Bracket	FB307287		1	2
8	Trackball Activating Plate	FB307288		1	1

Section 9-12
Cables

The cable diagram in the illustration below is valid for all Vivid 5.
(See "VIVID 5 Models Covered by this Chapter" on page 9-2.)
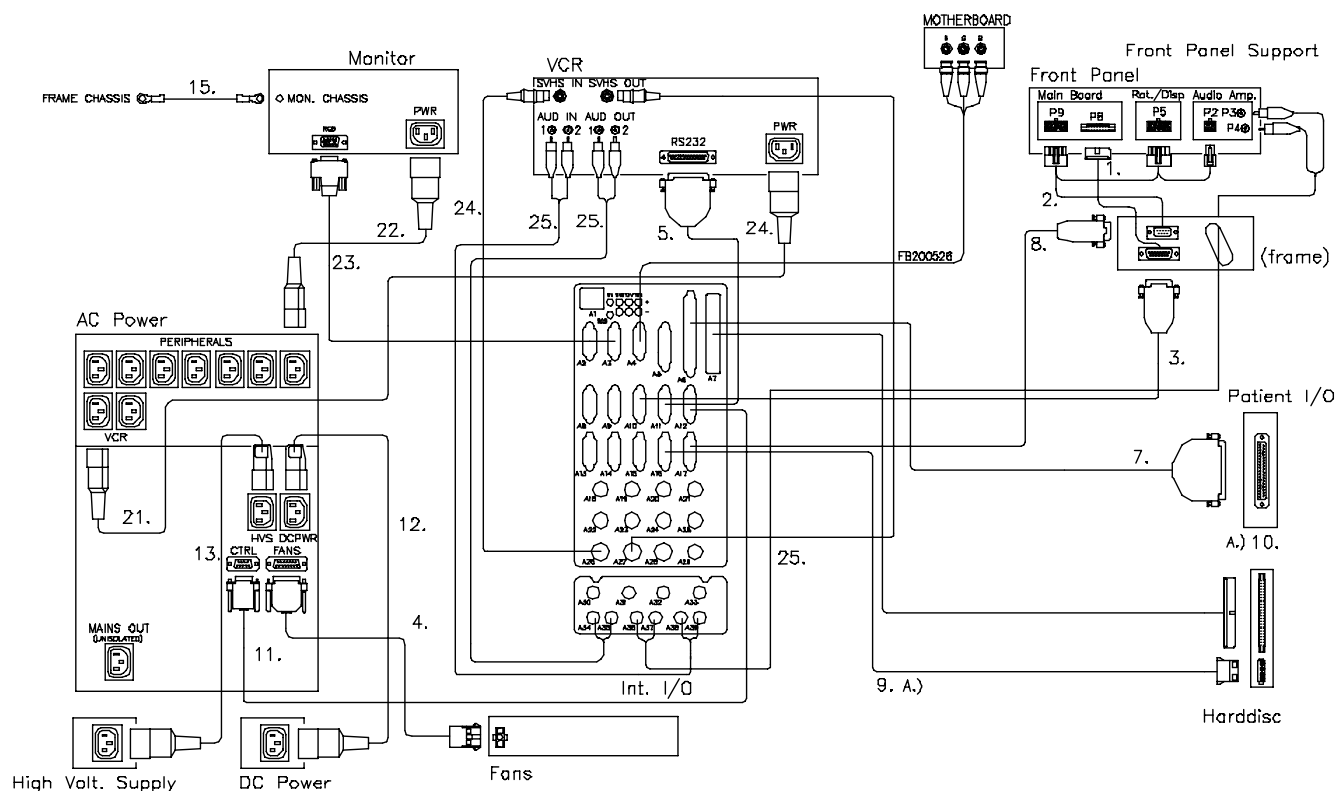
Figure 9-7 Internal Cables, 3rd version

For spare cables, please refer to:

Table 9-18 Cables for Vivid 5

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	FP CTRL, INTERNAL	FA200078		1	2
2	FP POWER, INTERNAL	FA200079		1	2
3	FP CTRL, EXTERNAL			1	N

Table 9-18 Cables for Vivid 5 (cont'd)

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
4	TEMP. SENSE & FAN	FA200147		1	1
5	VCR CONTROL	FA200155		1	1
6	NOT USED	NOT USED		-	-
7	PATIENT I/O CTRL	FB200399		1	2
8	TP POWER, EXTERNAL	FA200282		1	2
9	DC-POWER, SCSI DISC	FA200386		1	1
10	SCSI HDD CABLE			1	N
11	AC-CTRL.			1	N
12	POWER, DC-POWER	FA200313		1	1
13	POWER, HV-SUPPLY	FA200318		1	N
14	ETHERNET JUMPER	FA200370		1	1
15	MONITOR GND			1	N
16-20	NOT USED				
21	MAINS, SHIELDED 1.40 M			1	N
22	MONITOR POWER (PAL)			1	N
23	RGB TO MONITOR			1	N
24	VGA MONITOR CABLE	070D2910		1	1
	SIGNAL SHIELDED VIDEO	070M0006		2	2
25	SHIELDED W/PHONO CONN.			3	N

Section 9-13
Cables for Vivid 5 Peripherals

Table 9-19 Cables for Vivid 5 Peripherals

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CABLE, COLOR PRINTER	FA200446		1	2
2	CABLE, B&W PRINTER	FA200633		1	2
3	FP CTRL, EXTERNAL			1	N/A
4	VCR CONTROL	FA200155		1	1
5	PATIENT I/O II CTRL	FB200399		1	2
6	TP POWER, EXTERNAL	FA200282		1	2
7	AC-CTRL.	FA200312		1	N
8	GROUND PLATE	FA307736		2	N
9	GROUND CLAMP	MN307260	CABLE PROTECTOR CLAMP	2	2
10	MAINS, SHIELDED 1.40 M			1	N
11	MAINS, SHIELDED, 2.05M	070C5205	CABLE TO DEVICES	4	1
12	CABLE SIGNAL SHIELD VIDEO	070M0006		2	N
13	SHIELDED W/PHONO CONN.			3	N
14	RGB GRAPHIC CABLE	FB200526		1	2
15	SHIELDED W/PHONO CONN.			3	N
16	CABLE SCSI	070D3051	1.5 m	1	1
17	CABLE, COMP. VID. INT. LCD 3"	FA200693	CABLE WITH COMPOSITE VIDEO TO LCD SCREEN	1	1
18	CABLE, COMP.VID.EXT. LCD 3"	FA200694		1	2
19	CLAMP, MONITOR CABLE	MN307136		1	1

Section 9-14
Cables for Internal MAC

9-14-1 Overview

The list below lists the Apple Macintosh computers that have been delivered with, or used as FRUs for Vivid 5 units with integrated EchoPAC:

- Power Mac G4 V2 (See Figure 9-8 on page 9-26.)
- Power Mac G4 V3 (See Figure 9-9 on page 9-27.)
- Power Mac G4 V4 (See Figure 9-9 on page 9-27.)
- Power Mac G4 V5 (See Figure 9-9 on page 9-27.)
- Power Mac G4 V6 (See Figure 9-9 on page 9-27.)
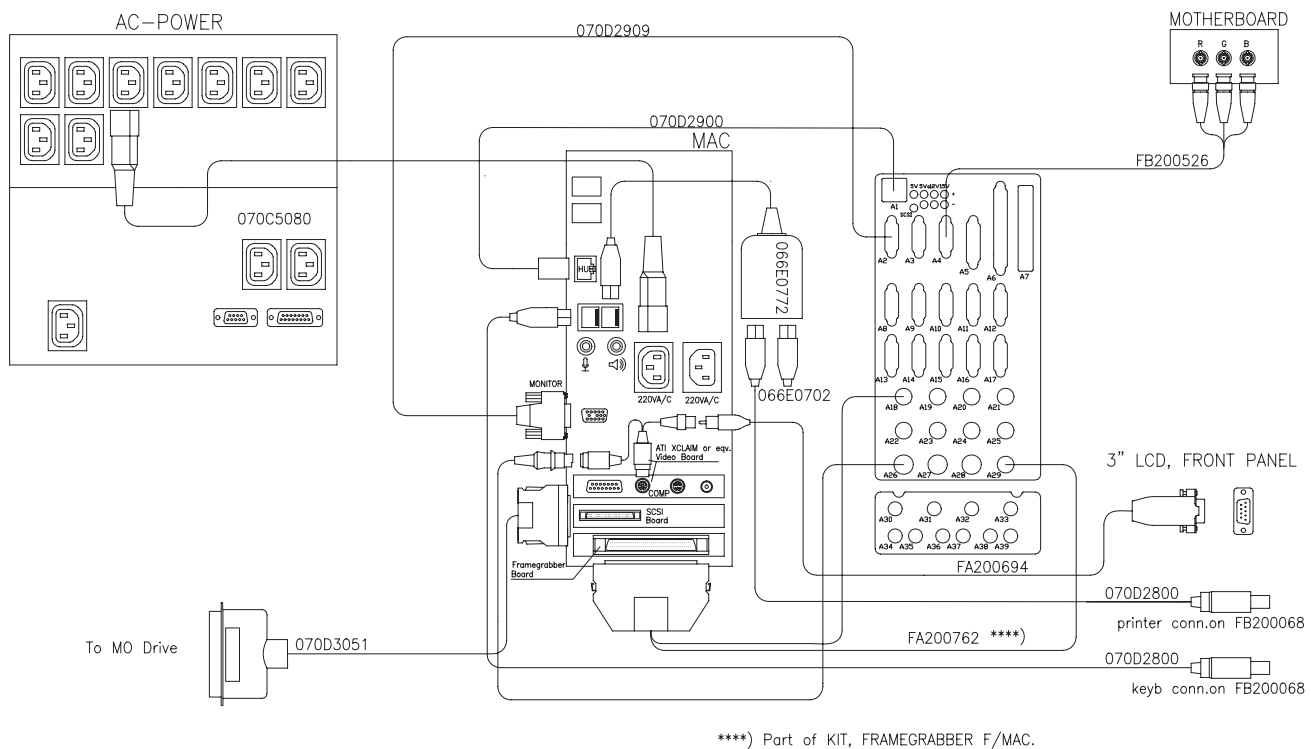
Figure 9-8 Intenal MAC Cable Harness with 3" LCD. Macintosh Computer G4 V2.

For spare cables, please refer to:

Section 9-14 Cables for Internal MAC (cont'd)

Figure 9-9 Intenal MAC Cable Harness with 4" LCD. Macintosh Computer G4 V3, G4 V4, G4 V5 and G4 V6.

For spare cables, please refer to:

Table 9-20 Cables for units with internal EchoPAC MAC

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CABLE MAINS SHIELDED 0,80M	070C5080		1	2
2	POWERCORD W/CONN. 3M GREY			1	N
3	CABLE ETHERNET 1,30M SHIELDED TWISTED PAIR			1	N
4	ECHOPAC LICENSE W/HW LOCK	066E0702	DONGLE	1	1
5	CABLE USB A to B 1,00M SHIELDED	070D2800		2	2

Table 9-20 Cables for units with internal EchoPAC MAC

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
6	USB HUB 2 ports.	066E0772		1	1
7	CABLE SCSI 1,5M	070D3051		1	1
8	CABLE, ECHOPAC/S5 INT. TRANSF.	FA200762	FRAME GRABBER INT CABLE (FRAME GRABBER (MAC) > INTERNAL I/O) VIDEO OUT: PIN 35, GND: PIN 36. TRIG OUT: PIN 62, GND: PIN 60.	1	1
9	RGB GRAPHIC CABLE	FB200526		1	2

9-14-2   Power Cables

Table 9-21 Power Cables

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CABLE MAINS SHIELDED 0,80M	070C5080		1	2
2	CABLE MAINS SHIELDED 1,15M	070C5115		2	1
3	CABLE MAINS SHIELDED 2,05M	070C5205	CABLE TO DEVICES, NTSC SYSTEMS ONLY	1	1

9.14.3   ECG Cables

Table 9-22 ECG Cables

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CABLE ECG MARQ. AHA/AMERICA	164L0025		1	1
2	CABLE ECG MARQ. IEC / EU + AS	164L0026 # E9002CB		1	1
3	LEADWIRES ECG MARQ. AHA/AMERICA	164L0027		1	1
4	LEADWIRES ECG MARQ. IEC/EU+AS	164L0028 # E9003CL		1	1

Section 9-15
Integrated (Internal) Macintosh with EchoPAC

Table 9-23 Macintosh Replacement Models

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	POWER MAC INT G4 800 MHz V6 ENGLISH	EP200468	NEEDS MAC OS 9.2.1 See the EchoPAC Installation Manual, Direction Number EP194010, for installation instructions.		1
2	POWER MAC INT G4 800 MHz V6 GERMAN	EP200491	NEEDS GERMAN MAC OS 9.2.1 See the EchoPAC Installation Manual, Direction Number EP194010, for installation instructions.		
3	APPLE, POWERMAC G4 733 MHz V5	EP200416 EP200418	(ENGLISH) GOING OBSOLETE (GERMAN) GOING OBSOLETE	1	1
4	APPLE, POWERMAC G4 533 MHz V4	EP200393 EP200394	OBSOLETE		N
5	APPLE, POWERMAC G4 400 MHz V3	066E0282	GOING OBSOLETE		1
6	APPLE, POWERMAC G4 400 MHz V2	066E0281	GOING OBSOLETE		1
7	Graphic Bd. ATI XCLAIM-VR 128	066E1044	GOING OBSOLETE		1

Section 9-16
Internal Peripherals

SCANNER WITHOUT
SIDE COVERS, SEEN
FROM THE RIGHT
SIDE.

① ② ③ ④ ⑤ ⑥ ⑦

NOT SHOWN IN
ILLUSTRATION
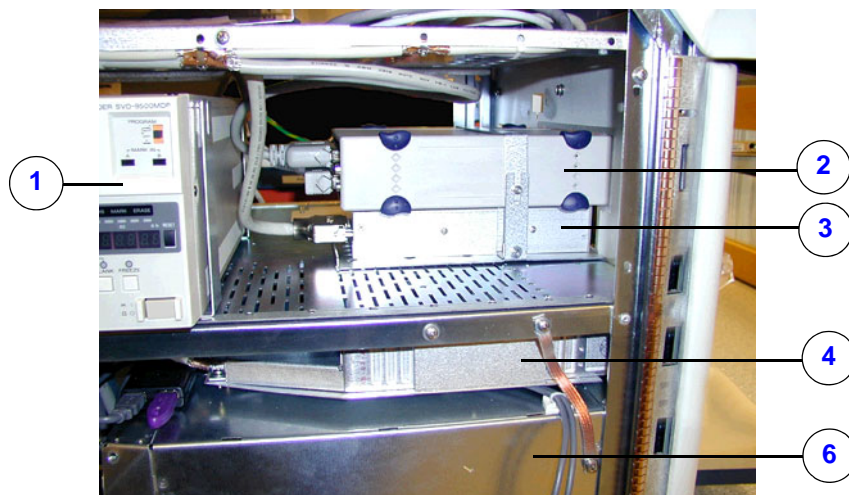
Figure 9-10 Internal Peripherals

Table 9-24 Internal Peripherals

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	VCR	See "External Details, Rear and Left Side" on page 9-10.			
2	MOD	066E0671	MO DRIVE, 5.2 GBYTES, INTERNAL	1	1
3	ASSY PATIENT I/O COMPL	FB200196	PATIENT I/O SUBASSY	1	2
	PATIENT I/O MODULE II	FA200801		1	1
4	KIT, SCA HDD CARTRIDGE + LABEL	FB200266		1	1
	CABLE, DC POWER SCSI-HD	FA200386		1	1
	HARDDISK FASTENING PLATE	FB307244		1	2
	HARDDISK EMC COVER	FB307243	EMC SCREEN	1	2
5	B/W VIDEO PRINTER, SONY UP890MDG	066E0087	OBSOLETE	1	N/A
	B/W VIDEO PRINTER, SONY UP890MDW	066E0088			1
	B/W VIDEO PRINTER, SONY UP890CE	066E0089	220 VAC - OBSOLETE		N/A
	B/W VIDEO PRINTER, SONY UP890MD	066E0090	110 VAC - OBSOLETE		N/A
6	MACINTOSH COMPUTER	See "Integrated (Internal) Macintosh with EchoPAC" on page 9-30.			

Table 9-24 Internal Peripherals

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
7	ZIP DRIVE 250 MBYTES 3.5" - USB	066E0680	NOTE: POWER SUPPLY VIA USB		1

9-16-1   Footswitch

Table 9-25 Footswitch

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	FOOTSWITCH	FB200723	FOOTSWITCH 3 PEDALS FOR VIVID 5	1	1

Section 9-17
External Peripherals

Table 9-26 External Peripherals

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1.	SONY UP21MD	066E2955	COLOR PRINTER UP21MD ASSEMBLY	1	1
2.	I'FACE USB-ETHERNET 230V HP PRT	066E0408	HP JET DIRECT 230 VAC	1	1
3.	I'FACE USB-ETHERNET 110V HP PRT	066E0409	HP JET DIRECT 110 VAC	1	1

Table 9-27 Network Printers

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1.	I'FACE USB-ETHERNET 230V HP PRT	066E0408	HP JET DIRECT 230 VAC	1	1
2.	I'FACE USB-ETHERNET 110V HP PRT	066E0409	HP JET DIRECT 110 VAC	1	1

Section 9-18
Probes

9-18-1   CLA Probes, Curved Linear Array Probes

CLA Probe

Probe Connector
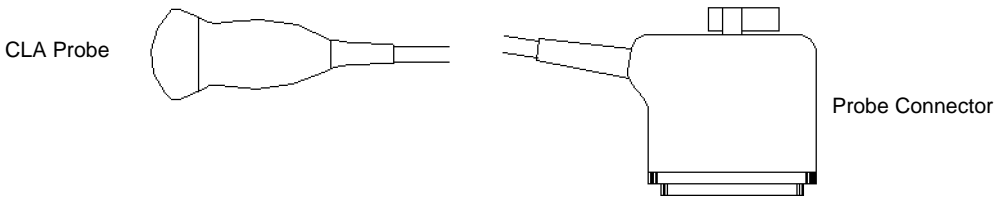
Figure 9-11 CLA Probe

Table 9-28 CLA Probes

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CLA, 3.5 MHz	KK100004	192 el. Field of view: 85°	1	1
2	CLA, 5 MHz	KN100008	192 el.Field of view: 68°	1	1
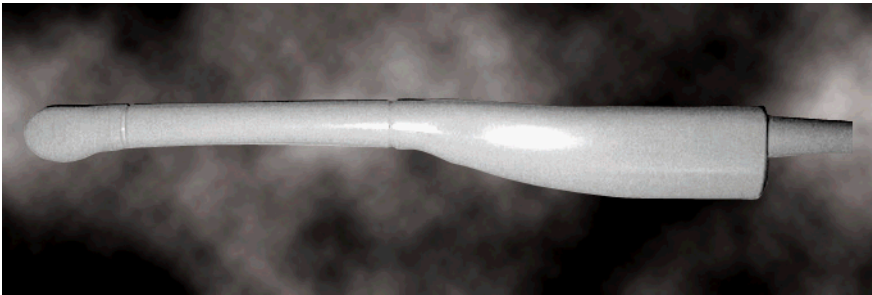
9-18-2   ECLA Probe

Figure 9-12 ECLA Probe

Table 9-29 ECLA Probe

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	ECLA, 6.5 MHz, TV	KQ100002	Trans Vaginal. Field of view: 124° 128 el.	1	1

9-18-3   FLA, Flat Linear Array Probes

FLA Probe

Figure 9-13 FLA Probe

Table 9-30 FLA Probes

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	FLA, 5.0 MHz	KN100003	Footprint: 60 mm x 17 mm, 192 el.	1	1
2	FLA, 7.5 MHz	KT100001	Footprint: 50 mm x 17 mm, 192 el.	1	N
3	FLA, 10.0 MHz,	KW100001	Footprint: 50 mm x 17 mm, 192 el.	1	1

9-18-4   FPA, Flat Phased Array Probes
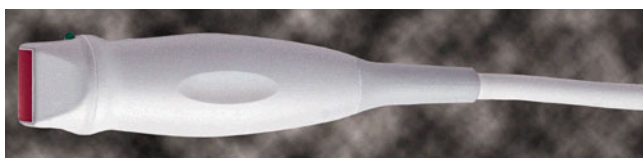
Red Lens   2.5 MHz FPA
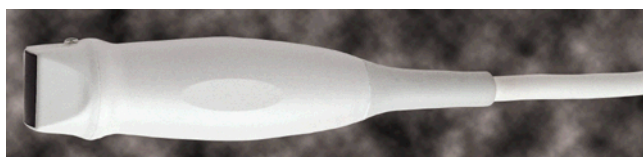
Black Lens   3.5-5.0 MHz FPA

Figure 9-14 FPA Probe

Table 9-31 FPA Probes

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	FPA, 2.5 MHz	KG100001	64 el., Footprint: 21 mm x 17 mm	1	1
2	FPA, 3.5 MHz	KK100005	96 el., Footprint: 21 mm x 17 mm	1	1
3	FPA, 3.5 MHz	KK100001	96 el., Footprint: 21 mm x 17 mm	1	1
4	FPA, 5.0 MHz	KN100001	128 el., Footprint: 21 mm x 17 mm	1	1
5	FPA, 5.0 MHz	KN100002	96 el., Footprint: 21 mm x 17 mm	1	1
6	FPA, 10 MHz	KW100002	96 el., Footprint: 14 mm x 10 mm	1	1

9.18.5   PAMPTE Probes

Figure 9-15 PAMPTE Probe

Table 9-32 PAMPTE Probes

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	PAMPTE, 5.0 MHz	KN100007	Oldelft, 14 mm, 64 elements	1	1
2	PAMPTE, 5.0 MHz	KN100006	GE Vingmed, 14 mm, 64 elements	1	1
3	PAMPTE, 5.0 MHz	KN100010	10.7 mm, Pediatric Multiplane, 48 elements	1	1

9.18.6 Doppler Probes
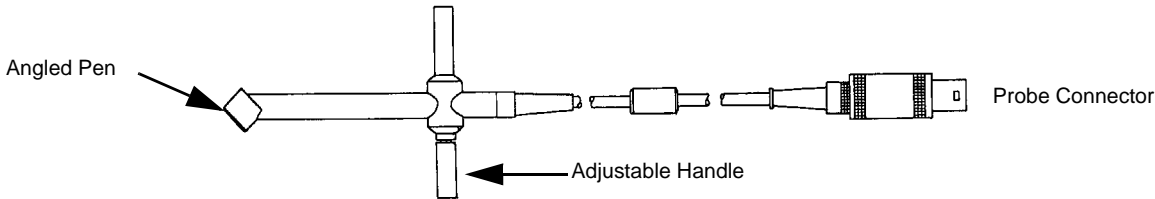
Figure 9-16 Doppler Probe, Angled Pen

Table 9-33 Doppler Probes

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Doppler stand-alone, 2 MHz	TE100024	Angled Pen	1	1
2	Doppler TC. probe, 2 MHz	KE100001	Straight, Trans Cranial	-	N
3	Doppler, pencil probe, 6 MHz, Vermont	TQ100002	Straight	1	1

9-18-7 Intraoperative Probes

i8Lv

i13Lv

Figure 9-17 Intraoperative Probe

Table 9-34 Intraoperative Probes

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	i8Lv	KQ100005		1	1
2	i13Lv	KW100003		1	1

Section 9-19
Service Kits

Table 9-35 Kits

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1.	WHEEL SUPPORT KIT	FC200409	Vivid 5 and System FiVe Frame Enforcement	1	1
2.	CASTER VIVID FIVE	FB200073	CASTER SET 4 WHEELS, WHEEL KIT V.2 (Vivid 5)	1	1
3.	BT-99 MOBILITY KIT	FB200077		1	1

Section 9-20
Other Parts

Table 9-36 Other Parts

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1.	INT.I/O SUBASSEMBLY (II/O-II)	FB200005		1	1
2.	EXT.I/O SUBASSEMBLY	FB200006		1	1

Section 9-21
Product Manuals

9-21-1 Manuals for Vivid 5

Table 9-37 Product Manuals for Vivid 5

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Vivid 5 SERVICE MANUAL	FB091565	(this manual)	1	N/A
2	VIVID FIVE USER MANUAL	FB092275	User Manual English	1	N/A
3	VIVID FIVE BEDIENUNGSANLEITUNG	FB092276	User Manual German		N/A
4	VIVID FIVE MANUAL D'UTILISATION	FB092277	User Manual French		N/A
5	MANUAL DEL USUARIO	FB092279	User Manual Spanish		N/A
6	MANUAL DO USUÁRIO, VIVID FIVE	FB092281	User Manual Portugal	1	N/A
7	ANVÄNDARHANDBOK, VIVID FIVE	FB092282	User Manual Swedish		N/A
8	VIVID FIVE BRUKSANVISNING	FB092283	User Manual Norwegian		N/A
9	ACUSTIC INFORMATION MANUAL	FB292541	User Manual Multilingual		N/A
10	ADVANCED TVI USER MANUAL	FB292262	User Manual English		N/A
11	ADVANCED TVI USER MANUAL	FB292780	User Manual French		N/A
12	ADVANCED TVI USER MANUAL	FB292776	User Manual portugese	1	N/A
13	ADVANCED TVI USER MANUAL	FB292779	User Manual german		N/A
14	ADVANCED TVI USER MANUAL	FB292778	User Manual spanish		N/A
15	ADVANCED TVI USER MANUAL	FB292777	User Manual italian		N/A
16	CONTRAST IMAGING USER MANUAL	FB292263	User Manual English		N/A
17	CONTRAST IMAGING USER MANUAL	FB292785	User Manual French		N/A
18	CONTRAST IMAGING USER MANUAL	FB292781	User Manual Portugese	1	N/A
19	CONTRAST IMAGING USER MANUAL	FB292784	User Manual German		N/A
20	CONTRAST IMAGING USER MANUAL	FB292783	Spanish		N/A
21	CONTRAST IMAGING USER MANUAL	FB292782	Italian		N/A
22	USER MANUAL FOR SONY MULTISCAN G200	N/A		1	N/A
23	DATA INTEGRITY GUIDE LINES	EP292267	PART OF FMI 76038	1	N/A

9-21-2   Manuals for EchoPAC (MAC)

Table 9-38 Product Manuals for EchoPAC

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	EchoPAC User Manual (6.3 sw)	EP192010 E	English User Manual		N/A
2	EchoPAC Manuel D'utilisation	EP192018 C	French User Manual		N/A
3	EchoPAC Bedeinungsanleitung	EP192019 C	German User Manual		N/A
4	EchoPAC Manual del usuario	EP192073 B	Spanish User Manual	1	N/A
5	EchoPAC Manual do usario	EP192074 B	Portugese User Manual		N/A
6	EchoPAC Manuale Utente	EP192075 B	Italian User Manual		N/A
7	Data Integrity Guidelines	EP292267 B	User Manual	1	N/A
8	EchoPAC Installation Manual	EP194010 M	EchoPAC Installation Manual	1	N/A

9-21-3   Manuals for EchoPAC 3D for Windows
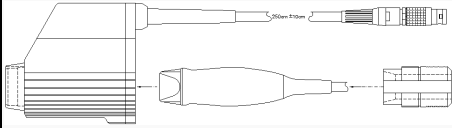
Table 9-39 Product Manuals for EchoPAC 3D

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	MANUAL INSTALL., POS.DET.	FA294719		1	N/A
2	Installation Manual for EchoPac-3D for Windows	EP294182		1	N/A
3	EchoPAC-3D for Windows Users Manual	FB292261	English	1	N/A
4	EchoPAC-3D for Windows Users Manual	FB292774	German	1	N/A
5	EchoPAC-3D for Windows Users Manual	FB292775	French	1	N/A
6	EchoPAC-3D for Windows Users Manual	FB292771	Portugese	1	N/A
7	EchoPAC-3D for Windows Users Manual	FB292773	Spanish	1	N/A
8	EchoPAC-3D for Windows Users Manual	FB292772	Italian	1	N/A

Section 9-22
EchoPAC 3D Spare Parts

Table 9-40 Service Parts for 3D and 4D Options

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	POSITION SENSOR	FA200512		1	2
2	BIRDBOX, SUBASSY	FA200584		1	2
3	BIRD POWER CABLE, LOW SYSTEM	FA200717		1	2
4	BIRD RS-232 CABLE, LOW SYSTEM	FA200718		1	2
5	ROTATION ADAPTER	FA200732		1	2
6	MANUAL INSTALL., POS.DET.	FA294719		1	2
7	ROT. ADAPTER INTERFACE BOARD	FB200210	OBSOLETE	1	N/A

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Chapter 10
Care & Maintenance

Section 10-1
Overview

10-1-1   Periodic Maintenance Inspections

Two PM inspections are recommended per year for Vivid 5.

10-1-2   Purpose of Chapter 10

This chapter describes **Care & Maintenance** on the scanner and peripherals. These procedures are intended to **maintain the quality** of the ultrasound **systems performance**. Read this chapter completely and familiarize yourself with the procedures before performing a task.

Table 10-1   Contents in Chapter 10

Section	Description	Page Number
10-1	Overview	10-1
10-2	Why do Maintenance	10-2
10-3	Maintenance Task Schedule	10-2
10-4	Tools Required	10-4
10-5	System Periodic Maintenance	10-5
10-6	Electrical Safety Tests	10-10
10-7	When There's Too Much Leakage Current...	10-22
	Ultrasound Inspection Certificate	10-29

⚠ **CAUTION** **Practice good ESD prevention. Wear an anti–static strap when handling electronic parts and even when disconnecting/connecting cables.**

⚠ **DANGER** **THERE ARE SEVERAL PLACES ON THE BACKPLANE, THE AC DISTRIBUTION, AND DC DISTRIBUTION THAT ARE DANGEROUS. BE SURE TO DISCONNECT THE SYSTEM POWER PLUG AND OPEN THE MAIN CIRCUIT BREAKER BEFORE YOU REMOVE ANY PARTS. BE CAUTIOUS WHENEVER POWER IS STILL ON AND COVERS ARE REMOVED.**

⚠ **CAUTION** **Do not pull out or insert circuit boards while power is ON.**

⚠ **CAUTION** **Do not operate this unit unless all board covers and frame panels are securely in place. System performance and cooling require this.**

Section 10-2
Why do Maintenance

10-2-1   Keeping Records

It is good business practice that ultrasound facilities maintain records of periodic and corrective maintenance. The Ultrasound Periodic Maintenance Inspection Certificate provides the customer with documentation that the ultrasound scanner is maintained on a periodic basis.

A copy of the Ultrasound Periodic Maintenance Inspection Certificate should be kept in the same room or near the scanner.

10-2-2   Quality Assurance

In order to gain accreditation from organizations such as the American College of Radiology (USA), it is the customer's responsibility to have a quality assurance program in place for each scanner. The program must be directed by a medical physicists, the supervising radiologist/physician or appropriate designee.

Routine quality control testing must occur regularly. The same tests are performed during each period so that changes can be monitored over time and effective corrective action can be taken.

Testing results, corrective action and the effects of corrective action must be documented and maintained on the site.

Your GE service representative can help you with establishing, performing and maintaining records for a quality assurance program. Please contact us for coverage and/or price for service.

Section 10-3
Maintenance Task Schedule

10-3-1   How often should maintenance tasks be performed?

The Care & Maintenance Task Schedule (provided on page 10-3) specifies how often your Vivid 5 should be serviced and outlines items requiring special attention.

NOTE: *It is the customer's responsibility to ensure the Vivid 5 care & maintenance is performed as scheduled in order to retain its high level of safety, dependability and performance.*

Your GE Service Representative has an in-depth knowledge of your Vivid 5 ultrasound scanning system and can best provide competent, efficient service. Please contact us for coverage information and/or price for service.

The service procedures and recommended intervals shown in the Care & Maintenance Task Schedule assumes that you use your Vivid 5 for an average patient load (10-12 per day) and not use it as a primary mobile unit which is transported between diagnostic facilities.

NOTE: *If conditions exist which exceed typical usage and patient load, then it is recommended to increase the periodic maintenance frequencies.*

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Table 10-2   Customer Care Schedule

Service at Indicated Time	Daily	Weekly	Monthly	Annually	Notes
Clean Probes	●*				* or before each use
Clean Probe Holders	●				
Clean Air Filter		●			more frequently depending on your environment
Inspect AC Mains Cable			●		Mobile Unit Check Weekly
Inspect Cables and Connectors			●		
Clean Console			●		
Clean Monitor and Touch Panel			●		
Inspect Wheels, Casters, brakes and Swivel Locks			●		Mobile Unit Check Daily
Check Operator Panel Movement			●		Mobile Unit Check Daily
Console Leakage Current Checks				●	also after corrective maintenance or as required by your facilities QA program
Peripheral Leakage Current Checks				●	also after corrective maintenance or as required by your facilities QA program
Surface Probe Leakage Current Checks				●	also after corrective maintenance or as required by your facilities QA program
Endocavity Probe Leakage Current Checks					also after corrective maintenance or as required by your facilities QA program
Transesphongeal Probe Leakage Current Checks					also after corrective maintenance or as required by your facilities QA program
Surgical Probe Leakage Current Checks					also after corrective maintenance or as required by your facilities QA program
Measurement Accuracy Checks				●	also after corrective maintenance or as required by your facilities QA program
Probe/Phantom Checks				●	also after corrective maintenance or as required by your facilities QA program
Functional Checks				●	also after corrective maintenance or as required by your facilities QA program

Section 10-4
Tools Required

10-4-1   Special Tools, Supplies and Equipment

Table 10-3   Overview of Requirements for Periodic Maintenance

Tool	Part Number	Comments
Digital Volt Meter (DVM)		
Anti Static Kit	46–194427P231 46–194427P279 46–194427P369 46–194427P373 46–194427P370	Kit includes anti–static mat, wrist strap and cables for 200 to 240 V system 3M #2204 Large adjustable wrist strap 3M #2214 Small adjustable wrist strap 3M #3051 conductive ground cord
Anti Static Vacuum Cleaner	46–194427P278 46–194427P279	120V 230V
Safety Analyzer	46–285652G1	DALE 600 KIT (or equivalent) for electrical tests
SVHS VCR Cassette	E7010GG E7010GF	60 minute 120 minute
SVHS VCR Head Cleaner		See VCR user manual for requirements
5.25" MOD MEDIA	2277190	Blank 2.3 M disk Blank 5.2 M disk
5.25" MOD Disk Cleaning Kit	066E0674	SONY MOA-D51
QIQ Phantom	E8370RB	RMI Grayscale Target Model 403GS
B/W Printer Cleaning Sheet		See printer user manual for requirements
Color Printer Cleaning Sheet		See printer user manual for requirements
Disposable Gloves		

Section 10-5
System Periodic Maintenance

10-5-1   Preliminary Checks

The preliminary checks take about 15 minutes to perform. Refer to the system user documentation whenever necessary.

Table 10-4   System Preliminary Checks

Step	Item	Description
1	Ask & Listen	Ask the customer if they have any problems or questions about the equipment.
2	Paperwork	Fill in the top of the Periodic Maintenance (PM) Inspection Certificate. Note all probes and system options.
3	Power up	Turn the system power on and verify that all fans and peripherals turn on. Watch the displays during power up to verify that no warning or error messages are displayed.
4	Probes	Verify that the system properly recognizes all probes.
5	Displays	Verify proper display on the monitor and touch panel.

10-5-2   Functional Checks (See Also Chapter 4)

The functional checks take about 60 minutes to perform. Refer to the system user documentation whenever necessary.

10-5-2-1   System Checks

Table 10-5   System Functional Checks

Check	Step	Description
	B-Mode	Verify basic B-Mode (2D) operation. Check the basic system controls that affect this mode of operation.
	CF-Mode	Verify basic CF-Mode (Color Flow Mode) operation. Check the basic system controls that affect this mode of operation.
	Doppler Modes	Verify basic Doppler operation (PW and CW if available). Check the basic system controls that affect this mode of operation.
	M-Mode	Verify basic M-Mode operation. Check the basic system controls that affect this mode of operation.
	*Applicable Software Options	Verify the basic operation of all optional modes such as Multi-Image, 3D, Contrast, Harmonics, Cine, Stress Echo,... etc. Check the basic system controls that affect each options operation.
	System Diagnostic	Perform the Automatic Tests, see 6-4-4 "Automatic Tests" on page 6-2, to verify that all boards function according to specifications.
	Operator Panel Test	Perform the Operator Panel Test Procedure, see 6-4-5 "Front Panel Test" on page 6-3, to verify that all keyboard controls are OK. This is performed by the internal PC (Back-End processor) which does a normal keyboard run through.
	Monitor	Verify basic Monitor display functions.
	Touch Panel	Verify basic Touch Panel display functions.
	Measurements	Scan a gray scale phantom and use the measurement controls to verify distance and area calculation accuracy.

*NOTE: * Some software may be considered standard depending upon system model configuration.*

10-5-2-2 Peripheral/Option Checks

If any peripherals or options are not part of the system configuration, the check can be omitted.

Table 10-6   GE Approved Peripheral/Hardware Option Functional Checks

Step	Item	Description
1	VCR	Verify record/playback capabilities of the VCR. Clean heads and covers if necessary.
2	B/W Printer	Verify hardcopy output of the B/W video page printer. Clean heads and covers if necessary.
3	Color Printer	Verify hardcopy output of the Color video page printer. Clean heads and covers if necessary.
4	Footswitch	Verify that the footswitch is functioning as programed. Clean as necessary.
5	ECG	Verify basic operation with customer

10-5-3   Input Power

10-5-3-1   Mains Cable Inspection

Table 10-7   Mains Cable Inspection

Step	Item	Description
1	Unplug Cord	Disconnect the mains cable from the wall and system.
2	Inspect	Inspect it and its connectors for damage of any kinds.
3	Verify	Verify that the LINE, NEUTRAL and GROUND wires are properly attached to the terminals, and that no strands may cause a short circuit.
4	Verify	Inlet connector retainer is functional.

10-5-4   Cleaning

10-5-4-1   General Cleaning

Table 10-8   General Cleaning

Step	Item	Description
1	Console	Use a fluid detergent in warm water on a soft, damp cloth to carefully wipe the entire system. Be careful not to get the cloth too wet so that moisture does not enter the console.
2	Probe Holder	Clean probe holders. (they may need to be soaked to remove excess gel).

10-5-4-2   Air Filter Cleaning

Table 10-9   Air Filter Cleaning - frequency varies with your environment

Step	Task	Description
1	Remove Filter Cover	
	a	Loosen the three screws holding the main air filter cover. This cover is located on the right lower side below the lower side panel.
	b	Remove the cover.
	c	Pull out the main air filter.
	d	Pull out the rear air filter, which is located underneath the AC- and DC power supplies.
2	Clean Filters	The filters can be cleaned in sprinkling water, or they can be dusted with a vacuum cleaner.
3	Install Filters	Install the clean filters, the covers and fasten the screws.

10-5-5   Physical Inspection

Table 10-10   Physical Checks

Step	Item	Description
1	Labeling	Verify that all system labeling is present and in readable condition.
2	Scratches & Dents	Inspect the console for dents, scratches or cracks.
3	Operator Panel	Inspect keyboard and Operator Panel. Note any damaged or missing items.
4	Wheels & Brakes	Check all wheels and casters for wear and verify operation of foot brake, to stop the unit from moving, and release mechanism. Check all wheel locks and wheel swivel locks for proper operation.
5	Cables & Connectors	Check all internal cable harnesses and connectors for wear and secure connector seating. Pay special attention to footswitch assembly and probe strain or bend reliefs.
6	Shielding & Covers	Check to ensure that all EMI shielding, internal covers, air flow panels and screws are in place. Missing covers and hardware could cause EMI/RFI problems while scanning.
7	External I/O	Check all connectors for damage and verify that the labeling is good.
8	Op Panel Lights	Check for proper operation of all operator panel.
9	Monitor Light	Check for proper operation of any monitor lights, if available.

10-5-6   Probe Maintenance

10-5-6-1   Probe Related Checks

Table 10-11   Probe Related Checks

Step	Item	Description
1	Probe Holder	Clean probe holders. (they may need to be soaked to remove excess gel).
2	Probes	- Thoroughly check the system probe connectors and use high pressure air to remove dust from inside the connector sockets if necessary. - Visually check for bent, damaged or missing pins

10-5-6-2   Basic Probe Care

The system user manuals and various probe handling cards provide a complete description of probe care, maintenance, cleaning and disinfection. Ensure that you are completely familiar with the proper care of GE probes.

Ultrasound probes can be easily damaged by improper handling. See the User Manual and probe care cards for more details. Failure to follow these precautions can result in serious injury and equipment damage. Failure to properly handle or maintain a probe may also void its warranty.

Any evidence of wear indicates the probe cannot be used.

Do a visual check of the probe pins and system sockets before plugging in a probe.

TEE and Interoperative probes often have special considerations and individual probe user manuals. For TEE and Interoperative probes also refer to their separate user manuals.

10-5-6-3   Basic Probe Cleaning

Refer to the User's Manual for details on probe cleaning.

⚠ **WARNING** *To help protect yourself from blood borne diseases, wear approved disposable gloves. These are made of nitrile derived from vegetable starch to prevent allergic latex reactions.*

⚠ **CAUTION** **Failure to follow the prescribed cleaning or disinfection procedures will void the probe's warranty. DO NOT soak or wipe the lens with any product not listed in the User Manual. Doing so could result in irreparable damage to the probe. Follow care instructions that came with the probe.**

⚠ **CAUTION** **Disinfect a defective probe before you return it. Be sure to tag the probe as being disinfected.**

Section 10-6
Electrical Safety Tests

10-6-1   Safety Test Overview

The electrical safety tests in this section are based on and conform to NFPA 99 (For USA) and IEC 60601-1 Medical Equipment Safety Standards. They are intended for the electrical safety evaluation of cord-connected, electrically operated, patient care equipment. If additional information is needed, refer to the NFPA 99 (For USA) and IEC 60601-1 documents.

⚠ **WARNING**   *THE USER MUST ENSURE THAT THE SAFETY INSPECTIONS ARE PERFORMED AT LEAST EVERY 12 MONTHS ACCORDING TO THE REQUIREMENTS OF THE PATIENT SAFETY STANDARD IEC-EN 60601-1. ONLY TRAINED PERSONS ARE ALLOWED TO PERFORM THE SAFETY INSPECTIONS MENTIONED ABOVE.*

⚠ **CAUTION**   **To avoid electrical shock, the unit under test must not be connected to other electrical equipment. Remove all interconnecting cables and wires. The unit under test must not be contacted by users or patients while performing these tests.**

⚠ **CAUTION**   **Possible risk of infection. Do not handle soiled or contaminated probes and other components that have been in patient contact. Follow appropriate cleaning and disinfecting procedures before handling the equipment.**

Test the system, peripherals and probes for leakage current. Excessive leakage current can cause injury or death in sensitive patients. High leakage current can also indicate degradation of insulation and a potential for electrical failure. Do not use probes or equipment having excessive leakage current.

To minimize the risk that a probe may shock someone the customer should:

- Not use a probe that is cracked or damaged in any way
- Check probe leakage current:
    - * Based on your facilities QA program for surface probes
    - * Based on your facilities QA program for endocavitary probes
    - * Whenever probe damage is suspected

10-6-2   GEMS Leakage Current Limits

The following limits are summarized for NFPA 99 (For USA) and IEC 60601-1 Medical Equipment Safety Standards. These limits are GEMS standards and in some cases are lower than the above standards listed.

Table 10-12   Chassis Leakage Current Limits—Accessible Metal Surfaces

Country	Normal Condition	Open Ground	Reverse Polarity	Open Neutral
USA	N/A	0.3 mA	0.3 mA	N/A
Other	0.1 mA	0.5 mA	0.5 mA	0.5 mA

Table 10-13   Type BF Applied Part Leakage Current Limits - Non-Conductive (Floating) Surface and Cavity Probes

Country	Normal Condition	Open Ground	Reverse Polarity	Open Neutral	*Mains Applied
USA	0.05 mA	0.05 mA	0.05 mA	0.05 mA	N/A
Other	0.1 mA	0.5 mA	0.5 mA	0.5 mA	5.0 mA

Table 10-14   Type CF Applied Part Leakage Current Limits - Surgical Probes and ECG Connections

Country	Normal Condition	Open Ground	Reverse Polarity	Open Neutral	*Mains Applied
USA	0.01 mA	0.05mA	0.05 mA	N/A	0.025 mA
Other	0.01 mA	0.05 mA	0.05 mA	0.05 mA	0.05 mA

NOTE: *Mains Applied refers to the sink leakage test where mains (supply) voltage is applied to the part to determine the amount of current that will pass (or sink) to ground if a patient contacted mains voltage.

The following tests are performed at the factory and should be performed at the site. These tests are: grounding continuity, chassis leakage current, probe leakage current, and ECG leakage current. All measurements are made with an electrical safety analyzer.

10-6-3   Outlet Test - Wiring Arrangement - USA & Canada

Test all outlets in the area for proper grounding and wiring arrangement by plugging in the neon outlet tester and noting the combination of lights that are illuminated. Any problems found should be reported to the hospital immediately and the receptacle should not be used.
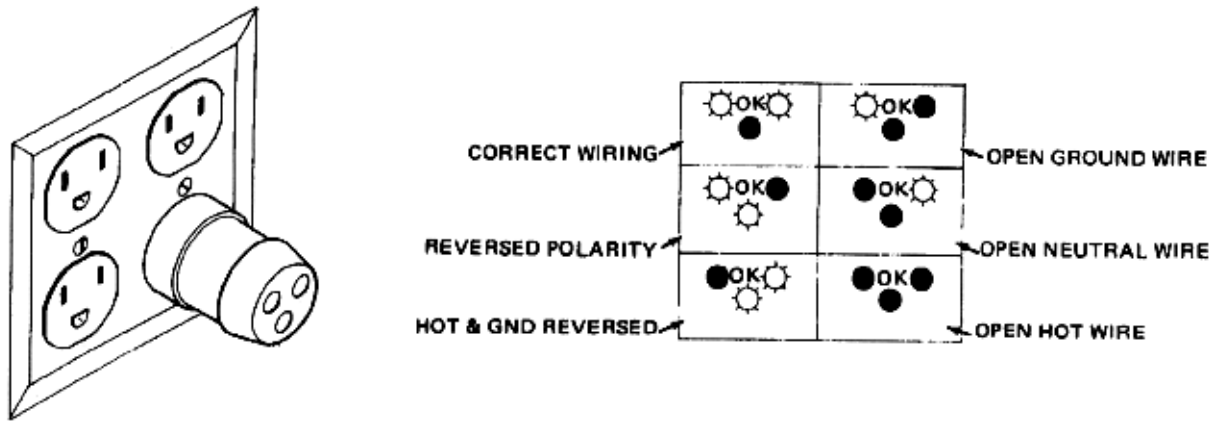
Figure 10-1   Typical Alternate Outlet Tester

NOTE: *No outlet tester can detect the condition where the Neutral (grounded supply) conductor and the Grounding (protective earth) conductor are reversed. If later tests indicate high leakage currents, this should be suspected as a possible cause and the outlet wiring should be visually inspected.*

10-6-4   Grounding Continuity

⚠ **CAUTION**   **Electric Shock Hazard. The patient must not be contacted to the equipment during this test**

Measure the resistance from the third pin of the attachment plug to the exposed metal parts of the case. The ground wire resistance should be less than **0.2** ohms. Reference the procedure in the IEC 601-1.1.
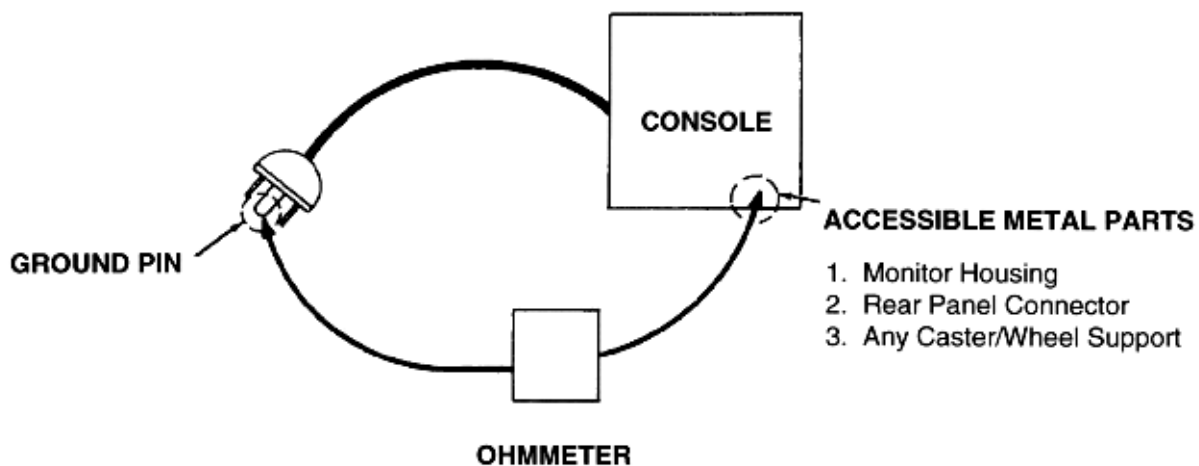
Figure 10-2   Ground Continuity Test

10-6-4-1   Meter Procedure

Follow these steps to test the ground wire resistance.

1.) Turn the Vivid 5 unit OFF.

2.) Plug the unit into the meter, and the meter into the tested AC wall outlet.

3.) Plug the black chassis cable into the meter's "CHASSIS" connector and attach the black chassis cable clamp to an exposed metal part of the Vivid 5 unit.

4.) Set the meter's "FUNCTION" switch to the RESISTANCE position.

5.) Set the meter's "POLARITY" switch to the OFF (center) position.

6.) Measure and record the ground wire resistance.

10-6-5   Chassis Leakage Current Test

10-6-5-1   Definition

This test measures the current that would flow in a grounded person who touched accessible metal parts of the bedside station if the ground wire should break. The test verifies the isolation of the power line from the chassis. The meter is connected from accessible metal parts of the case to ground. Measurements should be made with the unit On and Off, with the power line polarity Normal and Reversed. Record the highest reading.

⚠ **CAUTION**   **Electric Shock Hazard. When the meter's ground switch is OPEN, don't touch the unit!**

⚠ **CAUTION**   **Equipment damage possibility. Never switch the Polarity and the status of Neutral when the unit is powered ON. Be sure to turn the unit power OFF before switching them using the POLARITY switch and/or the NEUTRAL switch. Otherwise, the unit may be damaged.**

10-6-5-2   Generic Procedure

The test verifies the isolation of the power line from the chassis. The testing meter is connected from accessible metal parts of the case to ground. Measurements should be made with the unit ON and OFF, with the power line polarity Normal and Reversed. Record the highest reading of current.
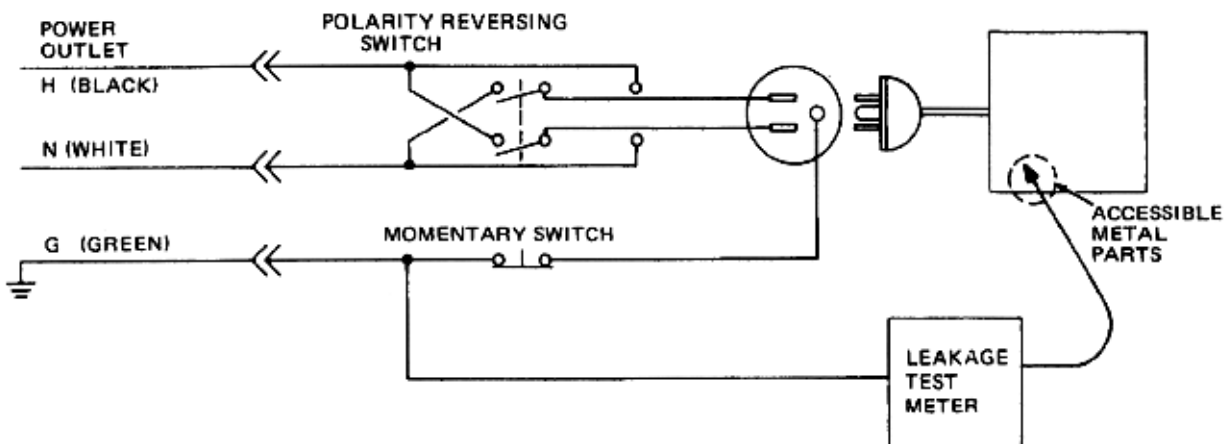
Figure 10-3   Set Up for Chassis Source Leakage Current, IEC 601-1 Clause 19 - Continuos Leakage Currents and Patient, Auxiliary Currents

When using the Microguard or a similar test instrument, its power plug may be inserted into the wall outlet and the equipment under test is plugged into the receptacle on the panel of the meter. This places the meter in the grounding conductor and the current flowing from the case to ground will be indicated in any of the current ranges. The maximum allowable limit for chassis source leakage is shown in Table 10-12 "Chassis Leakage Current Limits—Accessible Metal Surfaces" on page 10-11.

7.) Follow the test conditions described for respective test points shown in Table 10-15 "Chassis Leakage Current Test Condition" on page 10-15.

10-6-5-2   Generic Procedure (cont'd)

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Table 10-15   Chassis Leakage Current Test Condition

TEST	CONDITION
1	Mounting screw for probe receptacle
2	Wheel support
3	Mounting screw for CRT housing
4	Mounting screw for peripheral plugged into unit
5	Mounting screw for other peripheral powered by unit

8.) Keep a record of the results with other hard copies of PM data kept on site.

10-6-5-3   Data Sheet for Chassis Source Leakage Current

The test passes when all readings measure less than the value shown in Table 10-12. Record all data on the PM Inspection Certificate.

Table 10-16   Typical Data Sheet for Chassis Source Leakage Current

Unit Power	Tester Polarity Switch	Tester Neutral or Ground Switch	Test 1 Probe Connector	Test 2 Wheel	Test 3 CRT	Optional Test 4	Optional Test 5
Enter Name of tested peripheral here:							
ON	NORM	OPEN					
ON	NORM	CLOSED					
ON	REV	OPEN					
ON	REV	CLOSED					
OFF	NORM	OPEN					
OFF	NORM	CLOSED					
OFF	REV	OPEN					
OFF	REV	CLOSED					

10-6-6   Isolated Patient Lead (Source) Leakage–Lead to Ground

10-6-6-1   Definition

This test measures the current which would flow to ground from any of the isolated ECG leads. The meter simulates a patient who is connected to the monitoring equipment and is grounded by touching some other grounded surface. Measurements should be made with the ground open and closed, with power line polarity normal and reversed, and with the ultrasound console Off and On. For each combination the operating controls, such as the lead switch, should be operated to find the worst case condition.

⚠ **CAUTION**   **Equipment damage possibility. Never switch the Polarity when the unit is powered ON. Be sure to turn the unit power OFF before switching the polarity using the POLARITY switch. Otherwise, the unit may be damaged.**

10-6-6-2 Generic Procedure

Measurements should be made with the ground open and closed, with power line polarity normal and reversed, and with the unit Off and On. For each combination, the operating controls such as the lead switch should be operated to find the worst case condition.
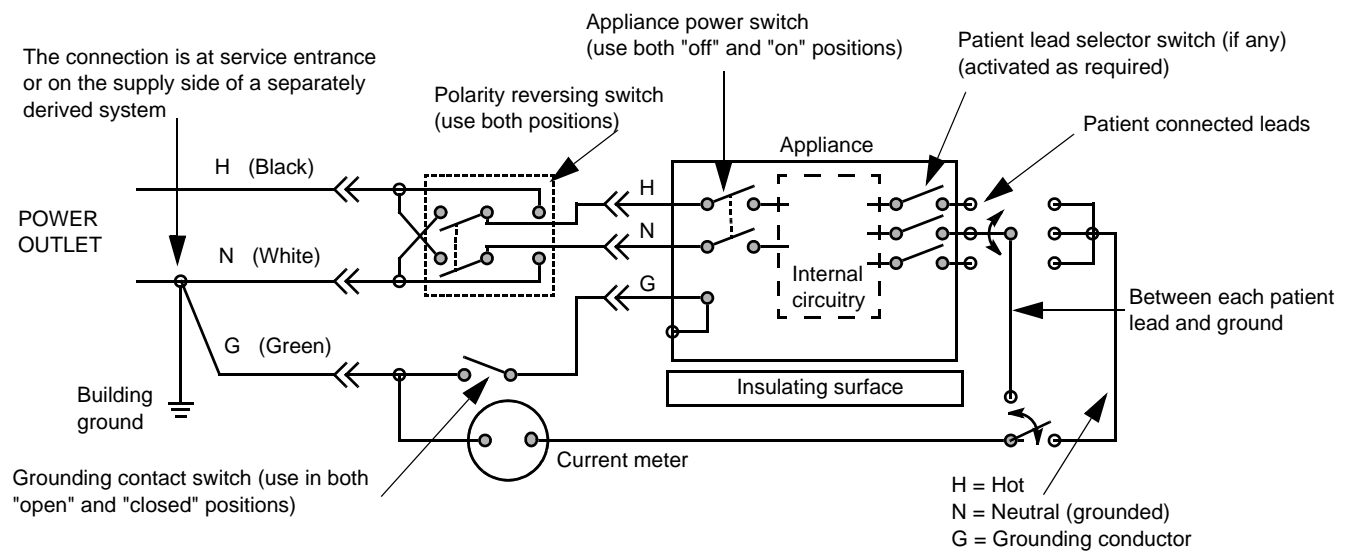
Figure 10-4 Test Circuit for Measuring Non-Isolated Patient Leads

Table 10-17 Testing Power Conditions

ECG Power	Meter's Polarity Switch	Meter's Neutral Switch
ON	NORM	CLOSED
ON	NORM	OPEN
ON	REVERSE	CLOSED
ON	REVERSE	OPEN
OFF	NORM	CLOSED
OFF	NORM	OPEN
OFF	REVERSE	CLOSED
OFF	REVERSE	OPEN

10-6-7 Isolated Patient Lead (Source) Leakage–Lead to Lead

Reference the procedure in the IEC 60601-1. When using the Dale 600, switch the meter's function selector to the LEAD-LEAD position. Select and test each of the five ECG lead positions (except ALL) on the LEAD selector, testing each to the power condition combinations found in the table. Record the highest leakage current measured.

10-6-8   Isolated Patient Lead (Sink) Leakage-Isolation Test

Reference the procedure in the IEC 60601-1. When using the Dale 600, switch the meter's function selector to the LEAD-ISO. Select the ALL position on the lead selector. Depress the rocker switch to ISO TEST to test lead isolation.

⚠ **CAUTION**   **Line voltage is applied to the ECG leads during this test. To avoid possible electric shock hazard, the system being tested must not be touched by patients, users or anyone while the ISO TEST switch is depressed.**

NOTE: *It is not necessary to test each lead individually or power condition combinations as required in previous tests.*

10-6-8-1   Data Sheet for ECG Leakage Current

The test passes when all readings measure less than the value shown in the table below. Record all data on the PM Inspection Certificate.

Table 10-18   Maximum Allowance Limit for ECG Leakage Current

	AC Power Source	Maximum Allowance Limit	
		GROUND OPEN	GROUND CLOSED
Patient Lead to Ground Leakage Current Test and Patient Lead to Lead Leakage Current Test	115V	10uA	10uA
	220/240V	500uA	10uA

Table 10-19   Maximum Allowance Limit for ECG Leakage Current

	AC Power Source	Maximum Allowance Limit
Patient Lead Isolation Current Test	115V	20uA
	220/240V	5mA

Table 10-20   Typical Data Sheet for ECG Leakage Current

ECG Power	Tester Polarity Switch	Tester Ground Switch	Tester Lead Selector				
			RL	RA	LA	LL	C
ON	NORM	CLOSED					
ON	REVERSE	CLOSED					
ON	NORM	OPEN					
ON	REVERSE	OPEN					
OFF	NORM	CLOSED					
OFF	REVERSE	CLOSED					
OFF	NORM	OPEN					
OFF	REVERSE	OPEN					

10-6-9   Probe Leakage Current Test

10-6-9-1   Definition

This test measures the current that would flow to ground from any of the probes through a patient who is being scanned and becomes grounded by touching some other grounded surface.

10-6-9-2   Generic Procedure

Measurements should be made with the ground open and closed, with power line polarity normal and reversed, and with the unit Off and On. For each combination, the probe must be active to find the worst case condition.
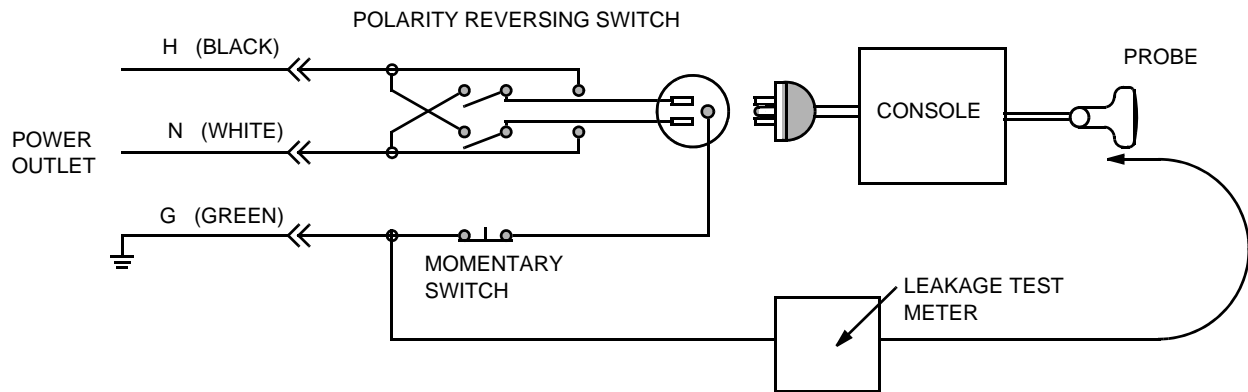
Figure 10-5   Set Up for Probe Leakage Current

NOTE: *Each probe will have some amount of leakage current, dependent on its design. Small variations in probe leakage currents are normal from probe to probe. Other variations will result from differences in line voltage and test lead placement.*

10-6-9-3   No Meter Probe Adapter Procedure
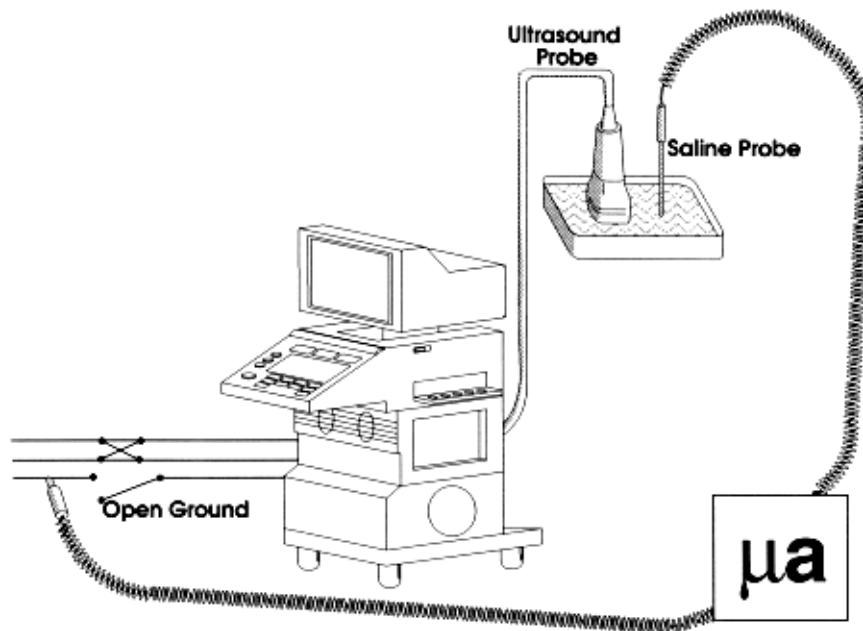
Figure 10-6   No Meter Probe Adapter Procedure

Follow these steps to test each transducer for leakage current.

1.) Turn the Vivid 5 unit OFF.
2.) Plug the unit into the test meter, and the meter into the tested AC wall outlet.
3.) Plug the external probe into the meter's "EXTERNAL" connector.
4.) Set the meter's "FUNCTION" switch to EXTERNAL position.
5.) Connect the probe for test with the connector of the console.
6.) Add the saline probe and the imaging area of the probe into the saline bath.
7.) Have unit power ON for the first part; turn it OFF for the second half.
8.) Depress the ISO TEST rocker switch and record the highest current reading.
9.) Follow the test conditions described in Table 10-21 for every transducer.
10.) Keep a record of the results with other hand copies of PM data.

10-6-9-4   **Data Sheet for Transducer Source Leakage Current**

The test passes when all readings measure less than the values shown in Table 10-13 and Table 10-14. Record all data on the PM Inspection Certificate.

⚠️   **CAUTION**   **Equipment damage possibility. Never switch the Polarity and the status of Neutral when the unit is powered ON. Be sure to turn the unit power OFF before switching them using the POLARITY switch and/or the NEUTRAL switch. Otherwise, the unit may be damaged**

.

Table 10-21   Typical Data Sheet For Transducer Source Leakage Current

Transducer Tested:			
Unit Power	**Tester Power Polarity Switch**	**Tester GROUND or NUETRAL Switch**	**Measurement**
ON	NORM	OPEN	
ON	NORM	CLOSED	
ON	REV	OPEN	
ON	REV	CLOSED	
OFF	NORM	OPEN	
OFF	NORM	CLOSED	
OFF	REV	OPEN	
OFF	REV	CLOSED	

Section 10-7
When There's Too Much Leakage Current...

CHASSIS FAILS

Check the ground on the power cord and plug for continuity. Ensure the ground is not broken, frayed, or intermittent. Replace any defective part.

Tighten all grounds. Ensure star washers are under all ground studs.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

NOTE: *No outlet tester can detect the condition where the white neutral wire and the green grounding wire are reversed. If later tests indicate high leakage currents, this should be suspected as a possible cause and the outlet wiring should be visually inspected.*

PROBE FAILS

Test the probe in another connector to isolate if the fault lies with the probe or the scanner.

NOTE: *Each probe will have some amount of leakage, dependent on its design. Small variations in probe leakage currents are normal from probe to probe. Other variations will result from differences in line voltage and test lead placement. The maximum allowable leakage current for body surface contact probe differs from inter-cavity probe. Be sure to enter the correct probe type in the appropriate space on the check list.*

If excessive leakage current is slot dependent, inspect the system connector for bent pins, poor connections, and ground continuity.

If the problem remains with the probe, replace the probe.

PERIPHERAL FAILS

Tighten all grounds. Ensure star washers are under all ground studs.

Inspect wiring for bad crimps, poor connections, or damage.

STILL FAILS

If all else fails, begin isolation by removing the probes, external peripherals, then the on board ones, one at a time while monitoring the leakage current measurement.

NEW UNIT

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

ECG FAILS

Inspect cables for damage or poor connections

PM INSPECTION CERTIFICATE

Customer Name:		System ID:	Dispatch Number / Date Performed:	Warranty/Contract/HBS
System Type		Model Number:	Serial Number:	Manufacture Date:
Probe 1:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 2:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 3:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 4:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 5:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 6:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 7:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 8:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 9:	Frequency:	Scan Format*:	Model Number:	Serial Number:

* Scan Format: Phased Array, Linear Array, Curved Array, Mechanical Array or Other

FUNCTIONAL CHECKS

Functional Check (if applicable)	OK? or N/A
B-Mode Function	
Doppler Modes Function	
CF-Mode Function	
M-Mode Function	
Applicable Software Options	
Applicable Hardware Options	
Operator Panel	
Monitor	
Touch Panel	
Measurement Accuracy	
GE Approved Peripherals	

PHYSICAL INSPECTION AND CLEANING

Physical Inspection and Cleaning (if applicable)	Inspect	Clean
Console		
Monitor		
Touch Panel		
Air Filter		
Probe Holders		
External I/O		
Wheels, Brakes & Swivel Locks		
Cables and Connectors		
GE Approved Peripherals (VCR, CD-R, MOD, Printers)		

COMMENTS:_____
_____
_____
_____
_____
_____

ELECTRICAL SAFETY

Electrical Test Performed	Max Value Allowed	Value Measured	OK?	Comments
Outlet (correct ground &wiring config.)				
System Ground Continuity				
Chassis Source Leakage Current - Probe				
Chassis Source Leakage Current - Wheel				
Chassis Source Leakage Current - CRT				
Patient Lead Source Leakage (Lead to Ground)				
Patient Lead Source Leakage (Lead to Lead)				
Patient Lead Source Leakage (Isolation)				
Peripheral 1 Leakage Current				
Peripheral 1Ground Continuity				
Peripheral 2 Leakage Current				
Peripheral 2Ground Continuity				
Peripheral 3 Leakage Current				
Peripheral 3Ground Continuity				

PROBES

Probe Number (from previous page)	Max Value Allowed	Max Value Measured	OK?	Comments
Probe 1:				
Probe 2:				
Probe 3:				
Probe 4:				
Probe 5:				
Probe 6:				
Probe 7:				
Probe 8:				
Probe 9:				

Final Check. All system covers are in place. System scans with all probes as expected.

Accepted by: _____

Abbreviations

Numerics

2DF
 2D Flow Processor board (Sometimes called CFP) *5-4*

A

ACCTRL
 AC Controller board *7-2*, *7-5*

ACPWR
 AC Power module *7-5*, *7-6*, *7-22*

ATGC
 Analog Time Gain Compensation *6-5*

B

BF
 Beamformer Board *5-4*
 Beamformer board(s) *7-1*

boot
 start up (used when a computer controlled equipment starts as inteneded) *4-1*

C

CFP
 Color Flow Proccessor(=2DF) *5-4*

CPU
 Microprocessor board *7-1*
 The Control Proccessing Unit (The "Master" Board in the scanner) *5-4*

D

DC/DC
 DC/DC Converter (Board) *5-4*

E

ECG
 Echocardiogram *4-1*

EMI
 Electromagnetic Interference *2-2*

ESD
 Electrostatic Discharge *1-11*

EXT I/O
 External In/Out *7-1*

F

FE
 Front End *5-4*

FE Bus
 Front End Bus *5-4*

FEC
 Front End Controller (Board) *5-4*
 Front End Controller Board *7-1*

FPA probe *4-1*

G

GRAPH board
 Graphical Processor Board *7-1*

H

HV
 High Voltage Power Supply *5-4*

I

INT I/O
 Internal I/O board *6-6*, *6-7*, *7-1*, *7-2*, *7-5*

IP-2
 Image Port 2 Board *5-4*, *7-1*

L

LED
 Light Emitting Diode *6-4*

M

MAC
 Macintosh Computer (or computer running the MacOS) *7-1*

MO Drive
 Magneto Optical Drive *5-2*

MOD
 Magneto Optical Drive *5-2*

N

NTSC
 Video Format used in the US and some other countries/ territories *3-3*

P

PAL
 Video Format used in Europe and some other countries/territories *3-3*

Pat I/O
 Patient I/O *5-4*

Patient I/O box
 Patient In/Out box (module) *7-1*

PC
 Personal Computer (running MS Windows or MSDOS or another disk operating system) *7-1*

PDS
 Power Distribution System *5-1*

R

RFT
 RF & Tissue Processor board *5-4*

RGB
 Red, Green, Blue *7-9*

RLY
 Relay Board *5-4*

RX
 Receiver Board *5-4*

S

SCONV board
 Scan Convertion Board *7-1*

SDP
 Spectrum Doppler Processor board *5-4*

T

Terminal

Data terminal used for communicating via a RS232 serial line. *7-1*

TX

Transmitter/Transmitter Board *5-4*

TXTRIG

Transmit Trigger *6-5*

V

VME

A bus standard *7-1*, *7-2*

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GE Medical Systems